

Water, sanitation, and hygiene services in health care facilities in the Autonomous Province of Vojvodina, Serbia

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ABSTRACT

Provision of safe water, sanitation, and hygiene (WASH) services in health care facilities is a priority at the global, national, and local levels. To inform improvements planning, conditions of WASH, waste management, and environmental cleaning were assessed in 81 facilities in the Autonomous Province of Vojvodina, Serbia, as part of a nationally representative survey in 2019. The survey included on-site checks, structured interviews, and drinking-water quality analysis. WHO/UNICEF indicators for WASH service levels and an advanced service level defined at the national level were applied. The results showed that all investigated facilities provided basic water services; 94% of facilities provided basic hygiene and waste management services; 58 and 2%, respectively, provided basic cleaning and sanitation services. Only 1% of investigated facilities met the basic level for all five WASH dimensions. Advanced service levels were only met for hygiene, waste management, and/or cleaning in 15–38% of facilities. In 33% of health care facilities, drinking-water quality was not in compliance with the national standards. The results revealed that there is a need for increased awareness and efforts to ensure basic provisions for sanitation, environmental cleaning, and drinking-water safety.

Key words: environmental cleaning, hazardous waste, hygiene, public health, sanitation, water

HIGHLIGHTS

- The majority of health care facilities (HCFs) in Autonomous Province Vojvodina provide basic services for drinking-water, hygiene, and health care waste management.
- Basic provisions for sanitation and environmental cleaning in HCFs emerged as priorities for future action.
- There is a need to increase efforts to ensure advanced WASH services (observed in up to 38% of facilities), to strengthen the provision of people-centred, quality health care, and outbreak preparedness.

INTRODUCTION

Water, sanitation, and hygiene (WASH) are essential determinants of health and a fundamental prerequisite for ensuring the quality of care and patient safety. The provision of continuous and safe WASH services prevents infectious and non-communicable diseases and reduces health care-associated costs (World Medical Association 2020). In the context of health care facilities (HCFs), the term 'WASH', typically, also refers to infrastructures and services related to health care waste management and environmental cleaning (WHO and UNICEF 2018).

Access to water and sanitation, recognized as basic human rights, is a focus of the 2030 Agenda for Sustainable Development, specifically under targets 3 and 6 of the Sustainable Development Goals (SDG). Of particular importance are SDG

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targets 6.1 and 6.2 to achieve universal and equitable access to safe and affordable drinking-water and sanitation for all (United Nation 2015) and target 3.8 to achieve universal health coverage and secure access to quality health care services.

In the European context, ensuring universal, equitable, and sustainable access to safe WASH for all and in all settings, including in HCFs, is one of the regional priority goals set by the Ostrava Declaration on Environment and Health (WHO Regional Office for Europe 2017a). WASH in HCFs is also recognized as a priority under the Protocol on Water and Health to the Convention on the Protection and Use of Transboundary Watercourses and International Lakes (WHO and UNECE 1999).

A 'basic' level of WASH services, as defined by WHO and UNICEF, corresponds to the minimum set of WASH services needed to protect the health of patients and staff. Governments can establish criteria for higher levels of WASH services in the national context. Such 'advanced' levels support identifying and implementing progressive actions towards ensuring safe services stipulated by SDG target 6 (WHO and UNICEF 2018).

The 2020 global progress report on WASH in HCFs shows that despite progress in implementing standards, improving infrastructure and operations, and maintenance, major gaps remain in the provision of basic hygiene, water, and sanitation services (WHO 2020). These gaps point to the critical need to develop national roadmaps, strengthen national surveillance and health information systems by integrating WASH indicators, and obtain a reliable and representative baseline of WASH conditions in HCFs at national, regional, and global levels.

In Serbia, national authorities recognized the need for a more in-depth nationwide survey to improve the evidence related to prevailing WASH conditions in HCFs. Current routine national surveillance on WASH in HCFs has limited scope and coverage, focusing only on secondary and tertiary level HCFs in urban areas (WHO Regional Office for Europe 2020). It is primarily oriented to core indicators capable of describing basic service levels (WHO Regional Office for Europe 2020). To fill this gap and introduce strategic priorities in this domain, the Institute of Public Health of Serbia 'Dr Milan Jovanović Batut' and the Network of Institutes of Public Health under the Ministry of Health of Serbia conducted a comprehensive, nationally representative situation assessment (WHO Regional Office for Europe 2020). It covered all three levels of HCFs in urban and rural settings in all regions (WHO Regional Office for Europe 2020).

