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The General and Oral Health Status in Older Adults from Rural Environment of Iasi County, Romania

Elena Mihaela CARAUSU [1], Cristina Gena DASCALU[2], Georgeta ZEGAN[3], Lucian Stefan BURLEA[4], Iulian Costin LUPU[5], Ileana ANTOHE[6]

Abstract

The older adults present different combinations of chronic multi-morbidity and functional limitations which determines health and social problems. The *aim* of the study was to assess the health status (general and oral) of the older adults because it can offer valuable information for estimation of the necessary health services. The targeted *objectives* were*:* the evaluation of oral morbidity, oral health related behaviors and attitudes towards oral health; evaluation of general morbidity; study of the addressability to health services and evaluation supplying medicines for rural area. From January–December 2016, we conducted a prevalence study focused on the main indicators of morbidity (general and oral). In our study were included 196 subjects, aged 65-74 years, 45.41% males, 54.59% females, from the rural community of Iasi County, in North Eastern region of Romania. In the studied group, the general morbidity model was the same for both male and female gender: in male gender, the morbidity was dominated by the cardiovascular diseases (63.24%), chronic digestive diseases (33.82%), diabetes mellitus (29.41%), osteoarticular diseases (27.94%), accidents and traumatisms (26.47%) and chronic respiratory diseases (23.53%); in female gender, it was also dominated by the cardiovascular diseases (67.82%), followed by diabetes mellitus

[1] Grigore T. Popa University of Medicine and Pharmacy, Faculty of Dental Medicine, Iasi, ROMANIA; E-mail: mihaelacarausu@yahoo.com

[2] Grigore T. Popa University of Medicine and Pharmacy, Faculty of Medicine, Iasi, ROMANIA. E-mail: cdascalu_info@yahoo.com (Corresponding Author)

[3] Grigore T. Popa University of Medicine and Pharmacy, Faculty of Dental Medicine, Iasi, ROMANIA, E-mail: georgetazegan@yahoo.com

[4] Grigore T. Popa University of Medicine and Pharmacy, Faculty of Dental Medicine, Iasi, ROMANIA; E-mail: lucianburlea@ yahoo.com (Corresponding Author)

[5] Grigore T. Popa University of Medicine and Pharmacy, Faculty of Dental Medicine, Iasi, ROMANIA, E-mail: lupu_costin@yahoo.com

[6] Grigore T. Popa University of Medicine and Pharmacy, Faculty of Medicine, Iasi, ROMANIA, E-mail: ileana.antohe@umfiasi.ro

(32.18%), osteoarticular diseases (31.03%) and chronic digestive diseases (24.14%). The oral morbidity model was relatively different between genders. At male gender, the predominant diseases were: dental caries (57.30%), lip and mucosal diseases (28.09%, OR=1.51, p<0.05), trauma (24.24%, OR=2.68, p<0.05) and total edentulism (25.84%). At female gender, the predominant diseases were: caries disease (59.81%), non-carious dental disorders (42.67%), periodontal disease (41.33%, OR=1.48, p<0.05) and total edentulism (29.91%).

Keywords: public health, rural health, geriatric population, general and oral morbidity, dentistry.

Introduction

It is projected that by the year 2020, there will be one billion elderly (65+ years) in the world and 71% of them will live in developing countries (Heinisch, 2010). In the last 20 years, in the European Union (EU), the aging demographic phenomenon registered an increasing trend following the life expectancy of the population. The onset and further global expansion mechanisms of this demographic phenomenon are complex, mainly being determined by migration and by reducing the rates of fertility and mortality. In its turn, Romania confronts with a deep social, economic and demographic transformation, the demographic phenomenon of ageing becoming quite severe in the last decade. It was registered approximately 3.419 million persons aged 65 and more, on the 1st of January 2015, the demographic ageing index being 103.5 seniors/100 young persons. The demographic phenomenon of ageing is significantly increased in the rural compared with the urban area; at the level of the entire population, the studies show that the population aged 65 and more represents 18.2% from the whole in the rural, as opposed to 12.7% in the urban.

In the rural environment, the demographic ageing phenomenon occurred especially in the case of female gender, which represents 27.8% out of the total number of women, in comparison to the male gender, that registers 20.1% out of the total male population (INS, 2015). According to the estimations (World Bank, 2014), the percent of the people aged 65 and more will rise up to 30% by the year 2060, being estimated also a significant increase of health services consumption regarding this age group (Romanian Guvernment, 2015). In Romania, the North-Eastern region is the area having the highest number of inhabitants with a mean population density of 100.2 inhabitants/km^2, which exceeds the mean value, 89.5 inhabitants/ km^2, corresponding to the entire country. Iasi is the county having the highest population density, of 149.9 inhabitants/ km^2 (INS, 2015).

Rural health is one of the public health main interdisciplinary approaches regarding the rural population. The concept of rural health involves many domains including public health, sociology and health economics, dental medicine, nursing and family medicine (Manuc & Carausu, 2014).

The changes in population dynamics are expected to have a major impact on the general health apart from the concerns on oral health. According to the principle of health equity, all citizens should have an equal opportunity to be healthy. However, wide disparities in health status exist within many countries worldwide (WHO, 2010). In developing countries, between urban and rural population, huge differences exist in overall health and oral health status (Duma *et al.*, 2014). Also, the demographic and socioeconomic factors affect health; therefore, the inequalities at rural environment are reflected in the geriatric population's general and oral health (WHO, 2008). The population aging has a major impact on the organization and delivery of healthcare especially in rural environment. Older adults in rural areas generally have less access to healthcare than their urban counterparts. Fewer medical practitioners, public health programs and healthcare facilities in rural areas often mean less preventative care and longer response times in emergencies (Rourke, 2008). In Romania, geriatric population from rural environment is highly disadvantaged, having an increased "medical consumption" and multiple health needs (primary and specialized) for the solving of which dental, medical and social approaches must be combined. Moreover, general health and oral health are interlinked because oral diseases and other no communicable chronic diseases share "common risk factors" (Conway *et al.*, 2013).

