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Involvement of Local Authorities in the Protection of Residents' Health in the Light of the Smart City Concept on the Example of Polish Cities

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Abstract: According to the modern guidelines of the Smart City (SC) concept, smart cities are not only cities that are above average in terms of technology, but first and foremost are focused on the needs of their residents. A key need for quality of life is taking care of health, including education, prevention, and access to medical infrastructure. In the context of the given circumstances, this article seeks to answer the following research question: What is the level of involvement of local authorities in protecting the health of residents in Polish cities in the context of the Smart City concept? The involvement of local authorities in healthcare is considered in five aspects: (1) monitoring of residents' health needs; (2) health education; (3) preventive healthcare; (4) healthcare infrastructure; and (5) environment and recreation. To obtain answers to the above research problem, surveys were conducted at the local government level in 399 Polish cities. The research utilized statistical measures of central tendency, indices of variation, and measures of interdependence. The results allow formulating the following key conclusions: (1) most of the surveyed cities do not monitor the health needs of their residents, contrary to the recommendations of the SC concept; (2) cities take measures to protect the health of their residents, but these are focused on sports and recreation; (3) the most neglected health areas are health education and environmental and climate protection. The level of involvement of the city authorities in protecting the health of residents is therefore quite low and is mainly image-related. The lack of monitoring of the expectations of the local community has a negative impact on the effectiveness of healthcare activities and the real improvement in the quality of urban life. Meanwhile, according to research results, cooperation with residents and care for meeting their needs is an important determinant of the effectiveness of healthcare. Given the above conditions, it is difficult to be effective both in terms of improving the quality of life of residents and developing fully sustainable smart cities. The research also shows that the involvement of the city authorities in holistic pro-health activities increases with the size of the city, which means that larger entities are more aware of cooperation with stakeholders and the importance of health for quality of life. Therefore, they are better prepared to implement the assumptions of the Smart City concept. The originality and scientific value of the conducted analysis will help fill the research gap in identifying the health determinants of Smart City development and assessing the involvement of city authorities in protecting the health of residents in a multifaceted perspective.

Keywords: social aspects of smart city; resident healthcare; health education and prevention; health monitoring; city government involvement in resident healthcare

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1. Introduction

Originally, at the end of the 20th century, the development of a Smart City (SC) was associated primarily with the implementation of modern Information Technology (IT) and Information and Communication Technology (ICT) solutions [1,2]. Their main task was to make life easier for residents. These solutions, however, very often were only an attempt to improve the image of the city government. There was no consultation with the urban

community, either. Therefore, they could not be a direct response to the needs of residents, which raised (and still raises) questions about the legitimacy of their implementation and effectiveness in improving the quality of life in cities.

As a result, the Smart City concept came under fire from critics. Accusations against it included excessive technicization and the domination of business interests over urban and social interests [3–7]. Furthermore, it was blamed for exacerbating economic inequality and generating social and digital exclusion [8,9].

In response to these objections, an attempt to balance the concept of smart cities emerged in the literature and practice. It was based primarily on the inclusion of all urban stakeholders in the process of creating and managing smart cities according to successive economic helixes [10,11]. Thus, in addition to local authorities and companies providing Smart City solutions, the group of Smart City co-authors included universities as representatives of science, the local community as a key recipient of the city's products and services, and environmental organizations as a representation of the interests of future generations [12–16]. Strengthening the composition of stakeholders was intended to diversify the identified needs and ways to meet them, and thus ensure more effective improvement of the quality of urban life.

Thus, the subject scope of Smart City analysis was also completed. In addition to the technological and business (economic) aspects, the social and environmental aspects were also included in the researchers' circle of interest [17,18]. This allowed—at least in theory—to fend off some of the objections formulated by adversaries of the Smart City concept and to balance the development of Smart City solutions.

Despite the above changes and the emergence of successive generations of Smart City (from 1.0 to 4.0) [19–21], environmental and social themes in the literature and practice still appear far less frequently than the dominant technological trend associated with the Internet of Things, artificial intelligence or Industry 4.0 [22]. Meanwhile, as emphasized in many publications, the identification and satisfaction of residents' needs is a key determinant of the quality of life in a city.

At the same time, as concluded by Shayan and Kim (2022) [23], the needs of people at risk of exclusion, i.e., the elderly and women, are particularly important in this case. Alizadeh and Sharifi (2023) [24] state that modern post-pandemic smart cities must have six key dimensions: social sustainability, citizen-centeredness, e-democracy, social justice, participatory governance, and cultural resilience. Without their coexistence, creating sustainable urban structures will not be possible. The positive impact of social relations and human capital on the quality of life is also noticed by Wang and Zhou (2023) [25] when studying Chinese cities. The results of many studies also show that the most effective way to improve the quality of life is to combine social and technological aspects in the process of implementing smart urban solutions [26].

Healthcare is one of the topics in the social area of Smart City research. At the same time, despite the evolution of the SC concept, it is also an area dominated by technological and IT aspects [27,28]. They frequently appear in the context of air quality monitoring systems [29,30] or recycling [31], which highlights the role of environmental protection in protecting health and urban happiness. They are also described in the research on the effects of the COVID-19 pandemic [32].

With these circumstances in mind, the authors of this article undertook research in a less recognized social stream of Smart City research, relating to the involvement of local authorities in protecting the health of residents, because health is an essential human need. Its inadequate quality or lack thereof prevents us from enjoying life to the fullest. Nor can it be subsidized by other urban environmental factors. Moreover, health has received relatively little attention in the literature on the social aspects of the Smart City. Meanwhile, from the point of view of the quality of life espoused in the SC concept, it is a very important element.

