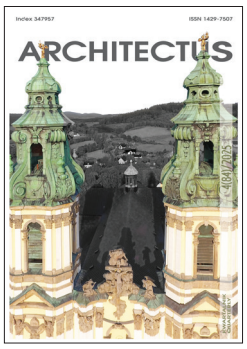

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Correlations and statistical analyses of user preference assessment in participatory design of healthcare facilities

Abstract

The article presents examples of the use of statistical methods in the study of users' declarations of willingness to participate in the design of healthcare facilities and the relationship of users' expectations to the evaluation of the existing built space of hospitals. Selected methods for assessing the correlation between relevant socio-demographic factors and the spectrum of users' functional-spatial preferences, such as Mann–Whitney *U* test, Spearman rank correlation, Kruskal–Wallis ANOVA test and stepwise regression models, are discussed. The study involved medical staff of selected hospital facilities in Poznan and caregivers of patients in the emergency room of one of Poznan's paediatric hospitals. The surveys were conducted in 2015 and 2021. The same research methods were used in both cases. The methods used made it possible to assess preferences towards the designed space, as well as the willingness to participate in participatory research (in the case of staff). Consequently, it was shown that the selected statistical methods can be an effective tool in assessing the spatial needs of users at the stage of investment programming and design. Thus, they can be used by architects and designers.

Key words: statistical methods, correlations, health care architecture, participatory design

Introduction

American architect and representative of postmodernism Michael Graves pointed out: *I am qualified to speak about the physical properties of hospital space not because I am an architect, but because I have spent the last three years as a patient there* (Graves 2011). These words emphatically highlight the importance of the participation of medical staff and patients in the design of healthcare facilities and the relevance of the choice of research methods that catalyse participatory processes.

The design of healthcare facilities is a speciality that is particularly determined by innovative and rapidly developing medical technologies and, at the same time, governed by a very large number of legal regulations. The efficiency of healthcare facilities must be ensured not only when the facility is commissioned, but during its use, with incredibly dynamic changes in treatment processes and forms of patient care. Hence, adaptation to changing functional and spatial needs is permanently embedded in the programming and design of these investments. Changing medical technologies generate the need to modernise and adapt the building structure more often than in other facilities.

It should also not be forgotten that in the case of hospitals, we are dealing with different groups of users of the same space, demonstrating radically different spatial and functional needs, which is important when including the users in the design processes. Hence, selected methods are used which take into account the specific characteristics of the users concerned, enabling the participation of all groups in the programming and design process. Statistical methods used in architecture and urban planning are often inferior to the entire spectrum of qualitative methods. Nevertheless, they ensure that user needs are evaluated in a systematic way, on a much larger scale, with objective weights and criteria. At the same time, they make it possible to analyse correlations, especially when including a large group of users with

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different characteristics and needs in the evaluation process (here: patients, staff, visitors).

The aim of the research work presented in this paper was to demonstrate the feasibility of using statistical methods as tools to assess the spatial needs of users of healthcare facilities and their willingness to participate in the investment programming and design process.

State of research

The role of the building user in the process of defining the spatial structure of the building is closely related to the design model adopted for the development project. When trying to establish the relationship between the designer and the other stakeholders in the design process, it is worth starting with an understanding of the process. Design process methodologies are well described in the scientific literature (Asanowicz 2010; Barełkowski 2009; Prokopska 2012). Research in architectural theory defines the design process based on the knowledge, experience and talent of the designer as historically primordial (Niezabitowska et al. 2021, 178). As civilisation developed and new social expectations of architecture emerged, the process transformed. This observation, outlined by, among others, a Swiss research team (Hegger et al. 2008, 187), was graphically presented by Beata Majerska-Pałubicka (2014, 174) (Fig. 1).

