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PREVALENCE OF GASTROINTESTINAL SYSTEM INFECTIONS ACQUIRED IN PROVINCIAL HOSPITAL IN 2004-2013

St. Lukas Provincial Hospital in Tarnów

ABSTRACT

INTRODUCTION. Gastrointestinal system infection (GI) is an infection which is frequently acquired in healthcare settings. In Poland, there are limited data on the distribution of gastrointestinal system infections in the epidemiology of healthcare-associated infections (HAIs). Therefore, a study was initiated with the objective to assess the prevalence and distribution of healthcare-associated gastrointestinal system infections in patients hospitalized in St. Lukas Provincial Hospital in Tarnów.
MATERIAL AND METHODS. Data of 297,545 patients hospitalized in 2004-2013 were subject to analysis. Standard epidemiological methods and unified definitions of healthcare-associated infections issued by the European Centre for Disease Prevention and Control (ECDC) were employed in the analysis.
RESULTS. A total of 944 healthcare-associated gastrointestinal system infections were indentified in the material analyzed. In a 10-year observation of HAI prevalence, GIs predominated over other HAIs registered in St. Lukas Provincial Hospital in Tarnów. Cumulative incidence rate (CIR) and incidence density rate (IDR) for GIs were 0.35% and 0.57/1,000 person-days, respectively. Infections with *Clostridium difficile* (GI-CDI), also referred to as *C. difficile*-associated diarrhoea (CDAD) were diagnosed in 301 patients. For GI-CDI, CIR and IDR were 0.11% and 0.18/1,000 person-days, respectively. Gastroenteritis excluding CDI (GI-GE) was identified in 643 patients with CIR and IDR amounting to 0.24% and 0.39/1,000 person-days, respectively. Gastroenteritis of rotavirus (CIR-0.11% and IDR-0.18/1,000), adenovirus (CIR-0.01% and IDR-0.02/1,000) and norovirus (CIR-0.01% and IDR-0.01/1,000) etiology was identified in 292, 32 and 17 patients, respectively. The highest number of infections was reported in paediatric ward, i.e. 307 persons (32.5%) (CIR-1.84% and IDR-2.79/1,000) and internal medicine and nephrology ward - 202 infections (21.4%) (CIR-1.47% and IDR- 1.66/1,000).
CONCLUSIONS. A 10-year observation of healthcare-associated infections showed a change in the distribution of HAIs. In recent years, GIs predominated over all infections acquired in healthcare settings. The most prevalent etiological agent identified was *Clostridium difficile.*

Key words: *healthcare-associated infection (HAI), gastrointestinal system infection (GI), rotavirus (GI-GE), Clostridium difficile infection (CDI).*

INTRODUCTION

According to literature data, the number of infections with *C. difficile (Clostridium difficile)* in hospitalized patients is on the increase. Such problem is observed in Poland as well as in other European and non-European countries (1 - 5) These infections have epidemiological and economic consequences associated with patient's stay in hospital which contribute to an extension of hospitalization, patient's suffering and stress. They may also be considered as a threat for public health (6). In Poland, marginal data on healthcare-associated gastrointestinal system infections exist. Available data discuss mainly diarrhoeas caused by rotaviruses identified in paediatric wards (7, 8). There is a lack of Polish epidemiological studies on the frequency of CDIs. Furthermore, information on long-term monitoring of CDIs in Polish hospitals is also lacking (9). Since 2004, however, St. Lukas Provincial Hospital in Tarnów registers healthcare-associated infections as separate causes of diarrhoeas with determination of etiological agents. Therefore, we decided to perform a comprehensive analysis of these infections using standard, uniform tools such as cumulative incidence

rates (CIRs) and incidence density rates (IDRs). Results obtained may serve as a base for comparing and evaluating epidemiological situation in Polish hospitals as well as high-specialist wards.