With such a systematic situation assessment, Serbia was one of the first countries in the European region that responded to the 2019 World Health Assembly resolution on WASH in HCFs (UNECE and WHO 2016). The survey included indicators beyond basic services, taking a first step towards defining national criteria for an advanced service level, mainly for drinking-water, health care waste management, hygiene, and environmental cleaning (WHO Regional Office for Europe 2020).

This paper presents the WASH situation in HCFs in the Autonomous Province Vojvodina (APV), Serbia, with 1,931,809 citizens and a third state population (APV 2020). APV comprises 45 municipalities and cities organized in seven districts (APV 2020). Ninety-three health care institutions, consisting of 433 eligible HCFs, divided into primary, secondary, and tertiary levels, provide health care in APV (Arsić *et al.* 2019).

The objective is to evaluate the WASH situation in HCFs in APV based on the data collected through a nationally representative survey and to identify the strengths and weaknesses of the current state of service provision to inform future action.

METHODS

The public health institutes responsible for the seven administrative districts in APV (South Banat, South Bačka, North Bačka, North Banat, Middle Banat, Srem, and West Bačka) implemented the survey in May and June 2019 as part of a nationally representative survey.

Data about WASH indicators were gathered through on-site inspections and structured interviews using a checklist consisting of 96 questions, which comprised basic and advanced WASH indicators divided into 6 domains: general data on HCFs (16 questions), water (18 questions), sanitation (27 questions), hygiene (9 questions), health care waste management (11 questions), and environmental cleaning (15 questions).

The WHO European Centre for Environment and Health initially developed a checklist based on the WHO guidelines for essential environmental health standards in health care (Adams *et al.* 2008) and the indicators suggested for monitoring progress in WASH in HCFs in the context of the SDG (WHO and UNICEF 2018). For this study's purpose, the checklist was translated into Serbian and adapted to reflect the national requirements, the terminology used, and the local conditions in Serbia.

Sample size

The sample covered 81 of the total number of 433 eligible HCFs for the whole area of APV. In Serbia, health care services are provided at the primary, secondary, and tertiary levels. At the primary level, the health centres provide at least preventive health care for all groups of residents, health care for women and children, as well as general practice health care, polyvalent patronage, and home treatment. General and specialist hospitals provide inpatient and specialist-consultative services at the secondary level. Highly specialized specialist-consultative and inpatient health care at the tertiary level from several branches of medicine is provided by clinical centres, clinical hospital centres, and institutes. Health services are established for the area of one or more municipalities, depending on the number of inhabitants ([Official Gazette of the Republic of Serbia 2021](#)). The registry of all public health care institutions and all their branches was obtained from the Institute of Public Health of Serbia 'Dr Milan Jovanović Batut'.

The total sample size for the nationally representative survey was 320. The study sample was identified from the national registry as representative of the number and type of HCFs at the national level (confidence interval: 95%; margin of error: 5%). The sample size was stratified by geographical area proportional to the population size and the resulting sample size for APV was 81 HCFs. The sample for APV was further stratified to seven districts, proportionally to the number of reported HCFs per district, the levels of service (primary, secondary, tertiary), and the distribution of HCFs (urban and rural). Finally, individual HCFs for the study were randomly selected from the registry of public health care institutions. The obtained sample for APV is, therefore, considered representative of this region.

The survey included 69 facilities for the primary health care level randomly selected from the district pull (primary health care centres, ambulances, and health stations), 9 facilities for the secondary care level (internal medicine or maternal/gynaecology departments within general hospitals), and 3 for the tertiary care level (internal medicine or maternal/gynaecology departments within clinical centres). All tertiary HCFs in APV were included but not considered HCFs for psychological, orthopaedic care, and other highly specialized HCFs. [Table 1](#) presents the number of the visited HCFs on the district level.

Drinking-water analyses

The staff from the seven districts' public health institutes' accredited laboratories took the drinking-water samples from each visited HCF for evaluating drinking-water quality. All sampling procedures and analyses followed the international standard methods and national regulation ([ISO 5667-5:2006](#); [ISO 19458:2006](#); [ISO/IEC 17025:2017](#); [Official Gazette of the Republic of Serbia 2019a](#)).