Methods

Taking this into account, and noting the specificity of hospital facilities, where a huge number of sensitive medical processes are carried out, it is important to select such methods of evaluating the space of a built healthcare facility that are as non-conflicting as possible with the day-to-day operation of the facility under analysis, non-invasive and at the same time enabling the collection of valuable and reliable data in the shortest possible time. This specificity of carrying out research in the buildings of healthcare facilities informed the choice of statistical methods in the two case studies described later in this thesis: a study of the socio-demographic factors influencing the cooperation of hospital staff with designers potentially undertaking the transformation of the workplaces of the employees concerned, and a study which involved the participation of patients of a paediatric hospital in the assessment of functional and spatial needs in the emergency room. The described studies indicate that it is worthwhile to integrate statistical methods into scientific work in the discipline of architecture and urban planning. They offer, through data analysis and correlations, a chance to uncover hidden connections in the perception of hospital space, characterised by objectivity and detachment appropriate for the purposes of research, which were emphasised by Jean S.K. Lee (1992, 89) in her comparative analysis of quantitative and qualitative methods (Table 1).

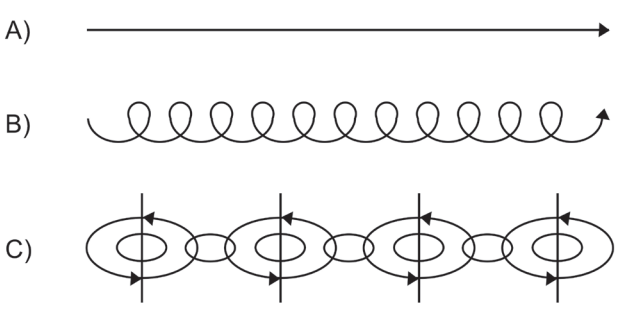


Fig. 1. Design processes: A) linear, B) iterative; C) integrated (source: Majerska-Pałubicka 2014, 174)

Il. 1. Procesy projektowania: A) linearny, B) iteracyjny; C) zintegrowany (źródło: Majerska-Pałubicka 2014, 174)

Selected statistical methods were indicated for the analyses: the Mann–Whitney *U* test, Spearman's rank correlation, Kruskal–Wallis ANOVA test and stepwise regression models.

The Mann-Whitney *U* test is a non-parametric test that demonstrates whether sample values from two independent populations show a magnitude correlation. The basic condition for the use of the *U* test is that the dependent variable is represented on an ordinal or quantitative scale. This prerequisite is fulfilled in the representation of the answers to questions on willingness to participate (the dependent variable of the question) as a five-point Likert scale (ordinal scale from 1 to 5) (Mann, Whitney 1947, 50–60). In the study described here, this test was used, among other things, to compare the declared level of willingness to participate for two separate groups, e.g.: Who shows a greater willingness to participate: women or men? Is the difference statistically significant?

Spearman's rank correlation is a non-parametric measure of the monotonicity of the statistical relationship between variables. It describes the strength of the correlation of two characteristics when both are qualitative, allowing them to be ordered by the strength of the characteristic. For the study in question, the values of age and length of service of the staff were analysed (sortable by their strength – in this case a numerical value) in relation to the declaration of willingness to participate (also sortable by magnitude, due to the structuring of the responses on a five-point scale) (Spearman 1904, 72–101).

The Kruskal–Wallis one-way ANOVA – one-way analysis of variance for rank ANOVA – is a non-parametric extension of the Mann–Whitney *U* test to more than two populations. In the present study, three primary occupational groups were defined, which qualifies the use of the test in question (Kruskal, Wallis 1952, 583–621). In the procedure described, it was used, among other things, to compare the declared level of willingness to participate for several separate groups, e.g.: Who shows a greater willingness to participate: doctors, nurses or other employees? Is the difference statistically significant?

Stepwise regression models – a statistical method that allows the degree of influence of several explanatory variables on a given explanatory variable to be determined. In a certain generalisation, regression models allow further prediction of data (explanatory variables) on the basis of separate known characteristics (explanatory variables). For the present study, a stepwise model was adopted, in which further explanatory variables would be added in an order of significance. This model was used to indicate whether hospital staff's willingness to participate in architectural design is more influenced by sociodemographic factors or by the spatial characteristics of their current workplace.

