Knowledge and Practices Related to Unused Medications in Households in Serbia

Zorica Terzic-Supic1, Dragica Bukumiric2, Milena Santric-Milicevic1, Aleksandar Corac3, Milica Paut Kusturica4, Momcilo Mirkovic3, Zoran Bukumiric3, Jovana Todorovic1,*, Biljana Ristic5, Goran Trajkovic5

1Institute of Social Medicine, School of Medicine, University of Belgrade, Dr Subotica 15, Belgrade, SERBIA.
2Department of Planning, Analysing and Statistics, Primary health care centre, Miloša Obrenovica 2-4, 26000, Pancevo, SERBIA.
3Department for Preventive Medicine, School of Medicine, University of Pristina – Kosovska Mitrovica, Anri Dinan bb, 38220 Kosovska Mitrovica, SERBIA.
4Department of Pharmacology, Toxicology and Clinical Pharmacology, School of Medicine, Hajduk Veljkova 3, 21000 Novi Sad, SERBIA.
5Institute of Medical Statistics and Informatics, School of Medicine, University of Belgrade, Dr Subotica 15, 11000 Belgrade, SERBIA.

ABSTRACT

Background: The objective of this study was to examine the knowledge and practices regarding expired medications and to identify their potential predictors. Methods: A cross-sectional study was conducted, between August and November of 2014 in Regional Community Primary Health Care centre in Serbia on 609 patients. The research instrument was the questionnaire. Univariate and multivariate logistic regression analyses were applied. Results: The lack of knowledge about the treatment of expired medications had 67.5% respondents, while 87.3% of the respondents had inappropriate practice. In the model of multivariate logistic regression with lack of knowledge as dependent variable, statistically significant predictors were: unemployment (OR=2.21; 95%CI: 1.35-3.59), lower economic status (OR=1.67; 95% CI: 1.01-2.58), unread instructions for use (OR=3.26; 95% CI: 1.51-7.02), unchecked medications’ expiration date (OR=3.30; 95% CI: 1.22-8.92). In the second model of multivariate logistic regression with inappropriate practice as dependant variable, statistically significant predictors were: the lower education level (OR=1.75; 95% CI: 1.09-2.80), unemployment (OR=2.66; 95% CI: 1.17-6.05), families with members incapable of taking care of their medicines independently (OR=0.27; 95% CI: 0.12-0.61) and lack of knowledge (OR=4.09; 95% CI: 2.31-7.23). Conclusion: Our study shows that there is a need for stronger control of the implementation of legally defined procedures for disposal of medications, as well as a proactive education of population about proper disposal of medications.

Key words: Knowledge, Practice, Disposal of medications, Expired medications, inappropriate practice

INTRODUCTION

Storing the expired medications in homes is nothing unusual.1,2 The quantity of such medications is approximately 0.28 kg per person.3 There are two main reasons why people store the medications at their homes. One of them is self-medication⁴ and the other is involuntary hoarding of medications, which often leads to the storage of medications after the expiration period. Self-medication can be seriously harmful and even fatal as it has potential to delay visits to the health professionals.⁵ On the other hand, involuntary hoarding of medications is practical storage of them, as the person look for the appropriate place for disposal, required by the law.⁶ Storing of non-used medications increases the risk of wide spectrum of possible problems: misuse,⁷ adverse drug reactions, overdose or accidental poisoning.⁸ Additionally, signifi-
cant number of patients discard these medications into the environment, which has a negative consequence for both the environment and people’s health.\textsuperscript{9,10} Some researchers showed that the medications stored in homes are kept in inadequate places,\textsuperscript{11} and unused medications are inappropriately disposed.\textsuperscript{12} Liquid medications are often rinsed down the sink, as opposed to solid tablets and capsules which are thrown into the trash bin.\textsuperscript{13} The studies of knowledge, attitudes, and practices regarding the proper storage and disposal of unused medications are not common.\textsuperscript{14} There is confusion about “proper” way for disposal of expired medications, as many countries have not defined standards and protocols for it. The situation becomes complicated if pharmacies refuse or do not support undertaking of unused medications\textsuperscript{12,15} or they apply unacceptable practices, like spilling it into the sink.\textsuperscript{16} As of 2008, Serbia has several regulations and recommendations providing a good basis for the appropriate waste management. According to the Law for the Waste Control, 2010 and the national guidelines for safe control of the medical waste, medical waste includes the municipal waste from the patients’ households and pharmaceutical waste.\textsuperscript{17} These are complemented by Regulations for managing the medical waste\textsuperscript{18} and by recommendations\textsuperscript{19} which arise from the project “Technical support for the treatment of medical waste in Serbia”. Pharmacies, state or private, established as health institutions are obliged to accept pharmaceutical waste and unused medications and to provide containers for that purpose, free of charge and for all citizens.\textsuperscript{18} This regulation is defined in a way that there is a space for different interpretations. For example, the existence of containers in clearly defined areas in pharmacy is defined, but it is unclear whether it is available for citizens or for the employees only. This creates confusion even for the informed citizens and disables the further spread of knowledge on what practices are appropriate relating the disposal of unused medications.

