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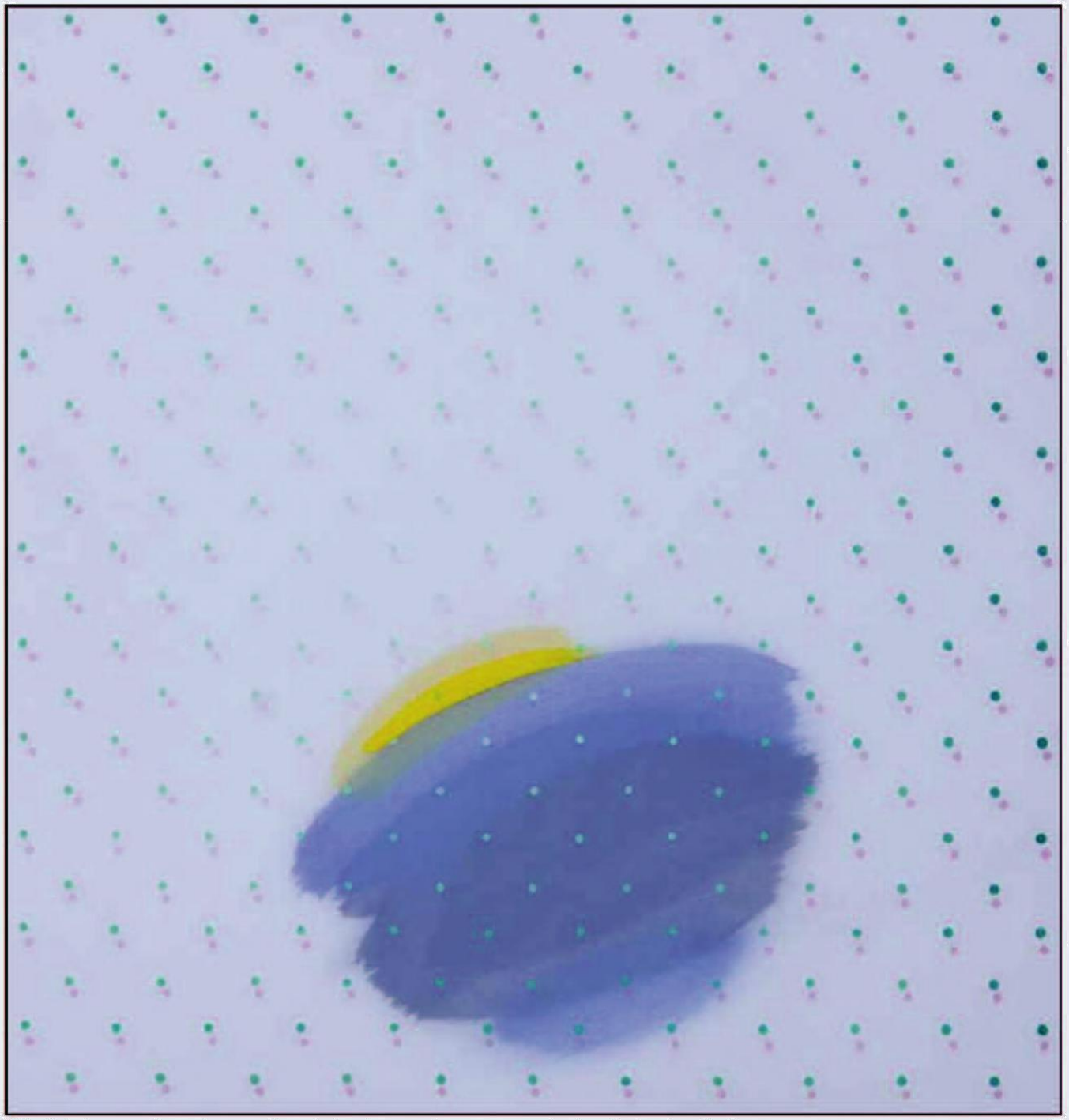

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Contents

EDITOR'S MESSAGE

SEEJSD is again on a board. This time, in front of you is its fourth edition. It takes some time to receive, review, consolidate and publish 19 articles from vast number of disciplines which somehow are closely related to sustainable development. In fact, sustainable development is one of the most important challenges of modern society interconnected with climate changes and a newcomer - ***green deal***.

In that sense, it is difficult to manage a journal like SEEJSD where every single topic in the articles which pretend to be published are from very heterogeneous fields and can be linked to sustainable development as top human priority. It was the main reason for Editorial board to undertake a measure of so called clustering of received and approved articles for publishing in this issue of SEEJSD.

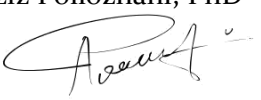
Namely, we decided to split this issue in two parts, having in mind that still there will be overlapping in the published manuscripts from both parts. So, part A is containing articles from technical, biotechnical and natural sciences, while part B is composed by the articles from humanities, health and social sciences. Doing this, the Editorial board is hoping that in such way it will be more convenient for SEEJSD more easily in enter in the process on international indexation of scientific journals and publications.

Regarding the disciplines, in this issue of SEEJSD in Part A the majority of the articles are from the field of information and communication technologies, more popular as ICT (5), followed by the ones from the environmental sciences (3) ending with the technical sciences (2). In Part B, there are mostly articles from an economy and humanities (4 of each) and one from health sciences. Nevertheless, we divided the SEEJSD in two parts; the articles in each part in some cases are overlapping in term of disciplines which implies multidisciplinary and interdisciplinary approach in most of the studies. SEEJSD is welcoming that reality as precondition for better understanding in wider publicity.

Related to the type of manuscripts, most of the manuscripts are original scientific papers, and few review papers and few professional articles. This composition of this issue is expressing its openness for different types of research activities and the promotion of their findings and recommendation.

In this occasion, let me express my optimistic expectation that in the new format, SEEJSD will continue to be attractive media for publishing of the scientific articles with appropriate quality which will accelerate the process of international indexation. At the end I would like to thank to the authors and coauthors who publish their manuscripts in this issue of SEEJSD and to the Editorial board members for their extraordinary efforts to finalize the completion of this issue of SEEJSD.

Editor in Chief,
Prof. Aziz Pollozhani, PhD



Knowledge Attitude and Practice of North Macedonian Dentists in Private Practice on Infection Control and Occupational Safety

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ABSTRACT

Objectives: to assess level of knowledge, attitude and practice on dental infection control and safety among dentists who work in private clinics in city of Skopje, North Macedonia.

Methods: A self-administered questionnaire with 97 variables assessing level of knowledge, attitude and practice on dental infection control and occupational safety was administered to a convenience sample of 120 dentists who worked in private clinics.

Results: 102 participants completed the Questionnaire, 61.8% were female and 38.2% were male. Mean age of participants was 38.3 ± 9.65. More than 90 % of participants were aware of the risk of transmission of bloodborne pathogens in dental settings and recognized the need for mandatory training on infection control. However, merely 20 % attended continuing education on infection control. Most of the participants (94.1%) always wore gloves when treated patients. Eye protection was used by 66.7% of participants. Immunization rate against HBV was 29.4 %. Over 90% of participants did not feel comfortable in treating patients with infectious diseases, and used extra precautions during their treatment. Less than 27% sterilized handpieces between patients, 53.5% used autoclave and 82.4% used dry heat to sterilize instruments.

Conclusions: Level of knowledge, attitude and practice on dental infection control of dentists who worked in a private dental practices in city of Skopje were not satisfactory. This highlights the need for development of national standards and protocols on dental infection control and occupational safety. Continuing education on dental infection control in North Macedonia should be mandatory.

KEYWORDS: *Dental Infection Control; Occupational Safety; Hospital Associated Infections; North Macedonia.*

1. INTRODUCTION

Health care Associated Infections (HAI's) are a major public health problem. HAI's are defined as infections acquired by patients during their treatment in health care settings, which were not present on patient admission, but appear after their discharge/treatment, as well as occupational infections among the health care workers (Allegranzi et al., 2011). In recent years, considerable professional and public attention is given to the danger of transmission of HAI's in dental health care settings (Bagg, MacFarlane, Poxton, & Smith, 2006; Kohn et al., 2003).

Dental interventions are among the most common minor surgical interventions mostly conducted ambulatory (Whitener & Hamory, 2004). Dental health care workers and dental patients are constantly exposed to blood, saliva (R Puttaiah, Shetty, Bedi, & Verma, 2010), and the potential infective airborne material that is produced during dental procedures (Harrel & Molinari, 2004) (Leggat, Kedjarune, & Smith, 2007). The most frequent reason for HAI's transmission in dental health settings is considered non-application of Standard Precautions, a set of minimal procedures that should be used for the treatment of all patients to prevent transmission of bloodborne pathogens (e.g. Hepatitis B Virus (HBV), Hepatitis C Virus (HCV), HIV), and a variety of disease-causing microorganisms that are present in the mouth and respiratory tract (Kohn et al., 2003).

The risk of infection during accidental exposure to bloodborne pathogens among health workers is 22-31% for hepatitis B, 1.8 to 10% for hepatitis C and from 0.1 to 0.3% (or 1 in 300 exposures) for HIV (McCarthy, 2000). It has been suggested that in countries with limited resources the risk of HAI's can be 20 times higher than in developed countries (Cardo et al., 2010). In republic of North Macedonai, most of the Primary and Secondary dental health care is provided in private dental care settings. However, to date, no studies have been found that have assessed knowledge, attitude, and practice (KAP) among dentists in North Macedonia. Therefore, the objective of this study was to assessment knowledge, attitude, and practice (KAP) of dentists who worked in private dental practices in city of Skopje, North Macedonia, on dental infection control and occupational dental safety.

2. MATERIAL AND METHODS

This cross-sectional study was carried out over a period of three months, from January to March 2012, in private dental clinics in Skopje, North Macedonia. A self-administered "Questionnaire on Dental Infection Control and Professional Safety" with 97 variables was used

to collect data from a convenience sample of 120 dentists working in private clinics in Skopje, Republic of North Macedonia. For the purpose of this research a self-administered "Questionnaire on Dental Infection Control and Occupational Safety" with 97 variables was used. The questionnaire was developed by researchers at the Baylor Colleague of Dentistry, Texas A & M health Science Center, Dallas, and was used for KAP assessment in several countries in Asia and USA (R Puttaiah et al., 2010; Raghunath Puttaiah et al., 2009). The Questionnaire was translated from English to Macedonian. It was hand delivered and collected personally by the principal investigator.

3. STATISTICAL ANALYSIS

Statistical processing of the obtained data was analyzed using SPSS for Windows, version 13.0. Analyzes included descriptive statistics for demographic variables, Chi – square tests, Mann-Whitney U test. The significance level was set at 0.05.

4. ETHICS

Approval was granted by the Research and Ethics Committees of the Faculty of Medicine "Ss. Cyril and Methodius University".

5. RESULTS

A total of 120 instruments were distributed and 102 were returned completed. 61.8% of participants were female and 38.2% were male. The mean age of participants was 38.3 ± 9.65. 64.7% of participants in the study were general dentists and 35.3% were specialists. 74.5% of participants were less than 15 years in practice, whereas 25.5% were in practice for more than 15 years. Table 1 provides detailed information on the KAP of participants on IC and occupational safety among study participants.

Table 1. Knowledge, Attitude, and Practice (KAP) regarding infection control and occupational safety among study participants (*n*=102)

Variables	*Percent*
Knowledge on Infection Control and Occupational Safety	
Infectious disease status is always known	8.8
Infection Control is a waste of time	2.0
HBV. HIV. HCV and STDs can be transmitted in a dental office	91.2
Potential for BBP transmission through splash/spatter	37.3
Potential for BBP transmission through percutaneous route	66.7
Dental water systems contain biofilms (greater than 1 million cfu/mL)	26.5
Microbes in dental water are a health risk to patients	44.1
Do not know proper procedures for safe removal of clinical waste	5.9
Percent affirmative responses on Attitudes vs. Practices	
Comfortable treating patients with bloodborne diseases	13.7
Have the right to refuse care for patients with IDs	33.3
Refused care for patients with bloodborne diseases/STDs	16.7
HIV patients should be treated in all clinics and dental schools	55.9
Refused care for ID patients--other patients feel uncomfortable	22.5
Respondents who treated patients of known HIV seropositive status	0.0

Respondents who treated patients of known HBV seropositive status	0.1
Respondents who treated patients of known HCV seropositive status	0.0
Respondents who see patients with TB (those who are not yet deemed non-infectious)	35.3
Everyone should know their HIV sero-status	83.3
Respondent has been tested for HIV sero-status	18.6
Practice measures being implemented	
Follow a prescribed protocol when exposed	48.0
Practice disinfection of impressions	62.7
Always sterilize all critical instruments between patients	88.2
Regularly sonicate all instruments before sterilization	26.5
Use autoclave to sterilize instruments	53.9
Use dry heat to sterilize instruments	82.4
Only wipe-down high-speed handpieces between patients	80.4
Use antimicrobial or germ-free water as coolant/irrigator	51.0
Use sharps container to dispose sharps	89.2
Change surface barriers between patients	75.5
Use of high volume evacuator regularly	83.3
Use of rubber dam regularly	9.8
Regularly hand wash instruments before sterilization	97.1
Immunization against HBV	29.4
Percent affirmative responses on IC status and needs in North Macedonia	
Obtained a copy of Macedonian Dental Safety Recommendations	16.7
Read and understood N. Macedonian Dental Safety Recommendations	35.3
Do not have adequate sets of instruments	20.6
Had a preventive exam within the past year from an Occupational Health Specialist	75.5
Attended CDE programs addressing UP recommendations	21.6
Trained adequately in Dental Safety to practice Safe Dentistry	52.9
Self-trained using books/journals	40.2
Self-trained using internet	31.4
Dental Safety CDE should be mandatory for dentists in Macedonia	90.2

Abbreviation: IC, Infection Control; BBP, Blood Borne Pathogen; TB, Tuberculosis; HBV, Hepatitis B Virus; HCV, Hepatitis C

Virus; STD, Sexually Transmitted Diseases; HIV, human immunodeficiency virus; CDE, Continuing Dental Education

6. DISCUSSION

Results from the current study indicated that the level of Knowledge, Attitudes and Practice on dental infection among study participants were unsatisfactory. These results will contributed to understanding the status and current regulations, and standards on Dental Health Care Associated Infections and Occupational Safety in Macedonia.

According to the results from the current study, the majority of respondents (91.2%) knew that there is a possibility for HIV, HBV, HCV and Sexually Transmitted Diseases (STD) transmiton in the dental office. Most participants recognized the need for continuing education (90.2%) and believed that the initial training and annual updates on "infection control and safety" through continuing education are necessary for dental health personnel. However, only 19.6% of respondents reported that they had attended continuing education on dental infection control. Most of the participants were self-taught about IC and safety at work. It is suggested that the level of knowledge can influence the attitudes, however, knowledge alone, without additional continuing education does not change the attitude of most of the health care workers (Park et al.,

2011).

Of particular concern in this study was lack of knowledge regarding the reprocessing of critical and semi critical instruments, and maintenance of noncritical / working surfaces. Evidence suggest that autoclaving allows for the fastest and most effective sterilization of critical and semicritical instruments and for many dental procedures currently there available aotoclavable instruments; More, each instrument that enters the oral cavity and can be separated from the dental unit should be sterilized (Kohn et al., 2003). According to the current study, only 41.2% of participants knew that critical and semicritical instruments must be sterilized. The majority of participants (80.4%) indicated that they only cleaned headpieces with surface disinfectants, and only 25.5 % of participants reported to autoclave the same.

The limited knowledge of study participants regarding infection control can be explained with the fact that in North Macedonia there are no national guidelines on dental infection control. According to the results of this study, only a small percentage of study participants (16,7%) had protocols on infection control in their dental practice. The absence of national guidelines has been associated with HIV and HBV outbakes in dentistry (Bagg et al., 2006; Bautista & Oróstegui, 1997; Control, 1987). These results are consistent with studies conducted in other developing countries (Hartshorne, 2002; R Puttaiah et al., 2010; Sofola & Savage, 2003). Contrary to our findings, developed countries have well established programs on infection control and safety (Kravitz, Bullock, Cowpe, & Barnes, 2014; Petty, 2006; Walsh, 2012).

Results from variables related to attitude of participants towards IC control and dental safety showed that only 59.8% of subjects felt that they had adequate knowledge on IC infection control to practice safe dentistry, 52.9% of respondents felt that they had been adequately trained on the same. 92.2% of respondents feel that Bloodborne Infectious Diseases are in rise in Macedonia and only about 14% felt comfortable in treating patients with Bloodborne diseases. These results are consistent with results from studies that were carried out in some Asian countries {Puttaiah, 2009 #1884}. The situation in developed countries such as the United States {Kohn, 2003 #1874} and Canada, where continuing education on infection control and safety is mandatory, is quite different {McCarthy, 1999 #1893}.

Stigma towards treating dental patients with infectious diseases is a common concern among dental health care workers (Park et al., 2011; R Puttaiah et al., 2010; Raghunath Puttaiah et al., 2009). In the current study, only about 56% of participants feel that HIV patients should be treated in all dental clinics; 16.7% of participants refused to treat patients with infectious diseases, and 33.3% believe they have a right to refuse care for patients with infectious diseases. Further, most participants (85.29%) used additional measures while treating patients with infectious diseases, double gloved, and scheduled the treatment of patients with known infectious status on different days or time. About 30% of participants believed that standard precautions should be used only for patients with infectious diseases. These findings are morally and ethically worrying (R Puttaiah et al., 2010). Evidence suggests that all patients should be treated as potentially infectious and the same IC measures should be applied for all patients regardless of their infectious status (Kohn et al., 2003).

As shown in Table. 1, most participants reported inadequate practices with regards to use of plastic barriers, disinfection of dental impressions, use of rubber dam, immunization,

instrument ultrasonic cleaners, cleaning, surface disinfectants, sterilization of instruments, use of PPE and post-exposure prophylaxis. Study participants were highly aware of the importance of gloves in dental infection control and most of them use gloves routinely (94.1%). However, the use of facemasks, protective jackets, protective eyewear, and side shields was reported to be unsatisfactory. In accordance to this study findings, one study reported that eye protection was also the less used PPE (Scully & Greenspan, 2006).

Evidence suggest that among dental health care workers percutaneous exposure is most common route of exposure (Saheeb, Offor, & Okojie, 2003). Whereas splash/ spatter of water counts for the second most important exposure and can be significantly reduced by wearing eye protection and face masks (Hartshorne, 2002). In the current study, participants reported high rate of percutaneous (41.2%) and splash/spatter exposure (73.5%). One plausible reason for a very high rate of splash / spatter exposure may be due to the fact that only a small percentage (37.3%) of participants recognized that spatter/splash could be a possible rout of infection transmission, and HBV, HCV, and HIV can be transmitted through percutaneous injuries (66.7%). Another reason may be due to unsatisfactory usage of eye protection, facemasks, and side shields of study participants.

Further, immunization of dental health care workers is an important elements of infection prevention programs and should be mandatory for all dental health care workers (Kohn et al., 2003). However, the immunization rate against HBV was only 29.4 %. One plausible reason for these findings may be related to the fact that in North Macedonia the vaccination against HBV is not mandatory, but recommended on epidemiological indications, or recommended for the health care workers that are at risk for occupational exposure to HBV. Another plausible reason may be related to the general fear that the HBV vaccine may have side effects and may be harmful to health. These findings highlight the need for development of comprehensive immunization programs in the country, as well as mandatory seroprophylaxis against HBV for all DHCW and students in dental schools. These results are similar to a study carried out among dentists in Romania (Duffy, Cleveland, Hutin, & Cardo, 2004), and lower as compared to other studies (Ahmed, 2014; McCarthy, Koval, John, & MacDonald, 1999; Raghunath Puttaiah et al., 2009).

After occupational exposure to blood and other potentially infectious material, every health care worker has the right to have access to Post Exposer Prophylaxis (PEP) (Kohn et al., 2003). In the current study, it was shown that only a significant minority of respondents (28.4%) possessed PEP. These results are significantly lower compared to findings from elsewhere (McCarthy et al., 1999; Raghunath Puttaiah et al., 2009). Lack of policies, protocols, guidelines and didactic curriculum on dental infection control, as indicated in the current study, may have been a plausible reason for inadequate practice on IC. Further, working conditions, which are very important in prevention of HAI's, as well as limited availability of equipment were identified as the major barrier towards application of standard precautions in the current study.

Evidence suggests that each instrument that enters the oral cavity and can be separated from the dental unit should be sterilized (Kohn et al., 2003). The most common method for instrument sterilization in the current study was reported to be dry heat (82.4%), followed by autoclave (53.92%) and chemical sterilization. More, the majority of participants (80.4%) used surface disinfectants to clean the headpieces, and only 25.5 % of participants used autoclaves.

One possible reason for low rate of autoclaving may be related to the fear of dentists that autoclaving may damage the headpieces, which is in line with findings from another study (Khader, Burgan, & Amarin, 2009). Another plausible reason may be related to the fact that autoclaves are expensive and not commonly affordable for the majority of the dentists in the country. More, lack of knowledge about sterilization of critical and semi critical instruments may also impact the practice regarding the sterilization of instruments.