Table 1. Statistical methods in the context of quantitative and qualitative research (elaborated by P. Springer, based on Lee 1992, 89)
Tabela 1. Metody statystyczne w kontekście badań ilościowych i jakościowych (oprac. przez P. Springer, na podstawie Lee 1992, 89)

	Quantitative	Qualitative
Ontological assumption	objectivity	subjectivity
Epistemological assumption	positivism	phenomenology
Aims of inquiry	universality	particularity
Role of researcher	outsider	insider
Researcher-respondent relationship	detachment	involvement
Research methods	statistics	description

A case study of the use of statistical methods in research on hospital staff participation in the design process

Six hospitals in Poznań were selected to carry out a survey (expert questionnaire) among staff of hospital bed wards[1]. The research work in question[2], referred, among other things, to the past experience of medical staff with participatory design, hence an important criterion for the selection of the territorial scope (in this case the selection of hospitals) was to select units that had undergone significant spatial transformations in the last ten years.

A total of 154 respondents took part in the survey. The survey was conducted in 2021 only among those who were employed and actively performing their duties in a given medical facility. The vast majority of people surveyed were women (109 respondents, 71% of the total survey group). The survey methodology was developed by the author on the basis of his own experience in the programming and design of healthcare facilities and the current state of research. In formulating the structure of the survey tool, reference was made primarily to the work of Scandinavian researchers at the forefront of considering participatory design of hospitals. One of the primary ones was the methodology of the HospiCaseY project[3]. In this study, the current hospital space was evaluated by staff, in separate functional categories, using a Likert scale. The content of the survey sheet was verified for understanding by potential respondents during a pilot study combined with interviews, conducted in two medical facilities: Face&Skin Dermatology and Dermatosurgery and Poznań Askodent Implant Centre. During the pilot, particular attention was paid to the content of the questionnaire, relating to participatory theory and the level of medical staff understanding of the nomenclature, identical to that of the architecture survey.

The content of the questionnaire was contained in two pages of A4 sheet and consisted of five main parts:

– information about the respondents,

– questions on the declaration of willingness to participate in the design of the renovation/expansion,

– questions on the evaluation of the quality of the respondents' current workplace,

– questions on previous experience with participatory design,

– open-ended questions about the hospital space.

The primary intention was to construct the spreadsheet in a way that allowed it to be received unambiguously and as intended. The resulting tool enabled the collection of data and analysis of their internal correlation.

An important part of planning a reliable statistical survey is determining the minimum sample. For this purpose, the formula (Kuszewski, Podgórski 2008, 26) was used:

$$N_{\min} = [N_P(\alpha^2 \cdot f(1-f))]/[N_P \cdot e^2 + \alpha^2 \cdot f(1-f)],$$

where:

$N_{\min}$ – minimum sample size,

N_P – size of the population from which the sample is taken,

α – confidence level for the results,

f – size of the fraction,

e – assumed maximum error, expressed as a fractional number.

The study assumed:

– population size – approximate, total number of doctors and doctors and nurses: personnel actively practising their profession in Poznań hospitals: 3990[4],

[1] The following hospitals in Poznań were selected to conduct an expert survey among the staff of inpatient wards Gynecology and Obstetrics Clinical Hospital of the Karol Marcinkowski Medical University in Poznań, ul. Polna 33, 60-535 Poznań, Independent Public Healthcare Center of the Ministry of Internal Affairs and Administration in Poznań named after Prof. Ludwik Bierkowski, ul. Dojazd 34, 60-631 Poznań, Heliodor Święcicki Clinical Hospital of the Karol Marcinkowski Medical University in Poznań, ul. Przybyszewskiego 49, 60-355 Poznań, Karol Jonscher Clinical Hospital of the Karol Marcinkowski Medical University in Poznań, ul. Szpitalna 27/33, 60-572 Poznań, Transfiguration Clinical Hospital of the Karol Marcinkowski Medical University in Poznań, ul. Augustyna Szamarzewskiego 84, 60-569 Poznań, Józef Struś Multispecialist Municipal Hospital with ZOL SP ZOZ in Poznań, ul. Szwajcarska 3, 61-285 Poznań.

