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ARCHITECTURAL AND PLANNING STRATEGIES FOR POST-TRAUMATIC STRESS DISORDER (PTSD)-SENSITIVE MENTAL HEALTH CENTERS

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Abstract. Purpose. *The purpose of this study is to identify relationships between architectural and planning organization of mental health centers and therapeutic conditions for individuals experiencing post-traumatic stress disorder (PTSD). The research focuses on spatial characteristics of healthcare facilities that influence perception of safety, predictability of environment, regulation of social interaction, and reduction of sensory stressors. Particular attention is given to functional zoning structure, spatial hierarchy, and circulation logic as factors contributing to formation of therapeutic environments adapted to users with increased sensitivity to environmental stimuli.*

Methodology. *The research methodology combines architectural and typological analysis of healthcare facilities with expert surveys involving professionals working in the field of mental healthcare. Spatial organization of buildings was analyzed in terms of relationships between functional zones, depth of spatial hierarchy, and structure of circulation routes. Qualitative characteristics of spatial configuration were translated into a system of architectural and planning indices enabling comparative evaluation of planning solutions. The proposed analytical framework allows interpretation of architectural planning structure as a spatial system influencing environmental perception and behavioral patterns of users.*

Results. *The results of the study demonstrate that spatial configurations characterized by coherent functional zoning, reduced number of incompatible adjacencies, and presence of alternative circulation routes provide more stable therapeutic conditions. Clustered and hybrid planning schemes demonstrate advantages in formation of environments with improved spatial legibility and clearer differentiation between public and private zones. Increased depth of spatial hierarchy contributes to formation of predictable spatial sequences, supporting emotional regulation and reducing environmental stress. Loop-based circulation systems allow greater flexibility of movement and reduce frequency of forced encounters between users.*

Scientific novelty. *The study proposes a system of architectural and planning indices including Conflict Adjacency Index (CAI), Privacy Depth Index (PDI), Circulation Loop Presence (CLP), and Vertical Hierarchy Index (VHI). These indices allow translation of qualitative spatial characteristics into structured analytical parameters and enable reproducible evaluation of spatial configurations of mental health centers.*

Practical relevance. *The obtained results may be applied in architectural design of mental health facilities and in development of typological models supporting*

therapeutic environments. The proposed methodological approach may be used in post-war reconstruction of mental healthcare infrastructure and contributes to improvement of architectural decision-making processes oriented toward psychological well-being of users.

Keywords: *mental health center, architectural planning organization, PTSD-sensitive environment, healthcare architecture, functional zoning, circulation structure, evidence-based design, therapeutic environment.*

INTRODUCTION

Research on relationship between architecture and mental health has developed at intersection of environmental psychology, healthcare architecture, and architectural theory [4; 18]. Numerous studies demonstrate that spatial characteristics of buildings influence emotional states, stress levels, behavioral responses, and effectiveness of therapeutic processes [4; 21]. Within this field, built environment is interpreted as a system of spatial relationships capable of supporting psychological recovery [19].

Evidence-based design emphasizes measurable impact of architectural parameters on patient outcomes and staff performance [8; 23]. Studies indicate that natural lighting, acoustic comfort, spatial legibility, and visual access to nature contribute to reduced stress levels and improved recovery outcomes [22]. Evidence-based design supports integration of empirical research into architectural decision-making processes [7].

Trauma-informed design focuses on creation of environments that reduce risk of re-traumatization and provide conditions for emotional stabilization [21]. Research demonstrates that individuals with increased sensory sensitivity require spatial environments characterized by predictability, clear orientation, and possibility of regulating social interaction [20]. Architectural solutions should minimize unexpected stimuli, avoid excessive crowding, and provide opportunities for withdrawal [22].

Architectural theory highlights importance of spatial perception and bodily experience in understanding built environments. J. Pallasmaa emphasizes multisensory character of architecture and its influence on perception of comfort and safety [15]. Lawson identifies relationships between spatial configuration and behavioral patterns in complex buildings [12].

