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CAUSES AND CONSEQUENCES OF HEAD INJURIES AMONG RURAL POPULATION HOSPITALIZED IN THE WARD FOR MULTI-ORGAN INJURIES. I. DEMOGRAPHIC AND SOCIAL STRUCTURE

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Abstract: The main objective of the study was the analysis of types, causes and consequences of head injuries among patients treated in the Ward for Multi-Organ Injuries during the period 1999-2002. The study aimed at the recognition of the health situation and selected demographic traits of people who had sustained head injuries. The authors' research tool – a Scientific-Research Protocol – was applied in the study. The survey covered 265 people, including 204 males (77.0%) and 61 females (23.0%) hospitalized due to head injuries; 90 people, i.e. 34% of the total population examined, were rural inhabitants 82.2% were males and 17.8% females. Thus, among the population examined the percentage of males was considerably higher than that of females, both in the sub-populations of urban and rural inhabitants. The percentage of people aged 65 and over was higher among the rural population, compared to urban inhabitants (21.1% and 8.0%, respectively), while the percentage of patients aged under 35 was lower (30.0% and 48.0%, respectively). A significantly higher percentage of patients living in rural areas, compared to urban inhabitants, had an elementary school or elementary vocational education level (77.8% and 46.3%, respectively). The number of patients who were never married was smaller among the rural than urban population (22.2% and 35.4%, respectively), whereas the percentage of those widowed was higher (13.3% and 2.9%, respectively). In the group of patients living in rural areas the percentages of people maintaining themselves on non-agricultural and agricultural work were similar (27.7% and 25.6%, respectively).

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INTRODUCTION

The consequences of injuries and poisonings are the main health and social problems in Poland. For about 15 years, injuries have been considered as a public health problem [5]. This is also an important cause of an increase in the number of the disabled, observed in each age category, in both genders, both in rural and urban areas. Injuries and poisonings are the third cause of death in Poland, following cardiovascular diseases and cancer [4, 17]. Injuries are most frequently the effect of road accidents, occupational accidents which take place at schools and cultural centres, during recreation and sports, as well as the result of suicidal attempts and murders. It is worth emphasizing that the problem of accidents and injuries sustained at home is frequently underestimated, although this is the place where the number of accidents is increasing year by year [6]. The disabled and elderly are most frequently the victims of accidents at home [2, 4, 12].

Statistical studies and data show that in recent years the causes of injuries, which had previously varied between rural and urban population, are fading. This may be associated

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with the fact that the life style of rural inhabitants is becoming similar to that of urban dwellers.

Head injuries occupy a significant position in the structure of injuries. These are generally severe injuries, which are often the cause of death. In Poland, the problems associated with the causes and consequences of injuries in the region of the head are not systematically monitored. The studies of farmers from the Lublin Region admitted to the emergency department due to injuries showed that work-related head injuries constituted 5.5% of the total number of injuries in this group [11]. This is an obstacle in solving health and socio-economic problems, especially among people who are long-term or permanently disabled due to this cause. This is also one of the main reasons for the lack of systematic improvement in health promotion and prophylactic programmes in the area of injuries prevention, including head injuries. Therefore, it is very justifiable to conduct the most comprehensive studies possible concerning the scope of these issues.

The results presented constitute a part of a large research programme conducted in cooperation with the Chair of Epidemiology, the Medical University and the Ward for Multi-Organ Injuries at the Regional Hospital in Lublin.

OBJECTIVES

The main objective of the study was the analysis of types, causes and consequences of head injuries among patients treated in the Ward for Multi-Organ Injuries during the period 1999–2002.

In order to realize the strategic goal the following groups of variables were analysed:

1. Demographic and social structure of the respondents: gender, age, marital status, education level, place of residence and source of maintenance.
2. Circumstances and site of an accident and injury.
3. Types of head injury inflicted and concomitant injuries.
4. Types of consequences of head injuries.

MATERIAL AND METHODS

Population examined. The study covered 265 people – 204 males (77.0%) and 61 females (23.0%) – hospitalized due to head injury in the Ward for Multi-Organ Injuries at the Regional Specialist Hospital in Lublin during the period 1999–2002. The study was of a retrospective character; therefore, patients who had a head injury diagnosed in medical records and hospitalized for more than one day were qualified for the study. For this purpose, all medical records concerning patients treated within the period of four years and meeting the above-mentioned criteria were analysed, which allowed the selection of 265 people for the presented study. The study was conducted during the period from November 2002 – November 2004.