As part of this research, the authors sought answers to the following research question: What is the level of involvement of local authorities in protecting the health of residents

in Polish cities in the context of the Smart City concept? The analysis of the problem formulated in this way is approached holistically, taking into account five aspects of healthcare that can be influenced by city authorities. They are: (1) monitoring of residents' health needs; (2) health education; (3) preventive healthcare; (4) healthcare infrastructure; and (5) environment and recreation.

To address the above research problem, surveys were conducted in 399 out of 930 Polish cities. This is a representative sample, assuming a maximum error of 5%, a fractional size of 0.5, and a 99% confidence level, which makes it possible to generalize the results of the survey to benefit other cities operating in developing economies. The study results allowed us to:

- assess the involvement of Polish city authorities in protecting the health of their residents, and thus estimate their predisposition to be smart according to the sustainable SC concept (the level of readiness to meet the key needs of residents);
- identify the relationship between the size of the city and its commitment to identifying the health needs of its residents and the extent of actual healthcare efforts;
- formulate recommendations for improving health promotion activities in Polish cities.

Research in the above area has not been conducted before, and it fills the research gap in identifying the health determinants of Smart City development and assessing the commitment of city governments to the health of residents using a multifaceted perspective.

The originality of the research undertaken in the article can be considered in three aspects: theoretical, methodical, and empirical. The research undertaken in the article combines three theoretical problems of Smart City development: urban management, social participation, and healthcare. In this way, they supplement their knowledge on the social issues of Smart City. The methodology used in the article in the form of surveys is not innovative; however, it includes a structured, original research questionnaire that can be used in international studies of other cities. Finally, empirical conclusions and recommendations enrich the social diagnosis of cities in developing economies and may be helpful not only for Polish municipal authorities.

Given the research intentions formulated above, the following sections of the article present literature studies relating to social, including in particular health aspects of Smart City development (Section 2.1). They also address issues related to city government involvement in monitoring and addressing social needs (Section 2.2). The research methodology (Section 3) and results (Section 4) are then presented, broken down into: (1) assessment of the involvement of city authorities in the healthcare of residents; and (2) identification of the relationship between the size of the city and its involvement in identifying the health needs of residents as well as the extent of actual healthcare activities. The final part of the article includes a discussion that considers previous research results and recommendations (Section 5), and concludes with the main theoretical and cognitive conclusions and directions for further research (Section 6).

2. Literature Overview

2.1. The Role of City Government in Smart City Development

The Smart City concept is a natural fit in the management process of virtually any city, as it combines technical and infrastructural aspects with social and environmental issues. International researchers, including Caragliu et al. (2011); Dameri (2013); Komninos (2014) and Vujković et al. (2022) [33–36] note that modern smart cities cannot develop without investing in social capital and attempting to solve environmental and social problems [37]. Only such an approach guarantees sustainable and effective improvement of the quality of life in the city.

In order to highlight the role of city government in the creation and development of the Smart City, the concept of Smart Governance (SG) has been formulated in the literature and in practice, combining key elements of modern public management and SC concepts [38,39]. According to He et al. (2022) [40] and Nina et al. (2022) [41], the key determinant of SG is real-time city management using IT and ICT technologies. However,

issues such as public participation, quality public services, and real-time information to residents about the state of the city [42–44] reflecting the transparency of the urban system [45] also remain important.

Hajduk (2020) [46] distinguishes five dimensions of SG implementation in the city, which at the same time illustrate the level of commitment of city authorities [47] to the conscious implementation of the Smart City concept. Among them, he includes:

1. strategic goal: the city has a strategy that includes investment in Smart City solutions;
2. data: the city collects data and information on the operation of the city and the needs of its residents, which it then processes and makes available, guaranteeing transparent and universal access to information for all stakeholders;
3. technology: the city implements and uses modern technology to provide residents with the highest possible level of public services;
4. governance and service delivery models: the city is adapting traditional organizational delivery models to take advantage of data and digital opportunities and investing in systemic partnership models focused on shared outcomes;
5. stakeholder engagement: the city is systematically improving the uptake of digital services and taking steps to prevent digital exclusion.

According to the above, the key in managing a city is having a good strategy and taking systematic measures to implement it [48,49]. In this regard, the classic stages of management are worth noting; these include planning, organizing, motivating, and controlling, and taking into account mutual feedback. City authorities should be involved in each of these stages so as to effectively implement Smart City solutions, as pointed out by Fonseca et al. (2021); Yoo (2021) and Saadah (2021) [50–52].

As the research carried out in this article is embedded in the Polish economy, it is worth referring to the extent of municipal involvement in the implementation of the Smart City concept with particular reference to developing economies located in Central and Eastern Europe.

In the region's cities, the Smart City concept is known and implemented [53–55]. It also finds a strategic dimension in municipal planning documents. Nevertheless, as Tantau and Santa (2021) [56] point out, Smart City development strategies in Europe's emerging and developing economies are poorly prepared and not holistic. A similar view is taken by Naterer et al. (2018) [57], who additionally note that some of them are incompatible with the guidelines of the Europe 2020 Strategy, which hinders not only urban development, but also causes problems with the control of actions taken by city authorities.

An additional problem in Central and Eastern Europe is the lack of sustainability in Smart City development. Urban plans and actions primarily emphasize infrastructure, technology, and transportation goals. Far less attention is paid to social and environmental issues [58,59], which, according to Baltac (2019) [60], contributes to exacerbating problems of exclusion.

Unfortunately, in the cities of the analyzed region, citizens are very often not interested in the participatory model of governance, as pointed out by Klimovský et al. (2016) [61], which "exempts" municipal governments from taking care of this aspect of Smart City development. This makes it impossible to identify the needs of residents and, consequently, also to meet them and improve the quality of urban life.