MATERIAL AND METHODS

In 2004-2013, patients hospitalized in St. Lukas Provincial Hospital in Tarnów were subject to epidemiological surveillance. As many as 21 surgical, conservative and paediatric wards were monitored. In the analysis, wards with no healthcare-associated gastrointestinal system infections detected were excluded. Diagnosis of infections was made on a basis of recommendations issued by the expert groups of CDC (Centres for Disease Control and Prevention) and then ECDC (European Centre for Disease Prevention and Control). Healthcare-associated infections identified (HAIs) were subject to analysis and classified according to ECDC definitions (10, 11). While registering the infections, the following classification of clinical manifestations was used: surgical site infection (SSI), pneumonia (PN), urinary tract infection (UTI), bloodstream infection (BSI), gastrointestinal system infection (GI) and other infections (OTH). Cumulative incidence rate (CIR per 100 and 1,000 hospitalizations) was calculated using the number of new cases of GI in the analyzed population over a specified time period: the number of GIs divided by the number of hospitalizations and multiplied by 100 or 1,000. Incidence density rate (IDR/1,000 person-days) was calculated as follows: the number of GIs divided by the number of person-days and multiplied by 1,000.

Gastrointestinal system infections (GIs) were grouped into: infections caused by *C. difficile* (GI-CDI) and those excluding *C. difficile* etiology (GI-GE). Subsequently, gastroenteritis/excluding CDI (GI-GE) was classified into subgroups by etiological agents identified, i.e. rotaviruses, noroviruses, adenoviruses, *C. albicans* and unspecified agent. Pursuant to provisions of law in force, patient suspected of infection or infected should be subject to adequate isolation. Etiological agents of GIs such as rotaviruses, noroviruses, *C. difficile* were monitored and analyzed within the frames of surveillance over alert pathogens.

Faeces sample testing was performed using the following culture media: chromogenic medium Chromid ID CPS, MacConkey agar, Hektoen agar, sodium selenite medium (bioMérieux media), Sorbitol MacConkey agar (selective isolation of *E. coli* O157:H7 – Grasso media), Sabouraud agar (with gentamicin and chloramphenicol). Furthermore, tests for the presence of rotaviruses and adenoviruses (VIKIA® Rota-Adeno by bioMériux) and *C. difficile* (C. DIFF QUIK CHEK COMPLETE by TECHLAB) were also performed.

RESULTS

In a 10-year period, a total of 297,545 patients were hospitalized in St. Lukas Provincial Hospital in Tarnów. Of them, 5,167 (1.7%) were diagnosed with HAI, including 944 GIs. In this period, 52 outbreaks of GI were detected where 404 out of 944 patients were affected. The remaining cases of GI, i.e. 540 out of 944 patients were not involved in these outbreaks. A systematic increase in the number of GI cases compared to the total number of HAIs was observed with the highest increase noted in internal medicine and nephrology and urology wards. The number of GIs in particular years ranged from 14 (2005) to 155 (2013) (Tab. I). In a 10-year observation, there was a shift in the distribution of GIs in HAIs. In 2004-2006, these infections were placed as 5th in hospital after SSI, BSI, PN, UTI while in 2010-2013 they moved to the first position (Tab. II). For all 944 GIs detected, cumulative incidence rate (CIR) was 0.35% while incidence density rate (IDR) amounted to 0.57/1,000 person-days (Tab. III). From the group of GIs, infections with *C. difficile* (GI-CDI) and those excluding *C. difficile* etiology (GI-GE) were distinguished.

A total of 301 patients were diagnosed with CDI with CIR and IDR amounting to 0.11%, 1.13/1,000 hospitalizations and 0.18/1,000 person-days, respectively.

Table I. Number of gastrointestinal system infections (GIs) in all healthcare-associated infections (HAIs) in 2004-2013

Number of GIs in all HAIs in 2004-2013											
Clinical manifestation of HAI	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	Total
SSI	119	102	85	97	107	128	121	127	137	137	1160
PN	40	65	48	86	77	65	55	61	58	64	619
UTI	37	53	67	94	128	115	122	101	91	77	885
BSI	59	69	93	109	130	117	68	76	108	73	902
GI	**21**	**14**	**48**	**98**	**76**	**117**	**116**	**155**	**140**	**159**	**944**
OTH	4.0	29	31	54	91	111	54	61	124	98	657
Total	280	332	372	538	609	653	536	581	658	608	5167

HAI - healthcare-associated infection, SSI - surgical site infection, PN - pneumonia, UTI - urinary tract infection, BSI - bloodstream infection, GI - gastrointestinal system infection, OTH - other infection.