In the presented study, the basic group for analysis was a sub-population of patients (90 people) living in rural areas, who constituted 34.0% of the total number of the population examined.

Organization of the study. The study was carried out by means of a specially designed Scientific-Research Protocol. It was preceded by a pilot study on a group of 20 patients in order to evaluate the value of the research tool and make the necessary corrections.

Application of the research tool. The scientific-research protocol was developed based on items in medical records, the scheme of which was obligatory during the period considered. This protocol consisted of 36 items.

The first section (7 items) covered demographic and social data, such as: gender, age, martial status, level of education, vocation learned and practised, and source of maintenance.

The second section of the research tool consisted of the most important data concerning the hospitalization of patients who had sustained head injuries (8 items). The following information was considered: way of arrival at hospital, circumstances of the injury inflicted, place of accident, date of accident, hour of admission to hospital, consumption of alcohol confirmed, and the number of days of hospitalization.

The third, most comprehensive section of the research tool (19 items), concerned the most important traits of the patients' state of health and needs for treatment, rehabilitation, orthopaedic and rehabilitation aids, and provision of technical means. This section covered selected data concerning types of diagnostic tests performed during hospitalization, evaluation of the state of health, number of hospitalizations in the Ward, the fact of hospital infection, place of discharge of a patient from the Ward, recommendations on discharge from hospital, types and consequences of head injuries, and auxiliary data for the presentation of medical epicrisis.

The fourth section (2 items) pertained to social problems and needs for care. One of the questions concerned the types of problems most frequently occurring in the everyday life of a patient, whereas the second question – types of demands for care after discharge from the Ward.

Statistical analysis of data. The majority of the data, except for age, had an ordinal and categorial status. For the needs of analysis, age was also converted into the ordinal scale, by grouping in 5 categories: ① <20; ② 20–34; ③ 35–49; ④ 50–64; and ⑤ ≥65. Statistical analyses were conducted with the use of the statistical package SPSS/PC v. 12. The significance of the differences was analysed by means of chi^2 test and U-Mann-Whitney test [16]. Interactions between the variables were assessed by means of logarithmic-linear analysis [8].

DEMOGRAPHIC AND SOCIAL CHARACTERISTICS OF THE POPULATION EXAMINED

Rural and urban population. The study covered 265 people – 34.0% of this group (90 persons) were rural inhabitants, while the remaining 66.0% (175 persons) – urban inhabitants. According to the data by the Main Statistical Office for the year 1999, 51% of the population in the Lublin Region lived in rural areas, and 49% were urban inhabitants [13]. With respect to these data, among the patients in the study a significant deficit of rural inhabitants and excess of urban dwellers was observed.

In order to control the possible interactions between the basic demographic variables analysed a hierarchical loglinear analysis was applied, considering in the model: place of residence, gender, age of patients (handled in 5 categories), and education level, which for the purpose of analyses was handled in 3 categories: ① elementary; ② vocational; ③ secondary school and university. It was noted that the total interaction between these 4 variables was insignificant (Tab. 1).

Table 1. Tests that k-way effects are 0[a].

K	df	Chi²	Probability
1	8	170.26	0.0001
2	21	153.81	0.0001
3	22	40.34	0.01
4	8	4.33	0.83

[a] The Table reports the significance of each k-way effect. K is an order of effect. K = 1 contains the effects of individual variables, K = 2 contains interactions between 2 variables, K = 3 are interactions between 3 variables, K = 4 contains the effect of a single interaction between 4 variables: PRESID * GENDER * AGE5 * EDU3. (Abbreviations: PRESID – Place of residence, AGE5 – Age 5-categorial, EDU3 – Education 3-categorial).

Table 2. Tests of partial associations[a].