The environmental situation is even worse. In this case, a considerable shortcoming is the low level of environmental awareness and reluctance to adopt new pro-environmental solutions [62], despite the low quality of the urban environment noted by residents [63]. Moreover, a study by Kronenberg et al. (2020) [64] shows that the authorities of Central and Eastern Europe cities show very low commitment and interest in environmental issues. They see the reasons for this as: tolerance of social inequality, lack of solidarity in society, lack of responsibility for the public interest, extreme individualization, and disregard for social interests. According to the researchers, this has resulted in the corporatization of urban relations with the economic environment and is a serious obstacle to the development of sustainable smart cities.

Taking into account the need to deepen research in the social area of Smart City development, the authors of this article took up the thread of city authorities' efforts to protect the health of residents. They placed the research carried out within the framework of this thread in the Polish economy, in order to confront previous observations of a social and environmental nature with the current state of involvement of municipal decision-makers in the actual improvement of the quality of life of residents of Polish cities—representing the region of Central and Eastern Europe. Before undertaking this task, the next subsection further deepens the literature study within the specific social aspect, which is urban healthcare.

2.2. Healthcare Issues in Smart City Literature

The issue of urban healthcare can involve various aspects. The present discussion follows a certain chronology related to this process. Thus, the city government's involvement in healthcare should begin with monitoring both the needs and health status of its residents (1). The city can and should also take measures to prevent the deterioration of community health. This can include pro-health education (2) and prevention (3). The direct impact on the state of healthcare, in turn, is investment in medical infrastructure (4). Finally, environmental issues (environmental quality) and recreational opportunities supporting health-promoting prevention are also associated with healthcare (5).

Urban health monitoring issues have received a great deal of attention in the Smart City literature. Nevertheless, these are mainly publications focused on identifying the health status of residents using technologies from the areas of Internet of Things, artificial intelligence, and Big Data [65–71].

There are also, but far less frequently, more social threads in this trend. For example, Hossain et al. (2019) point out the need to individualize health services rather than just mass processing of health data. To this end, they propose implementing voice pathology detection (VPD) to classify reported needs and forward them to the appropriate level of healthcare [72]. A similar solution is also proposed by Ali et al. (2017). It makes it possible to distinguish healthy people from sick people with voice disorders based on voice readings [73].

Notably, however, almost all of the proposed solutions are generally of a pilot or demonstration nature and are not implemented and used on a mass scale. Nevertheless, it is important to appreciate and emphasize the efforts in this area, which perhaps in the future will be more widely applied in urban reality.

It should also be added that health monitoring is dominated by a technological approach, where the focus is on collecting and analyzing data and processing them for decision-making use. The health-related needs and expectations of residents are not monitored. Indeed, the user aspect appears less frequently [74–76] or not at all in the literature.

Health education in cities is effectively supported by the Healthy Cities Project branded by the World Health Organization (WHO). The initiative emphasizes the ecological context of health and the need to reconcile human lifestyles with their impact on the environment and the lives of future generations. To this end, residents are made aware that health should be considered not only from an individual and biological perspective, but also from a social and environmental perspective.

In addition, the project envisages involving all urban stakeholders in health education and outreach activities, which is also in line with the latest development trends of the Smart City concept [77]. However, it is worth mentioning that the aforementioned project received much attention in the late 1990s and early 2000s [78–81]. Nowadays, it appears in publications far less frequently.

In the area of urban preventive healthcare, the latest technologies are also being used [82]. An interesting solution used in Japan is described by Trencher and Karvonen (2017) [83]. It is an application that monitors residents' physical activity and weight and suggests pro-health behavior change. A similar solution is also proposed by Casino et al.

(2017) [84]. It is an app that selects and suggests walking and jogging routes for residents of Spanish cities that are tailored to their health and physical condition.

The vision of leisure in a Smart City is developed a bit further by Yu et al. (2016) [85] as a relaxation farm for an urban community managed using the Internet of Things. The solutions described are experimental, but nevertheless the results obtained with them are promising. In the area of preventive healthcare, there are also publications on healthy eating [86–88], which has a significant impact on health and quality of life.

In the area of urban health infrastructure development, an integrated approach and management of all Smart City solutions is emphasized first and foremost [89]. In this vein, Trencher and Karvonen (2019) [83] highlight not only the implementation of modern technologies, but also proper communication between urban health services and the community. They also emphasize the need for the cooperation of residents, including their health awareness and willingness to lead a proper lifestyle.

In turn, Oueida et al. (2019) [90], note that cities, due to their high population density, can become a source of rapidly spreading health risks, and therefore require an optimized system of information flow and allocation of medical infrastructural and human resources. In this regard, the authors propose the Maximum Reward Algorithm (MRA) to improve the efficiency of urban healthcare operations.

Chauhan et al. (2021) [91] refer to the urban medical infrastructure focus on the management of medical waste, which, without a structured approach, can intensify health and epidemic risks. They propose a holistic system for their identification and disposal based on the principles of the closed-loop economy and Industry 4.0 solutions, which fits in with contemporary trends in Smart City development.

Due to the development of social and environmental aspects of SC creation mentioned in the introduction, the literature often combines the issues of health and recreation offered to the community. Thus, Xue et al. (2022) [92], postulate the use of urban recreational space in the process of improving the quality of life of residents with special attention to post-pandemic health needs.

Ramaiah and Avtar (2019) [93], in order to protect health as well as the environment and climate, recommend maximizing the area of green spaces in cities. This is because they serve not only a recreational and image function, but above all, an ecological one. The researchers point this out in the context of the increasing urbanization of cities in India, where building infrastructure is being intensively expanded at the expense of reducing urban green areas. In their view, such action does not fit into the strategy of developing truly smart cities.