Table II. Distribution (%) of gastrointestinal system infections (GIs) in all healthcare-associated infections (HAIs) in 2004-2013

Disribution of GIs in all HAIs												
Clinical manifestation of HAI		2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	Total
SSI	%	42.5	30.7	22.8	18.0	17.6	19.6	22.6	21.9	20.8	22.5	23.9
PN	%	14.3	19.6	12.9	16.0	12.6	10.0	10.3	10.5	8.8	10.5	12.5
UTI	%	13.2	16.0	18.0	17.5	21.0	17.6	22.8	17.8	13.8	12.7	17.0
BSI	%	21.1	20.0	25.0	20.3	21.3	17.9	12.7	13.1	16.4	12.0	18.0
GI	**%**	**7.5**	**4.2**	**12.9**	**18.2**	**12.5**	**17.9**	**21.6**	**26.7**	**21.3**	**26.2**	**16.9**
OTH	%	1.4	8.7	8.3	10.0	14.9	17.0	10.1	10.5	18.8	16.1	1.6
Total	%	100	100	100	100	100	100	100	100	100	100	100.0

HAI - healthcare-associated infection, SSI - surgical site infection, PN - pneumonia, UTI - urinary tract infection, BSI - bloodstream infection, GI - gastrointestinal system infection, OTH - other infection.

Table III. Healthcare-associated gastrointestinal system infections (GIs) by cumulative incidence rates (CIRs) and incidence density rates (IDRs) in 2004-2013

Year	Hospitalizations	Person-days	HAI case (GI)			
			N	CIR/100 hospitalizations	CIR /1,000 hospitalizations	IDR/1,000 person-days
2004	24278	160297	21	0.09	0.82	0.13
2005	24260	163004	14	0.06	0.54	0.09
2006	25559	171295	48	0.19	1.75	0.28
2007	26864	167202	98	0.36	3.41	0.59
2008	29232	165406	76	0.26	2.43	0.46
2009	28572	167168	117	0.41	3.87	0.70
2010	20341	171256	116	0.57	3.69	0.68
2011	29490	165146	155	0.53	4.74	0.94
2012	28858	159897	140	0.49	4.41	0.88
2013	29571	157249	159	0.54	4.90	1.01
Total	**267025**	**1647920**	**944**	**0.35**	**3.17**	**0.57**

HAI - healthcare-associated infection, GI - gastrointestinal system infection, N – number of infections, CIR/100 hospitalizations – cumulative incidence rate, CIR/1,000 hospitalizations - cumulative incidence rate, IDR/1,000 person-days- incidence density rate.

Table IV. Healthcare-associated gastrointestinal system infections (GIs) by cumulative incidence rates (CIRs) and incidence density rates (IDRs) for infections with *C. difficile* (CDI) and other gastrointestinal system infections (GE) in 2004-2013

Healthcare associated GIs as CDI and GE								
Year	CDI – infections with *C. difficile*				GE- infections excluding *C. difficile* etiology			
	Number of CDIs	CIR CDI/100 hospitalizations	CIR CDI/1,000 hospitalizations	IDR CDI/1,000 person-days	Number of GE	CIR GE/100 hospitalizations	CIR GE/1,000 hospitalizations	IDR GE/1,000 person-days
2004	1	0	0.04	0.01	20	0.08	0.82	0.12
2005	1	0	0.04	0.01	13	0.05	0.54	0.08
2006	8	0.03	0.31	0.05	40	0.16	1.57	0.23
2007	14	0.05	0.52	0.08	84	0.31	3.13	0.5
2008	22	0.08	0.75	0.13	54	0.18	1.85	0.33
2009	28	0.1	0.98	0.17	89	0.31	3.11	0.53
2010	33	0.16	1.62	0.19	83	0.41	4.08	0.48
2011	65	0.22	2.2	0.39	90	0.31	3.05	0.54
2012	51	0.18	1.77	0.32	89	0.31	3.08	0.56
2013	78	0.26	2.64	0.5	81	0.27	2.74	0.52
Total	**301**	**0.11**	**1.13**	**0.18**	**643**	**0.24**	**2.41**	**0.39**

CDI: gastrointestinal system infections with *C. difficile,* GE: gastrointestinal system infections (excluding CDI etiology), CIR/100 hospitalizations - cumulative incidence rate, CIR/1,000 hospitalizations - cumulative incidence rate, IDR/1000 person-days- incidence density rate.