Effect Name	df	Partial chi²	Probability
PRESID * GENDER * AGE5	4	2.56	0.63
PRESID * GENDER * EDU3	2	5.54	0.062
PRESID * AGE5 * EDU3	8	21.00	0.007
GENDER * AGE5 * EDU3	8	13.21	0.10
PRESID * GENDER	1	0.89	0.34
PRESID * AGE5	4	9.03	0.06
GENDER * AGE5	4	1.20	0.88
PRESID * EDU3	2	22.19	0.00001
GENDER * EDU3	2	12.80	0.002
AGE5 * EDU3	8	61.02	0.00001
PRESID	1	27.75	0.00001
GENDER	1	81.43	0.00001
AGE5	4	22.29	0.0002
EDU3	2	13.15	0.001

[a] The Table reports the significance of each of the individual k-way effects.

Education level was the variable interacting with all of the remainder. Among 3-order interaction, the interaction between place of residence * age * education was significant. All 3 tinteractions of this 2-order interaction were also significant: place of residence * education, gender * education and age * education (Tab. 2).

Gender. Among the patients from rural areas, 82.2% were males and 17.8% females. The situation was similar in the sub-population of urban inhabitants, where the percentage of males was significantly higher than that of females (74.3% and 25.7% respectively). According to the data by the Main Statistical Office for the year 1999, among the rural inhabitants of the Lublin Region the percentages of males and females were close to the value of 50%. Thus, with respect to the population in the region, among patients with head injuries, the percentage of males was significantly higher, compared to females.

Age. Table 3 presents the descriptive statistics concerning the age of patients in the study. The mean age of the rural inhabitants examined was 46.37 (SD = 18.70), while of urban inhabitants: 39.07 (SD = 17.93). The differences between age of rural and urban patients were evaluated by means of U-Mann-Whitney test. These differences were significant for the sub-population of males and for

Table 3. Age of rural and urban patients examined by gender.

	Place of residence		
	Rural area	Urban area	Total
Males			
n	74	130	204
Mean	46.73	39.07	41.85
SD	19.07	16.51	17.82
Median	49.03	38.48	42.58
Skewness	-0.007	0.275	0.225
SE of skewness	0.279	0.212	0.17
Females			
n	16	45	61
Mean	44.71	39.06	40.54
SD	17.34	21.75	20.7
Median	43.04	34.33	37.04
Skewness	0.205	0.927	0.738
SE of skewness	0.564	0.354	0.306
Total			
n	90	175	265
Mean	46.37	39.07	41.55
SD	18.70	17.93	18.49
Median	48.66	36.60	40.5
Skewness	0.03	0.562	0.372
SE of skewness	0.254	0.184	0.15

Table 4. Gender and age of rural and urban patients examined.

		Rural patients		Urban patients		Significance of differences between rural and urban patients		
		n	%	n	%	chi^2	df	Significance (2-tailed)
Gender								
Males		74	82.2	130	74.3	2.11	1	0.14
Females		16	17.8	45	25.7			
Total		90	100.0	175	100.0			
Age								
Males	<20	9	12.2	17	13.1	12.88	4	0.01
	20–34	13	17.6	44	33.8			
	35–49	18	24.3	30	23.1			
	50–64	18	24.3	30	23.1			
	≥65	16	21.6	9	6.9			
Females	<20	1	6.3	11	24.4	3.18	4	0.52
	20–34	4	25.0	12	26.7			
	35–49	5	31.3	9	20.0			
	50–64	3	18.8	8	17.8			
	≥65	3	18.8	5	11.1			
Total	<20	10	11.1	28	16.0	13.25	4	0.01
	20–34	17	18.9	56	32.0			
	35–49	23	25.6	39	22.3			
	50–64	21	23.3	38	21.7			
	≥65	19	21.1	14	8.0			

both genders jointly (both differences $p < 0.01$), whereas no statistically significant differences were noted for the sub-population of females. The distributions by age among rural and urban patients differed, not only by the location of the central value, but also by shape: age distribution of rural patients was close to symmetrical, whereas in urban patients – positively skewed.

Referring to the age variable handled in 5 categories (Tab. 4), among rural patients the most numerous group were people aged 35–49 (25.6%), followed by those aged 50–64 (23.3%), and people aged 65 and over (21.1%). The 2 youngest groups were less numerous: people aged under 20 constituted 11.1%, while those aged 20–34 – 18.9%. Among urban patients the most numerous group were people aged 20–34 (32.0%), while the least numerous – those aged 65 and over (8.0%).