Before this research, there was only one study on this subject, conducted in Serbia, in the South Backa District. Its objectives were to investigate the storage and disposal practices for medications and differences in medications’ disposal behaviour between the urban and rural population.\textsuperscript{20} This research showed that almost 90% of participants disposed their expired medications into the trash or into the toilet, although most of them agreed that this practice is detrimental to the environment.

Research objective
In spite of the existing legislative frame, although with insufficient implementation, practices regarding medications that are expired remain unclear, so the objective of this study was to examine the knowledge and practices regarding expired medications and to identify factors associated with it.

MATERIALS AND METHODS
Research was designed as the cross-sectional study of knowledge and practices of patients in the outpatient care. It was conducted in 59 general practitioners (GP) offices at the Regional Community Primary Healthcare Centre Pancevo in the period from August to November 2014. Out of 671 patients who visited their chosen GP on a day of research, 46 did not give their consent to participate and 16 did not meet the criteria for the participation in research. Criteria for inclusion in the study were the following: adult patients (18 years and older), good general health condition based on physician’s assessment and ability to understand and self-administer the questionnaire. The total number of respondents included in research was 609.

The research instrument
The research instrument was the questionnaire created on the basis of questionnaires used in similar researches.\textsuperscript{16,21} The questionnaire consisted of 58 questions divided into two sections. The first section, with 10 questions, referred to socio-demographic and socio-economic characteristics: gender, age, marital status, years of education, employment status (employed, unemployed, retired), residence (urban, rural) and the self-rated economic status of the family (good, average or poor). This section also included questions on family characteristics: number of family members, having children younger than seven years (“Do you have children under the age of 7 living in your household?”, Yes/No), individuals who were not capable to take care of their therapy independently (“Do you have family member who is not capable of taking care of his/her therapy independently?”, Yes/No). Based on the reported number of family members, the variable ‘number of family members was transformed into binary variable: living alone vs. living with family.

The second section, with 48 questions, referred to the existence of chronic or acute diseases (Yes/No), the way and the place the medications are being kept in home (“How do you store your medications’ plastic bag/
paper bag/drawer/ other; ‘Where do you store your medications?’, hallway/ living room/ kitchen/ bathroom/ bedroom/ other), the presence of expired medications in home (‘Do you have medications which you do not use?’, Yes/No), reading the instructions for use (‘Do you read the instructions for use of medications?’), Yes/No), checking the expiration date (‘Do you check expiration date on the medications?’, Yes/No), the way medications was obtained (‘Who prescribed you the medication?’; Doctor/ pharmacist/ I bought it/ other), the reasons for storing medications, knowledge and practices with expired medications. Knowledge about expired medications was assessed with questions:

1. Are you familiar with the effects of medications after the expiration date? a) The effect is the same as before; b) They have less effect or no effect at all after the expiration date; c) Their effect is harmful or it may be toxic after the expiration date; d) I do not know.

2. According to your opinion the best place for the collection of expired medications is: a) The special box for drugs collection e.g. container in the pharmacy, b) Special box for drugs collection e.g. container in healthcare centre, c) Special box for drug collection e.g. container in public place, d) Something else;

3. Can the medications which you threw out, rinsed down the sink or burned, be harmful for environment? a) Yes, b) I do not know, c) No.

Practices about expired medications were assessed with questions:

1. What do you do with the medications in solid form (e.g. tablets, capsules, etc) which are expired? a) Throw them out in the trash, b) Flush them down the toilette or rinse them down the sink, c) Burn them, d) Keep them in the special place at home, e) Give them back to the pharmacy or to the health centre, f) Others;

2. What do you do with the medications in liquid form (e.g. syrups, drops, etc) that are expired? a) Throw them out in the trash, b) Flush them down the toilette or rinse them down a sink, c) Burn them, d) Keep them in a special place at home, e) Bring them back to the pharmacy or to the healthcare centre, f) Others;

3. What do you do with medications in semisolid form (e.g cream, balms, etc) that have been expired: a) Throw them out in the trash, b) Flush them down the toilette or rinse them down the sink, c) Burn them, d) Keep them in the special place at home, e) Bring them back to the pharmacy or to the health-care centre, f) Others. The correct answer to these three questions was the one under (e).