Table V. Gastrointestinal system infections (GE) of viral etiology by cumulative incidence rates (CIRs) and incidence density rates (IDRs) in 2004-2013

Healthcare-associated gastrointestinal system infections by viral etiological agents in GI-GE group												
Year	***Rotaviruses***			***Noroviruses***			***Adenoviruses***			Total		
	Number of HAI-GE	CIR	IDR	Number of HAI-GE	CIR	IDR	Number of HAI-GE	CIR	IDR	Number of HAI-GE	CIR	IDR
2004	9	0.04	0.06	0	0.00	0.00	0	0.00	0	9	0.04	0.06
2005	13	0.05	0.08	0	0.00	0.00	0	0.00	0	13	0.05	0.08
2006	21	0.08	0.12	3	0.01	0.02	0	0.00	0	24	0.09	0.14
2007	47	0.17	0.28	0	0.00	0.00	0	0.00	0	47	0.17	0.28
2008	31	0.11	0.19	0	0.00	0.00	3	0.01	0.02	34	0.12	0.21
2009	42	0.15	0.25	5	0.02	0.03	6	0.02	0.04	53	0.19	0.32
2010	36	0.18	0.21	3	0.01	0.02	5	0.02	0.03	44	0.22	0.26
2011	40	0.14	0.24	0	0.00	0.00	9	0.03	0.05	49	0.17	0.30
2012	27	0.09	0.17	5	0.02	0.03	7	0.02	0.04	39	0.14	0.24
2013	26	0.09	0.17	1	0.00	0.01	2	0.01	0.01	29	0.10	0.18
Total	**292**	**0.11**	**0.18**	**17**	**0.01**	**0.01**	**32**	**0.01**	**0.02**	**341**	**0.13**	**0.21**

HAI - healthcare-associated infection, GI-GE: gastrointestinal system infections (excluding GI-CDI), CIR/100 hospitalizations- cumulative incidence rate, IDR/1,000 person-days - incidence density rate.

Table VI. Etiological agents of healthcare-associated gastrointestinal system infections (GIs) identified in hospital in 2004-2013

Distribution of HAIs (GIs) by etiological agents												
Etiological agent		2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	**Total**
Clostridium difficile	%	4.76	7.14	16.7	14.3	28.9	23.9	28.4	41.9	36.4	49.1	**31.9**
Rotaviruses	%	42.9	57.1	43.8	48.0	40.8	35.9	31.0	25.8	19.3	16.4	**30.4**
Noroviruses	%	0.0	0.0	6.25	0.0	0.0	4.27	2.59	0.00	3.57	0.63	**1.80**
Adenoviruses	%	0.0	0.0	0.0	0.0	3.95	5.13	4.31	5.81	5.00	1.26	**3.39**
Candida albicans	%	0.0	0.0	0.0	5.10	3.90	1.71	0.00	1.94	5.00	0.63	**2.22**
Lack of data	%	52.4	35.8	33.3	32.7	22.4	29.1	33.6	24.5	30.7	32.1	**30.3**
Total	%	100	100	100	100	100	100	100	100	100	100	**100**

Lack of data – etiological agent was not determined or material was not collected from patient

Table VII. Number of healthcare-associated gastrointestinal system infections (GIs) by etiological agents identified in particular wards in 2004-2013

Number of HAIs (GIs) in 2004-2013							
No.	Type of units	CDI - *C. difficile*	Viral GE*	GE - *C. albicans*	GI – agent unspecified	GI Total	(%) GI
		N	N	N	N	N	N
1	Ophthalmology	0	2	0	7	9	1.0
2	Neurosurgery	7	1	0	22	30	3.2
3	Urology	53	7	3	20	83	8.8
4	Cardiology	2	3	1	8	14	1.5
5	Internal medicine and nephrology	145	19	1	37	202	21.4
6	Internal medicine and acute intoxication	10	0	1	8	19	2.0
7	Trauma and orthopaedic	16	4	0	52	72	7.6
8	Surgery	23	2	2	8	35	3.7
9	Gynaecology and obstetrics	2	0	2	5	9	1.0
10	Anaesthesiology	15	1	5	6	27	2.9
11	Rehabilitaion	4	13	0	13	30	3.2
12	Oncology	2	0	1	2	5	0.5
13	Paediatric	0	259	0	48	307	32.5
14	Paediatric surgery	0	22	0	25	47	5.0
15	Neurology	21	8	4	20	53	5.6
16	Radiotherapy	1	0	1	0	2	0.2
Total		301	341	21	281	944	100.0

N - number, **rotaviruses, noroviruses, adenoviruses, agent unspecified- etiological agent was not detected or material was not collected from patient*; GI – gastrointestinal system infection, GE - gastrointestinal system infection (excluding CDI).