Drinking-water analyses comprised microbiological parameters (*Escherichia coli*, *Enterococcus faecalis*, and *Pseudomonas aeruginosa*), as well as physical and chemical parameters (temperature, colour, turbidity, conductivity, pH, arsenic, nitrates, nitrites, and residual chlorine). Drinking-water standards, according to the national regulation ([Official Gazette of the Republic of Serbia 2019a](#)), are present in [Table 4](#).

WASH evaluation

JMP classifications for improved (potentially safe) and unimproved (potentially unsafe) water and sanitation technology were used for the data analysis ([WHO and UNICEF 2018](#)). JMP classifications were applied to determine the level of minimum

Table 1 | The number of the visited HCFs on the district level in APV

District	Total number of the visited HCFs	Number of the visited HCFs on a primary level	Number of the visited HCFs on a secondary level	Number of the visited HCFs on tertiary level
South Banat	13	11	2	0
South Bačka	22	18	1	3
North Bačka	7	6	1	0
North Banat	8	6	2	0
Middle Banat	9	8	1	0
Srem	14	13	1	0
West Bačka	8	7	1	0
Total	81	69	9	3

WASH service provision in HCFs (no service, limited, and basic service) (WHO and UNICEF 2018), shown in supplementary material, Table 1. The indicators and criteria for the advanced service levels were defined in the national context to assess the coverage beyond basic provisions (WHO Regional Office for Europe 2020). Advanced services represented in this paper, among all defined at the national level, are listed in supplementary material, Table 1.

Statistical analysis

A descriptive statistic is presented as a per cent (relative numbers) for categorical variables. Data were analyzed with Microsoft Excel 2016 and SPSS.

RESULTS

Basic WASH services

Results of the coverage of basic WASH services in APV are shown in Figure 1. All the visited HCFs in the whole territory of APV provided basic water services. Although improved sanitation facilities and at least one usable toilet on the premises were available in 96 and 65% visited HCFs, respectively, only 2% of them fulfilled the criteria for basic sanitation services. The main reasons for such low coverage of basic sanitation services were the lack of sex-separated toilets available for patients (in 46% of the visited HCFs), the lack of toilets accessible for people with reduced mobility (in 94% of the visited HCFs), and the lack of menstrual hygiene facilities (a private place with water and soap and a bin with lid for disposal of used menstrual products) in female toilets (in 59% of the visited HCFs). In almost all visited HCFs (94%), functional hand hygiene facilities with water and soap and/or alcohol-based hand rub dispensers were available at points of care and within 5 m from toilet seats or cubicles. Waste was safely segregated, treated, and disposed of in almost all visited HCFs (94%). Furthermore, in more than half of the HCFs (58%), basic environmental cleaning protocols, indicating procedures, responsibilities, and schedules, were available and staff responsible for cleaning received structured training (i.e., the structured training program provided by a qualified trainer).

Table 2 presents the WASH services at the district level by type of health care level in the APV. In each district, all visited HCFs provided basic water services. Only some facilities at the primary and secondary health care levels of South Banat and South Bačka met basic sanitation services. Basic hygiene and basic health care waste management services were available in almost all HCFs across all districts, regardless of the type of health care. A few facilities from two distinct districts did not meet the basic indicators for hygiene and waste management: some primary HCFs in Srem lacked functional hand hygiene facilities, and in one secondary HCF in South Banat, waste was segregated into two rather than three bins. Only in Srem, did primary HCFs have lower coverage of basic services for more than two WASH dimensions (sanitation, hygiene, and