[2] Chapter based on dissertation (Springer 2023).

[3] Overcoming the language barrier of publishing the report in Finnish was helped by the report of the subsequent EVICURES research project, which refers in detail to the output of the preceding HospiCaseY study (Nykänen et al. 2016).

[4] Due to the lack of current and unambiguous data on the number of doctors and nurses strictly for the city of Poznań (only general data from the Central Statistical Office and the Supreme Chamber of Physicians for the Wielkopolskie Voivodeship are available), the size of Poznań's medical staff was calculated by assuming a nationwide ratio of 2.4 doctors per 1,000 inhabitants and 5.1 nurses per 1,000 inhabitants (European

Table 2. Comparison of responses to questions concerning declarations of willingness to participate, depending on occupation (elaborated by P. Springer)
Tabela 2. Porównanie odpowiedzi na pytania dotyczące deklaracji woli partycypacji w zależności od przynależności do wykonywanego zawodu (oprac. P. Springer)

Question	Profession	*N*	Average*	Median	Min.	Max.	Lower quartile	Upper quartile	Standard deviation	Standard error
1a) I would like to be informed about renovation/expansion plans	doctor	62	4.24	4	1	5	4	5	0.88	0.11
	nurse	67	3.90	4	1	5	3	5	1.18	0.14
	other	25	3.68	4	1	5	3	5	1.28	0.26
1b) I would like to be consulted on renovation/expansion plans	doctor	62	3.95	4	1	5	3	5	1.05	0.13
	nurse	67	3.34	3	1	5	2	4	1.25	0.15
	other	25	3.40	3	1	5	2	5	1.38	0.28
1c) I would like to decide on the scope of the renovation/expansion.	doctor	62	3.56	4	1	5	3	5	1.15	0.15
	nurse	67	3.19	3	1	5	2	4	1.20	0.15
	other	25	3.20	3	1	5	2	4	1.26	0.25
1d) I am willing to devote my free time to participate in the design of the renovation/expansion of my workplace	doctor	62	3.21	4	1	5	2	4	1.29	0.16
	nurse	67	2.66	2	1	5	2	4	1.25	0.15
	other	25	2.96	3	1	5	2	4	1.21	0.24

*The darker shade of green in the table corresponds to values that were found to be statistically significant in the Kruskal–Wallis ANOVA test.

– confidence level – non-random, strictly defined population assumed: 95%[5],

– fraction size – it was assumed that the sheets would be completed correctly by at least 90% of the population: 0.9[6],

– maximum error – the study group was assumed to be representative of the issue in question: 5%.

Based on the above factors, a minimum sample size of 134 respondents was determined. The data collected in the course of this survey research made it possible to determine which socio-demographic factors may influence the declared degree of involvement of medical personnel in design participation. Based on the indicated statistical methods, the investigators drew conclusions, of which the following are worth mentioning:

1. The majority of respondents declared that they would like to be informed about plans to renovate/expand their workplace (in relation to the statement: "I would like to be informed about renovation/expansion plans", 42.21% of respondents answered "definitely yes", while 30.52% answered "rather yes", which adds up to 72.73% interest in participation in the form of information).

2. The majority of respondents said they would like to be consulted on their workplace renovation/expansion project (in relation to the statement: "I would like to be consulted on renovation/expansion plans", 29.87% of the percentage of respondents answered "definitely yes", while 27.27% answered "rather yes", which adds up to 57.14% interest in participation in the form of consultation).

In order to analyse the latent correlations based on statistical tests, it was found that, among other things, differences between the answers given by representatives of separate professional groups were noticeable and statistically significant for consulting and declarations of devoting free time. In all categories of participation, doctors expressed the greatest willingness to participate in the project process (Table 2). On the basis of the results obtained, it can be concluded that the use of statistical methods may prove helpful in identifying specific groups of end users for whom there is the greatest justification for engaging in participatory design processes, due to their declaration of willingness to cooperate with designers.