Pre-testing of questionnaire was conducted on 10 respondents, to assure that questions are understandable and logic, that completing the questionnaire takes 20 min on average. Test – retest was conducted two weeks after and kappa coefficient as the measure of agreement between items was 0.8 or higher.

**Ethic approval**

The Ethics Committee of the Primary Healthcare Centre Pancevo gave its approval for conducting the research, in accordance to the Article 33 of Healthcare Centre Statute. Respondents were informed about the protection of privacy and the possibility to recede at any time. Confidentiality and anonymity of the data were guaranteed. The verbal consent was obtained from respondents.

**Variables included in research**

The data analysis included: variables relating to socio-demographic, socio-economic and family characteristics of the respondents (age, sex, marital status, years of education, employment status and place of residence, living alone or with family, having children under the age of 7, having family member incapable of taking care of their own medicines), variables relating to the use of medications for chronic and acute diseases, storage of medications which are not used (the term “medications that are not used” refers to the possession of unused medications or to the expired ones) and reading the instructions for the use and checking the expiration date of medications. Finally, the 2 dependent variables were related to lack of knowledge and inappropriate practices. Dependent variable the lack of knowledge was obtained on the basis of wrong answers to any of the questions relating to the assessment of knowledge about expired medications (effects of medications after the expiration date, best place for the collection of expired medications, effects on the environment). Dependent variable inappropriate practices, was obtained on the basis of answers to any question regarding the practices about expired medications (practices of disposal of medications in solid, liquid or semisolid form).

**Statistical analysis**

Data analysis was done with methods of descriptive and analytical statistics. Association between the dependent variables and potential predictors was analysed by univariate logistic regression models. Independent variables which were significant in univariate models of logistic regression were used as the inde-
Medications were in 296 cases (48.6%) supplied upon the doctor’s advice/receipt, but 98 respondents (16.1%) got them on their own initiative. Reasons for keeping the unused medications were: leftover from the previous treatment (40.9%), accumulation for the future use (28.0%), expired medications (11.9%), use by other family members (16.6%) and other reasons (2.6%). Lack of knowledge about the treatment of expired medications had 390 (67.5%) respondents, while inappropriate practice had 500 (87.3%) respondents. Inappropriate practice with expired medications had 73.9% participants with knowledge and 94.0% without it, which was statistically significant difference ($p<0.001$). Expired medications were most frequently thrown out in the trash (52.2%) while 16.2% was brought back to the pharmacy. Respondents with adequate knowledge less frequently threw the medications out in the trash versus respondents with lack of it: medications in solid form (45.1% vs 61.1%, respectively), in liquid form (35.8% vs 47.8%, respectively) and in semisolid form (50.0% vs 62.7%, respectively). Participants with adequate knowledge more often bring back the medications to the pharmacy compared with the ones with lack of it: medications in solid form (35.7% vs 7.0%, and in semisolid form (30.1% vs 6%). There is statistically significant difference in frequency of disposal practice of solid ($p<0.001$), liquid ($p<0.001$) and semisolid ($p<0.001$) forms of expired medications between the respondents with and without the adequate knowledge. Figure 1 shows the frequent practice relating to the knowledge about expired medications.

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**Table 1: Socio-demographic characteristics of respondents.**