The achieving of this study was *motivated* by the lack of recent data about health status (general and oral) in rural older adults. Also, such type of study provides valuable information that are necessary for the decision-makers (at national and local level) in order to assess the opportunity of health programs integrated at community level designed to solve the main health problems emphasized in geriatric population from the rural environment and to estimate the resources required for their implementation.

The *aim* of our study was to assess the health status in older adults, aged 65-74 years, from a rural community of Iasi County, in North Eastern region of Romania, in order to identify the main general and oral health issues. The main *objectives* of our study were: (1) to evaluate the oral morbidity, the oral health related behaviors and the attitudes towards oral health; (2) to evaluate the general morbidity; (3) to study the addressability to health services; (4) to evaluate the supplying medicines for the rural areas.

Material and methods

Material

The *studied group* was selected from a rural community having 4975 inhabitants, 1712 (35.51%) out of them being older adults aged 65 to 74 years. Initially, our study involved 208 individuals who visited three rural private practices for health services (one dental medicine practice and two family practices), during January to December 2016. The global response rate was 94.23% (5 persons left the study because they changed their residence and 3 deceased during the 2016). Finally, the studied group included 196 older adults and was statistically representative for the geriatric population from rural environment of Iasi County. The accepted maximum error was ±2.58%.

Data collection

The study was conducted by a multidisciplinary team including public health, dentistry, medicine and biostatistics specialists. The *data collection* was carried out following the main directions: (1) a clinical examination (general and oral) - subjects were examined by a physician and information on their general and oral health status were recorded; (2) a questionnaire with 21 items that targeted: the self-perceived overall health, the self-related oral health; the addressability to health services and the supplying with medicines. For the questionnaire, the Cronbach alpha coefficient was 0.724. The data related to oral health were collected by the dentist, because the professional experience allowed an efficient communication with the seniors, especially with the patients having special needs (for example, deaf people or people having ophthalmologic problems). The data related to general health were collected by the general practitioners.

Variables

The *study design* was built according to the methodology of prevalence studies. The following demographic and socioeconomic factors were considered as *independent variables*: age, gender (male/female), marital status, living arrangements (refer to the place in which the elderly stay, the type of family in which they live and the people they stay with) educational level and personal monthly income.

The distinct categories designed for the level of personal monthly income are: poor (less than 100€/month), near poor (101-200€/month), lower middle income (201-325€/month) and middle income (326€/month-medium salary income). The structure of the studied group in relation to the educational level was established according to the International Standard Classification of Education (ISCED, 2011). In our study, the general morbidity indicators, the oral morbidity indicators

(Petersen & Baez, 2013), the addressability to health services, the supplying medicines, the self-perceived overall health, the self-related oral health (SOH) and the use of dental prosthesis have been taken as *dependent variables*. For the oral morbidity we followed the European Global Oral Health Indicators (Topping, Bonner, & Pitts 2005) in association with the indicators of general health (Dascalu, Carausu, & Manuc, 2008). The oral health related behaviors (the using of dental services during the past 2 years, smoking and alcohol use) and the oral health attitudes were also assessed. The general health status was assessed using the International Classification of Diseases (WHO, 2013).

Ethics statement

The ethical approval for the study was obtained from the institutional ethical committee. Each patient signed the informed consent (Iliescu Bulgaru, 2014), on the first visit to the general practitioner.

Statistical analysis

The database was created using Microsoft Access for Windows. The *statistical analysis* was performed with the SPSS software package for Windows. *The descriptive analysis* was used to assess the general morbidity and oral morbidity indicators. To evaluate the gender differences in the prevalence of oral diseases and general health outcomes we used *analytic statistic* methods; Odd Ratio (Viera, 2008) and Attributable Risk (or risk difference) with 95% *C*onfidence *I*ntervals (*CI 95%*) were used as measures of association between demographic and socio-economic factors considered as *independent variables* and health indicators as *dependent variables*. To assess the significance of the identified differences we performed the Chi-squared test (Pearson χ^2); p values ≤ 0.05 were considered to be statistically significant.

Results

The morbidity of older adults from the rural environment, dominated by the chronic and degenerative diseases, determines health (general and oral) and social problems that are difficult to manage.

The *general characteristics* of the studied group were presented in *Table 1*.