This study assessed level of KAP among dentists in private clinics. These findings cannot be generalized for dental nurses and dentists who work in public dental health care settings.

7. CONCLUSION

In conclusion, the current study showed that knowledge, attitude and practices on infection control and safety among dentists in private dental clinics in Skopje, was inadequate. Standard Precautions were not understood well by significant number of study participants.
More, dental infection control measures used in North Macedonia were found to be far behind Standard Precautions implemented in developed countries, and similar with standards in other developing countries.

The high percentage of exposure to splash, spatter and percutaneous injures, and low immunization rate against HBV of participants, highlights the need for development of comprehensive immunization programs as well as mandatory seroprophylaxis against HBV for all dental health care workers and dental students (Kohn et al., 2003). Dental Schools should develop comprehensive Infection Control Curriculum and integrate the same in all dental courses. All dental health care providers should be educated to provide the best possible professional care for patients with infectious diseases.

Acknowledgements: I sincerely thank Dr. Raghunath Puttaiah, Associate Professor at TAMUS HSC Baylor College of Dentistry, Dallas, Texas, USA for providing a copy of the Questionnaire on IC and Safety. I would also like to thank all participants for their support and participation in this study.

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COMPARATIVE ANALYSIS ON FIRE RESISTANCE OF RC BEAMS WITH DIFFERENT CROSS SECTION DIMENSIONS ACCORDING TO EUROCODE 2

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ABSTRACT

A parametric analysis of two span continuous reinforced concrete beam exposed to standard ISO 834 fire curve is presented in this paper. The influence of the cross section dimensions on the fire resistance of the beam exposed to fire only from three sides is analyzed.

The analysis of the reinforced concrete beam is conducted by using the Method of Reduced Cross Section, given in Eurocode 2, Part 1-2. Temperature dependent mechanical and thermal properties of the constructive materials (concrete and steel) are taken according to the recommendations given in Eurocode 2, Part 1-2.

The analysis has shown that the height of the cross section has minimum positive effect on the fire resistance of the analyzed RC beam and this is due to the increased lever arm of the cross section, but not to the lower temperature of the reinforcement. The height of the cross section does not influence the temperature of the reinforcement which is in the bottom part of the cross section. In case of wider cross section, the temperature is slightly lower and a higher fire resistance is achieved.

Based on the results of the conducted analysis the behavior of the reinforced concrete beam exposed to fire has been defined and recommendations for increasing the fire resistance are given.

KEYWORDS: *Continuous RC beam; Standard fire curve; Thermal analysis; Non-linear thermal and static analysis; Non-linear and non-stationary temperature field; Fire resistance.*

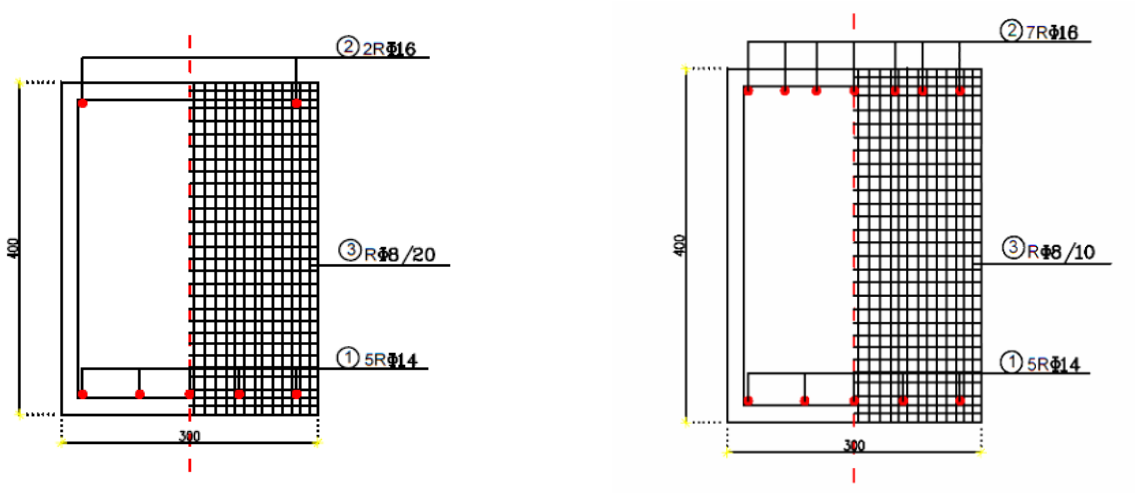
1. INTRODUCTION

The subject of this paper is the analysis of the impact of fire on continuous reinforced concrete beams as structural elements of a construction. The influence of the cross-section height of continuous reinforced concrete beams on their fire resistance is analyzed. The analysis is carried out on continuous reinforced concrete beams loaded with evenly distributed loads, exposed to the fire from three sides during the time: R60, R90, R180 and R240. The main objective of this paper is to define data on analyzed parameters impact on the fire resistance of continuous reinforced concrete beams. With this data, during designing cunstructions for ambient temperature, the appropriate measures and ensuring greater fire resistance and also fire safety of buildings should be taken. The parametric analysis of continuous reinforced concrete beams was performed using the Method of Reduced Cross Section, according to Eurocode 2, Part 1-2 [4]. The analysis was performed for continuous reinforced concrete beams with dimensions 30x40 cm, as well as for continuous reinforced concrete beams with dimensions 30x45 cm. The rise of temperature in the fire sector over time is defined by the standard fire ISO 834.Temperature dependent mechanical and thermal properties of constructive materials (concrete and steel) have been adopted in accordance with the recommendations given in Eurocode 2, section 1-2, which also provides the design procedures for the approximate calculation on fire resistance of structural elements.

2. COMPARATIVE ANALYSIS ON FIRE RESISTANCE OF RC BEAMS ACCORDING TO EUROCODE 2

The influence of the intersection height on the fire resistance of continuous reinforced concrete beam with length 2 x 5 = 10 m is analyzed. The first case is when the cross-section is 30x40 cm, while the second case is when the cross- section is 30/45 cm. In both cases, the beam is exposed to a constant load of 23 kN / m ' and a variable load of 10 kN/ m'.

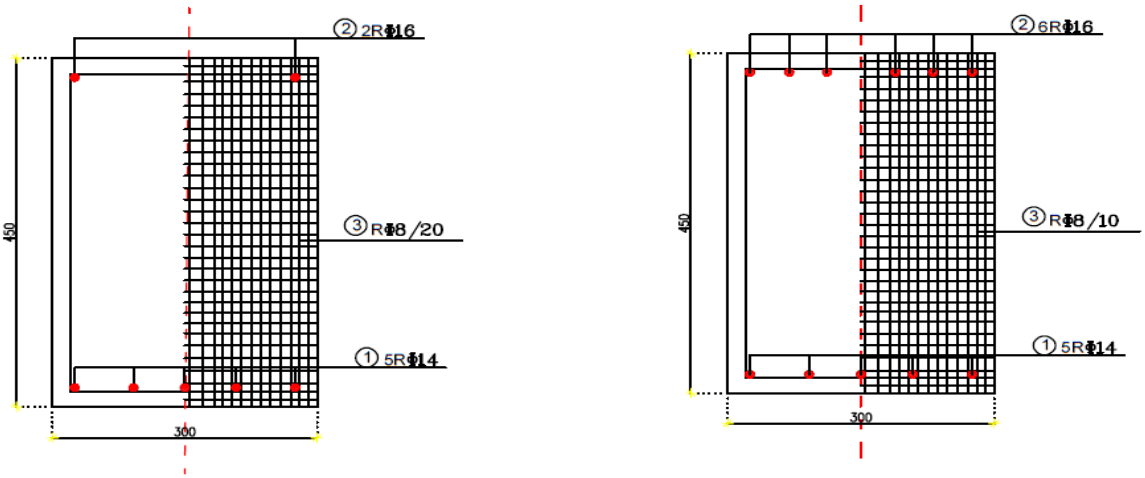
According to the calculations carried out for a 30x40 cm cross section, 5ϕ14 bars were adopted as the main bars in the lower zone, and 2ϕ16 bars were adopted as mounting bars in the upper zone, while 5ϕ6 bars were added above the support (Figure 2.1). According to the recommendations for providing greater fire resistance, part of the main reinforcement over the bracket should be left in the field, and for this reason the field mounting bars in the upper zone have been adopted to be 2ϕ16.



a) cross section in the field **b) cross section above the support**

Figure 2.1: Cross section of continuous reinforcement concrete beam in the field and above the support, for section dimensions 30x40 cm

When adopting reinforcement at a cross section of 30x45 cm, the only difference is the number of reinforcing rods adopted above the support, where the number of reinforced rods is 4ϕ16 for this cross section, one reinforcement rod less tha in the first case of cross section 30x40 cm (Figure 2.2).



a) cross section in the field **b) cross section above the support**

Figure 2.1: Cross section of continuous reinforcement concrete beam in the field and above the support, for section dimensions 30x45 cm

According to the calculations carried out using the Method of Reduced Cross Section given in Eurocode 2, Part 1-2 [4], for the cross section 30x40 cm the fire resistance is reached after 128 min., while for the cross section 30x45 cm it is achieved after 130 min.. For the both cross-sections, the temperature of the steel elements in the lower zone is read from the isotherms given in [1], which refer to a precisely defined time.

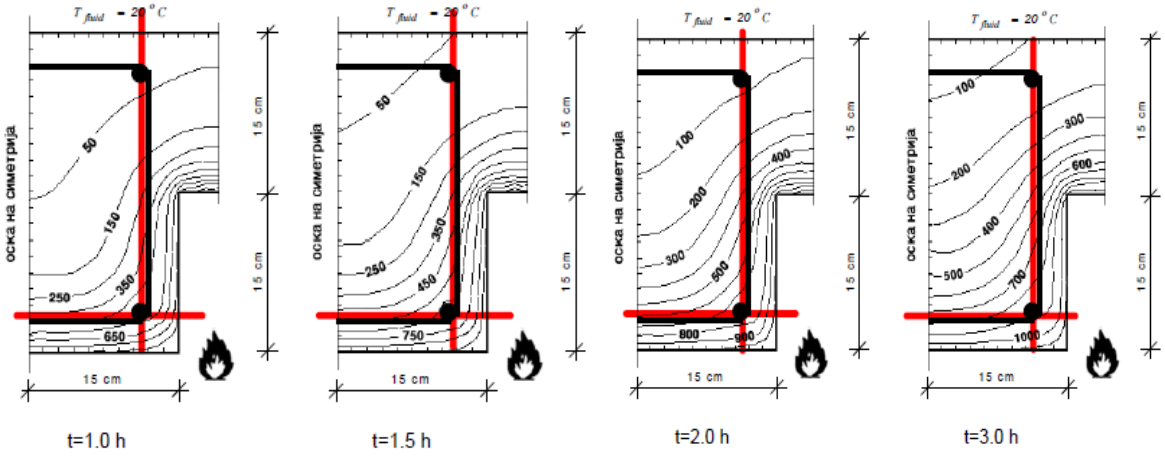


Figure 2.3: Time development of isotherms in cross section of RC beam with dimensions 30x40 cm, with fire exposed from bottom

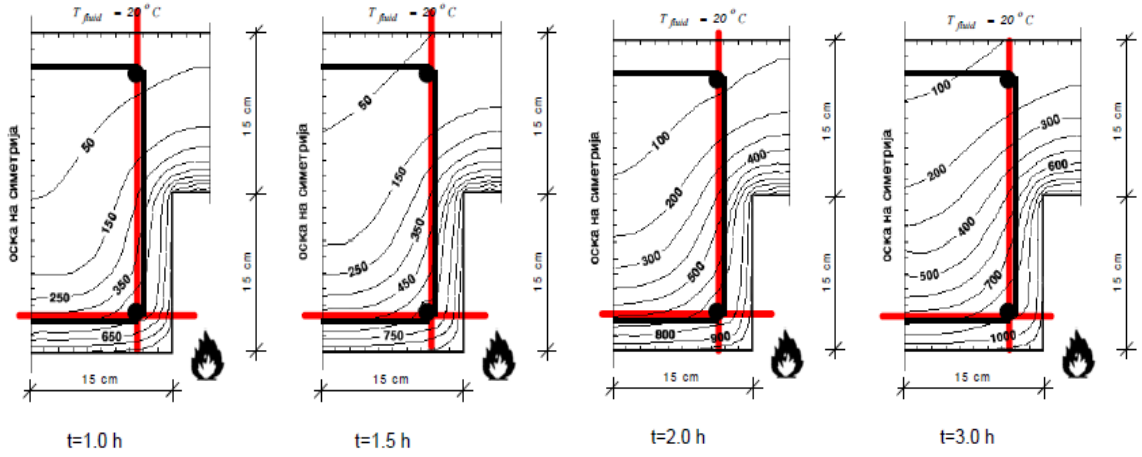


Figure 2.4: Time development of isotherms in cross section of RC beam with dimensions 30x45 cm, with fire exposed from bottom

The temperature values for the steel elements 1, 2 and 3, read from the isotherms for a particular time, are shown in Table 1.1.

Table 1.1: Temperature of steel elements according to Method of Reduced Cross Section given in Eurocode 2 for cross sections 30x40 cm and 30x45 cm

Eurocode 2, cross section 30x40 cm			Eurocode 2, cross section 30x45 cm		
Time (min)	Element	Temperatu re (°C)	Time (min)	Element	Temperatu re (°C)
60	1	450	60	1	450
	2	450		2	450
	3	550		3	550
90	1	550	90	1	550
	2	550		2	550
	3	700		3	700
120	1	600	120	1	600
	2	600		2	600
	3	750		3	750

The results show that the temperature in the steel elements does not differ due to the fact that their position is the same, and in addition the thickness of the protective concrete layer is the same for the both cross sections.

According to the analysis, for cross section 30x40 cm and cross section 30x45 cm, results for bending moment in the mid span and at the support were obtained. Results for redistribution of attacing moment at the support were also obtained.

Figure 2.5 and Figure 2.6 show the load bearing capacity of the RC beams with cross sections 30x40 cm and 30x45 cm during the time R60, R90, R120 and R180, using the Reduced Cross Section Method.

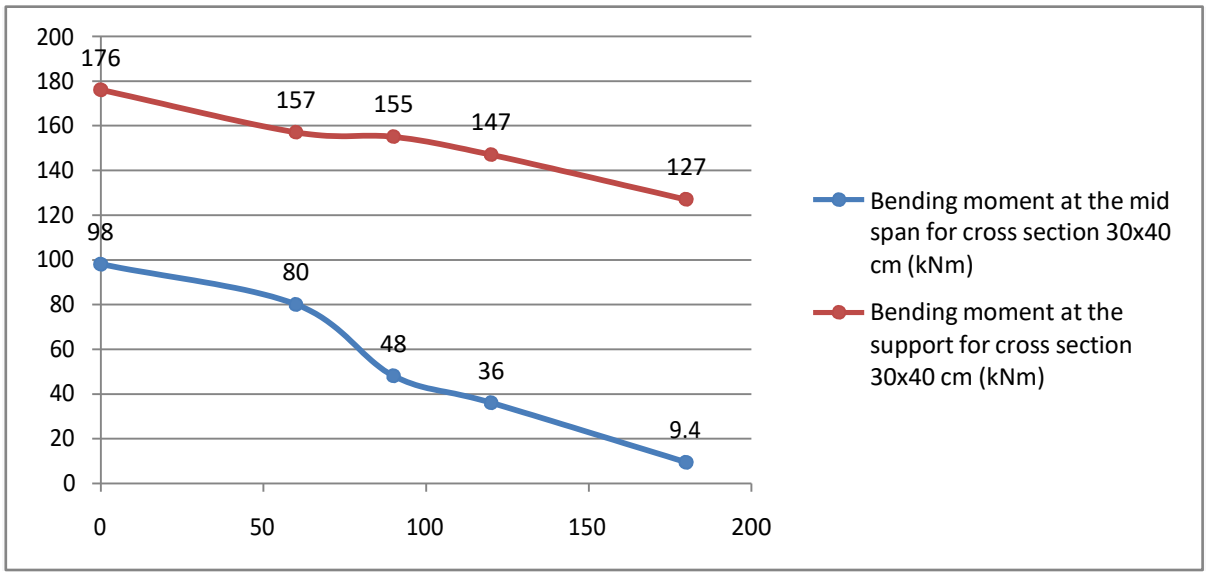


Figure 2.5: Load bearing capacity of the RC beams with cross section 30x40 cm, for time 60, 90, 120 and 180 min

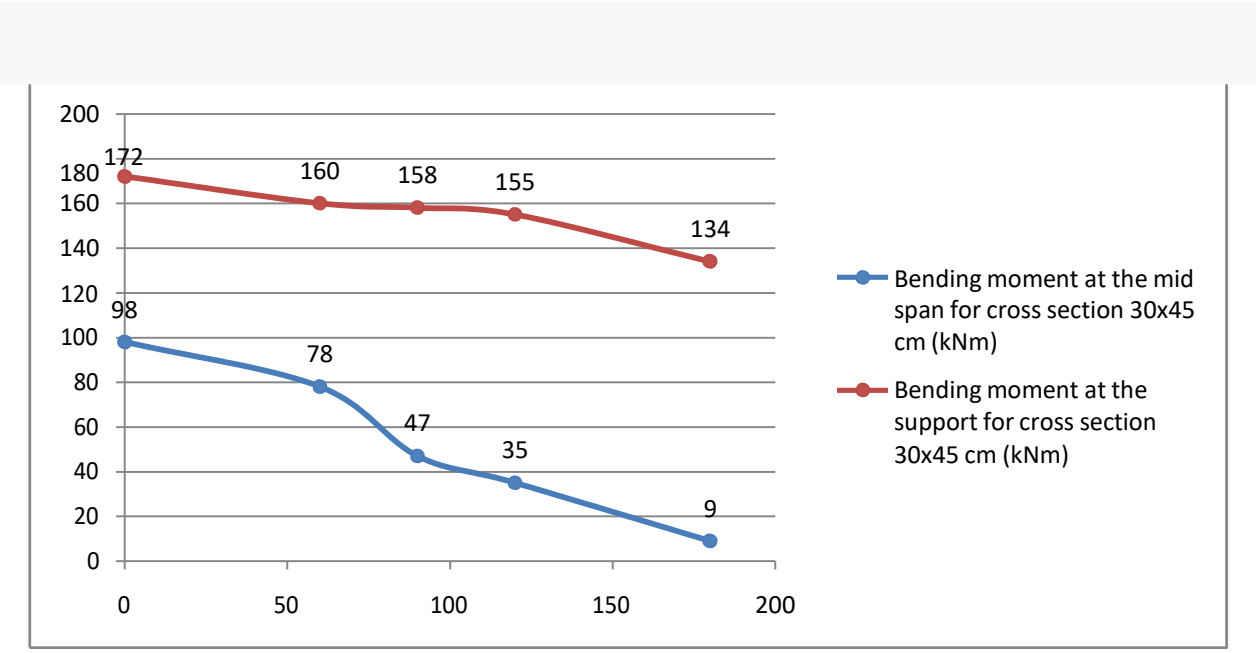


Figure 2.6: Load bearing capacity of the RC beams with cross section 30x45 cm, for time 60, 90, 120 and 180 min

The diagram shows a small difference in the results around the bearing capacity at mid span and at the support. For cross section 30x40 cm, at time t = 120 min, the bearing capacity for sagging moment in the mid span is **M+ = 36 kNm**, and bearing capacity for hogging moment at the support is **M- = 147 kNm**, while for the cross section 30x45 cm, the bearing capacity for sagging moment in the mid span and bearing capacity for hogging moment at the support are: **M+ = 35 kNm**, and **M- = 155 kNm**, respectively. The small change in the obtained results is due to the difference in the static height of the intersection. Table 1.2 presents the values of load bearing capacity in the mid span and at the support for different fire action times, for two different cross sections.

Table 1.2: Load bearing capacity in the mid span and at the support according to Method of Reduced Cross Section given in Eurocode 2, for cross sections 30x40 cm and 30x45 cm

Eurocode 2, cross section 30x40 cm					
Time (min)	Field loads (kNm)	Loads over support (kNm)	Time (min)	Field loads (kNm)	Loads over support (kNm)
60	80	157	60	78	160
90	48	155	90	47	158
120	36	147	120	35	155

As the field attack moment after 90 minutes exceeds the cross section load, the impacts are redistributed. At the expense of an attack moment that cannot be received in the field, the negative momentum above the support is increased. On the basis of the calculations performed, redistributions of the bending moments at the support for the beams with cross sections 30x40 cm and 30x45 cm are shown in Figure 2.7 and Figure 2.8, respectively.