Table VIII. Cumulative incidence rate (CIR) for gastrointestinal system infections (GIs) by type of units and etiological agents in 2004-2013

Cumulative incidence rate (CIR) for GIs in 2004- 2013							
No.	Type of units	Number of hospitalizations	CDI - *C.difficile N=301*	Viral GE* N=341	GE - *C. albicans N=21*	GI - agent unspecified N=281	Total N=944
			%	%	%	%	%
1	Ophthalmology	23345	0.00	0.01	0.00	0.03	0.04
2	Neurosurgery	15414	0.05	0.01	0.00	0.14	0.19
3	Urology	15749	0.34	0.04	0.02	0.13	0.53
4	Cardiology	20267	0.01	0.01	0.00	0.04	0.07
5	Internal medicine and nephrology	13759	1.05	0.14	0.01	0.27	1.47
6	Internal medicine (II)	19637	0.05	0.00	0.01	0.04	0.10
7	Trauma and orthopaedic	14358	0.11	0.03	0.00	0.36	0.50
8	Surgery	32028	0.07	0.01	0.01	0.02	0.11
9	Gynaecology and obstetrics	32165	0.01	0.00	0.01	0.02	0.03
10	Anaesthesiology	3182	0.47	0.03	0.16	0.19	0.85
11	Rehabilitaion	5513	0.07	0.24	0.00	0.24	0.54
12	Oncology	16601	0.01	0.00	0.01	0.01	0.03
13	Paediatric	16730	0.00	1.55	0.00	0.29	1.84
14	Paediatric surgery	15233	0.00	0.14	0.00	0.16	0.31
15	Neurology	19000	0.11	0.04	0.02	0.11	0.28
16	Radiotherapy	4044	0.02	0.00	0.02	0.00	0.05
Total		267025	0.11	0.13	0.01	0.11	0.35

** rotaviruses, noroviruses, adenoviruses, agent unspecified- etiological agent was not detected*
N = number of infections, GI - gastrointestinal system infection, GE - gastrointestinal system infection (excluding CDI), CIR/100 hospitalizations - cumulative incidence rate (%).

Table IX. Incidence density rate (IDR) for gastrointestinal system infections (GIs) by type of units and etiological agents in 2004-2013

Incidence density rate (IDR) for GIs in 2004- 2013							
No.	Type of units	Number of person-days	CDI - *C.difficile N=301*	Viral GE* N=341	GE - *C. albicans N=21*	GI - agent unspecified N=281	Total N=944
			‰	‰	‰	‰	‰
1	Ophthalmology	69189	0.00	0.03	0.00	0.10	0.13
2	Neurosurgery	113018	0.06	0.01	0.00	0.19	0.27
3	Urology	79259	0.67	0.09	0.04	0.25	1.05
4	Cardiology	111301	0.02	0.03	0.01	0.07	0.13
5	Internal medicine and nephrology	121730	1.19	0.16	0.01	0.30	1.66
6	Internal medicine (II)	124063	0.08	0.00	0.01	0.06	0.15
7	Trauma and orthopaedic	116727	0.14	0.03	0.00	0.45	0.62
8	Surgery	194822	0.12	0.01	0.01	0.04	0.18
9	Gynaecology and obstetrics	173218	0.01	0.00	0.01	0.03	0.05
10	Anaesthesiology	18911	0.79	0.05	0.26	0.32	1.43
11	Rehabilitaion	109591	0.04	0.12	0.00	0.12	0.27
12	Oncology	55619	0.04	0.00	0.02	0.04	0.09
13	Paediatric	110595	0.00	2.34	0.00	0.43	2.78
14	Paediatric surgery	54282	0.00	0.41	0.00	0.46	0.87
15	Neurology	138425	0.15	0.06	0.03	0.14	0.38
16	Radiotherapy	57170	0.02	0.00	0.02	0.00	0.03
Total		1647920	0.18	0.21	0.01	0.17	0.57