Table 1. General characteristics in older adults from rural environment

Age group: ***Gender:***	**65-74 years**						Odds Ratio (*CI 95%)*
	Male		**Female**		**Total**		
	n_1	(%)	n_2	(%)	N	(%)	
	89	45.41	107	54.59	196	100.00	
General characteristics [code of Item in data base]							
Education:							
-no formal schooling [1];	4	4.49	7		11	5.61	$OR_{[1+2+3]}$=0.
-primary school (ISCED1) [2];	11	12.36	16	6.54	27	13.76	7455
-secondary school (ISCED2)	14	15.73	27	14.93	41	20.92	(0.3074-
[3];				25.23			0.9878)
-post-secondary, non-tertiary	39	43.82	33		72	36.73	
education (ISCED3) [4];	11	12.36	15	30.84	26	13.27	
-vocational education	9	10.11	8	14.09	17	8.67	
(ISCED4) [5];	1	1.12	1	7.48	2	1.02	
-academic education (ISCED7)				0.93			
[6];							
-no answer [9].							
Pearson's χ^2	$\chi^2_{calculated\ value}$=5.433		Degrees of freedom=6		*p* value=0.48959127 NS		
Personal monthly income:							
-no income [1];	7	7.86	5	4.67	12	6.12	$OR_{[1+2]}$=0.9
-poor (less than 100 €/ month)	17	19.10	26	24.30	43	21.94	052
[2];	29	32.58	35	32.71	64	32.65	(0.4834-
-low income (101-							1.6952)
200€/month)[3];	28	31.46	31	28.97	59	30.10	
-lower middle income (201-							
325€/ month) [4];	8	8.98	10	9.35	18	9.18	
-middle income (326							
€/month- medium salary							
income) [5].							
Pearson's χ^2	$\chi^2_{calculated\ value}$=1.517		Degrees of freedom=4		*p* value=0.82415868 NS		
Marital status:							
-unknown [9];	1	1.12	2		3	1.53	
-not married [1];	2	2.25	3	1.87	5	2.55	
-widower [2];	33	37.07	36		69	35.20	
-divorced [3];	4	4.49	6	2.80	10	5.10	**$OR_{[4+5]}$=1.1**
-currently married [4];	43	48.31	52	33.64	95	48.47	**4**
-consensual union [5].	6	6.74	8	5.61	14	7.14	(0.65-2.01)
				48.59			*p*<0.05
				7.48			
Pearson's χ^2	$\chi^2_{calculated\ value}$=0.554		Degrees of freedom=5		*p* value=0.99001239 NS		
Living arrangements:							
-unknown [9];	0	0.00	1	0.93	1		$OR_{[1]}$=0.697
-not satisfying [1];	33	37.08	49	45.79	82	0.51	5
-satisfying [2];	26	29.21	23	21.49	49	41.84	(0.3928-
-good [3].	30	33.71	34	31.76	64	25.00	1.2385)
						32.65	
Odds Ratio (OR); *CI 95%- C*onfidence *I*nterval 95% for OR; OR bold values are Statistically Significant at p<0.05.							

By analyzing the age structure of the studied group, one can notice that most of the subjects (68.88%) were part of the aged group 65 to 69 years.

Oral morbidity in older adults from rural environment

The main results on the oral morbidity are shown in *Table 2*.

Table 2. Oral morbidity in older adults from rural environment

Age group: *Gender:* Oral morbidity	65-74 years						Odds Ratio (*CI 95%)*	Attributable Risk (AR)
	Male		Female		Total			
	n_1	(%)	n_2	(%)	N	(%)		
	89	45.41	107	54.59	196	100.00		
Prevalence indicators [code in data base]:								
Dental caries experience [K02.1, K02.2, K02.3, K02.5, K02.8]	51	57.30	64	59.81	115	58.67	OR=0.86 (0.49-1.52)	
Dental root residues [K08.3]	n_1=66	24.24	n_2=75 11	14.67	N=141 27	100.00 19.15	OR=1.86 (0.79-4.37)	AR=0.4624
Prevalence of other diseases of hard tissues of teeth [K03]: -dental erosion [K03.2]; -dental abrasion [K03.1]; -other.	21 7 6 6	31.82 10.61 9.09 9.09	32 16 13 5	42.67 21.33 17.33 6.67	53 23 19 11	37.59 16.31 13.48 7.80	$OR_{[K03]}$=0.63 (0.31-1.25)	
Prevalence of dental calculus [K03.5, subgingival and supragingival calculus]	31	46.97	28	37.33	59	41.84	OR=1.49 (0.76-2.91)	AR=0.3289
Prevalence of pulp and periapical tissues diseases [K04.0 K04.1, K04.2]	8	12.12	5	6.67	13	9.22	OR=1.93 (0.6-6.22)	AR=0.4817
Prevalence of periodontal diseases [K05.3, K05.4, K05.5, K05.6]	26	39.40	31	41.33	57	40.43	OR=1.48 (0.75-2.91)	AR=0.3243
Periodontal status- CP index (more than 20 teeth/ subject): -bleeding [1]; -calculus [2]; -pockets 3.5-5 mm [3]; -pockets 6 mm [4]; -healthy [5]; -excluded [6].	n_1=32 2 13 6 4 2 5	6.25 40.63 18.75 12.50 6.25 15.63	n_2=27 1 15 4 3 0 4	3.70 55.56 14.81 11.11 0.00 14.81	N=59 3 28 10 7 2 9	100.00 5.08 47.48 16.95 11.86 3.39 15.25	$OR_{[1]}$=1.7333 (0.1485-20.2332)	$AR_{[1]}$=0.4219
Pearson's χ^2	$\chi^2_{calculated\ value}$=3.227		Degrees of freedom=5		*p* value=0.66503512 NS			
Prevalence of gingival disorders [K06]: -gingival recession [K06.0]; -gingival enlargement [K06.1]; -alveolar pyorrhea.	n_1=89 22 11 5 6	24.72 12.36 5.62 6.74	n_2=10 7 29 17 8 4	27.10 15.89 7.48 3.74	N=196 51 28 13 10	100.00 26.02 14.29 6.63 5.10	$OR_{[K06]}$=0.88 (0.46-1.68)	
Pearson's χ^2	$\chi^2_{calculated\ value}$=1.444		Degrees of freedom=2		*p* value=0.48577972 NS			