Cao et al. (2019) [94] also emphasize the role of sustainability in the process of creating smart cities. This is—given their research conclusions—particularly important in emerging and developing economies. In addition, they conclude that green investments foster innovation and economic growth, which is an attractive side effect of green investments.

It should also be added that there are many publications on the Green Internet of Things (G-IoT) in the current trend of health and environmental research. In this case, information and communication technologies are used to minimize environmentally harmful factors, save energy, or improve the quality of life of residents [95–98]. These studies are directly in line with the genesis of the Smart City concept and efficiently relate to contemporary exposed, environmental analytical themes.

The above literature review allows us to conclude that health issues are analyzed in publications on healthcare in smart cities. They appear in the trends mentioned at the beginning of this subsection. Nevertheless, it is notable that the cited analyses are still very technological in nature and refer to the roots of the Smart City idea. This, in turn, means that social, managerial or strictly environmental threads are not given enough prominence.

Moreover, due to the prototypical nature of the proposed technological solutions, it is difficult to assess their current and holistic impact on the quality of life of residents and the development of smart cities. For these reasons, the authors of the article decided to conduct

their research in the social-management strand of Smart City considerations, setting them in the realities of cities in the developing economy.

This approach contributes to a less recognized and less spectacular research strand, but provides new research findings and can form the basis for holistic recommendations to improve the management of smart cities with a particular focus on residents as the main urban stakeholders interested in healthcare.

3. Materials and Methods

3.1. Research Intentions and Methods

When considering the following circumstances:

- few studies on healthcare in cities aspiring to be smart and operating in developing economies;
- the need to supplement analyses in the social-management aspects of smart cities;
- conceptual and, less often, practical dimension of research on the real activities of Smart City authorities on the process of improving the quality of life of residents;

The article, in its latter part, seeks an answer to the following research problem: What is the level of involvement of local authorities in protecting the health of residents in Polish cities in the context of the Smart City concept?

Due to the previously described abundance of publications on modern gadgets supporting healthcare in smart cities, the survey focuses on residents as the most important stakeholder in smart cities. The authors decided to choose surveys because it is a tool characteristic of social research. It was used in previous considerations on the sustainability of smart cities [99,100]. In addition to this methodology, case studies are often found in the social research on smart urban solutions [101–105]. In the context of social sciences, there are also many theoretical articles that use literature studies, discussion and polemics as research tools [106–108].

The originality of the methodology we have chosen results from the development of an original, universal survey questionnaire. An additional advantage of the study is its representative nature. Studies on such a scale (399 cities) are rarely conducted. More often—even in survey research—purposeful selection and a small research sample are encountered. Our results can be generalized to the entire population of Polish cities, which distinguishes them from other studies in the social area.

As already mentioned, in the latest generation of smart cities, the identification of the needs of the local community is a prerequisite for full sustainability and overcoming the shortcomings of the SC concept. For this reason, the first part of the research focused on determining whether and what health needs residents have. Subsequently, four aspects of urban health protection were taken into account, in line with the areas described in the literature studies. They form a logical sequence illustrating the city's systematic involvement in healthcare. The first element of this chain is health education, enabling the community to take care of its own health. The second link is the health infrastructure that determines the possibilities of taking care of residents in the event of illnesses and diseases. The third element examined is health prevention, which can effectively reduce morbidity. The fourth aspect of the research relates to environmental protection and urban recreation as an element supporting the care of the health of the urban community.

Within the areas described above, specific actions have been identified that can be taken by municipal authorities to protect the health of residents. The assessment of the scope of implementation of these activities (on a five-point Likert scale) made it possible to obtain an answer to the research problem posed regarding the assessment of the involvement of the city authorities in protecting the health of the local community.

This assessment was carried out in the course of survey research in 399 Polish cities, taking into account the areas identified on the basis of the literature studies conducted in the previous subsection. A summary of these areas with the survey questions assigned to them is presented in Table 1.

Table 1. Areas for assessing the city government's commitment to residents' healthcare, along with the survey questions assigned to them.

Research Area	Survey Questions Please Rate the Extent to Which the Activities Listed below Have Been Implemented by the City Government over the Past 5 Years.
(1) monitoring the health needs of residents	1. monitor the identified health needs of the population
(2) health education	2. run information and education activities for residents targeting health promotion, prevention and creation of conditions conducive to health, based on direct contact, e.g., thematic meetings with experts; 3. run information and education activities for residents targeting health promotion, prevention and creation of conditions conducive to health, based on indirect contact, e.g., using mass media; 4. organize thematic sports events for residents to promote a healthy lifestyle, e.g., a run, a match
(3) healthcare infrastructure	5. with the city's funds, implement investments in the infrastructure of medical entities, e.g., purchase of new equipment, renovation of the building
(4) preventive healthcare	6. organize prevention programs for city residents, e.g., on addictions and mental problems 7. organize hygienic and medical care for children and teenage students 8. organize and carry out immunizations for residents
(5) environment and recreation	9. establish new green zones in the city, such as squares and parks 10. reduce air pollution 11. create an outdoor gym in the city 12. build publicly accessible sports facilities in the city, e.g., soccer fields

The level of involvement was rated on a five-point Likert scale, specifying:

1. lack of implementation;
2. low implementation rate;
3. average implementation rate;
4. high implementation rate;
5. very high implementation rate.