A case study of the use of statistical methods in surveys to assess patient satisfaction and spatial expectations

A study conducted in 2015 examined the participation of paediatric hospital patients in the assessment of functional-spatial needs in the emergency room[7] (Gawlak 2019). It used the same statistical methods. The author's survey was

Observatory on Health Systems and Policies 2021), for a population of Poznań in 2020 of 532,048 inhabitants (Bieniek et al. 2021, 76).

[5] The survey sheets were handed over to the medical staff in the social areas of the hospital wards accessible only to them, which guaranteed a high level of confidence and at the same time a low maximum error.

[6] A level of fractionation conducive to the reliability of the study was ensured by the implementation of the pilot study described above.

[7] B. Krysiewicz Specialist Complex for Maternal and Child Health Care in Poznań (hereinafter: SZOZ).

conducted among 212 emergency room patients ("satisfaction assessment", survey 01) and 203 potential hospital patients ("expectations assessment", survey 02).

Satisfaction assessment

The first part of the study (satisfaction assessment, survey 01) was conducted among the parents (or guardians) of patients currently in the emergency room. The evaluation of their overall impression of the emergency room and the evaluation of the solutions integrally related to the quality of their stay in the hospital space were studied, but in this paper, due to the stated aim of the study, selected results are discussed, referring to the relation of the evaluation of the space in relation to: sociodemographic characteristics of the respondents, time of arrival at the emergency room and waiting time for registration.

In selecting the size of the study sample, reference was made to the average number of paediatric patients admitted by the emergency room at the HES in the year preceding the survey, which was approximately 20,000 (the record number of patients admitted was 30,000 in 2004). The resulting annual average was then converted into a monthly average.

Among the respondents, women were in the vast majority, 86%, and men 14%. The results of the comparative analysis show that statistically significant differences ($p < 0.05$) in the opinion of women and men on the evaluation of the quality of solutions concerned functional-spatial solutions (colour scheme, access to drinks, art and design, other furniture, play area). Women rated most of these solutions significantly higher. Men only rated the immediate surroundings of the hospital, the lighting and the waiting area higher. However, this difference was not statistically significant ($p \geq 0.05$). The result shows that there is a correlation between the assessment of the emergency room space and the gender of the respondent.

Further comparative analyses were carried out to demonstrate the relationship between the assessment of the quality of the space and functional arrangements of the hospital and the hour of arrival in the room of the subject. The Kruskal–Wallis rank-sum ANOVA test was used to compare the assessment related to the quality of stay and the hour of arrival at the hospital (10.00–12.00, 12.00–15.00, 15.00–20.00). It was assessed that those who arrived in the morning hours, i.e., between 10.00 and 12.00, rated the functional-spatial solutions in the emergency room the lowest, while the highest average ratings were given by the respondents who arrived in the afternoon and evening hours, i.e., between 15.00 and 20.00.

Another comparative analysis was carried out between the subjects' evaluation of the space and their waiting time for registration. For this purpose, the Kruskal-Wallis rank ANOVA test was again used. The evaluation of spatial-functional solutions for issues such as lighting, art and design, play area, waiting area, colour scheme, sanitary facilities differed statistically significantly ($p < 0.05$), depending on the waiting time for registration. The shorter the waiting time for registration, the higher the ratings were given to the individual solutions. Those waiting more than 30 min for registration were mostly less satisfied with the functional and spatial solutions of the chamber compared to the other waiting patients.

A comparative analysis was then carried out between the waiting time for a medical examination and the qualitative assessment of the functional and spatial arrangements of the emergency room. For this purpose, the Kruskal–Wallis rank-sum ANOVA test was used.

On the basis of the research carried out, one might be tempted to conclude that sociodemographic factors and the situational context (waiting time for a medical procedure and the time of arrival at the hospital) should also be taken into account when shaping tools for evaluating a hospital building. The results (opinions) obtained through the use of statistical methods can become an extremely important guideline for designers of healthcare facilities who will want to evaluate the way in which a facility that will be subject to spatial transformations functions.