Prevalence of gum diseases and edentulous alveolar ridge [K06.8, K06.9, K08.2]	n_1=38 7	18.42	n_2=55 12	21.82	N=93 19	100.00 20.43	OR=0.81 (0.29-2.29)	
Abscess [K04.6, K04.7, K04.8]	n_1=66 11	16.67	n_2=75 8	10.67	N=141 19	100.00 13.48	OR=1.68 (0.63-4.45)	AR=0.4048
Prevalence of salivary glands diseases [K11]	n_1=89 4	4.49	n_2=10 7 3	2.80	N=196 7	100.00 3.57	OR=1.63 (0.36-7.49)	AR=0.3865
Prevalence of lip and oral mucosal diseases [K13]	25	28.09	22	20.56	47	23.98	OR=1.51 (0.78-2.92)	AR=0.3377
Prevalence of stomatitis and related lesions [K12]	8	8.99	5	4.67	13	6.63	OR=2.01 (0.63-6.39)	AR=0.5025
Prevalence of lip and oral potentially malignant diseases [K13]	9	10.11	3	2.80	12	6.12	OR=3.9 (1.02-14.88)	AR=0.7436
Prevalence of temporo-mandibular joint diseases [K07.6]	11	12.36	15	14.02	26	13.27	OR=0.86 (0.38-1.99)	
Prevalence of dental trauma [1]: -missing tooth [5]; -excluded tooth [6].	n_1=66 16 14 2	24.24 21.21 3.03	n_2=75 8 7 1	10.67 9.33 1.33	N=141 24 21 3	100.00 17.02 14.89 2.13	$OR_{[1]}$=2.68 (1.06-6.75)	$AR_{[1]}$=0.6269
Yates' χ^2	$\chi^2_{calculated\ value}$=0.429		Degrees of freedom=1		*p*=0.51248004 NS			
Prevalence of edentulism: -total edentulism TE [2]; -partial edentulism PE [3]; -TE+PE [1].	n_1=89 23 15 38	25.84 16.85 33.71	n_2=10 7 32 23 55	29.91 21.50 51.40	N=196 55 38 93	100.00 20.06 19.39 47.45	$OR_{[1]}$=0.82 (0.44-1.53)	
Total / Partial edentulism ratio		1.53		1.39		1.48		
Use of dental prosthesis: -yes [1]; -not using the dentures [2].	22 1	24.72 1.12	31 1	28.97 0.93	53 2	27.04 1.02	$OR_{[1]}$=0.805 (0.42-1.52)	
Yates' χ^2	$\chi^2_{calculated\ value}$=0.203		Degrees of freedom=1		*p*=0.65231015 NS			
Prevalence of denture stomatitis [K12.1]	n_1=22 4	18.18	n_2=31 3	9.68	N=53 7	100.00 13.21	OR=2.07 (0.41-10.37)	AR=0.5169
No of natural teeth: -20 teeth or more [1]; -10-19 teeth [2]; -1-9 teeth [3].	32 19 15	35.96 21.35 16.85	27 25 23	25.23 23.36 21.50	59 44 38	30.10 22.45 19.39	$OR_{[1]}$=1.66 (0.89-3.07)	$AR_{[1]}$=0.3975

Pearson $\chi^2_{calculated\ value}$; Odds Ratio (OR); *CI 95%- Confidence Interval* 95% for OR; OR bold values are Statistically Significant at p<0.05; AR- Attributable Risk (risk difference).

The data found in *Table 2 and 3* draws up the *oral morbidity model* of the older adults from the rural environment, which is relatively different between genders. In male gender, the oral morbidity model is dominated by the dental caries, lip and mucosal diseases, dental trauma. The main risk factors for oral health are: dental calculus, radicular residues, poor oral hygiene and no tooth brushing. A relatively different oro-dental morbidity model is being emphasized in female gender, which is dominated by the caries disease, non-carious dental disorders, and periodontal disease. The main risk factors are: dental calculus, poor oral hygiene and no tooth brushing.

Addressability to dental medicine services

The main results of the addressability to dental medicine services and self-perceived oral health in older adults studied group are shown in *Table 3*.

The main factors that determined the *male patients* to *avoid the health services* are: lack of money, difficulties in walking, negligence, fear of pain and low educational level (under 8 classes). The *avoidance of health services* profile for female patients is linked to the same factors identified in the case of male gender.

General morbidity in older adults from rural environment

In rural geriatric population, the high prevalence of co-morbidities and barriers to care are observed, together with oral health care challenges in relation to major disease conditions. The main results regarding the general health outcomes are shown in *Table 4*.

The data displayed in *Table 4 and 5* emphasize the *general morbidity model* for both male and female gender of older adults from rural environment. In the case of male gender, the *general morbidity model* is dominated by the cardiovascular diseases, diabetes mellitus, osteoarticular diseases, accidents and traumatisms, chronic digestive diseases and chronic respiratory diseases. The main risk factors that have been identified are: the presence of co-morbidities, excessive alcohol consumption and smoking. The *general morbidity model* for female gender individuals is dominated by the cardiovascular diseases, diabetes mellitus, osteoarticular diseases, chronic digestive diseases and chronic respiratory diseases. The main risk factors for female gender older adults that have been identified are the same as in male gender: the presence of comorbidities, excessive alcohol consumption and smoking. A significant importance was given to the older adults suffering from diabetes mellitus, who also had periodontal diseases (OR=1.27).

Table 3. Self-perceived oral health and addressability to dental medicine services in older adults from rural environment