In addition to the assessment of the city's involvement in particular areas of healthcare, illustrating the level of its social sustainability, the study also attempted to identify the determinants of the city's involvement in healthcare. In this regard, two factors were taken into account. The first was the monitoring of health needs, the implementation of which should be conducive to the increase in the involvement of the city authorities in healthcare, because better recognition of expectations implies more effective actions. The second determinant concerned the size of the city expressed by the number of inhabitants. Literature research and criticism of smart cities show that the SC concept is intended and can be successfully implemented primarily in large cities. The authors verify this statement in relation to the involvement of the city authorities in healthcare.

As a result and as mentioned above, the analysis of survey results was carried out in the following research steps:

1. Assessment of the city government's involvement in activities in each area, taking into account statistical measures of central tendency (arithmetic mean; dominant; and median) and measures of variation (standard deviation; coefficient of variation). Central tendency measures were used to indicate the average and most frequent levels of involvement of city authorities in protecting the health of residents. The measures of variation were used to reflect the differences between the studied cities.
   (a) arithmetic mean:

$$\overline{x} = \frac{\sum_{j=1}^{N} x_j}{N} \quad (1)$$

   where:

   x_j—the variable value;

N—the number of variables;

(b) dominant:

$$D = x_D + \frac{n_D - n_{D-1}}{(n_D - n_{D-1}) + (n_D - n_{D+1})} \times i_D \quad (2)$$

where:

x_D—the lower bound of the class in which the dominant is found;
n_D—the size of the dominant interval;
n_{D-1}—the size of the interval preceding the dominant interval;
n_{D+1}—the size of the interval following the interval of the dominant;
i_D—the dominant interval;

(c) median: when N is odd:

$$Me = x_{\frac{N+1}{2}} \quad (3)$$

when N is even:

$$Me = \frac{1}{2}\left(x_{\frac{N}{2}} + x_{\frac{N}{2}+1}\right) \quad (4)$$

where:

x_j—the variable value;
N—the number of variables;

(d) standard deviation:

$$s = \sqrt{\frac{\sum_{j=1}^{N}\left(x_j - \overline{x}\right)^2}{N-1}} \quad (5)$$

where:

x_j—the variable value;
N—the number of variables;

(e) coefficient of variation:

$$V = \frac{s}{\overline{x}} \quad (6)$$

where:

$\overline{x}$—arithmetic mean;
s—standard deviation.

2. Identification of the relationship between monitoring the identified health needs of residents and the size of the city and the real actions of local governments to protect residents using Spearman's rank correlation coefficient. It identifies the strength and direction of correlations between variables. The assumed significance level is $p < 0.01$. This coefficient takes values from -1 to 1. The higher its absolute value, the stronger the relationship between the variables. The coefficient was used to verify whether the size of the city and the monitoring of the health needs of residents are related to the level of involvement of the city authorities in healthcare activities.

Calculations were made in Statistica 14.0.

3.2. Research Sample Characteristics

As already mentioned, 399 out of 930 Polish cities were surveyed. The sample size was therefore representative, assuming a maximum error of 5%, a fractional size of 0.5, and a 99% confidence level, which allows generalizing the results of the study, which can also benefit other cities operating in developing economies.

The structure of the surveyed cities with respect to their size expressed in terms of population is shown in Figure 1.

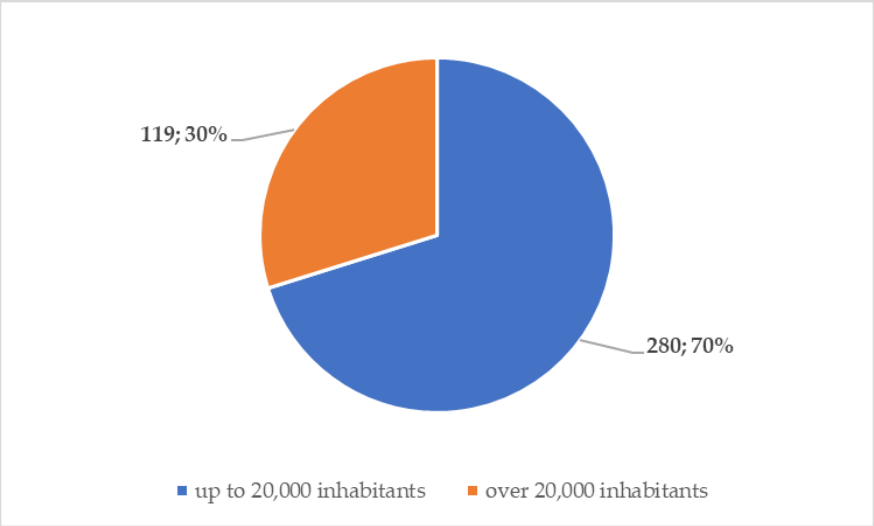

Figure 1. Structure of the surveyed cities by population.

According to the data presented in Figure 1, the survey sample included mostly smaller Polish cities, which is a reflection of the population and also allows us to assess how different-sized entities are coping with the challenges of the Smart City concept.

4. Results

4.1. Assessment of the City Government's Commitment to Specific Areas of Healthcare

According to the research methodology outlined in the previous chapter, the first stage of the analyses involved an assessment of local government involvement in various aspects of resident healthcare. Results, including measures of central tendency and variability for individual responses, are included in Table 2.

The first and quite important conclusion drawn from the data summarized in Table 2 is that more than half of the surveyed cities (median 3.0) do not monitor the health needs of residents, despite the fact that, as further analysis shows, these cities undertake a variety of health-promoting activities. Thus, one can conclude that cooperation between city authorities and residents as recipients of city services in the area of healthcare is weak or very weak. Nevertheless, it is worth adding that in terms of conducting needs monitoring, the analyzed entities differ quite significantly (high coefficient of variation and standard deviation).