Assessment of expectations

The sample size for the expectations survey (survey 02) was selected adequately to the sample size defined for survey 01. The survey was conducted on a randomly selected group of 203 people (66% women, 34% men) who were not emergency room patients at the time of the survey. Expectations towards the quality of the hospital space were examined in relation to several sociodemographic factors, but the article exemplarily discusses the results relating to the influence of gender and age on these expectations.

In order to demonstrate the relationship between the assessment of the expected quality of hospital space and functional solutions and the gender of the respondent, comparative analyses were carried out. An analysis was made of the answers given by women and by men. For this purpose, the Mann-Whitney U test was used. The results of the test indicate that the evaluations of the functional-spatial solutions of the emergency room, such as intimacy, accessibility, were rated higher by women, and this difference was statistically significant ($p < 0.05$). For the other solutions, the vast majority (art, waiting room, sanitary facilities, colours, furniture and lighting) were also rated higher by women, but the difference did not show statistical significance ($p \geq 0.05$). Men only rated access to refreshments, the hospital building environment and the changing room higher than women, this difference was also not statistically significant ($p \geq 0.05$). The above proportions are analogous to the results obtained in survey 01, where women also rated most of the chamber's functional-spatial solutions higher than men.

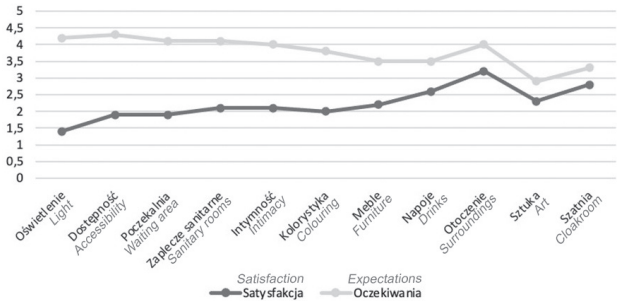
The results of the test indicate that the gender of the user of a space has little influence on the evaluation of the functional-spatial solutions if they are not a user of that space at the time of the survey (here: potential hospital patient). The most convergent responses of the respondents were indicating: tv, a separate room or so-called other form of improvement within the emergency room. The biggest difference in the answers given concerned: so-called other solutions (22% women vs. 10% men), wi-fi access (14% women vs. 20% men).

Next, the relationship between the assessment of the quality of the space and the age of the respondents was compared.

To test the correlation of data related to quality of stay and age of carers (in terms of the age groups adopted in the study: 18–25, 26–35, 36–45 and over 45 years), the Kruskal–Wallis rank-sum ANOVA test was used. Respondents responded most concurrently by indicating: tv, a separate room or so-called "other" form of improvement within the emergency room.

Relationship of satisfaction ratings to expectations

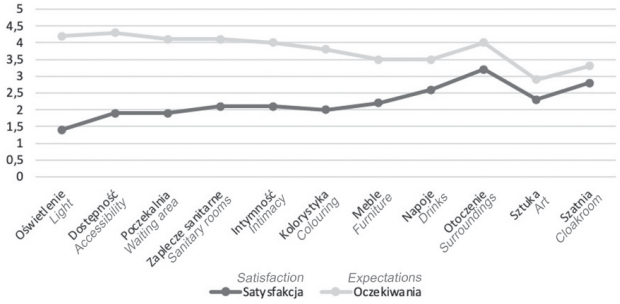
The results of the study were then collated using, among other things, statistical analysis, including comparative analyses of the two research models ("satisfaction assessment" vs. "expectation assessment"). In both models, the influence of factors such as the respondent's age, gender, time of day, waiting time for registration or medical examination on the perception of hospital space was considered. On this basis, as well as in the light of the literature studies carried out, it was proven that the functional-spatial solutions of the emergency room have a significant impact on the well-being, safety and satisfaction of patients. The analysis carried out was intended to confirm that emergency room patient satisfaction is shaped on many levels related to variables such as gender or age, while for qualitative studies of the facilities, the status of the users surveyed is also of great importance, i.e., whether they make their assessments while "in situ" or based only on their expectations of the assessed (surveyed) space. The evaluations of specific functional-spatial solutions of the reception room from both survey studies ("satisfaction evaluation" vs. "expectations evaluation") were compared with each other. The Mann-Whitney *U*-test was used to compare the results of the two surveys. Thus: in survey 01, the following were rated highest: lighting, changing rooms, access to drinks and art, while in survey 02 the following were indicated as most important: lighting of the chamber, accessibility, waiting room (overall impression), sanitary facilities and the hospital environment.