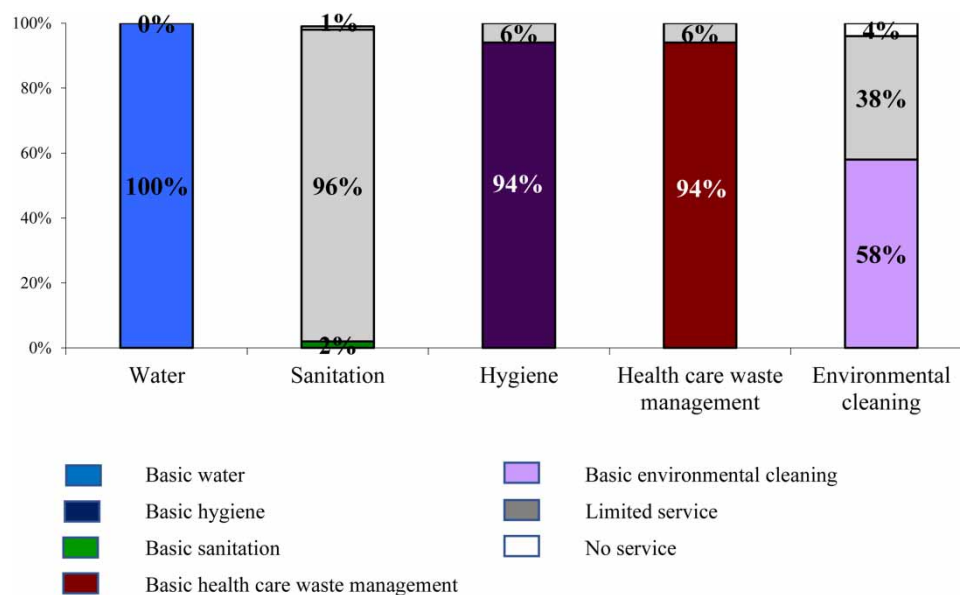


Figure 1 | Coverage of basic WASH services in HCFs in APV in 2019.

Table 2 | Coverage of basic WASH services in HCFs by districts and type of health care in APV, 2019

WASH service dimensions/Districts	Type of HCFs	Total number of HCFs	Number of HCFs according to type	Basic WASH services			Health care waste management	Environmental cleaning
				Water	Sanitation	Hygiene		
South Banat	Primary	13	11	100%	8%	100%	100%	91%
	Secondary		2	100%	0%	100%	50%	100%
	Tertiary		0	–	–	–	–	–
South Bačka	Primary	22	18	100%	0%	100%	100%	50%
	Secondary		1	100%	100%	100%	100%	100%
	Tertiary		3	100%	0%	100%	100%	100%
North Bačka	Primary	7	6	100%	0%	100%	100%	83%
	Secondary		1	100%	0%	100%	100%	100%
	Tertiary		0	–	–	–	–	–
North Banat	Primary	8	6	100%	0%	100%	100%	83%
	Secondary		2	100%	0%	100%	100%	100%
	Tertiary		0	–	–	–	–	–
Middle Banat	Primary	9	8	100%	0%	75%	100%	100%
	Secondary		1	100%	0%	100%	100%	100%
	Tertiary		0	–	–	–	–	–
Srem	Primary	14	13	100%	0%	23%	100%	39%
	Secondary		1	100%	0%	100%	100%	100%
	Tertiary		0	–	–	–	–	–
West Bačka	Primary	8	7	100%	0%	57%	100%	100%
	Secondary		1	100%	0%	100%	100%	100%
	Tertiary		0	–	–	–	–	–

environmental cleaning). Basic environmental cleaning services were observed with lower coverage in primary HCFs in various districts, particularly in Srem, followed by South Banat, North Banat, and South Bačka.

Concerning geographical location, visited HCFs located in rural areas had higher coverage of basic health care waste management services. In contrast, basic sanitation, basic hygiene, and basic environmental cleaning had higher coverage in urban HCFs. Both urban and rural settings equally provided basic water services (Table 3).

When all five WASH dimensions are considered together, only 1% of the investigated HCFs fulfilled all criteria to meet basic services. When excluding sanitation and health care waste management, 46% of HCFs provided basic services for the remaining three WASH dimensions at the same time. None of the visited HCFs had only limited service or no service for all WASH dimensions.

Further stratification by the district level showed that only one HCF in South Banat provided a basic level of services for all five WASH dimensions. In comparison, around 2/3 of HCFs in West Bačka, South Bačka, South Banat, and North Banat provided basic services for four WASH dimensions (water, hygiene, health care waste management, and environmental cleaning).

Table 3 | Coverage of basic WASH services in HCFs by geographical location in APV, 2019

Settings	Total number of HCFs	Coverage of basic service									
		Water		Sanitation		Hygiene		Health care waste management		Environmental cleaning	
		No.	%	No.	%	No.	%	No.	%	No.	%
Urban	39	39	100	2	5	38	97	35	90	27	69
Rural	42	42	100	0	0	38	90	41	98	20	48
Total	81	81	100	2	2.5	76	94	76	94	47	58

Stratified data represented by geographical location showed that HCFs in urban areas most often met all five or four (excluding sanitation) WASH dimensions (59% in urban vs. 40% in rural). Conversely, at the same time, HCFs in rural areas more often met basic provision of services for health care waste management (98% in rural vs. 90% in urban).