Studies related to space syntax demonstrate that spatial configuration influences patterns of interaction, accessibility, and hierarchy of spaces [10]. Spatial topology affects formation of cognitive maps and ability to navigate complex environments [16; 9].

Research in psychiatric healthcare architecture identifies importance of differentiation

between public and private zones, control of acoustic stimuli, presence of transitional spaces, and reduction of forced interactions [18; 19]. Clear spatial hierarchy and availability of quiet areas support emotional regulation and reduce stress reactions [20].

However, many studies remain descriptive and do not provide reproducible analytical tools for evaluation of spatial organization [27]. Functional zoning, adjacency relationships, circulation logic, and spatial hierarchy are rarely translated into measurable indicators applicable to comparative architectural analysis [7; 16].

Therefore, there is a need for analytical approaches enabling evaluation of architectural planning structures using consistent spatial criteria [27].

ANALYSIS OF RECENT RESEARCH

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PURPOSE

The aim of this study is to identify architectural and planning principles supporting formation of therapeutic environments in mental health centers adapted to needs of individuals experiencing PTSD, and to develop a structured analytical framework for evaluation of spatial configurations [27].

The research is based on assumption that spatial organization influences behavioral patterns, emotional stability, and perceived safety of users [4; 20]. Mental health centers represent a typology in which functional zoning, circulation structure, and spatial hierarchy directly affect therapeutic processes [18; 23].

Objectives of the research include identification of spatial characteristics influencing therapeutic environments, analysis of architectural planning structures, development of spatial indices, and identification of relationships between spatial parameters and expert evaluations of environmental quality [27].

Materials and methods. The research combines typological analysis of healthcare facilities with expert evaluation of spatial characteristics relevant to therapeutic environments [18; 19]. Architectural planning structure is interpreted as a system of spatial relationships influencing perception of safety, clarity of orientation, and regulation of social interaction [12; 15].

The study is based on the premise that spatial organization of buildings influences behavioral patterns and emotional responses through relationships between functional zoning, circulation structure, and spatial hierarchy. In mental health centers, where users often demonstrate increased sensitivity to environmental stimuli, spatial predictability and clarity of spatial sequences become important factors contributing to therapeutic stability. Architectural planning structure is therefore interpreted as a system of spatial relationships that can be analyzed using consistent criteria reflecting organization of functional zones and movement routes [27].

The empirical basis of the study includes architectural planning solutions of mental health facilities representing different spatial typologies. Case studies were selected to demonstrate variation in spatial organization, including corridor-based layouts, sectional planning structures, clustered configurations, and hybrid models combining several spatial principles. The analysis focuses on relationships between therapy rooms, consultation areas, waiting spaces, staff zones, and circulation routes. Particular attention is paid to spatial transitions between public and private zones, presence of intermediate spaces, and differentiation of movement routes for patients, visitors, and staff [18; 23].

Architectural plans were examined through functional zoning structures and adjacency relationships between rooms. Compatibility and conflict relationships between functional zones were identified based on spatial proximity between spaces characterized by different acoustic, social, and sensory requirements. The relationship between PTSD-related spatial sensitivities and architectural parameters influencing environmental perception is summarized in Table 1.

To complement architectural analysis with empirical observations, the study incorporates expert evaluations obtained from professionals working in mental health institutions, including psychiatrists, clinicians, and administrators involved in organization of therapeutic processes. Expert input was collected through structured questionnaires and semi-structured interviews focusing on spatial characteristics that influence emotional stability, perceived safety, and ability to regulate social interaction. Respondents

evaluated environmental factors such as acoustic comfort, spatial predictability, availability of private spaces, and clarity of functional zoning. Qualitative responses were grouped according to recurring spatial problems, including sensory overload, unpredictability of movement patterns, insufficient privacy, and excessive intersections of functional flows.