<table>
<thead>
<tr>
<th>Term</th>
<th>n (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (years) $x \pm SD$</td>
<td>52.3 ± 16.0</td>
</tr>
<tr>
<td>Gender</td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>245 (40.2%)</td>
</tr>
<tr>
<td>Female</td>
<td>364 (59.8%)</td>
</tr>
<tr>
<td>Marital status</td>
<td></td>
</tr>
<tr>
<td>Single</td>
<td>201 (33.1%)</td>
</tr>
<tr>
<td>Married</td>
<td>407 (66.9%)</td>
</tr>
<tr>
<td>Years of education</td>
<td></td>
</tr>
<tr>
<td>&gt;12 years</td>
<td>137 (22.5%)</td>
</tr>
<tr>
<td>8-12 years</td>
<td>347 (57.1%)</td>
</tr>
<tr>
<td>8 yrs or less</td>
<td>124 (20.4%)</td>
</tr>
<tr>
<td>Employment status</td>
<td></td>
</tr>
<tr>
<td>Employed</td>
<td>223 (36.7%)</td>
</tr>
<tr>
<td>Unemployed</td>
<td>177 (19.1%)</td>
</tr>
<tr>
<td>Retired</td>
<td>208 (34.2%)</td>
</tr>
<tr>
<td>Residence</td>
<td></td>
</tr>
<tr>
<td>Rural</td>
<td>376 (61.7%)</td>
</tr>
<tr>
<td>Urban</td>
<td>233 (38.3%)</td>
</tr>
<tr>
<td>Living alone</td>
<td>53 (8.7%)</td>
</tr>
<tr>
<td>Children under 7 years</td>
<td>126 (20.7%)</td>
</tr>
<tr>
<td>Persons incapable of taking care of their medications independently</td>
<td>56 (9.2%)</td>
</tr>
<tr>
<td>Self-rated economic status</td>
<td></td>
</tr>
<tr>
<td>Good</td>
<td>13 (2.1%)</td>
</tr>
<tr>
<td>Average</td>
<td>444 (73.3%)</td>
</tr>
<tr>
<td>Poor</td>
<td>149 (24.6%)</td>
</tr>
</tbody>
</table>

**Figure 1: The frequency of behaviour related to knowledge towards medications with expired date.**
unused medications, introduction with the instructions for the use, checking the expiration date), were statistically significant.

In the model of multivariate logistic regression (Table 2) with lack of knowledge about practices with the expired medications as dependent variable, statistically significant predictors were: unemployment (OR=2.21; CI95% 1.35-3.59), lower economic status (OR=1.67; CI95% 1.01-2.58), not reading the instructions for use (OR=3.26; CI95% 1.51-7.02) and not checking the expiration date (OR=3.30; CI95% 1.22-8.92). There was no significant collinearity among predictors.

Table 2 shows the univariate and multivariate logistic regression of inappropriate practices with expired medicines as dependent variable. In multivariate logistic regression model (Table 3) with inappropriate practice as dependent variable the statistically significant predictors were: the lower educational level (OR=1.75; CI95% 1.09-2.80), unemployment (OR=2.66; CI95% 1.17-6.05), families whose members were not capable to take care of their medications independently (OR=0.27; CI95% 0.12-0.61) and lack of knowledge (OR=4.09; CI95% 2.31-7.23). There was no significant collinearity among predictors.

### DISCUSSION

Study examines the knowledge and practices regarding disposal of expired medications and the possible predictors of knowledge and practices in a sample of 609 respondents in Health Centre Pancevo. Pancevo was chosen because of the fact that it is marked on domestic and foreign maps of Environmental Protection as the black point.²² Also, this is the first town in Serbia which had the local strategy for public health, developed within the project The Health of community – development and implementation of local strategies for public health.²¹ Now it has the strategic city development plan for the period 2014-2020.²³

In our study 2/3 of the respondents have medications that are unused, similarly to research in New Zealand,⁷ while this percentage in Ireland is higher and is almost 90%.¹⁵

Also, in our research, the respondents throw out to trash 50% of unused or expired medications. This practice is similar to practice of some other populations but from 10-20 years ago. In 1996 in Canada, 54% of unused medications were disposed in trash and 35.4% were flushed down the toilette or rinsed down a sink.²⁴ In six years, Canada succeeded in reducing inappropriate disposal practice, to 50% of the medications thrown...
Terzic-Supic, et al.: Unused Medications in Households in Serbia

Further research from 2005 showed that 1/4 of the Canadian households had unused medications and 20% to 70% of them throw medications into sewage or trash or even bury them instead of bringing them back to the pharmacy.

The similar situation was in: USA, where a half of unused medications were thrown into sewage and 22.9% were brought back to the pharmacy, in Kuwait, where 87.7% of respondents threw the medications to trash or spill them into the water, United Kingdom and New Zealand.

On the contrary, Sweden has long tradition of returning the unused medications to pharmacies which dates back to 1971, while the European Union carried out a directive in 2004 that all member states have to ensure the appropriate collection systems for medications that are unused or expired.