Marital status. In both sub-populations compared marital status was not significantly related to age. Especially the youngest people aged under 20 were exclusively unmarried, whereas those widowed were aged 50 and over.

The sub-population of rural patients significantly differed from urban patients by the structure of marital status ($p<0.05$). In the sub-population of rural inhabitants, married people dominated (58.9%), followed by those who were not yet married (22.2%). Those who were widowed constituted 13.3%, and the divorced – only 5.6%. Among urban inhabitants also dominated people who were married, and their percentage (54.3%) was similar to that noted in rural areas. Among urban patients, those who were unmarried constituted 35.4%, i.e. more than among patients living in rural areas. Divorced patients living in cities constituted 5.6%, and those widowed – 2.9% (i.e. approximately 4 times less than among rural patients).

Education. The majority of patients living in rural areas had an elementary or elementary vocational education level (38.9% each), while one fifth of the patients examined (22.2%) had a secondary school or university education level. Compared to urban inhabitants, where people with secondary or university education constituted 53.7%, rural patients were significantly worse educated ($p<0.00001$), and among only rural inhabitants, males were considerably less educated than females ($p<0.00001$): among rural males and females the percentages of people with secondary and university education were 16.2% and 50.0%, respectively. Among urban inhabitants no differences between males and females were observed with respect to education status.

The differences between rural and urban patients from the aspect of education structure also depended on patients' age. Among those aged under 35, the structure of education

Table 5. Marital status of rural and urban patients examined.

		Rural patients		Urban patients		Significance of differences between rural and urban patients		
		n	%	n	%	chi^2	df	Significance (2–tailed)
Marital status								
Males	never-married	18	24.3	46	35.4	10.23	3	0.05
	married	43	58.1	72	55.4			
	divorced	5	6.8	10	7.7			
	widowers	8	10.8	2	1.5			
Females	never-married	2	12.5	16	35.6	c1		0.11
	married	10	62.5	23	51.1	c2		0.56
	divorced	0	–	3	6.7			
	widows	4	25.0	3	6.7			
<20	never-married	10	100.0	28	100.0	–	–	–
	married	–	–	–	–			
	divorced	–	–	–	–			
	widowed	–	–	–	–			
20–34	never-married	8	47.1	31	55.4	–	–	–
	married	9	52.9	23	41.1			
	divorced	–	–	2	3.6			
	widowed	–	–	–	–			
35–49	never-married	1	4.3	1	2.6	–	–	–
	married	18	78.3	36	92.3			
	divorced	3	13.0	2	5.1			
	widowed	1	4.3	–	–			
50–64	never-married	1	4.8	2	5.3	–	–	–
	married	15	71.4	27	71.1			
	divorced	2	9.5	8	21.1			
	widowed	3	14.3	1	2.6			
≥65	never-married	–	–	–	–	–	–	–
	married	11	57.9	9	64.3			
	divorced	–	–	1	7.1			
	widowed	8	42.1	4	28.6			
Total								
	never-married	20	22.2	62	35.4	14.05	3	0.01
	married	53	58.9	95	54.3			
	divorced	5	5.6	13	7.4			
	widowed	12	13.3	5	2.9			

c1 Fisher's exact test for the evaluation of differences between rural and urban patients for the grouped categories never married females/the remaining females.
c2 Fisher's exact test for the evaluation of differences between rural and urban patients for the grouped categories married females/the remaining females.

among rural and urban population was similar. Differences were noted, however, between the respondents in the older age groups, starting with 35 and over (for the age group 35–49 – $p < 0.005$; for the age group 50–64 – $p < 0.0005$; for the age group 65 and over – $p < 0.005$). In these age groups, among rural inhabitants dominated people with elementary vocational or elementary education level (85.7%), while in the cities – with secondary school or university education (56.0%).

Sources of maintenance. Among the population of patients living in rural areas, the greatest number of people maintained themselves on non-agricultural work (27.7%), including 14.4% of those employed in public institutions and 13.3% in private enterprises. A slightly lower percentage of people maintained themselves on agricultural work (25.6%). The subsequent group were those who received old age pension or agricultural health benefit (15.6%). Non agricultural benefit was the source of maintenance for

Table 6. Education level of rural and urban patients.