To ensure reproducibility of the research, qualitative characteristics of spatial organization were translated into a system of architectural and planning indices reflecting relationships between functional zones and circulation structure. The Conflict Adjacency Index (CAI) reflects the proportion of spatial adjacencies between functionally incompatible zones, such as noisy circulation areas located near therapy or rest spaces. High CAI values indicate increased probability of sensory conflicts and reduced environmental

stability. The Privacy Depth Index (PDI) describes the number of spatial transitions required to reach spaces characterized by increased privacy, such as individual therapy rooms or quiet areas. Greater depth of spatial sequence is associated with increased predictability of spatial experience. The Circulation Loop Presence (CLP) index reflects the existence of alternative routes between functional zones, allowing avoidance of forced contacts and providing greater autonomy of movement. The Vertical Hierarchy Index (VHI) reflects differentiation of spatial levels according to intensity of use and degree of privacy, including separation of patient areas, therapy spaces, and staff zones. The system of indices and their architectural interpretation is presented in Table 2.

Architectural analysis was performed through examination of functional zoning

Table 1

Relationship between PTSD-related spatial sensitivities and architectural planning parameters

PTSD-related spatial sensitivity	Behavioral manifestation	Architectural planning parameter	Spatial implication
Hypersensitivity to noise	stress, distraction, irritability	acoustic separation of functional zones	distancing of therapy rooms from main circulation routes
Need for predictability	anxiety in complex spatial structures	clarity of spatial hierarchy	simple and legible zoning structure
Avoidance of crowding	discomfort in dense circulation nodes	distribution of movement flows	separation of patient and visitor routes
Need for privacy	avoidance of visual exposure	spatial depth and zoning gradient	placement of individual therapy rooms in deeper spatial zones
Sensitivity to sudden encounters	stress due to uncontrolled contacts	reduction of forced intersections	avoidance of crossing flows near therapy spaces
Need for control of social interaction	preference for gradual contact	presence of intermediate spaces	introduction of buffer zones between public and private areas
Sensitivity to spatial disorientation	confusion in complex layouts	legibility of circulation structure	intuitive navigation and clear spatial sequences
Sensory overload	fatigue caused by excessive stimuli	zoning according to intensity of use	separation of active and quiet functional zones

Table 2

System of architectural and planning indices for evaluation of therapeutic environments

Index	Description	Architectural meaning	Planning objective
Conflict Adjacency Index (CAI)	proportion of incompatible spatial adjacencies	reflects frequency of functional conflicts between zones with different sensory requirements	reduction of spatial conflicts between active and quiet zones
Privacy Depth Index (PDI)	number of spatial transitions to reach private areas	reflects hierarchical organization of spatial sequence	formation of clear gradient from public to private spaces
Circulation Loop Presence (CLP)	presence of alternative circulation routes	reflects flexibility of movement patterns	avoidance of forced contacts between users
Vertical Hierarchy Index (VHI)	differentiation of spatial levels by degree of privacy	reflects volumetric organization of building structure	separation of intensive and calm functional zones
Functional Zoning Coherence (FZC)	consistency of relationships between functional zones	reflects logic of spatial grouping	improvement of clarity of spatial organization
Environmental Predictability Factor (EPF)	degree of spatial clarity and legibility	reflects ability to intuitively understand spatial structure	improvement of spatial orientation

structures, spatial sequences, and circulation logic represented in architectural plans. Spatial relationships between rooms were interpreted as hierarchical systems in which depth of spatial transitions influences perception of privacy and environmental control. Comparative evaluation of case studies was conducted through calculation of architectural and planning indices for different planning structure types. The obtained values were interpreted in relation to expert evaluations of environmental quality, allowing identification of relationships between spatial configuration and therapeutic characteristics of environments.

The synthesis of analytical results enabled formulation of generalized architectural and planning principles reflecting relationships between spatial hierarchy, functional zoning, and circulation structure. These principles contribute to development of therapeutic environments characterized by increased predictability, reduced sensory conflicts, and improved spatial legibility, which are particularly important for users experiencing heightened sensitivity to environmental stimuli.

RESULTS AND DISCUSSION

The conducted research demonstrates that spatial organization of mental health centers significantly influences environmental predictability, behavioral stability, and perceived safety of users. Comparative analysis of architectural planning structures shows that spatial configuration affects the degree of sensory exposure, frequency of uncontrolled social contacts, and clarity of functional relationships between zones, which are particularly important for individuals experiencing heightened sensitivity to environmental stimuli [4; 23].