** rotaviruses, noroviruses, adenoviruses, agent unspecified- etiological agent was not detected*
GI - gastrointestinal system infection, GE - gastrointestinal system infection (excluding CDI),
N = number of infections, IDR/1,000 person-days- incidence density rate (‰)

GE was identified in 643 patients with CIR – 0.24%, 2.41/1,000 hospitalizations and IDR – 0.39/1,000 person-days (Tab. IV). For 341 patients, GI-GE were grouped based on the viral etiological agents identified. In this case, CIR and IDR amounted to 0.13% and 0.21/1,000 person-days, respectively. Of them, the following infections were identified: GE caused by rotaviruses – 292 patients (CIR-0.11%, IDR-0.18/1,000); adenoviruses - 32 patients (CIR-0.01%, IDR-0.02/1,000); noroviruses - 17 patients (CIR-0.01%, IDR-0.01/1,000) (Tab. V). At the beginning of study (2004-2010), infections of rotavirus origin predominated over other GIs. Their distribution ranged from 31.0% to 57.1% in all etiological agents of GIs. In the later phase of study (2011-2013), infections caused by *C. difficile* were placed as 1st with their distribution ranging from 36.4% to 49.1%. The distribution of *C. albicans* infections in other GIs stretched from 0 to 5.1%. For many GI cases, etiological agents were not determined (from 22.4% to 52.4%) (Tab. VI).

Having considered the type of wards, the majority of infections were detected in the following wards: paediatric – 307 infections (32.5%); internal medicine and nephrology - 202 (21.4%); urology - 83 (8.8%) and others (Tab. VII). The highest value of cumulative incidence rate (CIR) was observed in the following wards: paediatric - 1.84%; internal medicine and nephrology – 1.47%; anaesthesiology and intensive care unit – 0.85% and others (Tab. VIII). High incidence density rate (IDR) was noted in the following wards: paediatric – 2.79/1,000 person-days; internal medicine and nephrology – 1.66/1,000; anaesthesiology and intensive care unit – 1.43/1,000 (Tab. IX). Viral infections were most common in paediatric wards - 259 cases (CIR - 1.55%, IDR – 2.34/1,000). GI-CDI predominated in internal medicine and nephrology - 145 patients (CIR – 1.05%, IDR – 1.19/1,000) (Tab. VII - IX).

DISCUSSION

In wards enrolled in the study, surveillance over healthcare-associated infections (HAIs) is conducted since 2001. At the beginning of HAI monitoring, a special attention was given to the most important clinical manifestations of healthcare-associated infections, i.e. SSI, BSI, PN, UTI. In a routine medical practice, however, GIs were commonly reported to the Infection Control Team as adverse events associated with patient's treatment. These infections were also problematic with regard to care and treatment. Since 2004, GIs were added to the list of healthcare-associated infections under surveillance. An organizational problem consisting in ensuring GI cases adequate isolation conditions occurred as sanitary facilities were not present in all patient rooms. Provided there is no possibility for patient's isolation or lack of adequate sanitary conditions, etiological agents of gastrointestinal system infection may spread quickly in healthcare settings leading to the occurrence of epidemic outbreaks. Such situation contributes to an increased demand for nursing care, especially in case of bedridden patients. Furthermore, it generates additional treatment costs, deteriorates patient's state of being and makes patients losing confidence in medical personnel and methods of treatment. If a diagnosis of GI in hospitalized patient is made, urgent activities such as meticulous compliance with principles of hygiene, especially hand washing and disinfection and effective decontamination of equipment and rooms where patients stayed should be undertaken. The prevalence of GIs vary with regard to the types of wards. In Poland, these infections are often of viral etiology (7, 8, 12). In the majority of cases, these infections are attributed to rotaviruses, noroviruses and adenoviruses. In our study, viral GIs were mainly caused by rotaviruses for which typical are high infectivity and resistance to adverse conditions. The reasons of spread of healthcare-associated rotavirus infections are the presence of patients infected with rotaviruses, overcrowded wards, inappropriate hygiene behaviour in children, parents and medical personnel, failed or delayed patient's isolation, lack of adequate conditions for patient's isolation. According to Nitsch-Osuch et al. (13), incidence density rate of rotaviral diarrrhoea in the European Union amounts to 0.7-10/1,000 person-days while in 6-year own studies conducted in Poland in a group of patients aged 0-18 years CIR was 0.91% and IDR – 2.05/1,000 person-days. In paediatric ward of St. Lukas Provincial Hospital in Tarnów, CIR and IDR for rotavirus infections were 1.55% and 2.34/1,000 person-days, respectively. It indicates that the number of new cases in hospital studied was higher than in the hospital compared. However, the duration of stay in hospital carried similar risk of contracting an infection in hospitals compared. According to the data of Ołdak et al. (8), of the material collected in 2006-2009, the prevalence of infections caused by rotaviruses amounted to 31.4% of all healthcare-associated infections. In St. Lukas Provincial Hospital in Tarnów, distribution of GIs (including infections caused by rotaviruses) in the total number of healthcare-associated infections (HAIs) was 16.9% while the distribution of rotavirus infections in GIs amounted to 30.4%. In the analysis of gastrointestinal system infections conducted by the Provincial Sanitary and Epidemiological Station in Cracow (14,15), infections with norovirus (24%) and rotavirus (10%) predominated in Małopolskie province. Łoś-Rycharska et al. (16) state that infections caused by rotaviruses occur frequently and account for even more than 50% of acute gastrointestinal system infections.