In the area of health education, organizing thematic sports events for residents to promote a healthy lifestyle is the best. However, cities are far less likely to organize information and education activities oriented toward health promotion, prevention and the creation of conditions conducive to health, both directly and indirectly. This may be due to both low community interest and the city government's focus on more image-attractive sports and recreation ventures. Whatever the reason, however, it means that residents are not receiving professional information about health risks and measures to combat them.

Respondents also gave a low assessment of the level of investment in medical infrastructure, although the situation in individual cities varies in this regard, as evidenced by the high values of the standard deviation and coefficient of variation. The dominant analysis also indicates that most of the analyzed cities have taken measures to develop medical infrastructure in a wide range over the past five years, but the low average entitles one to conclude that the sample also includes a large number of cities that have taken no or very few infrastructure measures (left-handed asymmetric distribution).

Table 2. Results of assessing the city government's commitment to residents' healthcare, along with the survey questions assigned to them.

Research Area	Survey Questions Please Rate the Extent to Which the Activities Listed below Have Been Implemented by the City Government over the Past 5 Years.	Average	Dominant	Median	Stan. Deviation	Variation Coefficient
(1) monitoring the health needs of residents	1. monitor the identified health needs of the population	3.24	4.00	3.00	1.05	32.28%
(2) health education	2. run information and education activities for residents targeting health promotion, prevention and creation of conditions conducive to health, based on direct contact, e.g., thematic meetings with experts;	3.83	4.00	4.00	1.05	27.27%
	3. run information and education activities for residents targeting health promotion, prevention and creation of conditions conducive to health, based on indirect contact, e.g., using mass media;	3.73	4.00	4.00	1.02	27.02%
	4. organize thematic sports events for residents to promote a healthy lifestyle, e.g., a run, a match	4.14	5.00	4.00	1.04	25.14%
(3) healthcare infrastructure	5. with the city's funds, implement investments in the infrastructure of medical entities, e.g., purchase of new equipment, renovation of the building	3.62	5.00	4.00	1.28	35.32%
(4) preventive healthcare	6. organize prevention programs for city residents, e.g., on addictions and mental problems	4.22	5.00	4.00	0.91	21.56%
	7. organize hygienic and medical care for children and teenage students	3.98	4.00	4.00	0.94	23.71%
	8. organize and carry out immunizations for residents	4.04	5.00	5.00	1.02	24.22%
(5) environment and recreation	9. establish new green zones in the city, such as squares and parks	4.02	4.00	4.00	1.04	25.85%
	10. reduce air pollution	3.91	4.00	4.00	0.93%	23.66%
	11. create an outdoor gym in the city	4.45	5.00	5.00	0.84	18.84%
	12. build publicly accessible sports facilities in the city, e.g., soccer fields	4.23	5.00	5.00	1.02	24.22%

Evaluations in the field of preventive healthcare, including in particular the organization of preventive programs (e.g., on addiction, mental problems) and the conduct of immunizations (ratings above 4.0—high implementation rate) are much better. At the same time, the high rating in the field of vaccination was certainly influenced by the COVID-19 pandemic implying the need for widespread measures in this area.

In the area concerning the environment and recreation in terms of the highest ratings, activities for small and large sports infrastructure (the creation of gyms and other sports facilities) stand out above all. From an image point of view, these projects are noticeable and attractive. Their active use also has a positive impact on the health of residents. Nevertheless, sports and recreation are not the only dimension of residents' health. All the more glaring in the analyzed context is the low assessment of measures to reduce air pollution, which, according to previous studies, is one of the key problems of cities in emerging and developing economies.

The first stage of the research shows that the city authorities are not interested in identifying the city's healthcare needs. This is contrary to the assumptions of the contemporary SC concept and indicates low awareness of the importance of social aspects. It also means a lack of active cooperation between the city and the local community. The city authorities assume that they know the needs of the residents better themselves. Therefore, they do not implement the assumptions of the economic quadruple helix. In such circumstances, it is difficult to talk about the sustainability of the examined cities.

The analysis of individual aspects of healthcare shows that the city's activities focus on sports and recreational activities. Much less often they are based on the transfer of professional knowledge and the shaping of desirable health habits. This proves quite a marketing approach to the protection of the health of the urban community. Unfortunately, the identified facts provide arguments for the criticism of the SC concept and may be examples of its real distortion. However, it is worth adding that cities undertake various pro-health activities, but they can hardly be considered coordinated and holistic. Thus, there is still a large gap to be filled and actions to be improved.

Summarizing the above observations, it can be said that Polish cities are trying to take measures to improve the health of their residents, but they do so without in-depth identification and monitoring of health needs. These are undoubtedly efforts that need to be appreciated, but they are not coordinated and are not holistic in nature. City governments focus on sports and recreation, while neglecting health education and environmental and climate protection.

4.2. Interdependence Analysis: Health Needs Monitoring—Healthcare Activities and City Size—Healthcare Activities

Besides assessing the city government's commitment to residents' health, this article also assesses interdependence along two dimensions:

1. between health needs monitoring and individual healthcare activities to answer the question: Whether and to what extent does monitoring the health needs of residents affect the subsequent involvement of the surveyed cities in real healthcare activities?
2. between the size of cities, expressed in terms of population, and individual health measures, to obtain an answer to the question: Does the size of a city determine the scale of the city's involvement in health-promoting activities for its residents?

The correlation between the variables indicated above was assessed using Spearman's rank correlation coefficient, and the results are shown in Table 3.

Most of the correlations shown in Table 3 are statistically significant. All of them have a positive direction, which means that there are relationships between monitoring health needs and city size and healthcare activities in the analyzed areas. However, these are relationships of a very weak, weak or average nature.