The results indicate that spatial layouts characterized by increased Conflict Adjacency Index (CAI) demonstrate a higher probability of undesirable proximity between functionally incompatible zones, such as therapy rooms located adjacent to circulation corridors, waiting areas positioned near noisy entrance spaces, or consultation rooms exposed to intensive movement flows. Such spatial relationships contribute to acoustic overload, increase unpredictability of spatial experience, and may intensify stress reactions associated with uncontrolled environmental stimuli [22; 23]. Reduction of incompatible adjacencies contributes to improved environmental stability and supports differentiation between active and calm functional zones, which is consistent with principles of therapeutic architecture and evidence-based design [8; 23].

Analysis of Privacy Depth Index (PDI) demonstrates that therapeutic environments

benefit from spatial sequences characterized by gradual transition from public to private zones. Buildings with shallow spatial depth often exhibit direct visual or physical connections between entrance areas and therapy spaces, reducing perceived privacy and increasing psychological discomfort [20]. Spatial configurations with greater depth of functional hierarchy allow formation of buffer zones between public and private spaces, contributing to controlled adaptation to social interaction and improved emotional regulation [21; 23]. Hierarchical zoning structures also improve spatial orientation, allowing users to intuitively understand functional relationships between different areas of the building [12].

The presence of alternative circulation routes, reflected in the Circulation Loop Presence (CLP) index, demonstrates significant influence on flexibility of movement patterns within healthcare facilities. Linear corridor-based planning structures tend to produce repetitive intersections of functional flows, which may increase probability of forced encounters between users and reduce autonomy of movement [10]. Loop-based circulation systems allow multiple navigation options, enabling users to regulate spatial proximity to others and avoid potentially stressful interactions. Increased variability of movement routes contributes to perception of spatial control and supports formation of more comfortable therapeutic environments [22].

Comparative evaluation of spatial structures indicates that circulation systems characterized by excessive centralization often generate accumulation of movement flows in limited spatial nodes, increasing density of social interaction and intensity of acoustic stimuli. In contrast, distributed circulation systems provide more balanced distribution of spatial activity and reduce frequency of forced contacts between users [10; 16]. These findings correspond with theoretical approaches emphasizing importance of spatial configuration in regulating behavioral patterns and social interaction [10].

Vertical Hierarchy Index (VHI) analysis demonstrates that differentiation of spatial levels according to degree of privacy and intensity of use contributes to improved spatial legibility and functional clarity of buildings. Separation of therapy areas from intensive circulation zones through vertical zoning reduces acoustic interference and increases predictability of spatial experience [18; 19]. Hierarchical volumetric organization allows distribution of functions according to their environmental requirements and supports formation of spatial sequences reflecting logical relationships between different levels of privacy [9].

The results show that architectural planning structure influences not only functional efficiency of healthcare facilities but also environmental characteristics affecting emotional perception of space. Spatial clarity and predictability reduce cognitive load associated with navigation in complex buildings, allowing users to focus on therapeutic processes rather than orientation tasks [12]. Legible spatial hierarchy supports intuitive understanding of building organization and reduces uncertainty associated with unfamiliar environments [15].

Comparative interpretation of architectural and planning indices indicates that therapeutic environments are characterized by consistency between zoning hierarchy, circulation structure, and adjacency relationships between functional zones. Buildings demonstrating coherent spatial logic exhibit reduced number of conflict adjacencies, increased depth of private spaces, and more flexible movement patterns. Such spatial characteristics correspond with theoretical concepts of therapeutic architecture emphasizing importance of environmental control and sensory balance [19; 21].

The study demonstrates that spatial predictability represents one of the key characteristics of therapeutic environments. Predictable spatial sequences contribute to formation of stable cognitive maps, allowing users to anticipate spatial transitions and regulate behavioral responses [16; 9]. Environments characterized by clear spatial hierarchy provide conditions supporting perception of safety and reduce psychological tension associated with uncertainty [20].