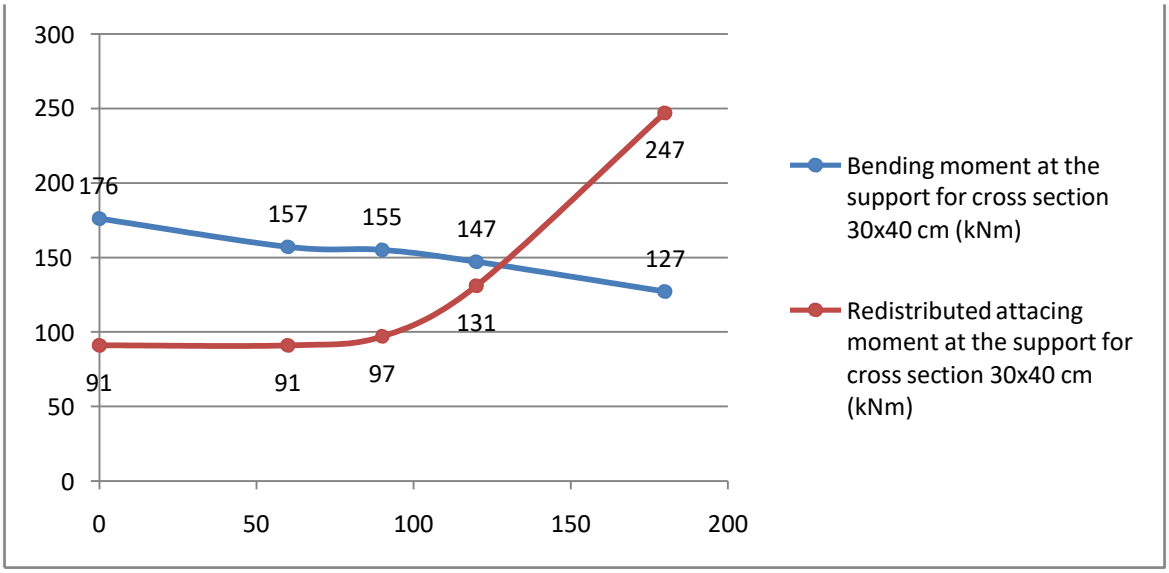


Figure 2.7: Load bearing capacity and redistribution of the bending moments at the support for the beams with cross section 30x40 cm

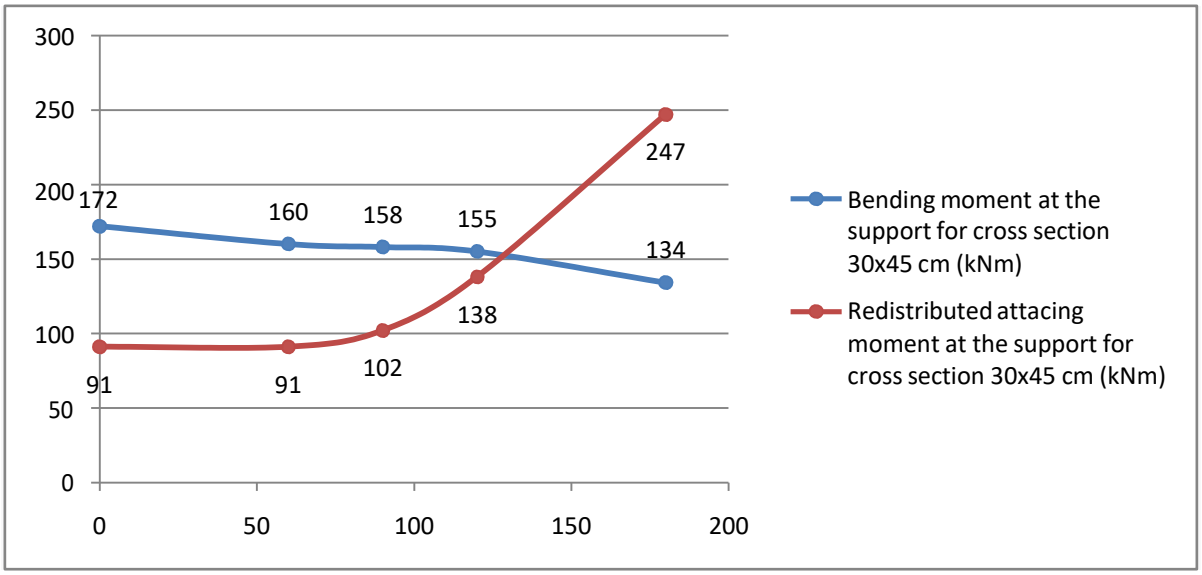


Figure 2.8: Load bearing capacity and redistribution of the bending moments at the support for the beams with cross section 30x45 cm

It can be seen from the diagram that the negative moment at the support for cross section 30x40 cm is **M- = 131 kNm**. But after only 8 min (t = 128 min) the intersection does not receive the redistributed moment, resulting in a plastic wrist at the support and the beam get fractured. For the cross section 30x45 cm, the maximum negative moment at the support is **M- = 138 kNm**. A plastic wrist at the support appears after 10 minutes (t = 130 min), and the beam get fractured. According to the analysis, for the both cross sections, the plastic joint in the field occur after 90 minutes of standard fire action, and from that moment the impact redistribution occurs. Impact redistribution lasts up to 120 minutes, while after 180 minutes the cross sections no longer carry, which means the fire resistance is slightly higher than R120. Table 1.3 shows the values for the redistribution of the attacking moment at the support, for the two cross sections, for different time of fire exposure.

Table 1.3: Redistribution of attacking moment at the support for cross section 30x40 cm and cross section 30x45 cm

Cross section 30x40 cm		Cross section 30x45 cm	
Time	Redistributed moment at the support	Time	Redistributed moment at the support
0	91	0	91
60	91	60	91
90	97	90	102
120	131	120	138

CONCLUSIONS AND RECOMMENDATIONS

Two types of cross-sections of continuous reinforced concrete beams, with dimensions of 30/40 cm and 30/45 cm, with variable external load "q" are considered. A comparative analysis regarding their height was performed using the Reduced Cross Section Method, in accordance with Eurocode 2, Part 1-2. Based on the analysis of fire resistance of continuous reinforced concrete beams, the geometrical characteristics, mechanical and thermal properties of the materials play an important role in determining the fire resistance of the beams. The analysis showed that the height of the cross section of the beam had a little positive effect on the fire resistance of the element due to the increased static height of the cross section, but not to the lower temperatures of the rods.

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Application of Data Analytics with Python Programming In Healthcare

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ABSTRACT

The goal of this research is to investigate how using data analytics and programming python platform can discover additional value from health information used in health care. Dominant part of the Healthcare information is frequently unstructured, exists in storehouses and dwells in imaging frameworks, clinical solution notes, patient information and so forth coordinating these heterogeneous information and calculating it in to progress investigation is basic to improve medical services results. The incorporation of health sector data analytics provides stakeholders with fresh perspectives that can advance personalized treatment, optimize patient outcomes and prevent excessive costs. Until now, medical healthcare has not completely gotten a handle on the possible advantages to be picked up from information examination. The developing medical care industry is creating an enormous volume of valuable information on tolerant socioeconomics, therapy plans, instalment, and protection inclusion pulling in the consideration of clinicians and researchers the same. Lately, various companion explored articles have tended to various components of information science application in medical care. Be that as it may, the absence of a thorough and methodical account roused us to build a study examinations on this field. This examination study characterizes information investigation and its qualities, remarks on its favourable circumstances and difficulties in medical care. Information examination gives new systematic open doors as well as faces parcel of difficulties. The research study begins from investigating the patient information. While picking the stage, a few rules like accessibility, usability, adaptability, level of security and coherence ought to be thought of. Analyses of all challenges of data analytics are analyzed and insights are represented and discussed and argumented.

CCS

Applied computing > Life and medical sciences >Health informatics

KEYWORDS

data analytics, healthcare, comparative analyses, data analytics platform

1 Introduction

Computer scientists and health-care providers may learn from one another when it comes to understanding the value of data and data analytics. There is an urgent need to develop and integrate new , mathematical, visualization, and computational models with the ability to analyze Data in order to retrieve useful information to aid clinicians in accurately diagnosing and treating patients to improve healthcare. According to [1] data science is a multi-disciplinary field that uses data analytics and different algorithms and systems to extract knowledge and insights from structured and unstructured data.. Data, derived by patients and consumers, also requires analytics to become actionable.

In the recent period, there is a growing research interest on the concept of Machine Learning that is used in data science. This approach deals with the creation of techniques and algorithms that facilitate thecomputers to acquire knowledge and procure intelligence that relies on the previous experience. Machine Learning represents a member of AI (Artificial Intelligence) and is much associated with statistics. Here, the system would be capable of recognizing and understanding the data related to the input, such that it could make predictions and decisions by depending on that data.

In this context, the learning process begins with the data collection by several means, from multiple resources. The subsequent step is data preparation which implies a data pre-processing method to address the data-associated issues and to decrease the space dimensionality by eliminating the unnecessary data. As the volume of data utilized for learning remains huge, it is problematic for the system to proceed with the decision making. In such scenario, algorithms are devised by employing logic, probability, statistics, and certain control theory for analyzing the data and retrieving it from the earlier experiences.

One of the most important issues in healthcare recently is Diabetes. Diabetes represents a well-known metabolic disease that could adversely affect the complete body system. Usually, type 2 diabetes onset occurs in the middle age and rarely in the old age. However, diabetes incidences are also identified in children. Diabetes is driven by multiple etiologic factors such as sedentary lifestyle, food habits, body weight, and genetic susceptibility. An undiagnosed diabetes could cause the levels of blood sugar to become excess. This condition is known as hyperglycemia and this could cause complications such as cardiac stroke, diabetic foot ulcer, neuropathy, nephropathy, and retinopathy. Hence, diabetes detection at the earliest stage is central to enhance the patient related QOL (quality of life) and life expectancy enhancement (Kaur & Kumari, 2018).

2 LITERATURE REVIEW

In order to identify articles that employ data analytics and its application in healthcare especially in diabetes extensive efforts were made. Several databases were searched: the extensively used in biomedical sciences, PubMed, the IEEE digital library, ACM digital library, the DBLP Computer Science Bibliography, containing more than 3.4 million journal articles, conference papers, and other publications on computer science.

Machine learning could be also used in several areas such as traffic management, prediction of disease, robotics, gaming, face tagging and identifying, filtering of email, ranking of web page and in search engine. Among these, the prediction of disease has good implications for the clinicians (Kaur & Kumari, 2018).

For instance, predictive analytics employs a machine learning strategy for predicting the unknown or future outcomes. Predictive analytics has been explored widely in health care especially in diabetes. By applying predictive analytics in diabetic care, diabetes related diagnosis, prediction, self-management, and prevention could be possible base on the surveys.

From the past research, there are two important predictive analytic types. These are unsupervised learning and supervised learning. Unsupervised learning will not employ any earlier known findings for training its models. It relies on employing descriptive statics. It recognizes groups or clusters. On the other hand, supervised learning represents a method of building predictive models employing historical data set and generates predictive findings. Examples include time-series analysis, regression, and classification (Jayanthi, Babu & Rao, 2018).

Additionally, predictive model classification is of nine kinds such as logistic regression, naive Bayes and linear regression, classification and decision trees, business rules, natural language processing (NLP), support vector machines (SVMs), machine learning, and neural networks (NNs). However, predictive analytics employs regression models based on the existing data for predicting the majority of outcomes in the medical field. With regard to diabetes, a multi stage adjustment model is believed to be applied. This has low rate of misclassification rate and could predict which individuals is susceptible to acquire diabetes. Say, researchers use KoGES dataset to build this model (Jayanthi, Babu & Rao, 2018).

Researchers devised the physiological model that could help in predicting the level of blood glucose thirty-minutes in advance by employing the data of five patients by training with the physiological characteristics. This assisted in giving reliable outcomes than that contributed by the physicians. In the similar

context, another predictive model is a graph model based on a sparse factor. The researchers could not only acquire get a forecast of the complications but also could detect the hidden connection between the complications specific to diabetes and the test types of a lab.

In an investigation, every algorithm was implemented by employing C++ program with features like 4 GB of memory, Intel Core i7 2.66 GHz, and Mac running Mac OS X. The data set employed for the trial was gathered from a geriatric hospital. The data set consists of one year old data related to 35,530 patients, 181,934 medical records, 1945 kinds of lab tests specific to Mac running Mac OS X

and 65% of data was selected for model training and the remaining for the testing. The proposed model was thought to address knowledge skewness and sparseness. In the similar context, a hybrid model was devised for predicting if the diagnosed patient could acquire diabetes within a period of five years or not. For this purpose, the tool employed was WEKA and the specific data set used was that of PIMA Indian population with diabetes.

This model attained an accuracy of 93% (Jayanthi, Babu & Rao, 2018).The authors have adopted the process in devising the predictive model where they initially did dataset pre-processing, and then calculating the values of F-score related to chosen characteristics with increased F-score as the discriminative characteristics.

Temurtas et al. (2009) employed two separate neural networks for expressing that would produce the precise classifier to predict diabetes. The two models of neural network are probabilistic neural network and multilayer neural network. The dataset carries the diabetic data of Pima Indians with 769 samples in two classes. Among these, researchers used 575 samples for the purpose of training and 190 were employed for testing.

Divya et al. (2014) devised a prediction model as per a H-TSVM (Hybrid-Twin Support Vector Machine) to predict whether or not a novel patient can suffer from diabetes. They employed the Pima dataset for carrying out the experiment. Here, 'kernel function' served as a unique factor to keep the proposed method distinct from the others. The classifier was able to give a 88% accuracy.In a study, Ahmed (2016) proposed a predicting model which classifies the treatment plans specific to type 2 diabetes into three categories such as medication, diet and insulin.. The dataset employed for devising the model was specific to the clinic centre named 'JABER ABN ABU ALIZ' that carries tree eighteen medical records. The model was devised employing WEKA tool by using the J48 classifier and it has induced 71% accuracy.

Yet in another trial by Devi et al. (2016), the study team devised a prediction model for predicting various disease types a diabetic patient could develop. For devising the data set model a 3 year period was spent in gathering the data from a hospital containing details of 740 patients as well as 31 attributes. Following the deletion of outliers by employing DBOD (distance based outlier detection), the pre processed data was provided as the logistic regression model input and this was constructed by employing the Bipolar Sigmoid Function. This, in turn, was evaluated by employing the function of Neuro based Weight Activation. The model induced 91% accuracy in the prediction.

Some workers developed FNC a tool which could be employed for a diabetes diagnosis. This model was devised by introducing three methods Case based reasoning, neural network and fuzzy logic, with with the details of two hundred patients who possess sixteen attributes of input attributes. The study team applied Matlab to implement neural networks and fuzzy logic, and applied MyCBR plug-in to implement Case based Reasoning. Following the collection of results from three methods, the research team applied rule oriented algorithm to every technique for enhancing the accuracy. Finally, the reliable accuracy was sought for case based reasoning (Thirugnanam et al., 2016).

Osman et al. (2017) devised a KSVM hybrid model. This model has chief criteria a selection algorithm which makes it distinct from various approaches. Data set specific to PIMA was used for the trials and findings were collected. It was demonstrated that the results specific to diagnosis employing K-SVM are 99.75, 99.79, and 99.82 for learning trials, and 99.92 for the testing trials.

Anand (2015) devised a prediction model which helps in predicting if an individual would acquire diabetes by relying on the activities specific to daily lifestyle. Here, for constructing the prediction model, data set specific to PIMA diabetes was applied and the machine learning classifier Classification and Regression Trees (CART) was used. This proposed model was thought to give a 75% accuracy.

Jakhmola (2015) devised a prediction model which helps in predicting if an individual acquired diabetic condition or not. For achieving that, dataset specific to PIMA diabetes was employed. In the method proposed, earlier regulated binning technique was applied and then multiple regressions was employed for enhancing the model accuracy. Following the introduction of every method a 78% accuracy was attained.

A team led by Aljarullah (2011) devised a type 2 diabetes diagnostic tree model. They employed the data set specific to Pima Indian diabetes. The techniques specific to pre-processing are those based on numerical discretization, handling missing values, recognition and selection for enhancing the data quality. The study team applied J48 decision tree classifier and Weka tool for building the decision tree model which produced a 79% accuracy.

Jahani and Mahdavi (2016) devised a prediction model by employing the neural networks for classifying and diagnosing the diabetes specific onset and its progression. They employed data specific to 550 patients from a diabetes center. Initially, they provided training and examined the neural networks with variety of neurons and observed a neural network with various neurons that induced highest accuracy.

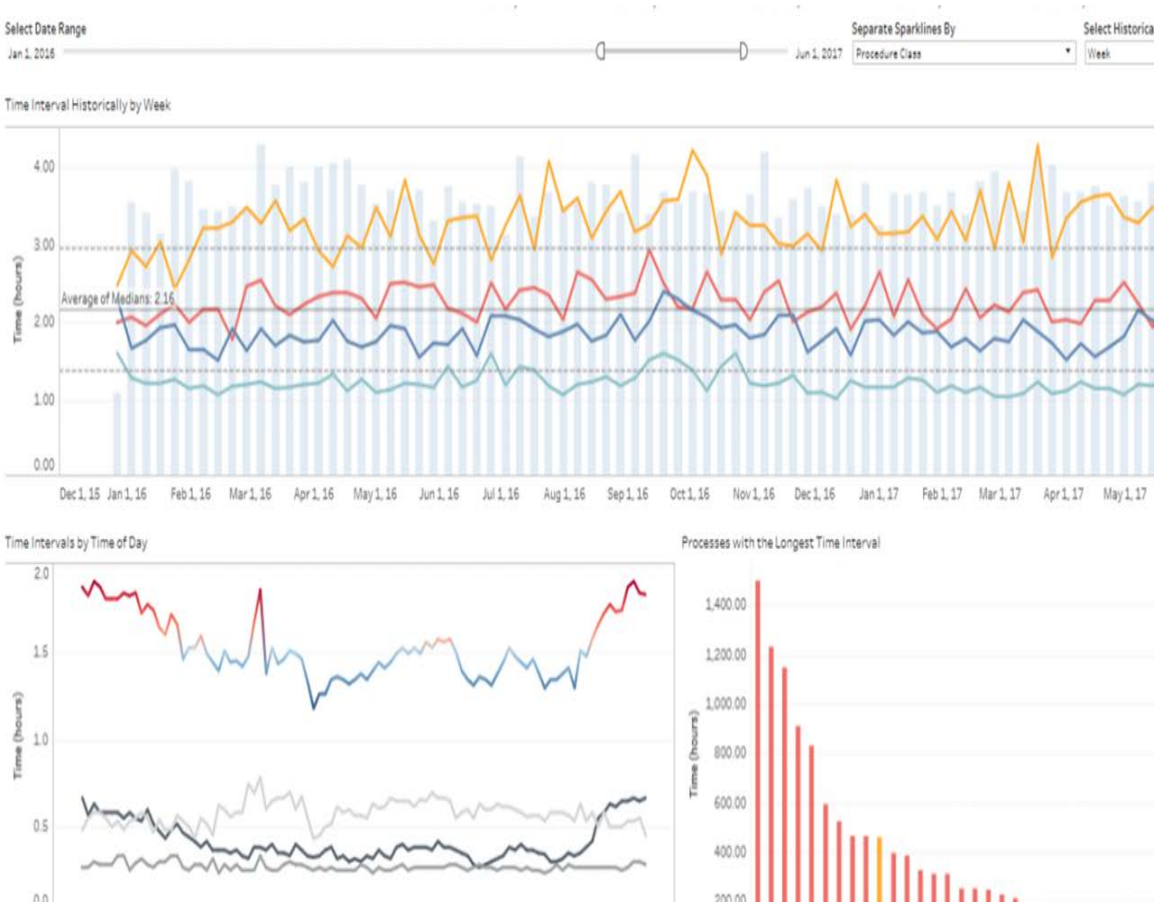

Figure 1. Data Analytics in Healthcare Trends

3 Conclusion

The main purpose of the research study was to investigate data analytics and its applications in healthcare. Primarily the focus was on diabetes as one of the biggest silent killers of patients. In conclusion, the survey done on various models specific to the area of diabetes is clear that data science has evolved well in predictive analysis with regard to prediction and diagnosis. This has furnished insights on the efficacy associated with the construction of clinical prediction models particularly in developing nations. Although, there seem to be a few gaps that need to be addressed in areas like plans specific to type 1 diabetes treatment, prediction model

implementation optimizations, using larger dataset. So, predictive analytics appears to gain much reputation with regard to the modern technology Big data. It has implications to go beyond the level of data mining.

This application has made feasible the exploitation of a huge quantity of available medical data is with regard to disease, signs and symptoms, etiology, and their impact on health, altogether.

An evidence based practice could also help in better streamlining the clinical research when applying the data science with a special emphasis on predictive analysis. Recommendations
As such and according to the results of the study, some recommendations can be given:

- The data analysts must raise their seriousity in developing secure and serious data analytics applications.
- The data science analyses applications should be user friendly and usable, so that will increase the clients' satisfaction.
- By having serious dissemination and presentation of the data science application and providing sufficient training, can raise the confidentiality towards the use of the data science software tools.

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Sustainable urban strategies applicable in the dense urban matrix of the city of Skopje

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ABSTRACT

This research analyses certain sustainable urban strategies that are in correlation with the improvement of the air quality, lowering of the air temperatures in summer period and improvement of the social cohesion of its habitants. More precisely, this research discusses about the possible ways of application of the analyzed sustainable urban strategies for achieving sustainable solutions regarding urban planning and design of a public space and underground parking in the center of Skopje.