Monitoring health needs has the strongest impact on:

- running information and education activities for residents oriented towards health promotion, prevention, and creation of conditions conducive to health, which is based on indirect contact, e.g., using mass media;
- running information and education activities for residents focusing on health promotion, prevention, and creation of conditions conducive to health, which is based on direct contact, e.g., thematic meetings with experts;
- organizing and carrying out immunizations for residents;
- organizing hygienic and medical care for children and teenage students.

Thus, it can be concluded that in cities involved in identifying the needs of residents, health education and prevention activities are carried out to a greater extent. This underscores the concern of the authorities of these cities for the fate of their residents, and exposes the need and role of monitoring health needs in the process of improving the quality of life and health of the community.

Table 3. Spearman's rank correlation coefficients for the correlations: health needs monitoring—healthcare activities and city size—healthcare activities.

Research Area	Survey Questions	Interdependencies Surveyed	
	Please Rate the Extent to Which the Activities Listed below Have Been Implemented by the City Government over the Past 5 Years.	**(1) Monitoring of Health Needs—Healthcare Activities**	**(2) Size of the City—Healthcare Activities**
(1) monitoring the health needs of residents	1. monitor the identified health needs of the population	1.0000 *	0.0761
(2) health education	2. run information and education activities for residents targeting health promotion, prevention and creation of conditions conducive to health, based on direct contact, e.g., thematic meetings with experts;	0.3960 *	0.1846 *
	3. run information and education activities for residents targeting health promotion, prevention and creation of conditions conducive to health, based on indirect contact, e.g., using mass media;	0.4181 *	0.2379 *
(3) healthcare infrastructure	4. organize thematic sports events for residents to promote a healthy lifestyle, e.g., a run, a match	0.3225 *	0.2225 *
	5. with the city's funds, implement investments in the infrastructure of medical entities, e.g., purchase of new equipment, renovation of the building	0.3147 *	0.1865 *
(4) preventive healthcare	6. organize prevention programs for city residents, e.g., on addictions and mental problems	0.3108 *	0.1166
	7. organize hygienic and medical care for children and teenage students	0.3531 *	0.1786 *
	8. organize and carry out immunizations for residents	0.4001 *	0.1452 *
(5) environment and recreation	9. establish new green zones in the city, such as squares and parks	0.2658 *	0.3225 *
	10. reduce air pollution	0.3006 *	0.1706 *
	11. create an outdoor gym in the city	0.2056 *	0.2182 *
	12. build publicly accessible sports facilities in the city, e.g., soccer fields	0.2599 *	0.1545 *

significance level: * $p < 0.01$.

In turn, the size of the city has the strongest impact on:

- establishing new green zones in the city, such as squares and parks;
- running information and education activities for residents oriented towards health promotion, prevention, and creation of conditions conducive to health, which are based on indirect contact, e.g., using mass media;
- running information and education activities for residents focusing on health promotion, prevention, and creation of conditions conducive to health, which are based on direct contact, e.g., thematic meetings with experts.

The obtained positive correlations between the monitoring of health needs and the involvement of the city authorities in health protection indicate the great importance of this factor in shaping the quality of urban life. Therefore, cities should not underestimate the expectations of the local community. This can serve both the sustainable development of the SC concept and the increase in the efficiency and effectiveness of urban management.

It is also worth adding that the monitoring of health needs has the greatest impact on the most neglected healthcare activities of cities, such as education and prevention, so it helps to make urban healthcare more holistic and sustainable.

The observations on the relationship between the size of the city and the scope of healthcare show that the awareness of educational and preventive aspects of healthcare increases with an increase in the number of inhabitants. The authorities of large cities are therefore more oriented towards the real needs of the inhabitants and real prevention of health problems than the authorities of smaller cities. It also means that they are more

predisposed to be smart and sustainable. Unfortunately, it also indicates difficulties in implementing the SC concept in small towns in analyzed area.

Accordingly, the larger the city, the greater the chances for health-promoting educational activities and the development of urban green space. Noteworthy, however, is the fact that the size of a city determines the level of city government involvement in healthcare to a lesser extent than the monitoring of residents' health needs described above. Thus, the presumption that larger cities are more likely to be smart and meet community expectations is not true. In this regard, it seems more important to take an interest in stakeholders and listen to their needs.

5. Discussion

As highlighted in the introduction, in recent years the Smart City concept has been systematically refined toward greater sustainability [17,18] and an orientation toward residents as key urban stakeholders [10,11]. The surveyed cities do not fully implement the above guidelines, as most of them do not identify and monitor the needs of residents in their healthcare activities. Thus, there is no direct cooperation between the city government and the local community. This can result in the misdiagnosing of needs and, as a result, waste of public funds and ineffective improvement of quality of life, since, as noted by Caragliu et al. (2011); Dameri (2013); Komninos (2014) and Vujković et al. (2022) [33–36] modern smart cities cannot develop without investment in social capital. The observed regularity also testifies to the low level of advancement of Polish cities in the potential implementation of the principles exhibited in the next generations of smart cities [19–21].

Smart Governance is also hindered in the above conditions. Indeed, Hajduk (2020) [46], distinguishing five dimensions of effective SG, draws attention to the need to create urban development strategies on the basis of identified community needs and expectations. Furthermore, Carrato-Gómez and Roig-Segovia (2022); Bokhari and Meyong (2022) and Faraju et al. (2021) [42–44] emphasize the importance of urban participation and informing residents about the principles of urban governance. The assumptions indicated above are therefore not realized in most Polish cities.