Age group: *Gender:*	65-74 years						Odds Ratio (*CI 95%)*	Attributable Risk (AR)
	Male		Female		Total			
	n_1	(%)	n_2	(%)	N	(%)		
	89	45.41	107	54.59	196	100.00		
Items of questionnaire [code of Item in data base]:								
Addressability to dental services: -not programmed [1]; -emergency [2]; -programmed [3].	4 32 53	4.49 35.96 59.55	6 45 56	5.61 42.06 52.34	10 77 109	5.10 44.39 50.51	$OR_{[2]}$=0.7735 (0.4337-1.3795)	
Pearson's χ^2	$\chi^2_{calculated\ value}$=1.033		Degrees of freedom=2		*p*=0.59660502 NS			
Your latest visit to the dentist: -I don't remember [9]; -last year [1]; -2 years ago [2]; -more than 3 years ago [3].	17 35 15 19	19.10 39.33 16.85 21.35	12 51 32 15	11.21 47.66 29.91 14.02	29 86 47 34	14.80 48.98 23.98 17.35	$OR_{[1+2]}$=0.3707 (0.1999-0.6876) $OR_{[3]}$=1.6648 (0.7904-3.5065)	$AR_{[3]}$=0.3993
Pearson's χ^2	$\chi^2_{calculated\ value}$=7.634		Degrees of freedom=3		*p*=0.05421356 NS			
Self-perceived oral health (SOH): -unknown [9]; -very poor [1]; -poor [2]; -average [3]; -good [4]; -very good [5].	1 11 19 49 7 2	1.12 12.36 21.35 55.06 7.87 2.25	2 17 28 44 11 5	1.87 15.89 26.17 41.12 10.28 4.67	3 28 47 93 18 7	1.53 14.29 23.98 47.45 9.18 3.51	$OR_{[1+2]}$=0.6823 (0.38-1.26)	
Pearson's χ^2	$\chi^2_{calculated\ value}$=4.168		Degrees of freedom=5		*p*=0.52549048 NS			
Reason for no visit to the dentist in the last year: -unknown [9]; -lack of money [1]; -difficulties in walking [2]; -fear [3]; -neglect [4].	1 48 18 7 15	1.12 53.93 20.22 7.87 16.85	2 64 23 12 6	1.87 59.81 21.50 11.21 5.61	3 112 41 19 21	1.53 57.14 20.92 9.69 10.71	$OR_{[1]}$=0.8556 (0.48-1.51)	
Pearson's χ^2	$\chi^2_{calculated\ value}$=6.806		Degrees of freedom=4		*p*=0.14650234-NS			
Reason for the current visit to the dentist: -pain [1]; -denture replacement [2]; -repair/adjustment denture [3]; -trauma [4]; -difficult mastication [5]; -oro-dental infection [6]; -complex oral rehabilitation [7]; -dental extraction [8].	32 4 12 5 15 7 5 16	35.96 4.49 21.35 5.62 16.86 7.87 5.62 17.98	27 8 19 2 21 4 8 11	25.23 7.48 17.78 1.87 19.63 3.74 7.48 10.28	59 12 31 7 36 11 13 27	30.10 6.12 15.82 3.57 18.37 5.61 6.63 13.78	$OR_{[1]}$=1.6634 (0.90-3.08)	$AR_{[1]}$=0.3888
Pearson's χ^2	$\chi^2_{calculated\ value}$=7.982		Degrees of freedom=7		*p*=0.3418381 NS			

Odds Ratio (OR); *CI 95%*- Confidence Interval 95% for OR; bold values of OR are Statistically Significant at p<0.05; AR- Attributable Risk (risk difference).

Table 4. General health outcomes in older adults from rural environment

Age group: *Gender:* General health outcomes	65-74 years						Odds Ratio (*CI 95%)*	Attributable Risk (AR)
	Male		Female		Total			
	n_1	(%)	n_2	(%)	N	(%)		
	68	43.87	87	56.13	155	100.00		
Prevalence indicators [code in data base]:								
Prevalence of cardiovascular diseases: -correctly treated [1]; -intermittent treatment [2]; -recently diagnosed [3].	43 16 13 14	63.24 23.53 19.12 20.59	59 32 10 17	67.82 36.78 11.49 19.54	102 48 23 31	65.81 30.97 14.84 20.00	OR=0.82 (0.42-1.59)	
Pearson's χ^2	$\chi^2_{calculated\ value}$=3.594		Degrees of freedom=2		*p*=0.16579553 NS			
Prevalence of chronic digestive diseases	23	33.82	21	24.14	44	28.39	OR=1.61 (0.8-3.24)	AR=0.3789
Prevalence of diabetes mellitus: -correctly treated [1]; -recently diagnosed [2].	20 12 8	29.41 17.65 11.76	28 15 13	32.18 17.24 14.94	48 27 21	30.97 17.42 13.55	OR=1.27 (0.64-2.51)	AR=0.2126
Pearson's χ^2	$\chi^2_{calculated\ value}$=0.196		Degrees of freedom=1		*p*=0.65796909 NS			
Prevalence of obesity	15	22.06	21	24.14	36	23.23	OR=0.89 (0.42-1.89)	
Prevalence of chronic rheumatic and osteoarticular diseases	19	27.94	27	31.03	48	30.97	OR=0.86 (0.43-1.73)	
Prevalence of trauma and accidents	18	26.47	9	10.34	27	17.42	OR=3.12 (1.3-7.49)	AR=0.6795
Pearson χ^2	$\chi^2_{calculated\ value}$=6.8996		Degrees of freedom=1		*p*=0.008621 SS			
Prevalence of chronic renal diseases	5	7.35	11	12.64	16	10.32	OR=0.55 (0.18-1.66)	
Prevalence of chronic respiratory diseases	16	23.53	13	14.94	29	18.71	OR=1.75 (0.78-3.95)	
Prevalence of neuropsychic conditions	4	5.88	3	3.45	7	4.52	OR=1.54 (0.33-7.15)	AR=0.3506
Prevalence of more than 2 chronic diseases in same subject (co-morbidities)	41	60.29	50	57.47	91	58.71	OR=1.12 (0.59-2.14)	AR=0.1071
Elderly with special needs: -motor special needs [1]; -sensorial special needs [2]; -psychiatric special needs [3].	8 5 2 1	11.76 7.35 2.94 1.47	5 4 1 0	5.75 4.60 1.15 0.00	13 9 3 1	8.39 5.81 1.94 0.65	OR=2.0148 (0.63-6.39)	AR=0.5036
Smoking prevalence: -more than 20 cigarettes/day [1]; -10-19 cigarettes/day [2]; -former smokers [3].	27 19 8 8	39.71 27.94 11.76 11.76	15 5 11 9	17.24 5.75 12.64 10.34	43 24 19 17	27.74 15.48 10.97 10.97	OR=3.16 (1.51-6.62)	$AR_{[1]}$=0.6835
Pearson χ^2	$\chi^2_{calculated\ value}$=9.7505		Degrees of freedom=1		*p*=0.001793 SS			

Prevalence of daily alcohol consumption (over 200 ml/day)	23	33.82	11	12.64	34	21.94	OR=3.53 (1.57-7.92)	AR=0.7167
Pearson χ^2	$\chi^2_{calculated\ value}$=9.9987		Degrees of freedom=1		p=0.001567 SS			
Added salt: -yes [1]; -dietary low sodium intake [3].	24 12	35.29 17.65	19 19	21.84 21.84	43 31	27.74 20.00	$OR_{[1]}$=1.95 (0.96-3.98)	$AR_{[1]}$=0.4872
Pearson χ^2	$\chi^2_{calculated\ value}$=2.11		Degrees of freedom=1		p=0.14633932 NS			
Odds Ratio (OR); *CI 95%- Confidence Interval* 95% for OR; bold values of OR are Statistically Significant at p<0.05; AR- Attributable Risk (risk difference).								