In our research, the most important predictor of improper disposal of expired medications was the lack of knowledge. Respondents with lack of knowledge had four times greater odds for inappropriate practices. In other studies, predictor for inappropriate disposal of unused medications was the presence of children under seven years in the family, which was not a significant predictor in our study. In our research, the important predictor was the family members who were not capable of taking care of their medications independently. These families had 2/3 less likelihood for inappropriate practices, which was, probably, the result of the higher responsibility relating the use of the medications.

Respondents with lack of knowledge, in our study threw out the expired medications more often into trash or rinse them down the sink, than returning them to the pharmacy or to the health centre. Although respondents

### Table 3: Univariate and multivariate logistic regression with inappropriate practice and disposal of the expired medications as dependent variable.

<table>
<thead>
<tr>
<th>Independent variable</th>
<th>Univariate model</th>
<th>Multivariate model</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (years)</td>
<td>1.01 (0.99-1.03)</td>
<td>0.158</td>
</tr>
<tr>
<td>Sex</td>
<td>1.32 (0.80-2.15)</td>
<td>0.282</td>
</tr>
<tr>
<td>Marital status</td>
<td>1.06 (0.63-1.80)</td>
<td>0.821</td>
</tr>
<tr>
<td>Years of education</td>
<td>2.19 (1.47-3.26)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Employment status</td>
<td>ref. category</td>
<td>&lt;0.002</td>
</tr>
<tr>
<td>employed</td>
<td>3.85 (1.87-7.94)</td>
<td>0.012</td>
</tr>
<tr>
<td>unemployed</td>
<td>2.07 (1.18-3.64)</td>
<td>0.17</td>
</tr>
<tr>
<td>retired person</td>
<td>2.66 (1.17-6.05)</td>
<td>0.019</td>
</tr>
<tr>
<td>ref. category</td>
<td>1.35 (0.71-2.58)</td>
<td>0.359</td>
</tr>
<tr>
<td>Residence</td>
<td>0.78 (0.48-1.29)</td>
<td>0.340</td>
</tr>
<tr>
<td>Living alone</td>
<td>1.07 (0.44-2.62)</td>
<td>0.877</td>
</tr>
<tr>
<td>Children under 7 years</td>
<td>1.08 (0.59-1.98)</td>
<td>0.808</td>
</tr>
<tr>
<td>Persons incapable to take care of their medications independently</td>
<td>0.44 (0.22-0.86)</td>
<td>0.016</td>
</tr>
<tr>
<td>Self-rated economic status</td>
<td>2.07 (1.15-3.71)</td>
<td>0.015</td>
</tr>
<tr>
<td>Using medications for chronic diseases</td>
<td>1.34 (0.82-2.20)</td>
<td>0.239</td>
</tr>
<tr>
<td>Using medications for acute diseases</td>
<td>1.16 (0.68-1.96)</td>
<td>0.580</td>
</tr>
<tr>
<td>Possessing unused medications</td>
<td>1.06 (0.63-1.78)</td>
<td>0.822</td>
</tr>
<tr>
<td>Reading instructions for use</td>
<td>14.09 (1.93-102.83)</td>
<td>0.009</td>
</tr>
<tr>
<td>Checking the expiration date before using the medication</td>
<td>8.20 (1.11-60.24)</td>
<td>0.039</td>
</tr>
<tr>
<td>Lack of knowledge</td>
<td>6.57 (3.24-9.57)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td></td>
<td>4.09 (2.31-7.23)</td>
<td>&lt;0.001</td>
</tr>
</tbody>
</table>
may be aware of the legal regulations about appropriate disposal of unused medications and about the adequate place for their collection they can ignore them in Sweden, 85% of respondents knew that unused medications should be returned to the pharmacy and 43% had done it within last year. However, in our study 73.9% of well-informed respondents did not dispose the medications appropriately. Reason for this might be the lack of adequate containers for disposal; though its possession is regulated by the law. Recent studies showed that the possible reason for the lack of information was non-existence of consensus about optimal disposal of unused medications. In the group of the respondents who knew where to dispose medications in the institution for collection or pharmacies, 25-30% of them respected it in comparison to 5-7% who had no information about the proper disposal.

Disposal of unused medications is becoming the growing problem for local communities and state administration from the aspect of environmental protection. Appropriate disposal of expired medications can be conducted by joint action on several levels. On the state level, situation could be improved by providing conditions for implementation of existing legislation (placing containers for collecting the unused medications). The next level belongs to health professionals and proper and rational prescription of medications or education. This should aim to better inform the users of health services, since research have shown that 80% of respondents have never received any information about proper disposal of unused medications, neither from doctors or the media. On community level, actions should provide the information and raise awareness about the importance of proper disposal of medications through the media, which are of vital importance for informing the public. Information could also be available to users via posters or pamphlets placed in pharmacies or in health institutions.