This study was conducted in the following steps. At first, the sustainable urban discourse was analyzed in order to give explanation which of the mentioned sustainable urban principles can be applied on the analyzed case. Then, different analytical methods and information from various scientific areas were used, which helped in detecting the real problems present on the analyzed location. In order to define the adequate sustainable strategies that will have ecological and socio-environmental qualities, the so called “green features” were established. “Green” feature in this research represents a sustainable quality of a particular strategy or urban measure that can improve the air quality, lower the summer temperatures, revitalize the location, improve the social cohesion, create people centered urban design and redefine the city values. These "green” features can assist in determining project’s sustainability value.

Having in mind that this location is situated in dense urban matrix in the city of Skopje – city well known for its air pollution and high temperatures during the summer period – the sustainable urban strategies recognized in this research as applicable can assist on finding better, healthier, more sustainable, eco-friendly and people-friendly solutions. These strategies and measures can also be applied in wider urban context on cities with similar environmental problems.

KEYWORDS: *Sustainable urban strategies, Air quality, Lowering of the air temperatures in summer period, Social cohesion, Environmental urban planning.*

1. INTRODUCTION

Environmental planning is a decision-making process that addresses environmental parameters when creating human designed environments. It is an interdisciplinary field that includes urban planning, landscape architecture, architecture, engineering, related arts, natural sciences (biology, geography, meteorology, physics…) and social sciences [1]. In today's modern societies, a great need exists for careful, thoughtful evaluation and planning of man-made and natural resources, in terms of both current and future usage [2]. Cities, towns, buildings and public spaces must be carefully planned for their habitants and for the complete environment. Environmental urban analysis and planning not only include architects, urban planners and other scientists working together but also incorporate input from the users of these spaces to achieve quality solutions [3]. In that manner, this research explains the analytical and design methods applied on this specific location in the center of the city of Skopje.

The analyzed location currently is an unappealing one level asphalt parking in the center of the city. It is near the River Vardar and all the important administrative and public buildings shown at *Figure 1*. There was an initiative to transform this space into a location containing four 60 floor buildings, *Figure 2*.

Figure 1: Current situation (left), Figure 2:One of the initiative proposals

Reviewing the scientific literature on low-carbon cities, green cities [4,5,6,7], healthy cities, the urban development EU documents [2], as well as conducting this research, helped us to come to the conclusion that this location should be designed as: green, compact, walkable, healthy, barrier-free and socially vibrant space that will deliver a high quality life to the people gravitating in this area. In that manner we strongly feel that this location should be designed as public space in a form of representative landmark of the city containing underground parking. The *mixed-use* character of the location will enable revitalization of the location by redesigning the existing parking and adding a number of new urban contents. Revitalization of locations in the center of the city that have lost their mining through time by adding new urban contents that enlighten the context of the nature and social cohesion represents very important sustainable urban principle [2,8]. Making a mix-used development plan for this location will include a variety of uses within a project, and will create opportunities for pedestrian-oriented design. Developing bigger areas in the center of the city that promote walking and bicycling represents imperative regarding the improvement of the air quality.

The city of Skopje represents economic, political, administrative and educational center of the Republic of North Macedonia. That is the main reason why a great number of people from all over the state are migrating in Skopje: seeking for greater job opportunities, income and quality of life. This trend is happening especially in the last three decades. Car ownership is on the rise as well. This city is trying to accommodate the explosive growth of automobile travel in the existing street grid and also by building ring road and new parking lots. Due to the Skopje's high population density, the problems of private-car-oriented transportation are creating big problems and pollution. The reality is that high- density cities cannot be designed around the car. It simply won't work. So, the opportunity to plan prosperous, livable, low-carbon city is urgent. These cities must increase the percentage of green surfaces and make public transport, walking, and bicycling their top priorities [3]. Without developing and applying urban strategies that are oriented towards sustainable and eco-friendly planning, these crowed asphalt cities will not reach their full potential. They will be gridlocked and polluted [3].

2. PRESENT SITUATION ON THIS LOCATION

The climate in Skopje is continental with cold winters and dry hot summers. Skopje, in the center of the Balkan Peninsula, is nestled in a valley between mountain ranges that surround the city from the north and the south. This landscape proves deadly in the winter period [9]. As warm air rises up toward the mountains, it meets the colder, heavier air travelling downwards. This temperature inversion creates a blanket of smog that settles heavily over the valley, trapping polluted air on city streets and in the lungs of residents [9]. Located in a valley without big wind flows, the air circulation and ventilation of the city doesn't help on reducing the air pollution especially in the winter period [10,12]. In the period from October till the end of April the level of air pollution is huge and way above normal [10,11,12]. The summer temperatures in Skopje very usually reach 38-40 C. If the temperature is measured close to the asphalt surfaces it grows for additional 10 C. These surfaces are radiating the heat for prolonged time till late in the evening.

Another big problem for the people that work, study, shop, dine or sight see in this area is the absence of vegetative and green surfaces, open public spaces for resting and enjoying the nature free of charge. They must go and sit in some of the restaurants and café bars located on the bank of the river Vardar.

The problem with the social cohesion in this area is also evident. The conducted questionary showed that the residents, as well as the people working and studying in the surrounding buildings do not have public open space where to enjoy the nature and gather. The children do not have enough green and open space for playing. The old people do not have open parks for walking and gathering. The students from the University Mother Teresa and secondary school Rade Jovcevski Korcagin wrote in the questionary that they are lacking of an open space where they can perform music, theatrical performances and different kind of student's competitions, exhibitions and gatherings….

The density in the center of the city grows every day by adding new building on every location that was empty and green. This trend especially escalated when the project Skopje 2014 emerged [13].

3. SUSTAINABLE URBAN PRINCIPLES

The sustainable urban discourse has been analyzed and discussed by many theoreticians and many institutions mainly because of its importance on global level. Reviewing the scientific literature as well as the existing frameworks related with sustainable urban principles [1,2,3], *The Copenhagen Agenda for Sustainable Cities* [2] was found as very useful for this research. This framework of 10 principles was created by 50 most important urban experts in the world. They shared their opinion on: what are the most important steps for creating sustainable cities. Representing all parts of the world and from a wide range of disciplines, they all agreed that for making cities sustainable we need a radical change of mindset, new strategies and new governance models to support development and foster a new generation of urban leadership [2].

These statements and observations have been categorized into the following **10 Principles** for future sustainable governance and strengthening the development of sustainable cities:

1. Rediscover the city.
2. Redefine city value.
3. Involve everyday experts.
4. Break down silos.
5. Redistribute urban decision-making.
6. De-design urban planning.
7. Promote corporate urban responsibility.
8. Go global.
9. Embrace chaos, crisis and change.
10. Encourage passion in urban leadership [2].

Another important framework of urban principles is given in the publication *Cities for People in Practice* (2015) by Chris Busch and CC Huang [3]. This publication represents a guide for creating sustainable urban forms and transportation solutions to some of the most pressing challenges facing modern cities, including congestion, pollution, and urban sprawl [3]. The **8 Principles** are essential ingredients to sustainable, economically vibrant cities that deliver quality of life for their residents [3]. They are the following ones:

1. **Walk** - Develop neighborhoods that promote walking.
2. **Connect** - Create dense networks of streets and paths for non-motorized transit.
3. **Transit** - Build extensive, high quality transit with good connections between modes.
4. **Cycle** - Prioritize bicycle networks that offer protected lanes.
5. **Mix** - Zone for mixed-use neighborhoods.
6. **Densify** - Actively encourage greater density around major transit hubs.
7. **Compact** - Set growth boundaries and plan for compact regions with short commutes.
8. **Shift** - Increase mobility by regulating parking and road use.

Some of the principles given in these two frameworks are found suitable for conducting further analyses on the chosen location and discovering ways to apply them through suitable urban strategies on the analyzed case.

3. METHODS FOR DETECTING THE REAL PROBLEMS ON THE ANALYZED LOCATION

As it was explained earlier in the text: *environmental planning* is a decision-making process that addresses environmental parameters when creating human designed environments. Different analytical methods and various scientific findings were used in order to come up with precise answers regarding the real problems at the analyzed location:

- problems that the people gravitating in this area are facing;
- problems related with the climate of the city in the summer period, and
- air pollution problems of the city of Skopje.

Methods used in this research illustrate the present situation at the location, they are shown in

Table 1. Methods for detecting the real problems on the analyzed location

Methods used in this research	Current situation on location
1. Measuring the air temperature on this location during day and night in summer period from 15.07.2019 till 25.08.2019	On the day 13.08.2019 at 15h the air temperature near the asphalt surface on the location was 53.6ºC, 41ºC in the surrounding area and 34ºC in the shade.
2. Counting the trees present on the location in the current situation	- 7 trees medium height, type: deciduous trees, inside location - 10 trees medium height, type: deciduous trees, on the perimeter of the location
3. Percentage of high greenery, low greenery and asphalt surfaces on the location	- 2% high greenery (trees) - 0% low greenery (grass) - 98% asphalt surface
4. Analyzing the high and low greenery in the surrounding area	Very small percentage of greenery in the closer surrounding area, except the green belt of high greenery (deciduous trees) on the walking path near the river Vardar
5. Analyzing the type of high greenery on the location and closer surrounding area	- 99% deciduous trees - 1 % evergreen trees
6. Analyzing the air circulation present on the location and nearby	Strong air circulation is present in East-West direction, following the bank of the river Vardar
7. Analyzing how many days in the winter period the air pollution was above the limits of normal in the center of the city (informations were taken from the measuring unit at Mavrovka / Rektorat / Vrhoven sud)	From October 2018 till April 2019 most of the days had high air pollution: - over 100 pm 10 (the highest value of pm10 = 670), -over 100 pm 2,5 (the highest value of pm2,5 = 600), - high amounts of CO2 in the air
8. Analyzing the pedestrian walking routines on the present location	On the current situation pedestrians usually cross the location for finding shorter path by walking around the parked cars.
9. Interviewing the people that gravitate in this area	For the purpose of this research 50 people were interviewed. The profile of the interviewed people was the following: - residents in the surrounding buildings, people that work in this area, students from University Mother Teresa and USO Rade Jovcevski Korcagin, people that park their cars on this location and go shopping in GTC, tourists.

10. Analyzing the height of the built environment that surrounds the location	The height of the surrounding buildings is not very big because they were designed in consideration with the seismic characteristics of the city of Skopje. From the East side of the location, there are ground floor houses. From West and South side the buildings are usually 3 - 6 floors high buildings, only three buildings are taller (the highest building in the surrounding area is 13 floors high).

4. Sustainable urban principles and strategies applicable in the analyzed location

The conducted methods helped in detecting the real problems present on the analysed case. Based on this analyses and the analyses of the sustainable urban frameworks explained above in the text, the following *Table 2* was created. *Table 2* shows which urban principles from the previously mentioned frameworks are the most adequate for implementing on this location and through which precise sustainable strategies:

Table 2. Sustainable urban principles and strategies applicable in the analyzed location

No	Basic sustainable urban principles relevant for the analysed location	Sustainable urban strategies that can be applied on the analysed location
1.	**Improve air quality** / Reduce carbon emissions	Planting and sustaining large green surfaces (grass, trees, sessional flowers)
		Designing bicycle paths
		Designing pedestrian paths - Developing bigger areas in the centre of the city that promote walking
		Positioning air purifiers into the open public space.
2.	**Reuse of "brownfield" locations instead of new ones - Revitalization** of locations in the centre of the city that have lost their mining through time by adding new urban contents that enlighten the context of the nature and social cohesion -making it a greener and socially vibrant place.	Revitalization of the existing one level asphalt parking. Making a mix-used development plan for this location: designing public space + underground parking on several levels below the ground. Mixed-use development includes a variety of uses within a project, and creates opportunities for pedestrian-oriented design.
		Adding amphitheatres and squares - spaces that are fulfilling the interests of different groups of people related with: music, theatrical performances, open exhibitions, public gatherings, ect…
		Adding energy efficient artificial lighting of the public space - brings life on the location during the night and makes it interesting and safe for the visitors. It can be treated in a traditional manner, but also it can be treated in a form of artistic light installations.
		Public space designed as new LANDMARK of the city.
		Barrier-free access - Parking, walkways and ramps designed as friendly surfaces for people with disabilities
		Adding urban furniture that offers the visitors a pleasant accommodation for drinking coffee, eating lunch and providing space for rest and relaxation.
		Adding green surfaces and water surfaces that bring closer the nature to the residents and people that gravitate in this area
		Adding playgrounds for children made of natural materials (wood, rubber, ropes).
3.	**Lower of the summer temperatures**	Planting and sustaining large green surfaces (trees, bushes)
		Designing water surfaces that reduce the air temperature in summer period and bring calmness and relaxation.
		Using the winds by opening the location towards the river and using the passive cooling strategies for increasing the air circulation.

4.	DE-DESIGN URBAN PLANNING. **City planning should be people centred**, rather than design centred. A city is a constantly evolving organism, and city planning must take a broader perspective than the design of individual buildings.	Adding amphitheatres and squares - spaces that are fulfilling the interests of different groups of people related with: music, theatrical performances, open exhibitions, public gatherings, ect…
		Barrier-free access - Parking, walkways and ramps designed as friendly surfaces for people with disabilities
		Adding green surfaces and water surfaces that bring closer the nature to the residents and people that gravitate in this area
		Adding energy efficient artificial lighting of the public space that brings life in that place during the night and makes it interesting and safe for the visitors.
		Designing the public space as new landmark of the city will represent a new tourist attraction.
5.	REDEFINE CITY VALUE. A sustainable city depends on the attitude and behaviour of each urban individual and user. We must encourage a **sense of citizenship and individual responsibility towards sustainable values** rather than plain consumerism.	Designing urban furniture that will offer the visitors a pleasant accommodation and in the same time will provide space for throwing and selecting the garbage –RECYCLE BINS (for glass, plastic, cardboard/paper)
		Starting an initiative for planting and sustaining green surfaces (grass, trees, flowers) by the citizens. Developing responsibility towards sustainable values by involving schoolchildren and students from the local schools and university Mother Teresa, to plant the sessional vegetation. Also, involving the old people in this initiative will be human gesture that will be positive for their physical and mental health.
		Increase mobility by regulating road use: combining bicycle streets + pedestrian paths that are designed as friendly surfaces for people with disabilities.
		Increase mobility by regulating parking of cars and bicycles. Designing the parking surfaces as underground stating that humans are more important than cars so they are the ones that should receive the location that offers sun, air, greenery and water, not the vehicles.

5. SUSTAINABLE "GREEN" FEATURES

After the basic conceptual framework of sustainable design was analysed in order to indicate which of the mentioned principles and strategies can be applied on the analysed case (*Table 2*), it came evident that some of the sustainable strategies are repeating or are very similar. In order to define adequate sustainable strategies that will have ecological and socio-environmental qualities [2,3], the so called "green" features are presented in *Table 3*. "Green" feature in this research represents a sustainable quality of a particular strategy or urban measure that can improve the air quality, lower the summer temperatures, revitalize the location, improve the social cohesion, de-design urban planning and redefine the city values. These "green" features can assist in determining project's sustainability values.

Table 3. Sustainable urban principles and strategies applicable in the analysed location

Nr	**GREEN FEATURES:**	**Referring to**
1.	Planting and sustaining large green surfaces.	VEGETATION
2.	Starting an initiative for planting and sustaining green surfaces (grass, trees, flowers) by the citizens.	
3.	Using the local winds and the passive cooling strategies for increasing the air circulation.	AIR
4.	Positioning air purifiers into the open public space.	
5.	Designing water surfaces that reduce the air temperature in summer period and bring calmness and relaxation.	WATER

4.	Revitalization of existing "brownfield" locations by making a mix-used development plan that includes a variety of uses within a project and creates opportunities for pedestrian-oriented design.	MOBILITY
5.	Developing bigger areas in the centre of the city that promote walking and gathering.	
6.	Prioritize bicycle networks - Increase mobility by regulating road use: combining bicycle streets + pedestrian paths.	
7.	Barrier-free access - Parking, walkways and ramps designed as friendly surfaces for people with disabilities.	
8.	Increase mobility by regulating parking of cars and bicycles. Designing the parking surfaces as underground structures for cars and bicycles.	
9.	Adding playgrounds for children made of natural materials (wood, rubber, ropes).	SOCIAL COHESION
10.	Adding energy-efficient artificial lighting in the public space - brings life on the location during the night and makes it interesting and safe for the visitors.	
11.	Adding amphitheatres and squares - spaces that fulfil the interests of different groups of people related with: musical and theatrical performances, open-air exhibitions, public gatherings…	
12.	Designing urban furniture that will offer the visitors a pleasant accommodation, socialization and in the same time will provide space for throwing and selecting the garbage – recycle bins (for glass, plastic, cardboard/paper)	
13.	Designing the public space as new landmark of the city will represent a new tourist attraction.	

5. POSSIBLE WAYS OF APPLYING THE DEFINED SUSTAINABLE "GREEN" FEATURES

In order to test the possibility of application of the defined "green" features, *Table 2* was explained to the students taking the course Urban studio 1 (2018/2019) at Faculty of Architecture and Civil Engineering at UMT, as guidelines for designing their own solutions regarding this location. Later, the *Table 3* was used by the teaching staff, to evaluate the project's sustainability value(s) of all the seven finished student projects. The presence of one or more of these "green" features in the presented students' projects determined the project's sustainability value. All of the students' projects have incorporated more than 7 from the 13 "green" features. After discussion with the students it was concluded that *Table 2* helped them think more about the environmental, social and ecological problems present at the location, rather than just coming up with visually interesting design solutions. The given guidelines helped them brainstorm and find solutions that can be characterized as sustainable concepts (Figures 3, 4, 5 and 6).

Figure 3: Student project 1: Hekuran Musilu, video source:

Figure 4: Student project 2: Ali Allmala

Figure 5: Student project 3: Jeta Ajdari

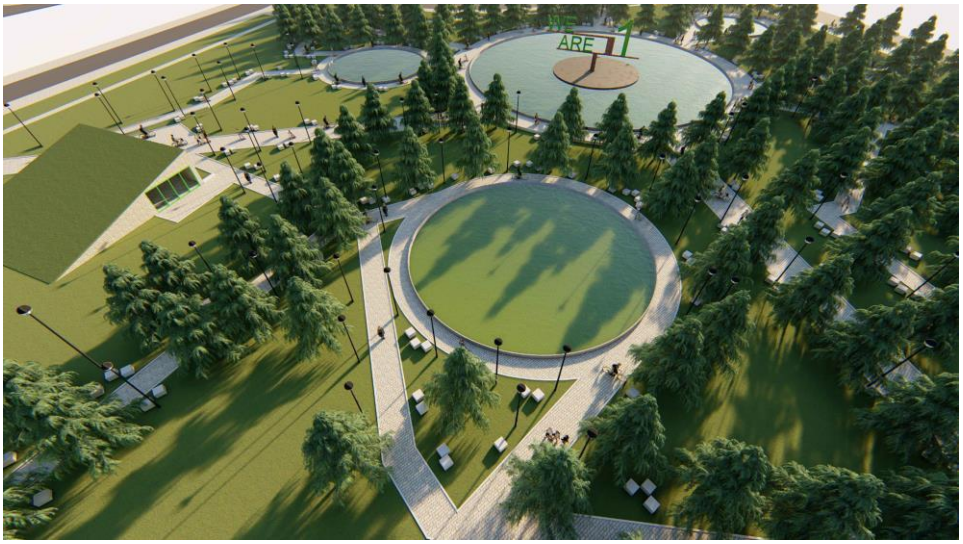

Figure 6: Student project 4: Genci Hani

4. CONCLUSION

Cities should function in harmony with nature rather than in opposition to it. Cities are potentially environmentally friendly, as they have the capacity to become self-sustaining and energy producing instead of energy consuming. To realize this potential, we must develop the concept of bringing the nature back to the city. We need to create awareness among the young architects, urbanists and city users to think about resource reduction and motivate them to change their behavior and consumption patterns.

The goal of this research was to show that if good analytical and methodological procedure is done before starting a project, then a solid platform is created for providing good guidelines in the process of designing and making quality urban design projects. The sustainable urban revitalization should be understood as multidisciplinary approach: analyzing all the possible aspects important for certain location in order to achieve quality solutions that will serve well for present and future generations enabling them to live in healthy, ecological, sustainable and socially vibrant environments.

The presence of the elaborated "green" features in any urban project done for this or similar location assists in determining project's sustainability value.

Benefits of sustainable urban planning in the city of Skopje and other cities facing similar problems should be:

- Improving the air quality,
- Lowering the high summer temperatures resulting from the large asphalt and concrete surfaces,
- Improving mobility and walkability,
- Reducing carbon emissions,
- Attracting out-door activities (such as walking, bicycling, exercising, gathering, playing, performing…)
- Improving social cohesion,
- Supporting a harmonious and prosperous society.

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Measuring Performance in Safety and Health Management

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ABSTRACT

Objectives: Incidence rate (IR) for non-fatal accidents at work is a metric that can be used as a tool to compare a company's safety performance against a national average, or with IR's in other countries, as well as safety benchmark to measure performance with other companies in the same sector.