		Rural patients		Urban patients		Significance of differences between rural and urban patients		
		n	%	n	%	chi²	df	Significance (2-tailed)
Males	elementary	31	41.9	17	13.1	32.36	2	0.00001
	vocational	31	41.9	46	35.4			
	secondary school and university	12	16.2	67	51.5			
Females	elementary	4	25.0	14	31.1	0.48[a]	1	0.49
	vocational	4	25.0	4	8.9			
	secondary school l and university	8	50.0	27	60.0			
<20	elementary	5	50.0	17	60.7	[ac]		1.0
	vocational	2	20.0	4	14.3			
	secondary school and university	3	30.0	7	25.0			
20–34	elementary	1	5.9	3	5.4	1.62[a]	1	0.20
	vocational	8	47.1	17	30.4			
	secondary school and university	8	47.1	36	64.3			
35–49	elementary	6	26.1	2	5.1	10.82[a]	1	0.001
	vocational	11	47.8	10	25.6			
	secondary school and university	6	26.1	27	69.2			
50–64	elementary	8	38.1	5	13.2	14.75[a]	1	0.0001
	vocational	12	57.1	12	31.6			
	secondary school and university	1	4.8	21	55.3			
≥65	elementary	15	78.9	4	28.6	8.38[b]	1	0.004
	vocational	2	10.5	7	50.0			
	secondary school and university	2	10.5	3	21.4			
Total	elementary	35	38.9	31	17.7	26.37	2	0.00001
	vocational	35	38.9	50	28.6			
	secondary school and university	20	22.2	94	53.7			

[a] In calculations concerning the sub-population of females the categories elementary and vocational were additionally joint. [b] In the analysis concerning the age ≥65 the categories: vocational and secondary school and university were joint. [c] Fisher's exact test.

10.0% of patients, while 6.7% of them earned an income from occasional occupations and other non-earned sources. The remaining 14.4% were people who had no personal source of income and were maintained by their families.

Nearly one third of the sub-population of males maintained themselves on work in agriculture, whereas among females this category was not represented. A considerably higher percentage of those maintaining themselves on work in public institutions (31.3%) was noted among females, compared to males. When omitting the category of work in agriculture and old age pensions, the structure of the sources of maintenance among rural population did not significantly differ from the structure of the sources of maintenance of urban patients.

DISCUSSION

In the presented study, among the patients examined, a considerably greater number of males than females was observed. The percentages of males and females similar to those obtained in the presented study were obtained by Australian researchers among patients with traumatic brain injury living in rural areas (M – 75.0%; F – 25.0%) and in urban areas (M – 80.0%; F – 20.0%) [3]. Polish studies, which covered the population of the Lublin Region, indicated that males are more often exposed to animal-related injuries, compared to females [10]. Also, other studies carried out in the above-mentioned region of Poland confirmed that 80% of severe penetrating eye injuries related with work in agriculture concerned males [7]. This indicates that the male gender is associated with a significant threat of head injuries. In addition, the non-significance of the interaction between gender and place of residence, rural or urban, suggests that the factors associated with gender which modify the level of risk of head injury acted in a similar way in both environments, irrespective of their specificity. Such factors, on the one hand, may be inborn traits conditioning higher inclination to risk in males, compared to females. On the other hand, considering the environmental variables, the representatives of both genders

Table 7. Sources of maintenance of rural and urban patients examined.

	Rural patients		Urban patients		Significance of differences between rural and urban patients		
Source of maintenance	n	%	n	%	chi[2]	df	Significance (2-tailed)
Males							
maintained by family	11	14.9	26	20.0	5.28[a]	4	0.26
work in public institutions	8	10.8	25	19.2			
work in private enterprises	9	12.2	42	32.3			
agricultural work	23	31.1	2	1.5			
old age pension, agricultural benefit	11	14.9	5	3.8			
non-agricultural benefit	9	12.2	14	10.8			
occasional occupations, other non-earned sources	3	4.1	16	12.3			
Females							
maintained by family	2	12.5	13	28.9	– [b]	–	–
work in public institutions	5	31.3	11	24.4			
work in private enterprises	3	18.8	11	24.4			
agricultural work	0	–	2	4.4			
old age pension, agricultural benefit	3	18.8	3	6.7			
non-agricultural benefit	0	–	3	6.7			
occasional occupations, other non-earned sources	3	18.8	2	4.4			
Total							
maintained by family	13	14.4	39	22.3	2.84[a]	4	0.59
work in public institutions	13	14.4	36	20.6			
work in private enterprises	12	13.3	53	30.3			
agricultural work	23	25.6	4	2.3			
old age pension, agricultural benefit	14	15.6	8	4.6			
non-agricultural benefit	9	10.0	17	9.7			
occasional occupations, other non-earned sources	6	6.7	18	10.3			