Advanced WASH services

None of the visited HCFs in APV met the criteria for the national definition of advanced water services (Figure 2 and supplementary material, Table 2). In total, 27 drinking-water samples (33%) were not in compliance with the national regulations. Ninety-five per cent of the visited HCFs had no hygiene plan or concept for the safe operation and maintenance of water services. A person or the team appointed as responsible for controlling the drinking-water supply system was recognized in all tertiary HCFs and 67% of secondary HCFs. Concerning additional advanced criteria assessed, only a few primary HCFs, mainly in urban settings in South Banat and North Bačka, had regular surveillance of the facility in the water supply system, regular monitoring of drinking-water quality, and water treatment procedures at the point of use, and preventive measures against contamination.

Advanced hygiene services were available in 38% of the visited HCFs (Figure 2 and supplementary material, Table 2). Eighty-one per cent of the visited HCFs in APV had both soap and a disinfectant as hand hygiene facilities (lowest coverage observed in Srem). All members of the health care staff received structured training (i.e., with a structured training programme and provided by a qualified trainer) on essential matters related to infection prevention and control (IPC) in 60% of the visited HCFs (79% in urban vs. 62% in rural areas; in 100% of tertiary, in 44% of secondary, and 61% of primary HCFs; lowest coverage observed in West Bačka). Reminders or instructions for proper hand hygiene practice were available at all critical points in 70% of the visited HCFs (mainly in urban areas and secondary HCFs, with the lowest coverage observed in West Bačka).

Advanced health care waste management services were available in 26% of the visited HCFs (Figure 2 and supplementary material, Table 2). Waste management protocols were in place in 86% inspected HCFs (in all visited tertiary and secondary HCFs and 84% of primary HCFs; lowest coverage observed in North Bačka). In 54% of the considered HCFs (36% in urban vs. 90% in rural areas; 100% of tertiary and secondary HCFs and 49% of primary HCFs), infectious waste was picked up daily or stored for a maximum of three days before treatment and/or disposal (lowest coverage observed in Middle Banat). Two-thirds of HCFs (65%) respected the criteria for safe storage conditions, i.e., the waste was stored in controlled and locked

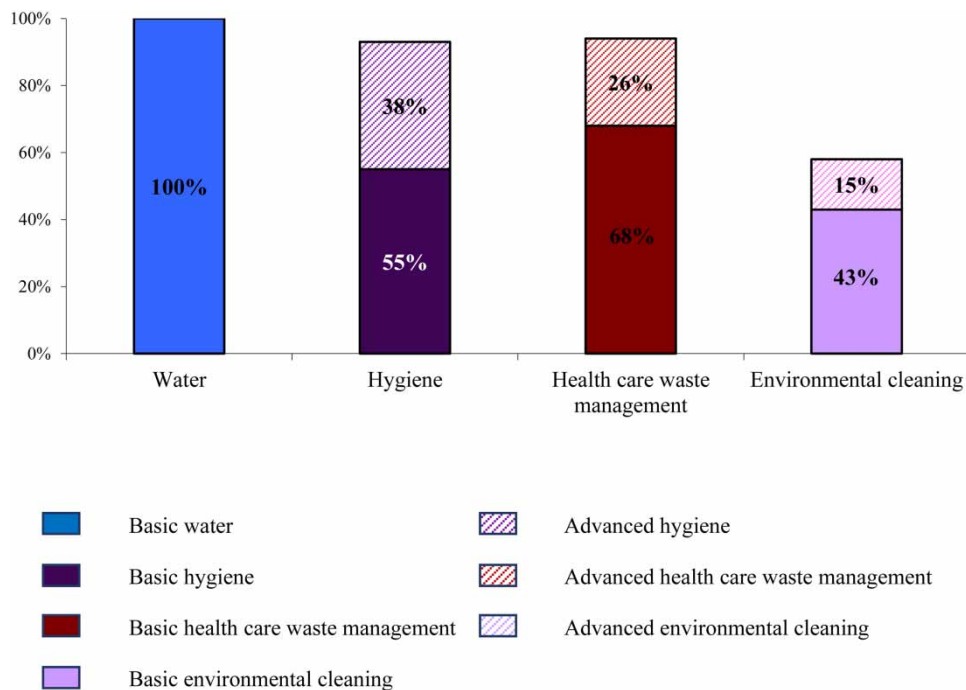


Figure 2 | Coverage of advanced WASH services in HCFs in APV, 2019.

areas, separate from non-infectious waste, away from drinking-water sources and protected from flooding. Possible risks related to unprotected storage of infectious waste were observed mainly in South Bačka and West Bačka, where the infectious and non-infectious wastes were stored together in the same area or infectious waste was stored in an area without controlled access.