The *Y*-axis indicates the number of points allocated by respondents on a five-point scale indicating how important each spatial aspect is to them, where: 1 – don't know, 2 – not important, 3 – not very important, 4 – quite important, 5 – very important.

Fig. 2. Assessment of the quality of emergency room solutions. Comparison of satisfaction with expectations (elaborated by A. Gawlak)

Il. 2. Ocena jakości rozwiązań w obrębie izby przyjęć. Porównanie satysfakcji z oczekiwaniami (oprac. A. Gawlak)



The *Y*-axis indicates the number of people, who have pointed out a solution listed on the *X*-axis.

Fig. 3. Comparison of indicated possible improvements between patients, residing in the emergency room and -responders who are potential patients (elaborated by A. Gawlak)

Il. 3. Porównanie możliwych ulepszeń wskazywanych przez pacjentów przebywających w izbie przyjęć i respondentów będącymi potencjalnymi pacjentami (oprac. A. Gawlak)

Importantly, respondents in the emergency room generally made proportionately lower assessments of spatial arrangements than prospective patients (Fig. 2).

The second comparison ("satisfaction rating" vs. "expectation rating") concerned the respondents' suggested possible improvements within the hospital emergency room.

Similarly, the responses of those who stay in the emergency room were compared with those of respondents who can imagine this stay. The so-called test of differences between the two percentage structure indicators was again applied. The results show statistically significant differences in the assessment of the impact of individual facilities on the comfort, satisfaction and sense of security of emergency room patients (Fig. 3).

By demonstrating significant differences in the perception of hospital space and qualitative assessment between those surveyed and present in the emergency room at the same time during the survey and those surveyed who are potential hospital patients, the expectations of potential hospital patients were verified in relation to their actual sensations and actual perception of hospital space and spatial needs.

The conclusions of the described research work (Gawlak 2019) point to the possibilities of using the results of the conducted research and, above all, to the necessity of continuing them in a broader context, i.e., taking into account other, including "non-architectural" factors influencing patients' satisfaction with their hospital stay. Comprehensive qualitative studies of architectural space, taking into account, for example, the acoustic quality of the space, the reputation of the hospital in question or the reputation of the medical staff, will allow an objective diagnosis of this space to be made by assessing the satisfaction of its users and, consequently, to properly guide design work when modernising, rebuilding, renovating or building a new hospital.

In view of the above, it can be stated with certainty that the qualitative assessment of the architectural space should be carried out taking into account the patient's expectations. This is confirmed by the analysis presented, according to which the potential patient's expectations of the hospital architecture are relatively higher than the satisfaction rating of the patient staying in the hospital (Fig. 2).

In essence, the indicated conclusions of the studies support the thesis that hospital architecture shapes the com-

fort and well-being of patients, depending on socio-demographic and other conditions, such as waiting times for registration and medical examination, and, above all, patients' expectations of the characteristics of the built space. The conclusions of the described research demonstrate the applicability of statistical methods in the pre-design evaluation process of the built space of healthcare facilities.

Summary

Both case studies presented above used convergent statistical methods. The aim was to create project recommendations based on reliable data.