Interpretation of research results suggests that PTSD-sensitive environments may be considered as a specific analytical model allowing identification of latent spatial deficiencies in architectural planning structures. Due to increased sensitivity of users to environmental stimuli, inconsistencies in functional zoning and circulation logic become more evident and measurable. Spatial configurations demonstrating high level of structural coherence provide more stable environmental conditions and contribute to reduction of sensory conflicts between functional zones [27].

The obtained results allow identification of a set of architectural and planning principles supporting formation of therapeutic environments in mental health centers:

- functional zoning based on differentiation of spaces according to intensity of use and sensory characteristics
- formation of gradual spatial transitions between public and private zones
- reduction of incompatible adjacencies between active and quiet functional areas

- organization of circulation systems allowing alternative movement routes
- introduction of intermediate buffer spaces mediating transitions between different functional zones
- hierarchical spatial organization improving legibility of planning structure
- distribution of spatial activity reducing concentration of movement flows
- differentiation of volumetric structure according to degree of privacy

These principles demonstrate that architectural planning organization represents an important factor influencing environmental quality of healthcare facilities and effectiveness of therapeutic processes. Spatial configuration may therefore be interpreted as an active component of therapeutic environment rather than a neutral physical container of medical functions [8].

The proposed analytical approach contributes to development of architectural theory by providing reproducible criteria for evaluation of spatial organization of mental health centers. Translation of qualitative characteristics of spatial perception into structured indices allows comparison of different planning structures and supports development of typological models adapted to contemporary requirements of healthcare architecture [27].

The results indicate that integration of architectural theory, evidence-based design, and spatial analysis methods allows formation of interdisciplinary methodological framework applicable to evaluation of therapeutic environments. The proposed system of architectural and planning indices may be used in further research related to typology of healthcare buildings and development of spatial standards supporting psychological well-being of users [9].

Thus, architectural planning structure may be considered a significant factor influencing therapeutic potential of built environment, particularly in facilities intended for users demonstrating increased sensitivity to spatial uncertainty and sensory stimuli. Systematic analysis of spatial configuration contributes to improvement of architectural decision-making processes and supports formation of environments oriented toward long-term social and healthcare needs [19].

CONCLUSIONS

The conducted research confirms that architectural planning organization represents a significant factor influencing environmental quality of mental health centers and conditions supporting therapeutic processes. Spatial configuration of healthcare facilities affects behavioral

patterns, perception of safety, and regulation of social interaction, particularly in environments characterized by increased sensitivity to sensory stimuli.

The study demonstrates that spatial predictability and clarity of functional relationships between zones contribute to reduction of cognitive load and improvement of environmental legibility. Hierarchical organization of space allows formation of spatial sequences supporting gradual adaptation to social interaction and reducing psychological tension associated with spatial uncertainty.

Analysis of functional zoning structures indicates that reduction of incompatible spatial adjacencies between active and quiet zones contributes to stabilization of sensory environment and improves conditions for therapeutic activities. Differentiation of functional zones according to intensity of use and acoustic characteristics allows formation of spatial structures supporting emotional regulation.

The research confirms that depth of spatial hierarchy plays an important role in formation of environments characterized by increased level of perceived privacy. Gradual transition between public and private spaces contributes to improvement of environmental comfort and supports controlled social interaction.

The presence of alternative circulation routes allowing flexible movement patterns reduces frequency of forced encounters between users and increases autonomy of spatial behavior. Loop-based circulation systems contribute to formation of environments characterized by greater spatial adaptability and improved perception of environmental control.

Differentiation of spatial levels according to degree of privacy supports formation of hierarchical volumetric structure improving spatial orientation and reducing conflicts between functional zones requiring different environmental conditions.

The proposed system of architectural and planning indices allows translation of qualitative spatial characteristics into structured analytical parameters, enabling comparative evaluation of spatial configurations of mental health centers. The developed methodological approach contributes to formation of reproducible criteria applicable in architectural research and design practice.

The results of the study demonstrate that PTSD-sensitive environments may be interpreted as an analytical model revealing spatial characteristics influencing environmental stability and therapeutic potential of healthcare facilities. Increased sensitivity of users to

environmental stimuli allows identification of spatial deficiencies that may remain less evident in other building typologies.