It is estimated that in 30% of cases, etiology determination of acute diarrhoea is not feasible. It should be highlighted that in hospital studied, the percentage of unspecified etiological agents of infections amounted to 30% as well. High infectivity of virus is attributed to high incidence of rotaviral diarrhoea. One microgram of faeces or respiratory tract secretion is sufficient enough for infection spread (17).

A systematic decrease in the prevalence of infections caused by rotaviruses and increase in the number of *C. difficile* infections are observed. In recent years, this pathogen is responsible for infection spread in wards more frequently. Bandoła et al. (14, 15) state that the distribution of *C. difficile* infections in the gastrointestinal system infections in Małopolskie province in 2012 was 7%. In St. Lukas Provincial Hospital in Tarnów, the distribution of *C. difficile* infections in gastrointestinal system infections was 31.9%. Elixhauser et al. (2), who evaluated the incidence of CDIs in American hospitals, state that 0.77% of hospitalized patients were diagnosed with this infection. In 2009, the results of similar studies showed prevalence at 0.9% and there was a 4-fold increase in the number of patients infected with *C. difficile* (18). In St. Lukas Provincial Hospital in Tarnów, 4-fold increase of CDI patients was also observed. An average incidence was 0.11% while in 2013 its value was the highest, i.e. 0.26%. There are many rates describing the prevalence of healthcare-associated infections, including GIs. Barbut et al. (1) estimated the incidence of CDIs in a study conducted in 2002 in 212 European hospitals at 1.1/1,000 hospitalizations. In St. Lukas Provincial Hospital in Tarnów, we obtained the same incidence of CDIs, i.e. 1.1/1,000 hospitalizations.

In the prevention of GIs of viral etiology, the simplest method is broadly defined compliance with principles of hygiene, especially hand washing and disinfection (17). Of importance is also hospitalization of patients in adequate conditions with possibility to ensure effective isolation (16). In case of GI-CDI, the reasons of increased incidence of CDIs are not unequivocally determined. In literature, the most important risk factor specified is frequent use of antibiotics (1, 9, 19, 21, 22).

Monitoring of healthcare-associated infections in Poland is obligatory. However, the scope of surveillance over HAIs as well as criteria for their diagnosis may vary. The type of data collected and their analysis should be considered by the Infection Control Team. Identification of the scale of GIs, their distribution and risk factors may lead to their effective prevention. However, the most important element of prevention of GIs is informing medical personnel, patients and their families as well as heads of wards. Only then, data collected may serve as useful tool for raising the awareness of healthcare-associated infections. Furthermore, these data should be the base for undertaking prevention activities following determination of priority areas.

SUMMARY AND CONCLUSIONS

1. Gastrointestinal system infections are the most prevalent healthcare-associated infections.
2. Infections with *C. difficile* and rotaviruses predominated in adult and paediatric wards, respectively.
3. Rationalization of antibiotic use should result in the reduction of *C. difficile* infections.
4. Compliance with hygiene principles and effective isolation of patients may lead to the decrease of rotavirus infections.

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