Limitations of this study relate to the town specificity so the results cannot be generalized to the whole Serbian population. Also, the possible limitation is the fact that it includes only the users of the primary healthcare service. Contribution of this study relates primarily to identification of predictors of knowledge and practices regarding expired medications and provision of basis for future researches. It also points out the necessity for clear formulations in the regulations for the proper disposal of expired medications and the control its implementation to reduce the harmful effects on health and ecology of the community caused by the medical waste.

CONCLUSION

Providing the safe disposal of unused medications is of high importance for the public health interest. In our study, the most important predictor of inappropriate practice toward expired medications is the lack of knowledge, contributed by unemployment, the lower economic status and omitting to read the instruction for use and to check expiration date. Inappropriate practices are affected by the lower educational level and inversely by the presence of family member who is not capable of taking care of his/her medicines independently.

ETHICAL APPROVAL

The Ethics Committee of the Primary Healthcare Centre Pancevo gave its approval for conducting the research, in accordance to the Article 33 of Healthcare Centre Statute.

ACKNOWLEDGEMENT

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CONFLICT OF INTEREST

The authors declare no conflict of interest.

ABBREVIATIONS

GP: General Practitioner; OR: Odds ratio; USA: United States of America.

REFERENCES


PICTORIAL ABSTRACT

SUMMARY

• Inappropriate disposal of medications is a public health issue, especially in low and middle income countries. Our study provides information on its association with lack of knowledge, lower educational level and unemployment. The lack of knowledge on proper disposal should be addressed through public health campaigns.

ABOUT AUTHORS

Zorica Terzic-Supic, Graduated at Medical Faculty, University of Belgrade, where she defended her MSc thesis and later PhD. Specialist of Social Medicine. She is working as a professor of Social Medicine, Medical Faculty and Center School of Public Health and Health Management, University of Belgrade. She is engaged in education of undergraduate and postgraduate students in the fields of Social Medicine, Public Health, and Health Management.

Dragica Bukumiric, she is graduated at the Faculty of Medicine. She works as Specialist of Social Medicine in the Primary Healthcare Center Pancevo, she is appointed as vice director. PhD student at the Medical Faculty of Pristina, Kosovska Mitrovica.
Milena Santric-Milicevic, is a Professor of Social Medicine at Medical Faculty and Center School of Public Health at the University of Belgrade at undergraduate and postgraduate level. Graduated at Medical Faculty, University of Belgrade, she latter defended MSc thesis and PhD. Specialist of Social Medicine.

Aleksandar Corac, is a of Preventive Medicine at Medical Faculty, University of Pristina, Kosovska Mitrovica, at undergraduate and postgraduate level. Graduated at Medical Faculty, University of Pristina. Specialist of Hygiene and Medical ecology.

Milica Paut Kusturica, is a of Department of Pharmacology, Toxicology and Clinical Pharmacology, Faculty of Medicine, University of Novi Sad, Novi Sad, Serbia.

Momcilo Mirkovic is Graduated at Medical Faculty, University of Pristina. Defended MSc thesis at Medical Faculty, University of Belgrade, and PhD thesis at the University of Pristina. Specialist of Social Medicine. He is working as a Professor of Social Medicine, at the Medical Faculty, University of Pristina- Kosovska Mitrovica.

Zoran Bukumiric, is an assistant Professor of Medical statistics and informatics at Medical Faculty at the University of Belgrade at undergraduate and postgraduate level. Graduated at Medical Faculty, University of Pristina and defended his PhD thesis at the Medical Faculty, University of Belgrade. Specialist of Clinical Pharmacology and Medical Toxicology.

Jovana Todorovic, is graduated at Medical Faculty, University of Belgrade. Defended master degree in Physical activity, health and exercise therapy in 2016. Phd student. She is engaged in education of undergraduate and postgraduate students in the fields of Social Medicine, Public Health, and Health Management.

Biljana Ristic, is graduated at Medical Faculty and Faculty of Philology, University of Belgrade. Currently she is woking as a general practitioner.

Goran Trajkovic, is a professor of Medical statistics and informatics at Medical Faculty at the University of Belgrade at undergraduate and postgraduate level. Graduated at Medical Faculty, University of Pristina where he defended his PhD thesis. Specialist of Psychiatry.