The prevalence of the gingival recession increases with age, correlated to the periodontal morbidity. The older adults suffering from diabetes mellitus face a significantly higher risk of gingival recession (OR=2.040), as opposed to the risk faced by the healthy older adults (OR=0.952). The gingival enlargement is registered in both age groups; its prevalence is higher in the aged group 70-74 years. The risk of gingival enlargement emergence is significantly higher in the case of the older adults suffering from diabetes mellitus (OR=1.972), in comparison to the healthy ones. The gingival enlargement was significantly frequent in the case of older adults suffering from diabetes and periodontal diseases which had also a precarious oral hygiene. For 28.81% of the patients suffering from periodontal diseases that have been taken into study, the evolution was not favorable, the periodontal affectation being medium and severe; a third of them were diagnosed also with diabetes mellitus. In which concerns the diabetic person suffering from periodontal diseases, the estimated risk of pyorrhea diagnosis is significantly higher (OR=1.829), as opposed to the estimated relative risk (OR= 0.933) in the healthy ones.

Addressability to health services and supplying medicines for the rural area

Particularly the older adults from the Iasi County rural environment faces difficulties concerning the medicines supply and low accessibility to health services (*Table 5*).

Table 5. Self-perceived overall health and addressability to health services in older adults from rural environment

Age group: *Gender:* Items [code of Item in data base]:	65-74 years						Odds Ratio (*CI 95%*)	Attributable Risk (AR)
	Male		Female		Total			
	n_1	(%)	n_2	(%)	N	(%)		
	68	43.87	87	56.13	155	100.00		
Health insurance coverage:								
-yes [1];	68	76.40	87	81.31	155	79.08	$OR_{[1]}$=0.74 (0.37-1.48)	
-without [2];	19	21.35	20	18.69	39	19.90		$AR_{[2]}$=0.152
-not used [9].	2	2.25	0	0.00	2	1.02	$OR_{[2]}$=1.18 (0.58-2.38)	
Pearson χ^2	$\chi^2_{calculated\ value}$=0.296		Degrees of freedom=1		p=0.586401 NS			
Number of visits to the family doctor (2016):								
-1-2 times [1];	19	27.84	22	25.29	41	26.45	$OR_{[1]}$=0.90 (0.45-1.83)	
-3-4 times [2];	18	26.47	26	29.88	44	28.39		
-5-12 times [3];	11	16.18	18	20.69	29	18.71		
-no visits [4].	20	29.41	21	24.14	41	26.45	$OR_{[3]}$=0.73 (0.32-1.69)	
Pearson χ^2	$\chi^2_{calculated\ value}$=5.439		Degrees of freedom=3		p=0.14233296 NS			
Where did you purchase the medication (in 2016):								
-local pharmacy [1];	46	67.65	68	78.16	114	73.54	$OR_{[1]}$=0.58 (0.28-1.19)	
-a city pharmacy within your residence [2];	1	1.47	2	2.30	3	1.94		
-no procurement [3];	18	26.47	16	18.39	34	21.94		
-no answer [9].	3	4.41	1	1.15	4	2.58		
Pearson χ^2	$\chi^2_{calculated\ value}$=1.811		Degrees of freedom=2		p=0.40433966 NS			
Difficulties in beneficiating from free/ compensated medicines (in 2016):								
-yes [1];	17	25.00	16	18.39	33	21.29	$OR_{[1]}$=1.47 (0.68-3.20)	$AR_{[1]}$=0.319
-no [2];	49	72.06	68	78.16	117	75.48		
-no answer [9].	2	2.94	3	3.45	5	3.23		
Self-perceived overall health (SPH):								
-very poor [1];	4	5.88	7	8.05	11	7.10	$OR_{[1+2]}$=0.83 (0.4-1.7)	
-poor [2];	13	19.12	18	20.69	31	20.00		
-average [3];	34	50.00	49	56.32	83	53.55		
-good [4];	14	20.59	11	12.64	25	16.13		$AR_{[4+5]}$=0.431
-very good [5];	1	1.47	1	1.15	2	1.29	$OR_{[4+5]}$=1.76 (0.76-4.08)	
-no answer [9].	2	2.94	1	1.15	3	1.94		
Pearson χ^2	$\chi^2_{calculated\ value}$=2.1		Degrees of freedom=4		p=0.71737239 NS			
Autonomy of daily living activities:								
-preserved [1];	49	72.06	62	71.26	111	71.61	$OR_{[1]}$=1.04 (0.51-2.1)	$AR_{[1]}$=0.0385
-walking outdoor [2];	13	19.12	18	20.69	31	20.00		
-indoor activities etc. [3];	4	5.88	7	8.05	11	7.10		
-no answer [9].	2	2.94	0	0.00	2	1.02		

Odds Ratio (OR); *CI 95%- Confidence Interval* 95% for OR; bold values of OR are Statistically significant at p<0.05; AR- Attributable Risk (risk difference).

Most of older adults reported physical exertion on a daily basis. A relatively healthy lifestyle was found in 30.32% of the subjects, the percent being insignificantly higher in men than in women (33.82% vs. 27.59%). The highest number of elderly people having a relatively healthy lifestyle was found in the aged group 65-69 years.