As the main objectives of this study, a statistical analysis of accidents with lost time in 10 construction companies (with 25-35 employees on average) in Republic of North Macedonia in the period 2017-2018 was made and IR for this period was calculated.

Methods: The IR values in the analyzed companies are calculated according to the appropriate formula, and the obtained annual figures for 2017 and 2018 are compared with official data published in EU countries in the past years.

Results: The comparison made, shows that we still have a high rate of injuries at work, especially in the construction industry. This situation is further complicated by the fact that many of non-fatal accidents at work both in our country and in some EU countries, remain unreported and unregistered, leading to unreal data for the injuries.

Conclusions: Thus, a possible comparison of these terrain data with the data for IR from the annual reports of accidents at work published by Macedonian Occupational Safety and Health Association (MOSHA) for the relevant years would be unrealistic. Consequently, reducing the IR and raising the level of awareness to emphasize the ultimate importance of occupational health protection at all levels, should be the primary goal of the risk management system.

Keywords: *accident, incidence rate, measuring performance, risk management*

1 INTRODUCTION

Unsafe and unhealthy working conditions still cause severe human and economic loss, even in the twenty-first century [1]. Social and cultural development, economic growth, national income, health and safety expenditures, and unemployment are important factors in causing occupational accidents, especially in developing countries [2].

Occupational and environmental conditions, such as type of business, shift work, working hours, risk management and establishment size have triggered occupational accidents [2]. According to the International Labour Organization (ILO) data, every 15 seconds, a worker dies because of a work-related accident or disease. There are more than 2.78 million deaths per year, or 6300 people die as a result of occupational accidents or work-related diseases every day [3]. Also, many of these accidents, about 374 million non-fatal work-related injuries annually, resulting in more than 4 days or extended absences from work, so the economic burden of poor occupational safety and health practices is estimated at 3.94% of global gross domestic product every year [4].

Increasing in Occupational Safety and Health (OSH) implementation experience, according to some researchers, clearly leads to a decrease in accidents at work, and emphasizes the relationship between work accidents and experience [2].

In this direction, measuring performance of safety and health executive system considers maintaining and improvement in OSH, monitoring of accidents, ill health and incidents, assessing specific plans and objectives achievement, providing the decision-making to improve risk control, as well as examining the extent of compliance with standards. [5].

Regular monitoring can also be usefully supplemented by random observation including senior managers, periodic surveys of employees' opinions on key health and safety aspects, and inspections by safety representatives or other employee representatives. These measures reinforce positive action by rewarding "works well done" rather than penalizing post-event failure, but also increase the motivation for continuous improvement and obtain additional benefits [5].

Therefore, "increasing the scope and effectiveness of the investigation of causes of occupational accidents and diseases, and identification and implementation of preventive measures", is the first, and probably the most important objective of the code of practice on recording and notification of occupational accidents and diseases (ILO, 1996) [6]. The ILO has adopted international standards aimed at achieving continual improvement in OSH performance and creating a successful OSH management that includes reporting and notification of occupational accidents and diseases [4].

1.1 Measuring performance safety and health executive system

Every year, companies with 10 or more employees need to report to Occupational Safety and Health Administration (OSHA) their incident rates, types of incidents and lost/restricted work days [7]. Accordingly, all work-related deaths, illnesses, and injuries with a loss of consciousness, restriction of work or motion, permanent transfer to another job within the company, or that require first-aid or some type of medical treatment, can be considered as recordable incidents. Furthermore, recordable incidents rates are used by OSHA to determine how companies from different sectors like manufacturing, food

processing, textiles, machine shops, etc., are compared to each other with regard to the past safety performance [7].

1.2 Incidence rate (IR)

Incidence Rate (IR) is only one of many tools that can be used for measuring performance. It is a metric that relate the number of new cases of occupational injury to the number of workers exposed to the risk [6]. It can be used to compare a company's safety performance against a national average, and also safety benchmark to gauge performance with other companies in the same business sector [7].

Published safety and health executive IR [5], give the number of full-time workers in a group of 100000 employees injured over a year and the formula for calculating non-fatal IR makes no allowances for variations in part-time or overtime employment [8]. The following equation (eq.1) takes into account recommendations regarding indicators and methods of standardization of data published by Eurostat (statistical office of the European Union), based on the European Statistics on Accidents at Work (ESAW) project [9]:

$$IR = \frac{Number\ of\ \ time-lost\ accidents}{Number\ of\ \ employees} \times 100000 \qquad (1)$$

The figures from this annual calculation need to be adjusted pro-rata if they cover a shorter period, and such shorter-term rates should not be compared with the national annual rates, but only for exactly similar periods [5].
The difficulty in this measure stems from the lack of an appropriate denominator number which is usually the total number of persons employed or insured, because those who are insured but not working, as well as groups not covered by occupational injury statistics, can be included. Ideally, this figure should be an average number of workers in the reference group throughout the reference period (eq.2), [6].

$$IR = \frac{Number\ of\ \ time-lost\ accidents}{Average\ number\ of\ \ employees} \times 100000 \quad (2)$$

In order to avoid distortions which may be caused in the IR calculations by part- and full-time employees and by overtime working, some parts of industry, especially the construction sector, prefer to calculate accident Frequency Rate, by counting hours worked, rather than the number of employees [10].

1.3 Accidents at work in European Union (EU) and in Republic of North Macedonia

In 2015, there were, on average, 1513 non-fatal accidents per 100000 persons employed across the EU member states. In accordance with Eurostat data [11], IR's for non-fatal accidents range from less than 100 accidents per 100000 persons employed in Bulgaria and Romania, to more than 2750 per 100000 persons employed in Spain, Portugal and France. So, the highest rate of 3160 non-fatal accidents per 100000 persons employed was recorded in France (Fig.1).

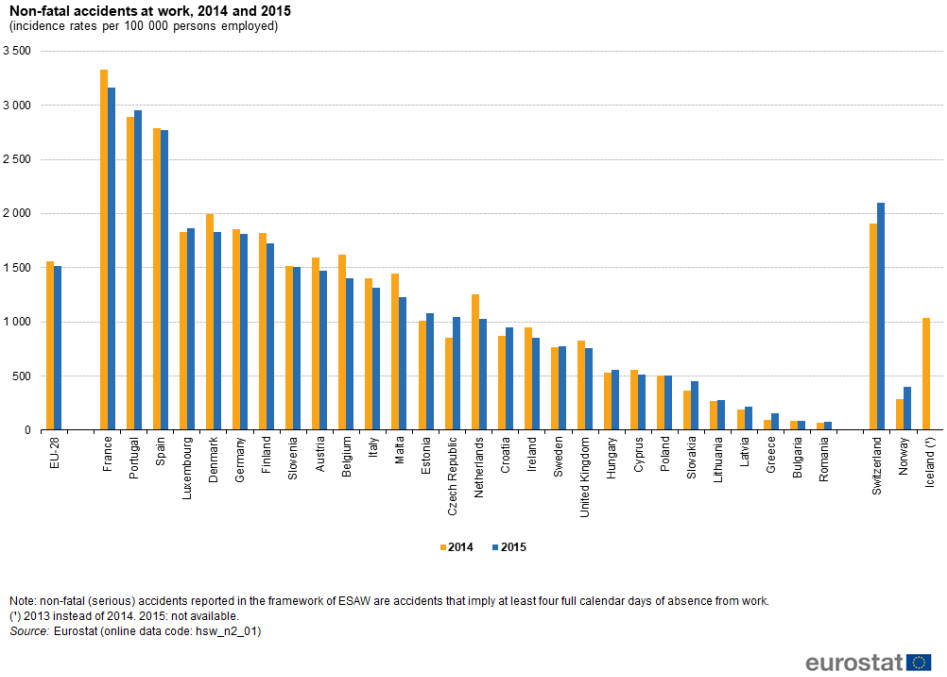

Figure 1: Non-fatal accidents at work by economic activity, EU-28, 2010-2015 (Source: Eurostat)

Particularly low IR's for non-fatal accidents that were recorded in Bulgaria and Romania may reflect reporting systems that offer no, or little financial incentive for victims to report their accidents [11].

In the Republic of North Macedonia, most of all accidents that had happened in 2018, occurred exactly in the construction industry, so out of a total of 157 injuries, 39 or 24.84 % were in this sector [12]. In the period 2010-2018, [12-20], the highest number of non-fatal accidents, 134, occurred in 2017. There is a slight decrease at 124, in 2018 (Table 1).

Table 1: Non-fatal accidents at work and IR in the Republic of North Macedonia (2010 to 2018)

Year	All sectors in North Macedonia		
	Total number of non-fatal accidents	Total number of employees	non-fatal IR
2010	85	-	-
2011	79	-	-
2012	116	674418	17.20
2013	70	685479	10.21
2014	88	696046	12.64
2015	105	715758	14.69
2016	94	723550	13.00
2017	134	745206	17.98
2018	124	759054	16.33

According to the official data on accidents at work published in annual reports for fatalities, injuries and accidents at work by Macedonian Occupational Safety and Health Association (MOSHA), the non-fatal IR values fluctuate between 10.21 for 2013, [16] to maximum value of 17.98 for 2017 [20]. In comparison with 2017 (Table 1), slight decrease to 16.33 was recorded for 2018 [12].

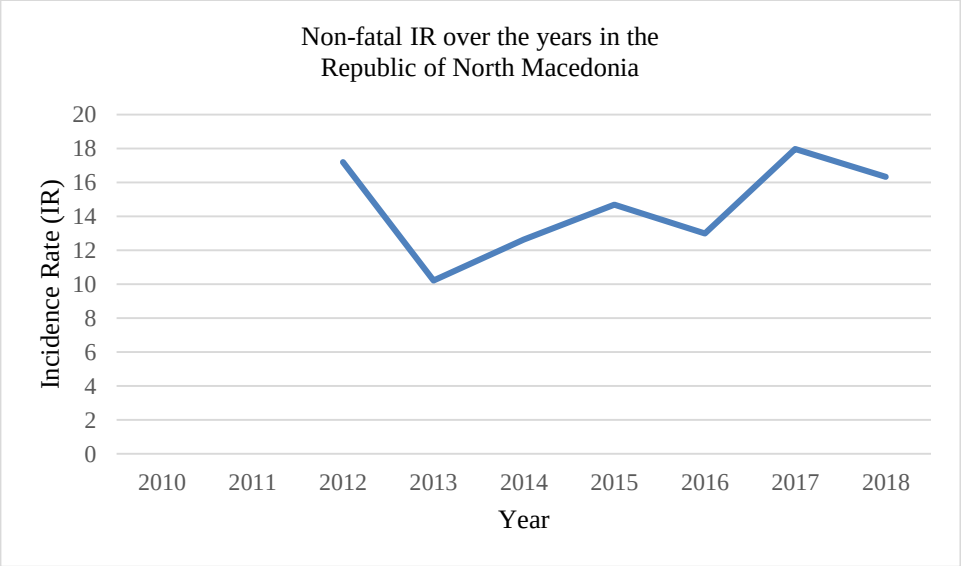

Figure 2: Non-fatal IR in the Republic of N. Macedonia over the years

1.4 Practical experiences

As the main objectives of this study, a statistical analysis of accidents with lost time in 10 small or medium-sized construction companies (with 25-35 employees on average) in Republic of North Macedonia in the period 2017-2018 was made.The original data for non-fatal accidents collected from terrain work in the construction sector, were used to calculate IR's according to the appropriate formula (eq.2) for the same period (Table 2).

Table 2: Non-fatal accidents at work and injury IR in the construction sector for 2017

Month	TotalNo. ofemployees (average)	No. ofaccid. withdayslost < 3 days	No. ofaccid. withdayslost >3 days	Monthlynon-fatal Incidence Rate (IR)	Annualnon-fatalIncidence Rate (IR)
Jan 2017	277	1	0	361.01	**6415.40**
Feb 2017	292	1	0	342.47	
Mar 2017	332	1	0	301.20	
Apr 2017	325	1	0	307.69	
May 2017	341	3	0	879.77	
Jun 2017	338	2	0	591.72	
Jul 2017	298	1	0	335.57	

Aug 2017	284	2	0	704.23	
Sep 2017	329	2	0	607.90	
Oct 2017	316	1	0	316.46	
Nov 2017	321	0	2	623.05	
Dec 2017	288	1	2	1041.67	
TOTAL (average) for 2017	311.75	16	4	534.40	

The situation when there are no reasonable circumstances, under which the injured employee could return to meaningful work, can be defined as lost days or inability for work [7]. Monthly non-fatal IR was calculated with adjusting pro-rata for the shorter period, by using the total number of accidents with lost days and the average total number of employees, within a month. In 2018, it can be noted that there is a slight decline for annual IR compared to 2017, but these are still very high values which rightly rank the construction sector in the riskiest industries (Table 3).

Table 3: Non-fatal accidents at work and IR in the construction sector for 2018

Month	TotalNo. ofemployees (average)	No. ofAccid. withdayslost < 3 days	No. ofAccid. withdayslost >3 days	Monthlynon-fatal Incidence Rate (IR)	Annualnon-fatalIncidence Rate (IR)
Jan 2018	301	0	0	0.00	
Feb 2018	307	3	0	977.20	
Mar 2018	344	1	2	872.09	
Apr 2018	346	2	0	578.03	
May 2018	326	1	1	613.50	
Jun 2018	311	1	0	321.54	
Jul 2018	320	1	0	312.50	
Aug 2018	347	1	0	288.18	**5856.61**
Sep 2018	325	2	2	1230.77	
Oct 2018	342	0	0	0.00	
Nov 2018	307	1	0	325.73	
Dec 2018	317	1	0	315.46	
TOTAL (average) for 2018	324.42	14	5	486.25	

The obtained data for non-fatal IR annually (6415.40 for 2017 and 5856.61 for 2018) are compared with the last EU statistics on OSH for annual non-fatal IR in the EU member states for the years 2014 and 2015. This comparison shows that we have a double annual IR even higher than France's, and several times higher than other EU countries [11].

Unfortunately, a comparison between calculated values for IR and our national values (17.98 for 2017 and 16.33 for 2018) published in the annual reports of MOSHA, is impossible to make.

2 Results and discussion

The comparison made with EU countries, shows that we still have a high rate of injuries at work, especially in the construction industry. This situation is further complicated by the fact that many of non-fatal accidents at work, both in our country and in some EU countries, remain unreported and unregistered, leading to unreal figures for IR's, the types of injuries and the reasons for their occurrence [11]. Employer under-reporting of injuries can be a serious problem that particularly disrupts the systematic approach and commitment to continuous improvement [5]. As a reflection of under-reporting, the phenomenon of low non-fatal IR's can be considered as a consequence of a lack of commitment, knowledge, experience or lack of financial resources [21]. The majority of deaths, in accordance with all of the data analyzed, occurred especially on projects undertaken by small or medium-sized enterprises as a result of insufficient implementation of appropriate safety rules or management procedures, as well as lack of training for the employees to carry out these practices [22]. In order to create a rational budget and set realistic goals without compromising safety, creating of more jobs and better quality of work conditions has become one of the main objectives of social policies for every government [23]. However, low annual rates, even for a period of few years, do not guarantee that risks are effectively controlled and will not lead to deaths, injuries or illnesses, until a low probability of accidents is measured despite the presence of major accident hazards [5].

Definitively, these indicators for non-fatal accidents do not mean that the companies have no injuries at work, but that they do not report them. However, the situation with IR's for fatal accidents is different, because it is impossible to avoid reporting fatal accidents [11].

3 Conclusion

Improving productivity and coherent policies to protect workers from occupational hazards and risks is closely related to the implementation of practical approaches and tools that will help establish, implement and improve occupational health and safety management systems in order to reduce injuries related to work, poor health, illnesses, incidents and deaths.

Incidence rates (IR's), as one of many parameters that can be used for measuring performance, are indicators of the incidents occurred, as well as their severity. In addition, the data for IR can be used for determination of the most common types of injuries, identifying economic activities where occupational injuries occur along with their extent and severity, and consequently developing different types of assistance programs in order to indicate important areas to which attention should be paid. These

areas should be the subject of more detailed investigation, in which more information could be gathered regarding the chain of events leading to an accidents and injuries. Consequently, reducing the IR and raising the level of awareness to emphasize the ultimate importance of occupational health protection at all levels, should be the primary goal in each risk management system.

Therefore, collecting independent information on the efficiency, effectiveness and reliability of the total OSH management system is the basic platform for drawing up plans for corrective actions.

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Association between salivary dehydroepiandrosterone, dehydroepiandrosterone sulfate and psychological stress in healthy younger adults: a systematic literature review

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ABSTRACT

Dehydroepiandrosterone (DHEA) and dehydroepiandrosterone sulfate (DHEA-S), have been implicated as playing a protective role against stress. This systematic literature review examines the association between self-reported psychosocial stress, DHEA, DHEA-S and cortisol in healthy young adults 18 to 30 years old, by using the PRISMA Statement for reporting systematic reviews. A total of 111 studies were revealed through the searches in different databases. 26 studies were retained for further evaluation and only six met the inclusion criteria. Risk of bias in all six studies was evaluated to be "high".

Association between cortisol, DHEA, DHEA-S and self-reported psychological stress depended on applied stressors. Apart from the type of stress stimulus involved, diversity in study designs, sampling procedures and different self-reported stress measures may be plausible explanation for these observations. Positive emotions in association with DHEA and DHEA-S concentrations should be assessed alongside negative emotions in both sexes.

Keywords: *Dehydroepiandrosterone; Dehydroepiandrosterone Sulfate; Saliva; Stress; Younger Adults; Systematic Review*

1. Introduction

It is well accepted that the overall balance of people's positive and negative emotions can be predictive of their subjective wellbeing, particularly under stressful conditions. Certain biomarkers—notably dehydroepiandrosterone (DHEA) and dehydroepiandrosterone sulfate (DHEA-S) have been implicated as playing a protective role against psychologicals stress (Bardi, Koone, Mewaldt, & O'Connor, 2011; Lennartsson, Sjörs, & Jonsdottir, 2015; Lennartsson, Theorell, Rockwood, Kushnir, & Jonsdottir, 2013). DHEA is an end product of hypothalamic–pituitary–adrenal (HPA) axis activity which is released by the adrenal cortex in response to psychosocial stress in parallel with cortisol (Maninger, Wolkowitz, Reus, Epel, & Mellon, 2009). Adverse effects of cortisol on health, including hypertension, psychosomatic and psychiatric disorders, (Allen, Kennedy, Cryan, Dinan, & Clarke, 2014; Foley & Kirschbaum, 2010; Hellhammer, Wüst, & Kudielka, 2009) are well established. However, the mechanism of action of DHEA and its sulfated form DHEA-S is not well understood.

DHEA and DHEA-S are the most abundant steroid hormones in both sexes (Grimley Evans, Malouf, Huppert, & Van Niekerk, 2006). They are precursors of sex hormones and may play an anti-aging role (Heaney, Phillips, & Carroll, 2012). Levels change across childhood, adolescence and adulthood, with peak increases in the 20s and 30s (Ahn, Lee, Choi, Kwon, & Chun, 2007; Goodyer, Park, Netherton, & Herbert, 2001) and steady declines of an average of 1–4 % between the ages of 40 and 80, with the lowest point at around 65 to 70 years (Maninger et al., 2009). It is believed that the enzymatic activity of sulfo-transferase and sulfatase inter-converts DHEA and DHEA-S in many peripheral tissues (Maggio et al., 2015) and that DHEA-S represents a pool for biosynthesis of DHEA (Lennartsson, Kushnir, Bergquist, & Jonsdottir, 2012). Apart from the adrenal glands, DHEA and DHEA-S are synthesized in the brain and are referred to as "neurosteroids" and putative biomarkers of wellbeing (Maninger et al., 2009).

Preclinical evidence suggests that DHEA and DHEA-S have anti-glucocorticoid and antitoxin action as well as anabolic, regenerative and neuroprotective properties (Taylor et al., 2012) that are age-specific (Grimley Evans et al., 2006). Further, DHEA and DHEAS is regarded as having a primary role, along with cortisol (Maninger et al., 2009) in allostatic maintenance or allostasis, our normal physiological regulatory system fluctuations for counteracting environmental demands (Epel, 2009). DHEA and DHEAS are amongst the ten biological markers of allostatic load including epinephrine, norepinephrine, high density lipoprotein, total cholesterol waist–to–hip– ratio, glycosylated hemoglobin, systolic and diastolic blood pressure. It is believed that they have anabolic, regenerative, neuroprotective, anti-glucocorticoid properties and direct role on mental health (Maninger et al., 2009).

The relationship between DHEA and DHEA-S and psychosocial stress has been investigated in many studies that have involved respondents of different age ranges; the results of these studies have been inconsistent. As suggested by previous research DHEA counteracts the negative effect of cortisol during stress (Lennartsson et al., 2012). Several reviews on the

association of DHEA and DHEA-S with age-related diseases and cognitive function in healthy elderly have reported reduced, elevated or no changes in hormonal levels (Maggio et al., 2015; Maninger et al., 2009). These conclusions, however, should be taken cautiously because the aforementioned studies were conducted on subjects from as early as adolescence (Goodyer et al., 2001) to clinical or healthy old age (Grimley Evans et al., 2006) and on healthy mixed-aged samples (Lennartsson et al., 2012; Vedhara et al., 2002) who were experiencing age-related changes in DHEA and DHEAS levels. Hence, the damaging effects of cortisol during stressful encounters may have been greater in these subjects than in younger adults who have higher DHEA and DHEAS levels and more protection against the damaging effects of cortisol (Grimley Evans et al., 2006).