The obtained results contribute to development of architectural theory related to typology of healthcare facilities and demonstrate importance of spatial structure as an active component influencing environmental perception. The proposed analytical approach may be applied in further research focused on architectural and planning organization of mental health centers and development of evidence-based design strategies supporting psychological well-being.

The research confirms that integration of spatial analysis methods with architectural theory provides new opportunities for evaluation of functional zoning, spatial hierarchy, and circulation structure in healthcare architecture. Application of structured analytical tools supports improvement of architectural decision-making processes and contributes to formation of therapeutic environments adapted to contemporary social challenges.

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АНОТАЦІЯ

Пархомчук М. Архітектурно-планувальна організація центрів ментального здоров'я як чинник формування терапевтичного середовища для осіб з посттравматичним стресовим розладом (ПТСР)

Мета. Метою дослідження є виявлення взаємозв'язків між архітектурно-планувальною організацією центрів ментального здоров'я та формуванням терапевтичних умов для осіб, які переживають посттравматичний стресовий розлад (ПТСР). Особлива увага приділяється просторовим характеристикам середовища, що впливають на відчуття безпеки, передбачуваність просторових послідовностей, регулювання соціальної взаємодії та зниження сенсорного навантаження. Дослідження розглядає функціональне зонування, ієрархію простору та структуру комунікацій як ключові фактори формування терапевтичного середовища, здатного підтримувати емоційну стабільність користувачів із підвищеною чутливістю до зовнішніх подразників.

Методологія. Методологічну основу дослідження становить архітектурно-типологічний аналіз об'ємно-планувальних рішень закладів психічного здоров'я у поєднанні з експертним опитуванням фахівців, залучених до організації терапевтичних процесів. Просторова структура будівель аналізувалася з точки зору взаємозв'язків між функціональними зонами, глибини просторової ієрархії та організації руху користувачів. Якісні характеристики просторової організації були трансформовані у систему архітектурно-планувальних індексів, що дозволяють порівнювати різні типи планувальних структур. Запропонований підхід дає можливість інтерпретувати архітектурне середовище як систему взаємопов'язаних просторових параметрів, що впливають на поведінкові моделі користувачів.

Результати. У результаті дослідження встановлено, що просторові структури з чіткою функціональною ієрархією, зменшеною кількістю конфліктних суміжностей та наявністю альтернативних маршрутів руху формують більш стабільні терапевтичні умови. Кластерні та гібридні планувальні схеми демонструють переваги у створенні середовищ із більшою просторовою передбачуваністю та чіткішою диференціацією між публічними та приватними зонами. Збільшення глибини просторової ієрархії сприяє формуванню послідовностей переходу між зонами різного рівня приватності, що позитивно впливає на процес адаптації користувачів до соціальної взаємодії. Наявність альтернативних комунікаційних маршрутів зменшує кількість вимушених контактів та підвищує рівень автономності просторової поведінки.

Наукова новизна. Запропоновано систему архітектурно-планувальних індексів, що включає Conflict Adjacency Index (CAI), Privacy Depth Index (PDI), Circulation Loop Presence (CLP) та Vertical Hierarchy Index (VHI). Використання цих індексів дозволяє трансформувати якісні характеристики просторового середовища у структуровані аналітичні параметри, що забезпечують відтворюваність результатів дослідження та можливість порівняльного аналізу різних планувальних рішень центрів ментального здоров'я.

Практична значущість. Отримані результати можуть бути використані у процесі архітектурного проектування центрів ментального здоров'я, розробленні типологічних моделей лікувальних закладів та формуванні просторових рішень, орієнтованих на психологічне благополуччя користувачів. Запропонований підхід може бути застосований у процесі післявоєнної відбудови системи психічного здоров'я та сприяє вдосконаленню архітектурно-планувальних рішень у сфері медичної архітектури.

Ключові слова: центри ментального здоров'я, архітектурно-планувальна організація, PTSD, типологія, функціональне зонування.

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