Fifteen per cent of the visited HCFs met the criteria for providing advanced environmental cleaning services (Figure 2 and supplementary material, Table 2). Seventy per cent of visited HCFs, usually in tertiary and secondary HCFs and mostly in the Middle Banat, performed cleaning toilets and critical surfaces at least twice per day and whenever soiled. Twenty-seven per cent of visited HCFs, mostly in secondary HCFs and South Banat, replace linen or disposable bed sheets between patients or whenever soiled. In contrast, adequate cleaning and disinfection of soiled linen were performed even rarely (in 16% of visited HCFs), usually in secondary HCFs and in some of the visited HCFs in North Banat. Safe transportation and storage of soiled linen (in sealed and marked bags) and disinfection of beds were done in 13% of the visited HCFs, usually in secondary HCFs, and observed mainly in the HCFs visited in the Middle Banat.

Drinking-water quality

Considered for the calculation of the provision of advanced water services, the drinking-water quality at the premises of the visited HCFs emerged as a crucial aspect of the data analysis. Drinking-water was available from an improved source distributed by central (municipal or local) water supply system in almost all (99%) visited HCFs in APV. Only in one visited hospital was an individual water supply system present. In some drinking-water samples in HCFs, known microbiological (*Enterococcus faecalis* and *Pseudomonas aeruginosa*) and chemical hazards (arsenic, nitrates, and nitrites) were detected (Table 4).

Microbiological hazards were identified in drinking-water samples from primary HCFs in South Bačka (3 samples), South Banat (1 sample), and North Banat (1 sample). At the same time, residual chlorine was below the detection limit in four out of these five non-compliant water samples.

Nitrate and nitrite levels in drinking-water samples were not compliant with national regulations mostly in rural primary HCFs in South Bačka and Srem. Arsenic concentrations were above the regulation values in drinking-water samples in facilities on primary (15 HCFs) and secondary (3 HCFs) levels. HCFs in urban and rural settings and all districts, except South Banat, had an equal distribution of high arsenic drinking-water levels.

Table 4 | The results of drinking-water quality in HCFs in APV, 2019 ($n=81$ samples)

Parameter	Unit	Parametric value of national drinking-water standard	Number of non-compliant samples	Proportion of non-compliant samples (%)
<i>Escherichia coli</i>	cfu ^a /100 ml	0	0	0.0
<i>Enterococcus faecalis</i>	cfu ^a /100 ml	0	3	4.0
<i>Pseudomonas aeruginosa</i>	cfu ^a /100 ml	0	2	2.5
Temperature	°C	Same or below the temperature of the source	0	0.0
Colour	Pt-CO ^b	5	32	39.5
Turbidity	NTU ^c	1	16	19.8
Conductivity	µS/cm	2,500	0	0.0
pH	pH unit	≥6.8 and ≤8.5	0	0.0
Arsenic	mg/L	0.01	18	22.0
Nitrate	mg/L	50	1	1.0
Nitrite	mg/L	0.03	4	5.0
Residual chlorine	mg/L	up to 0.5	1	1.0

^aColony form units.

^bPlatinum-cobalt scale units.

^cNephelometric turbidity unit.

Only three HCFs at the primary level (20% of all inspected primary HCFs) and in one secondary HCF (3% of all inspected secondary HCFs) secured an alternative drinking-water source.

DISCUSSION

The presented study is the first systematic assessment of WASH conditions in primary, secondary, and tertiary HCFs in APV, Serbia, including analyses by geographical (rural/urban) and administrative levels. The outcomes of the survey present a unique opportunity to assess the existing gaps in the provision of WASH services in HCFs and identify actions that can be undertaken to improve the situation at the district and regional levels.