Age is one of the most important factors associated with prevalence, onset and course of mental disorders (Friis & Sellers, 2014; Organization, 2001). Evidence suggests that most mental disorders begin in youth (12 to 24 years of age) (Patel, Flisher, Hetrick, & McGorry, 2007); up to 25 % and 50% of lifetime mood disorders appear by age 18 and 30 years, respectively (Owens et al., 2014). In view of the aforementioned evidence, the objective of this paper is to review the literature on whether levels of DHEA and DHEA-S in healthy younger adults, age range 18 to 30 year, change in response to psychological stress, and to review whether in this group of healthy young adults there is association between cortisol, DHEA and DHEA-S measured in saliva and self-reported psychological stress.

2. Methods

2.1. Eligibility criteria for considering studies in this review

This systematic review was conducted according to the PRISMA Statement for reporting systematic reviews and meta-analyses (Liberati et al., 2009)**.** The decision to include studies in this review was based on the following distinctive characteristics of HPA axis hormone secretion:

a) Participants were healthy younger adults (age 18 to 30 years) not diagnosed or suffering from systemic disease such as diabetes, thyroid disease or known psychiatric disease, and were not taking medications that may have affected the HPA - axis function; b) Only studies that assessed measurable self-reported psychological stressors were included in the review (Burke, Davis, Otte, & Mohr, 2005). Studies that used physical activity as an inducer of HPA axis activity were excluded due to influence of physical, strenuous exercise influence on HPA axis (Gatti & De Palo, 2011; Tak et al., 2009); c) Studies were included if outcome assessment included evaluations of subjective stress and negative affect of recognized validity and reliability and salivary cortisol, DHEA, DHEA-S; d) All studies that had assessed association between salivary cortisol, DHEA, DHEA-S and psychosocial stress in healthy younger adults were included in the review.

2.2. Information Sources

A search of all articles published in the English Language in the EBSCOhost (Medline, Psych Info, CINAHL Plus) online database was conducted with no limiters. The PubMed database was also searched and the following limiters were activated: Publication dates: Jan 1966–Dec 2014, "English Language" and "Humans." Reference lists of retrieved papers were also searched for potential studies. The search strategy included the terms "saliva," "cortisol," "DHEA", "DHEAS", "dehydroepiandrosterone" and "stress". The search on the PubMed database was updated on 22 November 2019, the following key words and limiters: DHEA, DHEA-S, saliva, stress, cortisol, and dehydroepiandrosterone and "psychological stress"; limiters activated: Publication dates: 1 January, 2015 – 22 November, 2019.

2.3. Study Selection

UDSH reviewed the retrieved studies. If the title and the abstract clearly indicated that the study had examined the association between psychological stress and salivary DHEA and DHEAS in healthy participants, it was considered a potential study for the review. When generalized terms were used in the title, the decision on the study's eligibility was based on the full text. In the second stage, the full texts of the potential studies were screened independently by UDSH and SA, and their eligibility for review marked as "yes," "no" or "maybe." The agreement on study inclusion and exclusion between the two reviewers was 100%.

2.4. Data Items and Assessment of Risk of Bias in Individual Studies

A data extraction form was used independently by UDSH and SA. The risk of bias in included studies was evaluated with an adapted version of QUADAS-2, a tool for quality assessment of diagnostic accuracy studies in systematic reviews. We used the QUADAS-2 tool because it is more informative method of bias rating than numerically specifying the methodological components into a single number (Liberati et al., 2009; Whiting et al., 2011) and has been used in a previous systematic review of the HPA axis (Knorr, Vinberg, Kessing, & Wetterslev, 2010).

The four domains discussed in QUADAS-2 are: participant selection, index test, reference standard and flow and timing (of the participants and index tests and reference standard). The overall risk of bias was rated as "low," "high" or "unclear." The risk of bias was judged as low if all the signaling questions in that domain were answered "yes"; potential for considerable bias was recognized if any signaling question in one or more domains were answered "no" (Whiting et al., 2011).

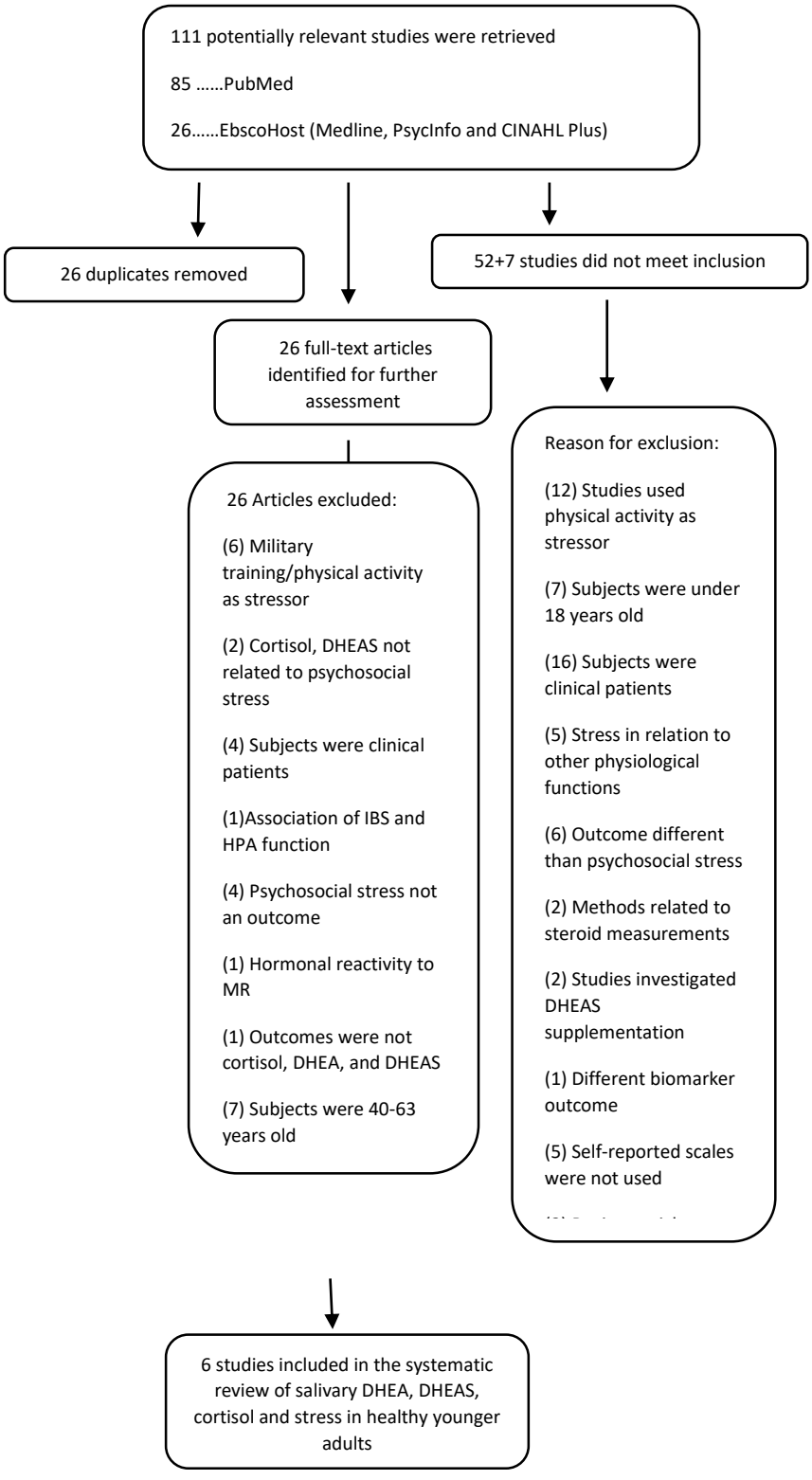
3. Results

3.1. Study Selection

Our first search carried out from January 1966 to December 2014, yielded a total of 93 articles, of which 65 were sourced from PubMed and 28 from EBSCOhost (Medline, PsychInfo and CINAHL Plus). 73 studies were left to review after three duplicate studies from EBSCOhost and 17 duplicates from PubMed were automatically deleted. After reviewing the titles and abstracts of 73 studies, 52 were excluded in the first stage and 21 full text papers were initially selected for review in the second stage. At the second stage, a further 17 studies did not meet the inclusion criteria and were discarded. Four studies were included in the full review: two experimental studies (Izawa et al., 2008; Shirotsuki et al., 2009), one prospective observational (Izawa et al., 2012) and one cross – sectional study (Petros, Opacka-Juffry, & Huber, 2013).

Due to limited number of studies that met the inclusion criteria of this review, we did not exclude any studies that assessed association between blood levels of DHEA and DHEA-S reaction to psychological stress in healthy younger adults 18 to 30 years old. We extended our research to studies that investigated healthy adults 18 to 39 years old. However, we did not find any additional studies that met the inclusion criteria of this review. The updated literature search on PubMed on 22 November 2019, revealed 20 studies. Of these, two experimental studies (Lam et al., 2019) met the inclusion criteria for evaluation in this review. A short description of the included studies is shown in Table 1.

Figure 1. Study Flow Chart for both data searches



Abbreviation: HPA, hypothalamic–pituitary–adrenal axis; DHEA, dehydroepiandrosterone; DHEAS, dehydroepiandrosterone sulfate; IBS, irritable bowel syndrome; MR, magnetic resonance.

3.2. Study Characteristics

Six studies with a total of 208 participants (119 males; 89 female; mean age = 19.5 ± 3.3 to 29 ± 5.7 years) met the inclusion criteria (Table 1). The sample size in each study varied from 22 to 61 participants. Exclusion criteria including age, gender, chronic illnesses, major psychiatric disorders or use of medication that may affect HPA axis function were described in all the included studies in the review. Two laboratory studies investigated the association between cortisol, DHEA and psychosocial stress response to acute laboratory stress test (Trier Social Stress Test, TSST) in healthy male (Izawa et al., 2008; Shirotsuki et al., 2009). Lam et al. (2019) examined associations between life stress and DHEA responses to laboratory – based stress task called Trial Social Stress Test for Groups (TSST-G) (Lam et al., 2019). Whereas, Prall et al. (2017) investigated cortisol, DHEA and DHEAS response to modified Trial Social Stress Test (mTTS) in healthy male (Prall et al., 2017). All participants were healthy, young, non-smoking subjects, and none were on medication that may have altered HPA axis activity. Shirostuki et al. (2009) used the Short Fear of Negative Evaluation scale (FNS) score to prescreen the participants; only the higher socially anxious (HA group) and lower socially anxious (LA group) participants were included in the study; participants did not meet the clinical criteria for Social Anxiety Disorder (SAD) (Shirotsuki et al., 2009).

The other two included papers in the review were field studies that investigated the HPA axis response to prolonged stress. Izawa et al. (2012) investigated longitudinally the effects of prolonged stress among 33 healthy female students during and after two weeks of teaching practice (period of stress) on salivary cortisol, DHEA levels and cortisol/DHEA ratio (Izawa et al., 2012). Whereas, Petros et al. (2013) investigated the association between salivary cortisol, DHEA-S, resilience and depression in a non-clinical community population (Petros et al., 2013). Of 196 participants, 32 (12 males and 20 females, mean age 29±5.7 years) were included in the biomarker study based on the Centre for Epidemiologic Studies Depression Scale (CED – D – 10) score, participants who were included in this study did not meet the clinical criteria for depression. All six studies applied a variety of standardized self-reported psychometric scales. Quantitative measurements of salivary cortisol and DHEA in all studies were done by the enzyme-linked immunoassay method using ELISA/EIA Kit (Salimetrics LLC, USA). Based on the evaluation of the four domains, the risk of bias in the reviewed studies was considered as “high.”

3.4. Results of Individual Studies

A short narrative description of the included studies in the review is given in Table 1. Two studies reported that the lifetime stress exposure (Lam et al., 2019) and high social anxiety (Shirotsuki et al., 2009), were associated with blunted cortisol response, and blunted cortisol and cortisol to DHEA ratio to acute stress, respectively; one study reported positive association between DHEA response to acute stress and lifetime stress exposure (Lam et al., 2019); two studies (Lam et al., 2019; Prall et al., 2017) reported no association between DHEA, and DHEA and DHEA-S and perceived stress, respectively. Negative association between DHEA and cortisol/DHEA with negative mood was reported by Izawa et al. 2008 (Izawa et al 2008). The association between DHEA-S and depression was negative (Petros et al., 2013). Whereas DHEA-S and resiliency were positively associated (Petros et al., 2013). One study found no association between cortisol, DHEA and prolonged psychological stress (Izawa et al., 2012).

Table 1. Characteristics of the reviewed studies: Association between physiological and subjective stress measures.

4. Discussion

In this review we have summarized the available evidence on the effects of psychological stress on DHEA and DHEA-S in healthy younger adults, 18 to 30 years old. The narrow age range was defined due to effects of age on DHEA (Prall et al., 2017). The risk of bias in all studies included in the review was evaluated as “high”.

Evaluation of studies in this paper showed that as part of healthy stress response, levels of cortisol, DHEA and cortisol/DHEA ratio were altered by applied psychological stressors. Further, results showed evidence for an association between DHEA and self-reported psychological stress, cortisol and cortisol/DHEA ratio in healthy young adults. It was found that these association may vary between biological outcomes and different stressors. Apart from the type of stressor (Prall et al., 2017), one plausible explanation for these observations may have been due to differences in the duration of psychological stressors (Michaud, Matheson, Kelly, & Anisman, 2008; Weekes et al., 2006). Acute laboratory stressors such as the TSST (Kirschbaum, Pirke, & Hellhammer, 1993) and naturalistic stressors (Bardi et al., 2011; Preuß, Schoofs, Schlotz, & Wolf, 2010) may not trigger the same increase in hormonal levels (Wolfram, Bellingrath, Feuerhahn, & Kudielka, 2013).

	Sample (*n*, age)	Stressor	Assessment of subjective experience		Method of cortisol, DHEA, DHEAS measurement	Results
			Assessment frequency and precise time	Assessment tool		
(Shirotsuki et al., 2009), Japan	22 male college students Mean age (21.6±2.46)	TSST (Kirschbaum et al. 1993): 10-min rest before the stress tasks; 10-min preparation; 5-minute speech in front of two assessors; 5-min serial subtraction; 30-minute recovery	Repeated 7 times relative to start of TSST: after cessation of baseline, preparation, speech, arithmetic task and 20, 30, 40 min after the start of recovery.	VAS that assesses six moods: (Tension/Anxiety, Anger/Hostility, Depression, Vitality, Fatigue, Confusion)	Salivary cortisol and DHEA were collected by passive drooling 7 times relative to the start of the TSST.	Reduced cortisol response to TSST in LA group (social anxiety) and no significant difference in the DHEA response to TSST between the HA and LA groups
(Izawa et al., 2008), Japan	33 male college students Mean age (22.6±3.6)	TSST: Introduction; 10-min preparation; 5-min public speech; 5-min mental arithmetic task in front of two people	Repeated 7 times relative to start of TSST: after cessation of baseline, preparation, speech, and mental arithmetic task and 10, 20, 30 min after the start of recovery.	VAS that assess six moods: (Tension/Anxiety, Anger/Hostility, Depression, Vitality, Fatigue, Confusion; State Trait Anxiety Scale)	Salivary cortisol and DHEA were collected by passive drooling 7 times relative to start of TSST.	Negative mood was negatively associated with DHEA levels during the recovery period ($R^2 = 0.146$, $\beta = -.0.382$), and positively associated with cortisol/DHEA ratio during the preparation period (PR) ($R^2 = 0.165$, $\beta = 0.407$, $p<0.05$) and after TSST ($R^2 = 0.209$, $\beta = -.0.457$, $p<0.05$)
(Lam et al., 2019), USA	61 healthy young adults (36 females) Mean age (20.62±5.14)	TSST-Group (TSST-G) 10-min anticipation phase 20-min stressor phase (3 min- speech; counting backwards; math test) 10-min postsstressor offset (30 min after stressor onset)	At baseline, prior to laboratory stressor and immediately following the stressor.	Adult STRAIN v1.6; Unmarked scale to assess negative affect; BDI	Salivary cortisol and DHEA were collected by passive drooling twice: first at baseline measure, second, 30 min after the stressor onset (The stressor lasted 20 min + 10 min post stressor offset).	Greater cumulative stress exposure over the life course was associated to a blunted cortisol response ($\beta = -0.25$, $p = 0.033$), but with a heightened DHEA response to an acute laboratory stress ($\beta = -0.32$, $p < 0.001$)
(Prall et al., 2017), USA	27 young adult males – university campus; Mean age (21.6±2.7)	Modified (m) TSST 10-min acclimatization, 5-min verbal task, 4-min subtraction task,	After the informed content was obtained, participants were given a survey and were asked to return it at the second appointment	PSS, MacArthur "ladder" of subjective social status, Assessment of Public speaking by responding to one question	Four saliva samples (salivary cortisol DHEA, DHEAS, testosterone, innate immunity), pre-test, 1 blood sample after the TSST, afterwards three saliva samples were collected: post-stress (immediately after blood draw), post-stress+10min, post-stress+20 min	No significant association between cortisol, DHEA and DHEAS response to modified acute laboratory stress (mTSST) and PSS scores ($p>0.05$)
(Izawa et al., 2012), Japan	33 female college students Mean age (19.5±3.3)	Prolonged stressful situation during 2-week teaching practice	Data were collected at four time points (T:1–T:4), at awakening, 30 min after awakening and 1 hour before bed time on each sample day (weekday)	Japanese version of the Perceived Stress Scale Japanese; POMS-S	Saliva was collected at 4 time points by passive drooling: 2 weeks before the teaching practice (Day 1), the first week of the teaching practice (Day 2), the second week of the practice (Day 3), and a few days after the practice (Day 4).	No significant elevation in DHEA levels in response to prolonged stress.
(Petros et al., 2013), United Kingdom	32 university students and workers Mean age (29±5.7)	Cross-sectional, assessment of early childhood and adolescent stressors	Data collected immediately after awakening	SD-RISC; GSE; LOT-R; STAI Form – Y; CES-D-10; WHO-5; BSSS; ELSI	Self-administered protocol, chewing salivates for 45 seconds immediately after awakening	Positive correlation between resilience and DHEA-S levels ($r = 0.35$; $n = 32$; $p < 0.05$); No association between salivary cortisol and depression.

Table 1

Abbreviation: Visual analogue scales (VAS); Stress and Adversity Inventory for Adults (Adult STRAIN); Beck Depression Inventory (BDI); Perceived Stress Scale (PSS); Short Form of the Profile of Mood States (POMS-S); Connor –Davidson Resilience Scale SD-RISC; Generalised Self-Efficacy scale (GSE); Life Orientation Test – Revised (LOT-R); (STAI Form – Y); Centre for Epidemiologic Studies Depressive Scale (CES-D-10); Wellbeing Index (WHO-5); Berlin Social Support Scale (BSSS); Early Life Stress Inventory (ELSI)

In addition to the type of stressors, the observed results may be due to the small number of studies and different methodological approaches used in the reviewed studies including: sample size, gender composition of the samples, use of different subjective measures, time of the day of the saliva collection, as well as non-compliance with study protocol (Kudielka & Kirschbaum, 2005).

It was suggested that sample sizes across the studies were rather small (22 to 61) to examine HPA axis function and intended associations in general population (Adam & Kumari, 2009). More, salivary DHEA levels may be a reflection of diurnal, developmental and gender differences (Granger et al., 1999). Unlike cortisol, whose secretory activity shows more day-to-day variability (Lac et al., 2012), DHEA shows a very stable diurnal secretory pattern and consistent individual differences regardless of the day and the period within the day of sampling (Hucklebridge, Hussain, Evans, & Clow, 2005). DHEA has a life-span of 1–3 hours; it is cleared more rapidly than DHEA-S (Maggio et al., 2015) and is commonly measured as a marker of acute psychosocial stress (Lennartsson et al., 2012). DHEA-S has a half-life of 10–20 hours (Maggio et al., 2015). DHEA-S levels increase 2 hours following stress and stay high for 10 hours before they decrease, suggesting that one assay at a given hour could be enough to indicate daily mean levels (Lac et al., 2012). It shows no diurnal variations and is a preferred marker in studies of long term effects of stress (Lennartsson et al., 2012).

Further, it has been suggested that studies on the HPA axis that are conducted in the morning should pay attention to participants' wake-up time, which may modulate intra- and inter-individual HPA axis reaction to stress (Preuß et al., 2010). Time of collection in relation to awakening should also be considered when assessing cortisol/DHEA ratio (Hucklebridge et al., 2005). Further, low compliance with saliva sampling protocol when saliva collection is self-made may bias the results (Izawa et al., 2012; Petros et al., 2013). Different sampling collection procedures among the studies may be another reason for the observed results. Establishing consistent collection and storage procedures across study groups can improve steroid analysis in saliva (Lewis, 2006). In general, studies used validated instruments for evaluation of psychological stress.