[a] Analysis of the differences was performed omitting the categories: agricultural work, old age pension, agricultural benefit.
[b] Analysis of the differences was not performed due to the small numbers of respondents.

differ by the type of occupational roles performed – males more frequently than females undertake occupations and perform activities associated with an increased risk of accident or injury.

The remaining results are difficult to compare with the results by other authors, because the population examined was not selected by the random method. The presented demographic traits concerned patients in the ward of one hospital, treated within a specified time. This weakens the possibilities of interpretation of the presented differences between patients living in rural and urban areas with respect to age, marital status and education from the aspect of head injury risk factors. However, the presented results indicate what is common and what is specific for each of the 2 environments: rural and urban, with respect to the intensity of the demand for treatment, health care and rehabilitation generated by head injuries in the environments discussed.

In the rural environment there is still the problem of registration of all injuries, although the situation has changed slightly for the better after the Agricultural Social Insurance Fund began functioning in 1990. It should be emphasized that in Polish rural areas the actual number of occupational accidents on private farms is not known. Many accidents, so-called 'light', are not reported due to the fact that only people with permanent or long-term health loss are entitled post-accident compensation [15].

The importance of the health problem may be objectively evaluated mainly by death rates. Based on the prognoses concerning mortality by causes it is possible to calculate the foreseen Years of Life Lost. In the Global Burden of Disease, 10 foreseen main causes of death in 2020 have been presented (the primary scenario), where the death rates due to road accidents are expected to increase by 45% in relation to the year 1999, this increase being greater among females (by 46.5%) than in males (by 41.5%) [9].

In 2001 in Poland, the actual death rate due to external causes was higher among the rural population (16.5%) than among urban inhabitants (14.3%). This rate was significantly higher among males living in rural areas (28.9%),

compared to urban areas (25.2%), while the differences which occurred in analogous sub-populations of females were slight (4.1% and 4.4% respectively) [17].

The mortality rate due to external causes shows a downward tendency, but still remains considerably higher than the average in West European countries [17]. The results of studies and statistical data show that for more than 10 years certain specific causes of injuries in rural areas have been becoming similar to those occurring in the cities. This is mainly the result of the greater urbanization of rural areas. The studies conducted among the population of the Lublin Region showed that the frequency of animal-related accidents was similar in rural and urban environments; however, differences were observed with respect to the type of animal involved in an accident. In the rural areas, injuries were associated with large animals (e.g. cattle, horses), whereas in the urban environment – with small animals (e.g. cats, dogs) [10].

In Poland, similar to other European countries, the epidemics of injuries at the beginning of the 21st century is a problem forcing the implementation of changes in the organization of prophylaxis and health promotion for the rural and urban population, with a particular consideration of children, the disabled and the elderly [1, 14].

CONCLUSIONS

1. Among patients hospitalized due to head injuries the percentage of males was significantly higher than that of females, both in the sub-population of rural and urban patients.

2. Among rural patients, compared to those living in urban areas, a higher percentage of the oldest people was observed (aged 65 and over), while a lower percentage of those aged under 35 was observed. Significant differences in the age structure between rural and urban patients were noted in the total population and in the sub-population of males.

3. The education structure of rural patients was characterised by a significantly higher percentage of people with elementary and elementary vocational education, compared to urban areas. These differences were highly significant in the total population and in the sub-population of males, but non-significant among females.

4. Among patients living in rural areas, compared to urban inhabitants, a smaller number of people never-married was observed, while the number of those widowed was higher.

5. Among rural population hospitalized due to injuries, the percentages of those maintaining themselves on non-agricultural occupations and agricultural work were similar.

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