Basic water services are provided in all HCFs in APV. However, advanced water services were not met in any of the visited HCFs in APV. The low coverage was mainly due to lack of dedicated staff and protocols, and plans for the safe and hygienic operation and maintenance of the water supply in the HCFs. Meanwhile, lack of microbiologically and chemically safe drinking-water at the point of use was the most relevant gap for the health of patients and staff in the visited facilities – observed in almost one-third of HCFs. Efforts will need to be made to improve water management within HCFs and raise awareness of the need to establish facility plans and/or standards for the safe operation and maintenance of drinking-water systems (such as a water safety plan). Training of staff to carry out and maintain monitoring of the drinking-water supply system within the HCF is also of great importance.

In terms of drinking-water quality, arsenic, a Group I human carcinogen, as well as nitrite and nitrate, which have been associated with the occurrence of methaemoglobinaemia in bottle-fed infants, are known to be present in drinking-water throughout APV (IARC 2006, 2012; WHO 2017; WHO Regional Office for Europe 2017b). On the other hand, fecal pollution indicators such as *Enterococcus faecalis* and *Pseudomonas aeruginosa* found in drinking-water in APV may result from inadequate maintenance of the plumbing system in the HCF or inefficient disinfection of the drinking-water supply. The presence of *Pseudomonas aeruginosa* in HCF drinking-water systems can cause a range of infections, such as faecal-contaminated drinking-water (WHO 2017). The findings imply that all HCFs should implement water and sanitation protocols (e.g., for adequate water treatment and disinfection) to provide both staff and patients with safe water for all purposes (WHO 2018).

Basic sanitation services were available in only 2% of HCFs (i.e., two facilities, both in urban settings). This study revealed two major obstacles to meeting basic sanitation services: the lack of accessibility and adequacy of toilets for people with limited mobility and the lack of toilets designated for women to meet their menstrual hygiene needs. First, toilets for persons with limited mobility must be designed and built to be accessible, usable, and equipped according to their needs. Nevertheless, according to the current national regulations, toilets for persons with limited mobility are only provided in newly built and reconstructed public buildings (Official Gazette of the Republic of Serbia 2015), making many old HCFs surveyed deficient in this criterion. Second, meeting menstrual hygiene needs requires toilets that are designated for women and equipped with closable waste bins and hand-washing places with water and soap in the same toilet cubicle. Considering that this criterion is also not foreseen in the existing national regulations, it may take some time to be implemented in legislation and practice in the country's HCFs. The findings of this study indicate the need for taking priority actions to strengthen policies and regulations and implementing step-by-step measures to meet the complex and multi-dimensional criteria for basic sanitation services in all HCFs. However, the complexity of the requirements should not be seen as an obstacle, but rather an impulse to achieve decent and universal sanitation for all, especially for vulnerable groups and patients in different types of HCFs.

The observation and assessment of WASH conditions in this survey were limited to ambulances and health stations in primary health care centres and internal medicine or maternal/gynaecology departments in secondary and tertiary HCFs. Therefore, the findings may not be fully representative of the situation in other departments with more vulnerable patients, such as surgical rooms, intensive care units, dialysis units, transplant wards, etc. Health outcomes, recovery, and rehabilitation of patients in secondary and tertiary facilities may depend on the hygienic-sanitary conditions of the sanitation facilities. The extent to which all other departments within secondary and tertiary facilities meet the criteria for basic sanitation is unknown and a topic for further investigation.

Ninety-four per cent of HCFs in APV provided basic hygiene services, with no differences between urban and rural facilities. The field investigation pointed out that hand hygiene stations were often missing in common areas, patient rooms, and areas other than nursing stations and toilets, posing a risk for transmission of infections among staff and visitors. The findings

of the study suggest that the provision of advanced hygiene services should be improved, mainly in West Bačka, South Banat, North Banat, and Srem. This can be achieved, for example, by ensuring adequate provision and stocking of soap and hand sanitizer, providing regular structured training to staff on the current state of evidence regarding essential WASH and IPC practices and procedures, and providing visual reminders and instructions to promote good hand hygiene practice among staff and patients – a low-cost intervention with proven positive results.

Basic health care waste management services were provided in almost all visited HCFs in APV (94%), more frequently in rural than in urban HCFs. While safe storage was broadly observed, more than half of the visited HCFs across the districts stored infectious waste on-premises longer than the nationally recommended limits (three days without cooling). At the same time, it is important to ensure adequate implementation and monitoring of measures for transport and final disposal of infectious waste in accordance with the national rule ([Official Gazette of the Republic of Serbia 2019b](#)), especially in primary and secondary HCFs that typically lack the capacity for on-site treatment.