Overall, the review will be a good supplement to the systematic reviews on dehydroepiandrosterone (DHEA) supplementation for cognitive function in healthy elderly people (Grimley Evans et al., 2006), the review on DHEA and cognitive function in the elderly (Maggio et al., 2015), and the review on neurobiological and neuropsychiatric effects of dehydroepiandrosterone (DHEA) and DHEA sulfate (DHEAS) (Maninger et al., 2009). Results this review cannot be generalized to both genders and could be regarded as uncertain for older participants.

5. Conclusion and future directions

The present systematic review provides preliminary support about the importance of DHEA and DHEA-S response to acute and chronic HPA axis action in healthy young adults aged 18 to 30 years old. Evaluation of studies in this paper showed that significant main effect of time was found for cortisol, DHEA reactivity and cortisol/DHEA ratio. The review showed that lower cortisol to DHEA ratio may constitute a link between psychosocial stress and mental health, and blunted cortisol reactivity as expressed by lower cortisol to DHEA ratio in the distressed individuals under chronic stress may be a risk factor in the etiology of psychiatric disorders even when the levels of DHEA remain unchanged (Izawa et al., 2008). Further, it was suggested that the DHEA may be potential markers of acute stress (Izawa et al., 2012), whereas DHEA-S may be a better marker of resilience and chronic stress (Petros et al., 2013).

More research into longitudinal association between the DHEA, DHEA-S, positive and negative emotions in healthy younger adults is needed. Longitudinal studies will allow better understanding of the complex interactions of stress responses, psycho-pathology and well-being (Foley & Kirschbaum, 2010). Further, assessment of cortisol/DHEA or cortisol/DHEA-S ratios could be a better indicator of HPA – axis reactivity to stress (Epel, 2009; Piazza et al., 2010) than assessment of each hormone separately (Aldao et al., 2010; Maggio et al., 2015). Assessment of positive emotions, alongside negative emotions, in association with DHEA and DHEA-S concentrations should be carried out in larger numbers of healthy younger individuals in both sexes, and in more diverse populations.

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Credit Author Statement

Urime Demiri – Shaipi: Conceptualization, Methodology, and Writing - original draft preparation and the Review **Sagheer Ahmet:** Formal Analyses, Validation; **David Koh:** Supervision, Reviewing, and Editing

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ANALYSIS OF KINDERGARTEN BUILDINGS IN MARIBOR, POSSIBILITIES OF RECONSTRUCTION FOR IMPROVING ENERGY EFFICIENCY AND FUNCTIONAL ASPECTS OF BUILDINGS

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ABSTRACT

Kindergartens present an important segment of the public building stock in the Municipality of Maribor, Slovenia. As they were built over different time periods, their architecture reflects features of various social systems, norms and construction trends. Consequently, the existing building stock of kindergartens is quite heterogeneous, the average age of the buildings is more than 45 years.

In accordance with the contemporary trends, most of the older kindergartens do not correspond to current requirements related to functionality, indoor environment quality, safety and predominately energy- efficiency. Therefore, the issue of their transformation is very important in the contemporary context. The buildings should be transformed to fulfill functional requirements of modern preschool educational process, at the same time, the transformation should provide the improvement of building energy performances, as one of the most important aspects nowadays.

The current paper analyses three kindergartens built in the late 1970s in the city of Maribor. It compares parameters, important for the aspect of energy efficiency: basic characteristics of the building, representative elements of the thermal envelope and available data of the energy efficiency and energy consumption. The second step of the study considers possibilities of buildings reconstructions and provides options of transformations for chosen buildings. The paper presents transformations of the buildings considering both, possibilities for improving energy efficiency and functional aspect of the building.

KEYWORDS: *kindergartens, building reconstruction, energy efficiency, city of Maribor*

1 INTRODUCTION

Kindergartens present an important segment of the public building stock in the Municipality of Maribor, Slovenia. The pre-school education in Maribor takes place in 8 independent public educational organizations, which founder is the Municipality of Maribor. More than 4000 children are involved in kindergarten programs [8], operating in 36 single kindergarten units in the Municipality [6]. In accordance with the contemporary trends, most of the older kindergartens do not correspond to current requirements in terms of functionality, indoor environment quality, safety and predominately energy-efficiency. Therefore, the issue of their reconstruction is very important in the contemporary context.

The current paper analyses three kindergartens built in the late 1970s in the city of Maribor. Particularly, it studies important parameters for the aspect of energy efficiency, and presents possibilities of reconstructions for chosen buildings. Moreover, the paper deals with transformations of the buildings considering both, possibilities for improved energy efficiency and functional aspect of the building.

An intensive engagement in the preschool buildings is carried out in the frame of the scientific-research project *VRTEC+* (Eng.: *Kindergarten+*) at the University of Maribor, Faculty of Civil Engineering, Transportation Engineering and Architecture. The main goal of the project can be defined as the development of the model in the refurbishment of buildings for the preschool education in Slovenia, which bases on our own methodology, developed in accordance with the analysis of the actual state in existing buildings. In addition, the approach to the model refurbishment covers precise analyses of the existing buildings.

2 BUILDING STOCK OF KINDERGARTENS IN THE MUNICIPALITY OF MARIBOR

Kindergartens together with schools form dominant part of the public building stock in Maribor. They were built over different time periods and their architecture reflects features of various social systems, norms and construction trends. Consequently, the existing building stock of kindergartens is quite heterogeneous. The average age of the buildings is more than 45 years.

The analysis of building stock of kindergarten buildings showed interesting results in terms of building typology, construction, architecture, etc. The buildings which today serve the purpose of preschool education programs have been initially 1. built and designed on purpose as kindergartens (with all accompanied amenities both indoor and outdoor) or 2. built with different purpose and readopted as kindergartens.

The oldest kindergarten building in the Municipality of Maribor, originally built for different purpose, was constructed in 1927, whereas the youngest building, built and designed as kindergarten, was built in 2017 [11]. Consequently, the existing building stock of kindergartens is quite heterogeneous, the average age of the buildings is more than 45 years.

The analysis of building stock also shows that average useful area of the kindergarten building in Maribor is approximately 794.9 m² while the biggest kindergarten building with useful area measures 1983 m² [2]. The useful area of the kindergarten buildings in Maribor (m²) related to the year of construction is presented on the diagram (Figure 1). The diagram also shows that the most intense kindergarten construction period in the city of Maribor was in the decade from 1970 to 1980, which was also proved to be the decade with the biggest number of built kindergartens in the Republic of Slovenia [5]. Also, the biggest kindergarten building in Maribor was built in the same decade.

In terms of energy efficiency of the building, kindergartens range from old buildings with no reconstruction so far, energy reconstructed buildings from the 1970s, up to newly built low-energy and passive buildings. Most of the buildings were constructed before 2002 when the national legislation on efficient energy use in buildings tightened essentially and regulations on energy efficiency in buildings entered into force for the first time in Slovenia [4]. Only three buildings out of 36 were built after the year 2002, which basically means that 33 kindergarten buildings have to be reconstructed to fulfil requirements of current legislations on efficient energy use in buildings.

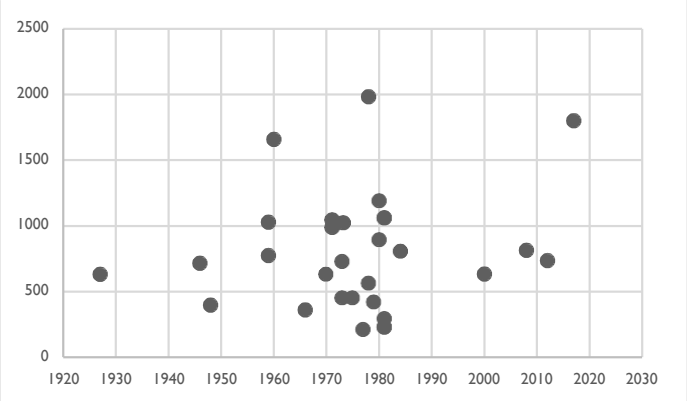

Figure 1: The useful area (m²) of the kindergarten buildings in Maribor related to the year of construction.

In terms of functionality most of the exiting kindergartens, especially buildings which were not initially built and designed as kindergartens, are facing the challenges. Buildings usually have problems with the inadequate architectural concept of the buildings, also problems with safety and problems with lack of spaces in executing contemporary preschool educational process.

Overall, the building stock of kindergartens in Maribor has a great variety of different buildings. Most of the older buildings does not correspond to current or future requirements of the users. Therefore, buildings should be reconstructed to fulfil current requirements not only in terms of energy efficiency but also in terms of requirements of contemporary preschool education. Furthermore, this paper analyses possibilities of reconstruction with improving energy efficiency and functional aspect of the buildings for three typical kindergarten buildings from the late 70`s.

3 ANALYSIS OF THREE KINDERGARTENS IN MARIBOR

The current paper discusses three kindergartens built in the late 1970`s in the city of Maribor. Selected kindergartens represent typical kindergartens built in the residential neighborhoods, which were constructed massively all over Republic of Slovenia at that time (Figure 2).

Figure 2: Three typical kindergartens I / II / III.

Kindergarten I – the building was constructed in 1984. It has ground floor, the outer walls are made of prefabricated elements, including a timber load-bearing structure with sheathings. The thickness of the wall is d=23 cm. All windows are original, wooden, single glazed, and made of termopan. The floor of the object has minimal insulation in the screed.

Kindergarten II – the building was constructed in 1978. It has ground floor, the outer walls are made of prefabricated elements including timber load-bearing structure with sheathings. The thickness of the wall is d=23 cm. The roof is inclined and covered with 5 cm of isolated sheet metal roofing on the floor of the loft, the insulation is approximately 12 cm thick.

Kindergarten III – the building was constructed in two parts: in 1959 a kindergarten, in 1974 a nursery. The outer walls of the nursery are made of prefabricated elements, including a timber load-bearing structure with sheathings. The thickness of the wall is 23 cm. The outer walls of the older kindergarten building are made of solid bricks and lime-cement plaster on the outer side. The roof is inclined and covered with 5 cm of isolated

sheet metal roofing and thermal insulation on the floor of the loft, which is approx. 12 cm thick. All windows were in 2010 replaced by single glazed PVC windows that cannot be refurbished. The basement is not isolated.

Presented buildings are common kindergartens from that period, still exiting over the Slovenia. Most of them with failures to maintain, still in original condition, due to a lack of financial resources. Presented architectural type of the kindergarten buildings (ground floor, timber load-bearing structure with sheathings, most of them built by Slovenian company *Marles*) represents 20% of all kindergartens built in the 1970`s [5]. Table 1 shows a comparison of basic parameters for three chosen kindergartens.

Table 1: Basic data – kindergarten I / II / III.

	Kindergarten I	**Kindergarten II**	**Kindergarten III**
Year of built	**1984**	**1978**	**1959 / 1974**
Useful area (m^2)	**807**	**562**	**822 / 1851**
Situation	**Stand-alone building**	**Stand-alone building**	**Two stand-alone buildings**
Construct. type	**Prefabricated building**	**Prefabricated building**	**Brick / Prefabricated building**
Form factor	**0,95**	**0,84**	**0,82 / 0,84**
Past reconstructions	**Year 2009 – roof refurbishment**	**Year 2009 – roof refurbishment**	**Year 2007 – roof refurbishment** **Year 2012 - façade joinery replacement**

4 MODELS OF RECONSTRUCTION

The second step of the conducted study considers general possibilities of building reconstructions and provides options of transformations for chosen buildings.

In the last ten years, the Municipality of Maribor witnessed many energy reconstructions of kindergarten buildings, including various interventions on buildings, such as renovations of technical systems and interventions on building thermal envelopes, as well as window replacement. Buildings were renovated according to budget plans, without comprehensive approach which can provide improvement of both energy

efficiency and functionality of the buildings. Partial renovations of kindergarten buildings were usually focused on the relatively narrow target area, prioritizing partial improvements of building energy efficiency, usually only single measures were taken.

Different buildings require distinguished consideration of renovation measures and strategies applicable to building renovation. Renovation approaches has to be adjusted to a building needs and has to optimize all the interventions in proper order. Kindergarten buildings should be transformed to fulfill functional requirements of contemporary preschool educational process, at the same time, the transformation should provide the improvement of building energy performances, as one of the most important aspects today. Consequently, applied intervention measures and strategies, also have environmental implications and the implications on indoor environmental quality and sustainability aspect of the building.

So far renovation measures were discussed in the majority of research studies. In this paper three of them will be discussed and analyzed on the chosen examples of kindergarten buildings: **I.** building extension, **II.** renewal of the building thermal envelope and **III.** renewal or addition of active technical systems.

I. Building extension. In addition to increase the level of sustainability of the existing buildings, there is also a high requirement for new usable surfaces in kindergartens. Therefore, comprehensive reconstructions of usually ground floor kindergarten buildings should include building extensions (additional spaces, creating of buffers, etc.). The solution could resemble the example of kindergarten III, which has two buildings and reconstruction offers the design which connects two buildings with additional facilities (Figure 3). Building extension can also provide additional outdoor spaces with light timber constructions attached to the building (Figure 3). Besides extensions in ground floor plane reconstructions should also include extensions in the cross section of the building. The volumetric of the building could be expended (Figure 4). Such a design provides more volume in the space, better insulation, and therefore, more space for the daily activities in kindergarten buildings. Presented solutions not only increase the exiting building functionality, but also the energy efficiency potential of the building.

Figure 3: Model of reconstruction for kindergarten III – connection of two building parts [7]

Figure 4: Cross section of kindergarten II – current situation / model of reconstruction [8]

II. Renewal of the building thermal envelope. The envelope quality plays an important role in the energy efficacy of the building. Measures of renewal of the building thermal envelope are directly involved with the building energy saving potential, especially in cold and temperate climate, where majority part of operational energy is used for heating. Individual renovation measures on the building thermal envelope usually contains: insulation of external walls, façade joinery replacement, insulation of attic or roof, etc. Regarding the three chosen kindergartens, where most of the outer walls were made of prefabricated elements (timber load-bearing structure with sheathings) with the thickness of the wall d=23 cm, addition of the thermal insulation reduces the energy consumption significantly. The energy saving potential will be analyzed further in this paper. Reconstruction of building envelope should provide better energy performance of the building in the first place. On the other hand, it is an opportunity to use natural materials such as wood on the external walls and also an opportunity for application of the attractive contemporary design of the building (Figure 5).

Figure 5: Model of reconstruction for kindergarten II – usage of natural building materials on the building facade [8]

III. Renewal or addition of active technical systems. Renovation of active technical systems usually includes un upgrade of space and water heating and cooling systems, also lightening systems upgrade, implementation of energy efficient technologies and the use of renewable energy resources. Most of the active technical systems in three presented kindergartens, as well as in most of the kindergartens from that period, are dated. Renovation of active technical systems in the buildings offers a great energy savings, besides it should offer a higher comfort and the better indoor comfort conditions for the users of the building.

5 ENERGY SAVING POTENTIAL OF KINDERGARTEN BUILDINGS RECONSTRUCTIONS

The average energy consumption in non-residential part of the European building stock is estimated to be 40% higher than equivalent value for the residential sector (the average specific energy consumption in non- residential sector in Europe is approximately 280 kWh/m²) [1]. In addition, non-residential buildings, are more complex units regarding the number of occupants, HAVAC systems and limited personal control over thermal and ventilation conditions [12]. Therefore, improvement of the energy efficiency of non-residential building should be treated with the great attention involving comprehensive approach to building renovations.

Today, the average energy consumption of kindergarten buildings in Slovenia differs significantly. Different building types of kindergartens in building stock with various levels of energy refurbishment of the buildings resulted in different energy consumptions. According to data of the local energy agency *Energap,* the average energy consumption for heating of a kindergarten building in Maribor was 129.86 kWh/m ² in 2018. Among 36 kindergarten buildings energy consumption was in range from 16.2 kWh/m² for newly built energy-saving kindergarten buildings up to 240.25 kWh/m² for older, non-reconstructed buildings [2].

Renovation the older public buildings, built before the introduction of strict national directives on the energy performance of buildings, represents an enormous potential to improve their energy efficiency and to reduce the final energy consumption. Analyses of the available data can lead to the conclusion that most of the buildings for the pre-school education in Maribor were built before year 2002, which is before the stricter legislation entered into force [7]. Only three buildings, three units out of 36 were built after year 2002. This basically means that most of the kindergarten buildings in Maribor have to be energy reconstructed in order to correspond to the current legislations requirements in terms of energy efficiency in buildings.

Presented paper analysis the energy saving potential of reconstructions for three chosen kindergarten buildings in Maribor by compering energy consumption of the building in original condition and different models of reconstruction. Computation of energy consumption for each building considered three different levels of building energy performances: **1.** original condition of the building **2.** addition of thermal insulation on external walls, and **3.** total reconstruction of the building: addition of thermal insulation on all thermal envelope elements, façade joinery replacement and building extension. Energy saving potential of reconstruction models is presented on the diagram (Figure 6).

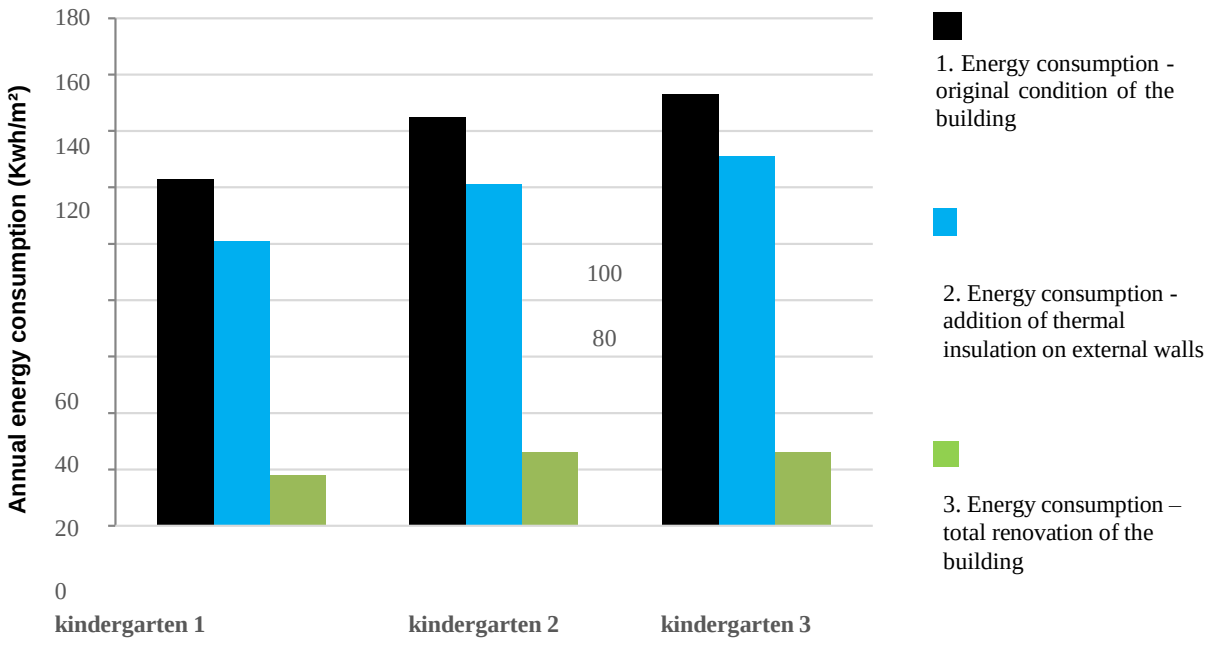

Figure 6: Energy saving potential of building reconstructions

Based on the achieved results, this study shows that comprehensive reconstruction of three kindergartens in Maribor is potentially highly beneficial with significant reduction in energy consumption. The average reduction of energy consumption for three analyzed buildings is from 15% for improved energy efficiency of external wall up to 83% for total reconstruction of the building. Presented models of building renovation, besides energy savings, provide functional transformation of the building in accordance with requirements of the contemporary preschool educational process.

Reconstruction of the public buildings also has to follow the legislations of the Republic of Slovenia in the area of energy efficiency in buildings, which has become more and more tightened. According to the Directive EU EPBD, all new and (bigger) renovated public buildings should be almost zero-energy after year 2018 [3]. Which all together makes a process of public building reconstructions extremely demanding.

6 CONCLUSIONS

Kindergarten buildings are facilities providing services to the most vulnerable population, children. Therefore, reconstructions of kindergarten buildings should be specially treated and should not compromised the building functionality, design or indoor comfort conditions of the buildings.

Based on the analyses of three kindergartens, presented research shows that comprehensive reconstruction of the kindergarten building is potentially highly beneficial and could significantly reduce energy consumption. Besides reducing the energy consumption, chosen renovation measures for building reconstructions show significant improvement in building functionality, comfort and design.

The paper presented possibilities of reconstruction of kindergarten buildings considering both, possibilities for improving energy efficiency and functional aspect of the building. Such an approach in comprehensive building reconstruction has great energy improvement potential and potential to improve building functionality and therefore could be a basis for the further reconstruction in public building sector in Slovenia.