A limitation of the conducted studies, but also of similar ones, is usually the so-called institutional barriers, often the fear of evaluation and possible detection of irregularities, sometimes simply the reluctance to introduce research teams evaluating space and functional-spatial solutions into the constructed healthcare facility.

The life cycle of a building consists of stages that last from several months to several tens or hundreds of years (Niezabitowska 2004). For the creation of space quality in architecture, by far the most important is the planning and programming phase of a building, and then the actual architectural design, because it is at the planning and programming stage of an investment that decisions are made relating to, for example, the choice of location for the building (in the case of a new hospital) and the creation of a functional programme begins, which is of key importance for the quality of the space designed later.

Consequently, it is important from the users' point of view to programme healthcare buildings properly and comprehensively, based on qualitative studies for buildings and qualitative assessments for buildings with similar functional programmes.

To this end, during the programming stage of an investment, whether it involves a new hospital or the expansion, renovation or modernisation of an existing one, efforts should be made to include representatives of all groups of future users of the building in the design process: staff and patients, which is possible – this is confirmed by the case studies cited in this article. Thus, it should be concluded that the aim of the research work as stated in the introduction (statistical methods can be an effective tool in assessing the spatial needs of users at the stage of programming and designing an investment) has been achieved.

This is borne out by the Evidence-Based Design process in hospital design, i.e., making design decisions related to the functional-spatial programme based on the results of reliable scientific research.

In terms of practical recommendations arising from this research work, it is worth highlighting:

1. The need to use nomenclature in the survey sheets that is understandable to the recipient – depending on the research: staff or patients. To this end, pilot surveys should be carried out before the implementation of the targeted studies.

2. With regard to surveys involving hospital staff – when formulating the survey, it is necessary to narrow its scope to aspects relevant to the investment in question, so that the survey does not involve long-term involvement of the staff, who are likely to fill in the questionnaires during their work.

3. In relation to surveys with the participation of patients – both the observations of this user group in relation to the existing space and the expectations towards the space after the implementation of the target design intervention (construction, reconstruction or extension) should be considered relevant.

4. When selecting the study group, particular attention should be paid to ensure a minimum size, determined by the formula indicated in chapter: "Case study of the use of statistical methods in research on designer participation with hospital staff".

At the same time, consideration should be given to limiting access to the surveys to designated users only, which will increase the confidence level for the results.

Translated by
Agata Gawlak

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Streszczenie

Korelacje i analizy statystyczne w ocenie preferencji użytkowników w projektowaniu partycypacyjnym obiektów ochrony zdrowia

W artykule zaprezentowano przykłady wykorzystania metod statystycznych w badaniach deklaracji woli partycypacji użytkowników obiektów ochrony zdrowia w projektowaniu tych obiektów oraz relację oczekiwań użytkowników do oceny zastanej przestrzeni zbudowanej szpitali. Omówione zostały wybrane metody pozwalające na ocenę korelacji pomiędzy istotnymi czynnikami socjodemograficznymi a spektrum preferencji funkcjonalno-przestrzennych użytkowników, takie jak: test *U* Manna–Whitneya, korelacja rang Spearmana, test ANOVA Kruskala–Wallisa oraz krokowo postępujące modele regresyjne. W badaniu wzięli udział pracownicy medyczni wybranych obiektów szpitalnych Poznania oraz opiekunowie pacjentów izby przyjęć jednego z poznańskich szpitali pediatrycznych. Badania przeprowadzono w 2015 i 2021 r. W obu przypadkach wykorzystano te same metody badawcze. Zastosowane metody umożliwiły ocenę preferencji względem projektowanej przestrzeni, jak również wolę udziału w badaniach partycypacyjnych (w przypadku personelu). W konsekwencji wykazano, iż wybrane metody statystyczne mogą stanowić efektywne narzędzie w ocenie potrzeb przestrzennych użytkowników na etapie programowania i projektowania inwestycji. Tym samym mogą zostać wykorzystanie przez architektów oraz projektantów.

Słowa kluczowe: metody statystyczne, korelacje, architektura ochrony zdrowia, projektowanie partycypacyjne