The provisions for basic environmental cleaning services showed higher coverage in urban than in rural settings. Cleaning frequency in HCFs was observed to be insufficient as it was done irregularly or less than once per day in some HCFs, mainly in rural areas. Key measures to improve basic services in APV should include regular cleaning and application of protocols that clearly describe procedures, responsibilities, and schedules for cleaning. There is also a need to focus on increasing the number of trained cleaners through regular structured training. Guidance and training materials developed at the national level could support such implementation. With respect to advanced cleaning services, Middle Banat, South Bačka, and Srem had the lowest coverage. To improve this, we suggest advocating and promoting the adoption of protocols and practices to ensure sufficient cleaning frequency, especially of the toilet areas and high-touch surfaces. The WHO's essential environmental health standards for health care ([Adams *et al.* 2008](#)) recommend cleaning surfaces at least once a day and when soiled, and toilets twice a day. There is also a need to improve practices related to bed hygiene by ensuring that linen or bed sheets are changed between patients and also adequate cleaning and disinfection of soiled linen and beds are carried out, including the safe transport and storage of soiled linen.

The results presented from the stratified data on WASH indicators in APV show that less than half of all HCFs visited (45%) met the basic level for four WASH indicators (water, hygiene, health care waste management, and environmental cleaning), mainly in urban facilities (52% in urban vs. 38% in rural facilities). Efforts in APV, especially in ensuring basic WASH services, need to prioritize HCFs in specific districts and rural areas, especially primary HCFs.

Considering the findings presented and recognizing the need for sustaining basic and advanced WASH criteria over time, it appears clear that efforts are needed at the legislative level as the primary means of promoting and enforcing improvements. Regulations should explicitly recognize all WASH dimensions in national health regulations and programs. For example, while national regulations require HCF operators to appoint professional teams for IPC ([Official Gazette of the Republic of Serbia 2006](#)), ensuring safe drinking-water management in HCFs has not yet been recognized as an essential element of IPC and as a responsibility of the IPC team. In early 2020, a new national regulation on prevention, early detection, and control of hospital-acquired infections was adopted. It includes surveillance, evaluation, and education and addresses basic and advanced WASH indicators, mainly for drinking-water, hygiene, and cleaning ([Official Gazette of the Republic of Serbia 2020](#)).

Based on this new regulation and the needs that emerged from this survey, further attention and action are needed at the local, district, and provincial levels in HCFs in APV to raise awareness and strengthen WASH services. We suggest defining procedures specific to each HCF in the relevant IPC documentation, including the roles and responsibilities of the various teams within the HCFs with regard to the implementation, monitoring, and improvement of the basic and advanced WASH indicators. In the long run, this will guarantee the provision of safe and high-quality health care. Regional guidance for HCFs, specific to local drinking-water quality challenges, could support enforcement of the new national regulations and guide improvements.

In addition, several actions could be taken immediately in HCFs not meeting WASH services, such as the training of staff regarding water and sanitation operation and maintenance, establishment of water safety plans, reconstruction of toilets for patients, staff, and persons with disabilities, provision of menstrual hygiene means in toilets designated for women, provision of hand hygiene means and placement of hand-washing posters in all toilets, points of care and patients' rooms, provision and maintenance of places for safe disposal of infectious waste before treatment, and training of staff and supervision over regular cleaning of the departments, critical areas, and toilets in the facilities.

CONCLUSION

The survey results confirm that most HCFs in APV provide basic services for drinking-water supply, hygiene, and health care waste management. Priority areas that require attention and improvement are sanitation, environmental cleaning, and drinking-water quality. In addition, it is important to sustain the provision of basic and advanced hygiene and waste management services in APV and develop targeted WASH interventions for HCFs facing particular challenges to improve the quality of health care services (e.g., primary HCFs and facilities in districts where coverage was lower, such as in Srem).

The results of the survey show that there is a need to move progressively towards the provision of safe and sustainable WASH services in HCFs that go beyond the basic level and meet the requirements for advanced service levels defined at the national level for all WASH dimensions in APV and the whole country.

DATA AVAILABILITY STATEMENT

All relevant data are included in the paper or its Supplementary Information.

DISCLAIMER

Valentina Grossi, Oliver Schmolli and Enkhtsetseg Shinee are staff members of the World Health Organization. The authors alone are responsible for the views expressed in this publication and they do not necessarily represent the views, decisions or policies of the World Health Organization.

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