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The Importance of Intellectual Property for Small and Medium-sized Enterprises (SMEs)

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ABSTRACT

Sustainable economic development requires the existence of highly competitive small and medium-sized enterprises (SMEs) operating within highly developed technological and global standards. Global standards in the 21st century are constantly pushing intellectual property to the forefront. The increasing need for intellectual property to develop competitive advantage undoubtedly imposes the need for active involvement of SMEs in this area. The purpose of this research is therefore to emphasize the need for active involvement of intellectual property in SMEs development strategies. This need is a result of the increasing participation of intellectual property in the capital of highly competitive enterprises. Diagnosing the current state of SMEs in the field of intellectual property and their competitive position with respect to large enterprises is the starting point of the research. The positive aspects of intellectual property rights and the need to include them in the SME portfolios are analyzed to enable SMEs to make a serious innovative breakthrough in the industry in which they operate. The activity of the European Union (EU) aimed at increasing the percentage of intellectual property rights exploitation by SMEs is also analyzed. In the research EU SME activity is a substitute for the direction in which SMEs from EU candidate countries should develop their own intellectual property strategy. Analyzing the general situation of the use of intellectual property rights by SMEs, the research attempts to emphasize the need to incorporate these rights into the development strategy of the enterprises and to provide guidance on how SMEs should position themselves in the field of intellectual property in the future conditions of global trade competition.

CCS CONCEPTS: *Intellectual property • Small and Medium-sized Enterprises • European Union*

KEYWORDS: *Intellectual property, Small and Medium-sized Enterprises, European Union*

1 Introduction

In the global world economy, intellectual property is a key factor in the field of business competition. SMEs aiming to internationalize their business in particular should focus on intellectual property as one of the basic methods of securing a return on investment in the innovation sector. It is typical for SMEs that they have limited resources and time, but it is especially important for them to be aware of the positive aspects of intellectual property in their business. Intellectual property should not be understood solely as a means of protecting against competition in the field of innovation, but SMEs should exploit intellectual property as a source of additional cash-flow by concluding license agreements or selling intellectual property rights that represent an important basis for attracting investors.

In the research the most widely used research methods are the method of analysis, the method of comparison and the method of synthesis. The method of analysis has its own demonstration of trying to represent SME activity in the field of intellectual property in Europe. The situation with the involvement of SMEs in the field of intellectual property in Europe can be traced through a study called Intellectual Property SME Scoreboard which provide more insights and evidence as to why SMEs do or do not register IPRs, what problems those who register encounter and how they think such problems could be solved in the most efficient manner. This study is the starting point of the analysis of the use of intellectual property rights by SMEs in the EU. The research uses the comparative approach when is trying to compare the use of intellectual property rights by SMEs operating in the EU and those in the EU candidate countries.

Research boundaries primarily concern the use of intellectual property rights by SMEs in the EU. Analyzing the experience and extent of the exercise of these rights within the Union, an attempt is made to formulate policy guidelines that could be used by EU SMEs and those SMEs operating in the EU candidate countries.

Finally, using the synthesis method, conclusions are drawn and guidance's are given to increase the use of intellectual property rights by SMEs in their development strategies. It also sets out guidelines that state authorities should apply in order to stimulate an atmosphere of increased use of these rights by SMEs.

2 The Importance of Intellectual Property for SMEs in General

Innovation is a leading mechanism in developing quality products and increasing market competition and this is also a key feature of the current global economy. The pressure on companies to improve their efficiency and effectiveness is much more pronounced in times of globalization. A key driver of the economy in recent decades is innovation leading to significant improvements in the way businesses are run and their productivity.

SMEs must recognize the need to create an appropriate intellectual property portfolio that may be essential. An essential prerequisite for SMEs is to understand the value of intellectual property as a condition for their further development. Diversification of innovation development is only possible through the protection of intellectual property rights, which excludes other market participants from creating, using, offering, selling

and manufacturing for a limited period of time.

Intellectual property is characterized as an area that actively contributes to the development of competitive advantage and therefore emphasizes the need for increased participation of SMEs in this area. However, the importance of this area is not only important for SMEs but also for developing countries as they can contribute to the development and protection of intellectual capital that can be considered as a contribution to increased innovation and development. This can be seen through the stages of product development and product design, through the accumulation of financial resources and in particular through the development of a competitive strategy. That is why the role of intellectual property in the creation of innovation is undoubtedly important.

The major worrying factor for SMEs in terms of intellectual property is the infringement of intellectual property rights that have a significant impact on their functioning. Most often it leads to loss of profits, investment opportunities, reputation and competitive advantage, and also has an impact on the foreign and domestic market where SMEs operate.

Every product of human intellect can be defined as intellectual property. In hugely competitive markets, each company highly evaluates its investment and expects maximum return on investment. The exclusivity of inventiveness provided by intellectual property is the starting point and the most important point that must be understood by SMEs.

Bearing in mind that the focus of the research is on EU SMEs there is a need to present the definition of SMEs in the EU. SMEs are defined in the EU recommendation 2003/361. The main factors determining whether an enterprise is an SME are: staff headcount and either turnover or balance sheet total. [1]

Table 1: SME definition in EU.

Company category	Staff headcount	Turnover (€)	Balance sheet total (€)
Micro	<10	≤ 2 million	≤ 2 million
Small	<50	≤ 10 million	≤ 10 million
Medium-sized	<250	≤ 50 million	≤ 43 million

3 Differences Between SMEs and Large Companies in the Field of Intellectual Property

The intellectual property system is designed to help SMEs during the utilization of the intellectual property to protect their innovation and creativity. SMEs should make extensive use of intellectual property rights as they are the starting point for developing their own business. However, it is notable that only a small number of SMEs register these rights for various reasons. SMEs, due to their lack of adequate resources and knowledge on how to protect and enforce their rights, are often exposed to infringement of intellectual property rights.

Building large intellectual property portfolios in different areas of technology is one of the core characteristics of large companies, which use such portfolios to compete with each other and to increase market entry barriers for small and new companies. If we take patents as an example, it can be seen that they are expensive for SMEs and they cannot afford to form large patent portfolios. On the other hand, there is a big difference even if the situation is quite bad for SMEs when it comes to court costs.

Usually the technical challenges have to be overcome during the innovation process. SMEs will have to overcome these challenges, primarily due to their lack of research and development, by developing their own solutions within their own organization or by collaborating with research organizations or other companies. In trying to overcome the technical challenges and develop a new product or process a very small number of SMEs focus their attention on gaining external intellectual property. However, if SMEs want to reduce the time to develop a new product on the market, they must consider the option of acquiring external intellectual property rather than focusing on developing new intellectual property.

In the field of innovation, the contribution of SMEs is significant and steadily increasing. Large companies are a major source of innovation, as evidenced by traditional economic theory and empirical studies. Large companies have greater financial resources than SMEs to devote on research and development, greater ability to take risks associated with their innovation activity, better market share and, in each case, lower costs for developing innovations. However, it is notable that large companies undertake more research and development in much more severe conditions. On the other hand, SMEs enjoy distinctive advantages over the process of creating innovation as a result of their own structure and in some cases can contribute to the innovation process in a way that is characteristic of them having a greater and more significant contribution than large companies.

SMEs have seen increasing use of their intellectual property rights in recent years, but there is still a difference in different areas regarding the use of its opportunities, especially when it comes to acquiring intellectual property. There is a noticeable difference here between large companies that have developed their own intellectual property strategies and also work with private companies that provide opportunities to identify and process intellectual property acquisition opportunities. Such qualification in this field cannot be given to SMEs. SMEs lack the ability to formulate a strategy for resolving technical problems, there is a lack of awareness of intellectual property and its benefits, and in particular the lack of the human factor required in identifying and

acquiring intellectual property.

In the field of innovation for large companies it is characteristic that they have better advertising campaigns, can hire much more skilled workers and have lower financial costs. When it comes to the costsincurred by large companies in the field of intellectual property, the costs incurred as a result of social protection and the costs incurred by environmental legislation in capital investment should also be added. It is obvious that large companies can afford more intellectual property rights, but they are also more exposed to the need for intellectual property rights and have to pay higher costs if they use the rights owned by others. In principle it is noticeable that the costs associated with intellectual property are commensurate with the size of the company itself and there is not much difference in favor of large companies compared to SMEs. However, if SMEs protect their basic technological inventions from being taken over by their competitors, intellectual property rights can be key to them. In no case can it be said that it is easy for SMEs to enforce their intellectual property rights against a large company that is its competitor. But on the other hand, one thing is certain: SMEs will never be in a position to protect their technological advances from copying if they do not use their intellectual property rights. [2]

In a number of sectors SMEs have the organizational and economic advantages of developing innovation. When it comes to fast-developing innovative sectors, which include controlled development and information technology, the intensity or size of capital is not of great importance. Therefore the focus of SMEs should be on a narrow range of specific innovations. In this regard, there are several advantages that SMEs would have over large companies primarily due to organizational characteristics such as less bureaucracy, the existence of an innovation-focused management structure and a greater number of initiatives to succeed. [3]

In recent years, there has been a positive trend of increased contribution of SMEs in the field of innovative industry and job creation. This trend is supported by a large body of evidence that SMEs as a result of designing new products and adapting existing products to customer needs actively contribute to enhancing and improving the performance of the innovation system.

4 The Use of Intellectual Property by SMEs in the European Union

The European Union is a leader in policy-making that fosters innovation, creativity and the development of market competitiveness. In this respect, the European Union seeks to increase the use of intellectual property opportunities in the field of SME development. To address the underlying problems and create a quality foundation on which to build future policies the EU has conducted numerous analyzes of the state of the use of intellectual property by SMEs. Such analysis forms the basis of the review of this research.

In essence, the majority of European SMEs are considered innovative. SMEs are left with the choice of whether to protect their innovations through formal protection of intellectual property rights or through alternative measures. In any case, SMEs strive to protect their rights in a way that best suits their needs and opportunities.

Domain name registration and trademarks have been identified as the most important forms of protection of intellectual property rights by most European SMEs. However, the need for a greater level of knowledge related to the protection of innovation, greater presence in the process of protection and perception of the benefits of the process is the basis for ensuring a more effective protection of the overall intellectual property strategy. Such knowledge on which to base their decision is largely lacking in most SMEs in Europe. [4]

Regarding the question of whether intellectual property protection has a positive effect on the functioning of the business, a large majority of SMEs stated that there was, in particular, reputation and reliability, strengthening of long-term business projections and increased turnover. SMEs cite copyright protection as their most important goal in initiating a protection procedure, although there are many more reasons why SMEs should approach intellectual property protection formally. Nearly one in three SMEs claims to have suffered as a result of intellectual property infringement, a particularly depressing fact from a legal point of view. Infringement of intellectual property rights was most affected by medium-sized enterprises, although this problem affects all successful innovators of all sizes. Providing simplified procedures for protection and their creation in order to increase efficiency and reduce costs is a very important starting point for the overall functioning of the intellectual property system. On the other hand, complicated and costly courtprocedures are an important obstacle for some, and especially for small enterprises, in trying to actively protect their intellectual capital. Very few SMEs have stated that they are accused of infringing intellectual property rights, although there are theories suggesting that intellectual property rights are being used as a tool by large companies to intimidate small entrepreneurs by accusing them of infringing their intellectual property rights. [5]

Realistically, the level of innovation in the European Union in recent years is the highest among those who have already registered intellectual property rights, but despite this fact, the majority of European SMEs consider themselves innovative. This view is also confirmed by the fact that more innovative SMEs are more willing to register their intellectual property rights to protect their innovations. The three most important measures for building a company's ability to develop competitive advantage by exploiting their innovative activities SMEs are listing internet domain names, trade secrets and trademarks. On the other hand, it is worrying that SMEs cite the three most important reasons why they do not protect their innovations, is the perception that there is no benefits of innovation protection, the lack of knowledge on how to protect innovations and the costs of the protection procedure.

When it comes to how to protect intellectual property rights SMEs in the EU first come up with alternative protection measures, and statistically they mostly register trademarks at national and EU level. For SMEs, intellectual property rights registration is considered important in two crucial areas: innovation and marketing, i.e. commercialization of a product, process or service. If we diagnose the reasons why SMEs register intellectual property rights, the three most common reasons are protecting from copying their products and services, better legal certainty and enhancing the value and image of SMEs. Although many SMEs, almost half of them,

say that they have not experienced any difficulty in registering intellectual property rights, however, if they have experienced difficulties, the main causes of the difficulties indicate the costs and length of the proceedings. [6]

European SMEs cite the need for simpler and shorter procedures and improved access to intellectual property databases as the most effective measures to help the protection on their intellectual property rights. Less importantly SMEs cite the need to reduce costs or provide financial assistance and information, guidance and support to SME services. On the other hand, when defining the reasons why SMEs do not register intellectual property rights, they cite the belief that intellectual property rights do not encourage innovation, lack of knowledge on how to register intellectual property rights, and the belief that there are no additional benefits from acquiring protection of intellectual property rights.

The situation is very different when it comes to European SMEs that have already registered intellectual property rights as the majority of them report that registration has a "positive" or "very positive" impact on their performance. The three most positive aspects are the increased reputation and image of confidentiality, the consolidation of long-term business projections and the increased turnover.

One of the most critical points is that almost one third of SMEs in the EU report that they have suffered from infringement of rights. The infringement grows in proportion to the size of SMEs. According to SMEs, infringement of intellectual property rights has a direct impact on loss of turnover, damage to reputation or loss of competitive advantage. Regarding the mechanisms used to resolve conflicts that arise when intellectual property rights are infringed, SMEs state that they first approach bilateral negotiations, and the second most common mechanism is litigation. SMEs tend to avoid litigation as a mechanism for resolving conflicts arising from infringement of intellectual property rights due to the length and cost of the proceedings. SMEs regarding the improvement of litigation find that there is a need for a faster, simpler and cheaper procedure, along with the parallel existence of special procedures and mechanisms for conducting intellectual property rights proceedings. [7]

The registration of intellectual property rights by SMEs that have registered some of the intellectual property rights has a positive or very positive impact on their operations. However, there is a noticeable difference between micro and small enterprises in which intellectual property rights have no impact on their business, while medium-sized enterprises report that the registration of rights has a positive impact on their business. The positive impact of intellectual property rights can be directly expressed through increased turnover, profitability or employment. Often the positive impact of intellectual property rights is expressed indirectly through increased reputation, perspectives and opportunities. While observed from the standpoint of micro-enterprises when they determine the positive effects of intellectual property rights, they most often report positive effects in terms of increasing employment and turnover or expanding into new markets. [8]

5 Next Steps To Be Taken by SMEs

The need for SMEs to take an active approach in the field of intellectual property implies taking their concrete steps to protect their intellectual property rights, first and foremost in litigation if these rights are infringed by a third party. The next step that should be cited as a necessary step to be taken by SMEs is to strengthen their own intellectual property portfolios by acquiring other companies' intellectual property rights. Focusing on developing an effective intellectual property portfolio is a normal outcome with the development of SMEs and provides strong protection for their innovations and the possibility of their future commercialization.

The driving force in this area is undoubtedly the need of a public policy that will focus on providing SMEs with the means to motivate them to use the process of acquiring intellectual property rights at reasonable costs. The main goals to pursue this policy could be summarized as follows:

- To provide SMEs with the means to identify and acquire intellectual property from external sources. The background of this aim is to encourage SMEs to acquire intellectual property from external sources and to use it to increase their competitiveness. Acquiring intellectual property from external sources would reduce the time for their entry into the market and would quickly identify and overcome the disadvantages arising from lack of own research and development facilities. In general, it is about accelerating access to funds that would increase the SME market presence in the sector in which they operate.
- To ensure that SMEs are aware of the need to use intermediaries to provide them with access to innovation. The role of intermediaries in acquiring the needed industrial assets is important for SMEs in that they would thus be assisted in acquiring intellectual property from external sources, guided by their technological needs. This approach will assist SMEs in identifying and finding appropriate funding, training, best practices and enforcing intellectual property rights through their capitalization process.
- To ensure that SMEs are aware of the benefits of acquiring intellectual property from external sources. It is still notable that SMEs are not sufficiently aware of the benefits they can derive from acquiring intellectual property from external sources, especially in order to save time in their own market positioning and in increasing their innovative capacity. It is particularly important for this policy that the steps taken to raise awareness of SMEs to be integrated with the other taken steps.

The acquisition of intellectual property from external sources is based on the idea that it is crucial in the process of developing innovation and creating the final product. Existing intellectual property and knowledge are not sufficiently exploited by SMEs, also when it comes to exploitation of intellectual property SMEs are dependent on programs and activities that are result from the demand of potential users and therefore the acquisition of intellectual property by external sources is seen as a rational step to be taken by SMEs. [9]

What developing countries should take is to follow the example of some countries that have set up systems, structures and networks of nonprofits organizations to try to help

individual innovators and SMEs to acquire and manage their intellectual property rights effectively. In order to provide an active form of innovation incentive, it is necessary to provide provisions in financial and tax laws that create favorable conditions for intellectual property creators and their activities. Such stimulating conditions should include a reduced tax rate on revenue arising from licenses and transfer of know-how, fees charged for the acquisition and maintenance of intellectual property rights for individual rights holders, special loans or subsidies, including interest-free loans or low-interest grants to support the development of certain inventions and innovations and opportunities to conclude research contracts that would be directly funded by government and public institutions.

Effective use of intellectual property rights by SMEs could be aided by the establishment of an innovation center which is an important element in innovative structures. An innovation center could also be a network of entities that will act as a link that connects researchers, individual inventors, research centers and unions on one hand and SMEs, investors, industries and ultimately those entities that launch new products and market services. The core mission of the innovation center should be to assist individual inventors, university researchers, SMEs, and other intellectual property creators to complete their initiated innovations to the full. The services of the innovation center should be aimed at accelerating the development of innovation and innovation ideas and assisting their commercialization and market dissemination. In order to realize the mission of the innovation center, besides its main functions, it must also perform certain administrative services. The core functions can be performed by permanent staff at the center or by a specialized network or co-operative structures.

6 Conclusion

The general conclusion that can be drawn is that SMEs using intellectual property rights are far more successful than those who do not. This directly demonstrates a link between the use of intellectual property rights and the business performance of companies. Most often this relationship is directly perceived by comparing the size of the intellectual property portfolio with the increase in turnover and profit growth.

What is important for SMEs is primarily to develop an intellectual property strategy or, if they have a strategy to revise it, directly to assess the intellectual property rights they own and to make changes to their intellectual property portfolios according to modern technological requirements. When it comes to the state of technology SMEs need to understand the need for an active approach to studying new technological trends and the competitive environment in the relevant field in which they operate.

Increasing SMEs' awareness of the value of their intellectual property rights, access to facilities (internal or external) that will enable them to identify and acquire intellectual property from external sources, can contribute to increasing the presence of SMEs in the market. and reduce the effect of lack of own research and development resources. In this regard, well-structured and well-developed technology markets would be particularly beneficial to SMEs. Such markets would also have a positive effect on the countries in which they operate. Both countries, especially developing countries, and SMEs can be stimulated to develop their intellectual property activities as a

result of the advantages they possess. Such incentives would be particularly pronounced in terms of increased investment and development in developing countries, as well-functioning markets provide access to new technologies at affordable prices. [10] Increased SME activity in the area of intellectual property should also be encouraged by public authorities in order to establish an information platform to support SMEs and create an action plan that would put intellectual property rights on the SME agenda, in direction of increased innovation and development. State authorities need to understand the concept that their role in the field of intellectual property does not end with the creation of laws and access to international treaties or the provision of basic protection to the holders of these rights. The administrative apparatus must be effective and not expensive to ensure that all obstacles to the acquisition and enforcement of intellectual property rights are overcome.

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South East European Journal of Sustainable Development (SEEJSD)

AUTHOR GUIDELINES

AIMS AND SCOPE

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Books:

[1] H. Chum, M. Baizer, *The Electrochemistry of Biomass and Derived Materials*, ACS Monograph 183, American Chemical Society, Washington, DC, 1985, pp. 134–157.

Chapter of book:

[1] C. C. Chan, Potency method validation. In: C. C. Chan, H. Lam, Y. C. Lee, X. M. Zhang (eds.). Analytical Method Validation and Instrument Performance Verification, New Jersey; John Wiley and Sons: 2004, pp. 11-26.

Patents:

[1] H. Aviv, D. Friedman, A. Bar-Ilan, M. Vered., US Patent, US 5496811, 1996**.**

Scientific meetings:

[1] M. S. Steel, Creating woodlands for wildlife and people in Scotland, *18th Commonwealth Forestry Conference; Restoring the Commonwealth's Forests: Tackling Climate Change*, Edinburgh, Scotland, 2010, Book of Abstracts, p. 3.

For the web references, as a minimum the full URL should be given. Any further information, if available (author names, dates, reference to a source publication, etc.) should also be given.

[1] National Library of Medicine. Specialized Information Services: Toxicology and Environmental Health. http://sis.nlm.nih.gov/Tox/ToxMain.html (Accessed May 23, 2004)

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