Detailed analyses of specific areas of healthcare in Polish cities also indicate a piecemeal rather than holistic, systemic approach to the issue under study, which, according to recommendations—Fonseca et al. (2021); Yoo (2021); Saadah (2021); Laurini, (2021) and Maurya and Biswas (2021) [48–52]—can be treated as a strategic error. The results of the research in this regard also confirm earlier observations by Tantau and Santa (2021) [56] and Naterer et al. (2018) [57] about the need to improve the strategic documents of cities in developing and emerging economies located in Central and Eastern Europe.

Given that in healthcare, Polish cities focus primarily on activities related to sports and recreation, and pay less attention to health education and environmental protection, one can also confirm the research conclusions previously obtained by Cepeliauskaite et al. (2021) [62]; Jonek-Kowalska (2022) [59] and Baltac (2019) [60] regarding less involvement of municipal authorities in social and environmental issues.

Measures to reduce air pollution received one of the worst scores in city government self-assessments, confirming the problems that cities in developing economies have with environmental and climate protection, also described by Kopackova (2019) [63] and Kronenberg et al. (2020) [64].

Despite the above criticisms, it is worth noting that Polish cities are taking measures for healthcare in all the isolated areas. They are not perfect, and they certainly need to be expanded and improved, but the rating of the city government's commitment to individual activities in most cases is greater than 3.5 (on a five-point rating scale).

As mentioned above, most of the cities surveyed are focusing on sports and recreation, which, as highlighted by Xue et al. (2022) [92]; Ramaiah and Avtar (2019) [93] and Cao et al. (2019) [94], is an important aspect of the development of modern smart cities. A significant number of surveyed entities are also trying to make investments in medical infrastructure, although here, especially in less affluent cities, these activities may be hampered by a lack

of financial resources, typical of emerging and developing economies [54]. Preventive healthcare, including the organization of immunizations and hygienic care for children and adolescents, is also not doing too badly.

Health education and environmental protection, however, remain areas that need to be greatly strengthened. Activities in these areas were rated quite low, but their role in healthcare is very important, because education helps prevent health risks and the development of diseases, as clearly pointed out by Ashton (1991); Goldstein (2013); Kegler et al. (2000); Flynn et al. (1994) and Adams (1989) [77–81]. In addition, compared to treatment, it is a low-cost activity. In turn, environmental protection reduces exposure to harmful agents, reducing morbidity and mortality. Actions taken in this regard are also an investment in the health of future urban generations.

In view of the correlation analysis, an important and new research finding is that there is a correlation between monitoring residents' health needs and the commitment and scale of healthcare activities. The identified relationships allow us to conclude that identifying and observing community expectations increase the scope and effectiveness of municipal health policies, and therefore, health monitoring is worthwhile.

Based on the results of the study, the following recommendations can also be made for the surveyed cities:

- before developing a municipal health action strategy—they should identify and then monitor the health needs of the community, which would increase the efficiency and effectiveness of public action;
- healthcare activities should be holistic and sequential, because only then can they be effective and improve the quality of urban life, and therefore should include not only sports and recreation and investment in medical infrastructure, but also health education, prevention, and environmental and climate protection;
- activities in the area of population health education should be strengthened and developed, as they can reduce morbidity and thus reduce budget expenditures on medical care; they are also an effective support for preventive healthcare;
- environmental and climate protection activities also need to be improved, both on the part of the city authorities and the residents themselves; an important role in this process is played by the formation of environmental awareness and desired behavior.

6. Conclusions

The research shows that most of the cities analyzed do not identify and monitor the health needs of their residents, which indicates and low awareness of their role in building smart cities. Nevertheless, local authorities are making efforts for healthcare in all the areas identified in the literature and the article. Additional detailed conclusions are as follows:

- the activities of the surveyed cities focus on the sphere of recreation and sports, which contributes to both health and resident satisfaction, but may involve a focus on image effects and ignoring other areas related to healthcare;
- health education and environmental and climate protection are the areas in which the surveyed cities are least involved, posing a serious threat to the continuity and holistic nature of efforts to maintain and improve community health;
- the surveyed cities are strongly differentiated in terms of investment in medical infrastructure (a high engagement rating dominates with a relatively low arithmetic mean);
- actions for specific areas of healthcare are more strongly determined by the fact of monitoring health needs than by the size of the city, this is especially true for health education and environmental and climate protection.

With the assumptions of the Smart City concept in mind, the above observations allow us to conclude that Polish cities are trying to take pro-health measures, but they are not coordinated and holistic, as they do not monitor the health needs of the population, which is currently a prerequisite for creating smart and sustainable cities. In addition, they focus on single areas, and this means that they cannot be fully effective.

The research presented in the article complements the knowledge, methodology and empiricism regarding the involvement of municipal authorities in activities for healthcare and sustainability. This is a much less discussed social topic. Its originality is based on the trichotomous subject matter: municipal governance, healthcare, and social participation. In addition, the uniqueness of the considerations results from the development of an original, universal questionnaire identifying the involvement of the city authorities in healthcare. Furthermore, the obtained diagnostic conclusions are the basis for new city recommendations in the area of public management.

The main limitation of the present study is that it assesses cities' involvement in population health from the perspective of local authorities, which may result in subjectivity and overestimation of the final results. Nevertheless, the results clearly indicate a certain hierarchy and imbalance in health-promoting activities, which is a valuable cognitive observation and a basis for making improvement recommendations. In addition, the geographical narrowing of the research to the area of Poland may also be a research limitation, although the proposed methodology and some of the conclusions can also be successfully used in other cities of emerging and developing economies.

Given the results obtained and the research limitations presented, further analysis should be conducted in the direction of identifying the health needs of city residents, which would be justified from both a scientific and practical point of view. The question of residents' assessment of the city government's involvement in healthcare could also be an important research aspect, which would help offset the subjectivity of the present findings.

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