Discussions

Demographic and socioeconomic characteristics

In the studied group the female subjects were predominant, compared to males. From a *socioeconomic perspective*, the studied group included older adults who work in their own establishments doing subsistence agriculture and animal husbandry, pensioners in agriculture and persons who benefit from support allowances. For the most persons in the studied group, the personal monthly income is quite low, therefore in the recent years they are confronting with a lot of significant financial difficulties. It is noticed that for most of the older adults from rural environment, the main income came from the pension, which is not sufficient, especially for agriculture pensioners. The lack of other activities that might provide incomes is motivated by their old age and precarious health status (CNPV, 2014). The *marital status* is related with health outcomes. All of the various unmarried states (being single, never married, being separated/ divorced and being widowed) have been associated with high values of morbidity (Kiecolt-Glaser & Newton, 2001). *The living arrangements* refer to the place in which the older adults stay, the type of family in which they live and the people they stay with.

Oral morbidity in elderly from rural environment

Oral diseases are usually progressive and cumulative. The process of aging may directly or indirectly increase the risk of oral disease, characterized by poor general health, illnesses or chronic diseases. By analyzing the morbidity caused by oral diseases, it was found that the dental caries, the total edentulism, the periodontal diseases and the oral potentially malignant disorders (Carausu, 2016a) were the most frequent oral health problems in rural geriatric population.

Also, the *precarious oral hygiene* and the lack of hygiene in prostheses determine an excessive germ colonization that has negative consequences over the oral health status of the older adults in rural environment.

The *dental caries* are the most common cause of tooth loss. A low socioeconomic and health literacy status is associated with a high prevalence of dental caries (Naseem, 2005). After 65 years old, the prevalence of root caries is higher.

Also, the gingival recession and the abrasion defects at the neck of the tooth increase the amount of root caries.

The non-caries odontal pathology is rather diversified, with a relatively high prevalence in rural geriatric population. The dental erosion is the progressive, irreversible loss of dental hard tissue which is chemically etched away from the tooth surface by extrinsic and/or intrinsic acids. The specific non-caries lesions, with cervical or occlusal location, are determined by multiple factors, also registering a close correlation between dental abrazion and aging (Petersen & Kwan, 2011). These have a relatively high prevalence in rural geriatric population, but most of the times they remain untreated.

The periodontal diseases are one of the major causes of tooth loss. These include pathological conditions of the supporting structures of the teeth, gingiva, alveolar bone, periodontal ligament and cementum. The periodontal diseases share many common risk factors with other chronic diseases such as diabetes and cardiovascular diseases. The periodontal pathology found in elderly can be caused by poor oral hygiene, deficiencies existent in the sanogenous behavior and chronic diseases (Naseem, 2005).

The periodontal diseases affect 40.43% of the rural older adults included in our study. Therefore, the various causes of periodontal diseases are: direct causes (poor oral hygiene leading to accumulation of dental plaque and calculus) and distant causes (difficult access to an oral healthcare facility, poor oral health awareness, low socio-economic status and health literacy). Also, old and/or inappropriate prosthesis favor the excessive accumulation of dental plaque, which maintains the gingiva inflammation.

The morbidity caused by oral potentially malignant disorders and oral cancer

The term “oral potentially malignant disorders” cover a number of lesions of the oral mucosa, but the former term generally refers to leukoplakia, erythroplakia and lichen planus conditions with recognized potential (especially the latter) for malignant transformation (Carausu, *et al.*, 2016b). In the studied group, the prevalence of potentially malignant disorders was 6.12%.

The term “oral cancer” generally refers to oral squamous cell carcinoma (Glick & Johnson, 2011). The prevalence was high, but it has been observed that the most cases of oral cancer occur in the developing countries (Murray, 2014).

The edentulism is a relevant public health problem in dental medicine (WHO, 2012). The edentulism is defined as the loss of all permanent teeth and is the treatment outcome of a multifactorial process involving biologic factors (related to dental caries, periodontal diseases, trauma and others) as well as non-biologic factors (related to the access to dental services and dental procedures). The WHO considers edentulism as a poor public health outcome, which significantly affects the oral and general health as well as quality of life (WHO, 2012).

We found that the prevalence of edentulous older adults is 26.02%. The total edentulism prevalence is highest in rural individuals with lower educational level, lower social class, over 70 years old and female gender. Also, the edentulism and a small number of remaining teeth are associated with low education levels and low personal incomes.

In our study, the high level of necessary prosthetic treatment for the age group 65-74 years, reported through the number of teeth that require prosthetic interventions, can be explained by the low addressability level of the rural older adults to the dental medicine services, following the precarious economic level (out of the entire studied group, only 6.12% were reimbursed for the social prosthesis through health insurances in 2016), and the psychological, social, medical and individual factors. The older adults who belong to an under-privileged population group don't benefit from health education and are more frequently edentulous.

The disorders of the temporomandibular joint (TMJ) and the associated anatomical structures are important problems that often prove refractory to treatment and can be the cause of a significant increase of oral morbidity for rural older adults (Murray, 2014). Arthritis (Ancuta *et al.*, 2016) is the most frequent pathologic condition affecting the TMJ (the degenerative, rheumatoid, traumatic and infections arthritis are common in geriatric population) (Checherita *et al.*, 2017).

General health outcomes

With age increasing, a lot of underlying physiological changes occur, and the risk of chronic diseases rises (Ciobotea *et al.*, 2016). The *general morbidity* in our studied group made from older adults from rural environment is dominated by chronic and degenerative diseases. The burden associated with these conditions in geriatric population is generally far higher in low- and middle-income countries (WHO, 2015), also in Romania. The geriatric population has multiple health needs (primary and specialized), for the solving of which dental, as well as medical and social aspects need to be combined. After the age of 65+, the major burdens of disability and death arise from age related losses in hearing, seeing and moving (Ruse E *et al.*, 2005), and no communicable diseases, including heart disease, stroke, chronic respiratory disorders, cancer (Ursu *et al.*, 2015) and neuro-psychic conditions (Untu *et al.*, 2015; Bolos *et al.*, 2012).

Aging is accompanied by physiological changes that can negatively impact the nutritional status (Popa, Botnariu, & Antohe 2014). Sensory impairments, such as a decreased sense of taste or smell or both, may result in reduced appetite (Divaris *et al.*, 2012).

A poor oral health can lead to difficulty in chewing and a monotonous diet that is low in quality, all of which increase the risk of malnutrition in rural geriatric population.

The edentulism can affect the general health in several ways as indicated below: (1) the lower intake of vegetables and fibers and the increased cholesterol and saturated fats can increase the risk of cardiovascular diseases and gastrointestinal disorders; (2) an increased risk of hypertension, heart failure, ischemic heart disease, stroke, and an increased risk of coronary heart disease (Polzer *et al.*, 2010); (3) increased rates of chronic inflammatory changes of the gastrointestinal mucosa, higher rates of gastric or duodenal ulcers and upper gastrointestinal, hepatic and pancreatic cancer; (4) an increased risk of diabetes mellitus non-insulin-dependent; (5) decreased daily function, physical activity, and physical domains of health-related quality of life (Elham *et al.*, 2013).

In which concerns the diabetic older adult suffering from periodontal diseases, the chronic renal disease was also associated with hypertension for the individuals who have had this disease for a longer period of time (Mocanu, 2013). In the case of non-diabetics, the chronic renal disease is explained by the age and hypertensive angiopathy.

The causative or risk factors in oral disease are often the same as those involved in the major general diseases. The main risk factors for oral diseases include: poor oral hygiene, tobacco use, harmful alcohol use (Iliescu Bulgaru *et al.*, 2015) and unhealthy diet. These are risk factors for the leading chronic diseases (cardiovascular diseases, chronic digestive diseases, diabetes mellitus, chronic respiratory diseases), and the oral diseases are often linked to chronic diseases also (Cojocaru, *et al.*, 2013).

Addressability to health services

The *access to health services* is critical for rural geriatric population. The health services accessibility has four dimensions: economic accessibility (or affordability), physical accessibility, nondiscrimination and the accessibility of information. All of these are particularly relevant for the rural older adults who may face age-based rationing of services, physical limitations that make access particularly difficult, financial insecurity as a result of their age, and information barriers ranging from health literacy.

The Romanian elderly, residents in rural environment, often experienced barriers to health services. A lack of healthcare professionals can inhibit the accessibility by limiting the available health services. The elderly in rural areas are more likely to have to travel long distances in order to access the health services. This can be a significant burden in terms of both time and money. In addition, the lack of reliable transportation is a barrier to care. This is particularly a main factor in rural environment. In order to assure for rural residents an adequate healthcare access, necessary and appropriate health services must be available, which can be accessed in a timely manner (ODPHP, 2016).

In Romania, the accessibility of geriatric population (especially the population from the rural environment) to the medicines and healthcare services (Voitcu & Carausu, 2004) are influenced in a negative way by factors related to the organizing and the functioning of the health system, by the insurance status of each individual within the national health insurance system, by the education level, but also by the low level of individual income.

Most of the older adults declared that in 2016 they purchased their medication from the local pharmacy. Also, 21.94% of them faced difficulties when buying free/ compensated medicines (the most frequently mentioned reasons being: bureaucracy, the lack of medicines, the insufficient funds allocated to the pharmacies). At individual level, the difficulties faced by the elderly in the rural environment in which concerns the medication supply are related to the lack of money, and the high price of medicines.

The rural older adults may have more difficulties in accessing effective interventions to prevent and to control the orodental diseases than the urban individuals. One major barrier is the lack of money. This results in paying the dental expenditures from their own pocket as they age. The medium dental expenditures were lower among persons aged 70-74 years and older, as compared to the persons aged 65-69 years, fact which reveals that the rural elderly aged 65 or more request dental medicine services with a relatively rare frequency- 41.33% of them haven't visited the dentist for the last 2 years or even more.

The *perception of oral health* (SOH) is one of the indicators recommended for the analysis of the population health status. The positive perception about the individual's own health status is reduced once they age. Therefore, the percent of older adults registering a good and very good oral health is significantly reduced among persons aged 70-74 and older.

According to WHO, the solutions proposed by the public health specialists (increasing access to oral health of rural population, rural oral health training programs and recruitment, rural oral health research, reimbursement for oral health services for rural geriatric population) with regards to the improvement of population's health are efficient as long as they are integrated at a community level together with the solutions for the chronic diseases within coherent health programs; the oral health program proposed by WHO aligns to the strategies for promoting health (WHO, 2012). This emphasizes a coherent health policy that includes: (1) a good control of the risk factors for oral health and maintaining the risk factors common to those of chronic diseases, in order to be able to identify both oral and general chronic diseases simultaneously; (2) implementing health programs integrated at a community level, in rural area and poor environments, for vulnerable and under-privileged groups; (3) insuring the necessary technical and legislative support to configure an efficient oral health and to integrate the oral health system in the general healthcare frame.

Conclusions

From the results of our research the following conclusions are drawn: (1) The geriatric population in rural environment has a precarious general and oral health status; (2) During the aging process, the structural and mechanical characteristics of the dental structures are changing; this influences both the anatomic aspect of the teeth, as well as their functionality; (3) The solutions proposed by the public health specialists to improve the oral and general health status in rural geriatric population are efficient as long as they are integrated together with the solutions for the chronic diseases within certain public health programs integrated at a community level; (4) Knowing the health status of the elderly from rural areas, the policy makers (the Health Ministry and the Health and Social Insurance Houses) can estimate the resources necessary to implement community integrated health programs designed for the geriatric population; (5) Increasing access to health services in rural area includes a multifaceted approach conducted by the rural health providers and residents who desire to end the overall and oral health disparities in rural population; (6) The high morbidity revealed by the present study suggests that is necessary to develop public health services for the geriatric population from rural area of the North-Eastern region of Romania.

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