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FEATURES DESIGN DESIGN OF MEDICAL COMPLEX

Abstract: In the article, going near planning of architectural environment of medical complexes is examined on principles of the scientifically–grounded dezign (EBD) by integration of experience of architects, strict methodology of scientists–re–searchers and understanding of necessities of patients, taking into account influence of light and color.

Keyword: hospitals, domain–spatial environment, ergo–dizaning approach.

Statement of the problem. In recent years in the field of design designing architectural environment medical complexes (LC) had been achieved by the system address the needs of patients and medical staff in the development environment of their life. Accumulated considerable potential in the field of methodology and practice of ergo-design software, creating, operating expertise and ergonomic "man-machine", "man - an architectural object environment", the implementation of which contributes to improving the functioning of developed and modernized LK, reduce costs, psychophysiological resources physician operator, patients and increase their positive motivation. [36] However, the development of ergonomics and the use of its achievements in the moment is very limited due to the fact that the symbiosis of medical, biological, psychological and technical sciences, to develop specific targets for improved quality and reliable performance systems "doctor-environment", examines and optimizes only private, local case "medium": usually microclimate and physical conditions at the workplace physician-operator or a limited amount of patient stay (cabin compartment, chambers, etc.).

Analysis of recent research and publications. Practically there are no papers on evidence-based design of architectural environment LK based on reliable data, in order to improve the life of patients and caregivers, to accelerate the healing process of patients, reducing stress levels and improve safety. Insufficient intensively conducted research aimed at developing methods for evaluating projects of architectural environment LK in terms of their therapeutic properties and security. Not received its development work on systematization of data on completed projects and their implications psycho-physiological effects on patients and medical staff.

Research directly related to the implementation: the Law of Ukraine "Fundamentals of Legislation on Health Care" (memory number 2801-XII), as well as "The concept of development of public health in Ukraine" (Presidential Decree N 1313/2000 12.07.2000) integrated interdisciplinary "Health of the Nation" for 2002 - 2011

GG Dnipropetrovsk Oblast Rada adopted (decision of 19 March 2002 number 520-22/HHIII). direction of this research is part of the state budget of the department of design of architectural environment and DVUZ PGASA Khnus on "Concept interior color forming separate premises civilian buildings."

Study on the impact of light and color were engaged: in color in the interior - Ponomareva ES, Freeling H., K. Auer, Johannes Itten, N. Stepanov, in the field of psychophysiology effects of color and light - Bebb ED, Goydenko VS Lugova AM, VA Zverev; Gotovskiy YV, Vshteslavtsev AP Korareva LB, Karandashov VI Petukhov EB, Serov H . V. Zajkov SF Sheremetyeva GB, Stephanie Norris, Ambika Wauters, Gerry Thompson, Theo Gimbel, Karu TI, Calendar, GS, Lobko VV Zaguskin S.L .; Petukhov EB, VS Zrodnikov, Liberman, OD, Jacob, and others [1-5].

The wording of the purposes of article. Purpose of this paper is to develop a methodological foundations of design designing architectural environment LK, considering the effect of light and color, using the principles of "evidence-based medicine."

The main part. Prerequisites of this work was to study the practice of designing evidence-based projects EBD *(Evidence-based design* - a field of study, emphasizing the importance of reliable data in order to influence the design process). This term is used by designers in many countries of the West, despite the lack of studies on the reaction of patients to completed projects, details of which can be used in the preparation of design solutions LK. This approach became popular in the field of health care in the United States to improve the life of patients and caregivers, acceleration processes recovery of patients, reducing stress levels and improve safety. cientific This district-based elaboration of a relatively new area of research that adopts the terminology and ideas from several disciplines: *environmental psychology, architecture, neuroscience and behavioral economics*. Evidence-based design practice can be considered consistent with the evolving trends in our information-oriented society the production of knowledge in an interdisciplinary and social context. Its foundations are widely used in the health care industry where standardization strategy known as "evidence-based medicine" *(EBM - Evidence-based medicine - medicine based on evidence),* has emerged over the last two decades [6]. This branch of medicine requires a search, comparison, generalization and wide dissemination of evidence for use in the interests of patients. Philosophical meaning of this concept can be explained by the dualistic thesis, long debated in the medical community: medicine - the science or art? Known European and American model of medical practice. American model and is considered to be formalized within strict standards of care. The advantage and weakness of this model is hard programming the doctor's actions, on the one hand, reduces the number of medical errors, and on the other - limits the possibilities in the choice of therapeutic tactics. T. o., American model of medicine recalls conveyor - high, but unwieldy. The European model is more reminiscent of art because it provides a doctor for creativity. This model is more flexible, but less productive and less resistant to errors than the American. More recently, the difference between the two models medicine leveled by the use *of* the *principles of*

medicine, based on the evidence. In analyzing the results of research in evidence-based medicine (EBM) apply a scale of evaluation of evidence: *A convincing evidence:* there is strong evidence in favor of this method, *in the relative strength of the evidence:* there is enough evidence in favor of recommending the proposal, *C-no sufficient evidence:* the evidence is insufficient to make a recommendation, but the recommendations can be given taking into account other circumstances; *D-sufficient negative evidence:* there is sufficient evidence to recommend the elimination of the use of this method in a particular situation, and *E - strong negative evidence:* there are enough compelling evidence to exclude this method from recommendations.

One of the main principles of EBM is "the conscientious, explicit and judicious use of current best evidence in decision-making models for assistance to individual patients" [7]. In DM accounted skills and experience of the doctor, needs and interests of patients and themselves proofs are based on a rigorous scientific methodology and are fundamental elements of the model for decision making. This model has migrated to other industries, including education, social work, information technology, environmental management and *architectural environment.* Although the degree of recognition and application of evidence based practice varies widely, a common motif is that current practice in these industries haphazard overly rely on intuition, exposed undue influence of various scientific schools, or simply ill-suited to improve performance. The main goal of evidence-based practice is to improve performance by taking into account the skills and experience of the practitioner and the use of valid and reliable data.

Efforts to introduce scientific principles into practice historically characterize the development and formation of many professions, including architecture. An interesting example is related to the research project of constructing the data environment to the end of the 1960s, aimed at the development of ecological design. Despite extensive research of the built environment, this material for various reasons failed to introduce into professional practice, leaving architects depending on their individual experience, intuition and evaluative information, and not strictly formulated research. There are signs of a shift towards the use of research and evidence-based practice in the field of architecture, which are most often referred to as evidence-based projects and the focus here is directed to the design of healthcare facilities. Such attention to the correlation of the physical environment with the results of treatment of patients, medical staff performance and satisfaction can be seen as a logical continuation of the recognition of evidence based medicine.

Scientifically-based ***design-design.*** Served as the base of our research materials at Latrobe Research Fellowship American Institute of Architects (AIA) comprising Chong Partners Architecture, Kaiser Foundation Health and the University of California, Berkeley. Latrobe, exploring the meaning of a partnership approach to evidence-based design through an experimental study of the effect of light and color, found its impact on the welfare of patients in the LC. Latrobe suggested that a partnership approach will help get closer to the principles of EBD by integrating design experience architects, rigorous

methodology researchers and understand the needs of patients, using an interdisciplinary approach that using physiological, behavioral and economic measures that will increase the quality and applicability of research results. Latrobe organized a pilot study has affected the study of the effect of light and color, and the health and patient outcomes. Were grounded two main objectives of the study:

1. gain knowledge that can be applied when designing objects design architectural environment LK;
2. evaluate the approach in terms of its value as a model for research that will be used in EBD.

Researchers developed a plan that included:

- overview of the projects and the biomedical literature on the impact of light and color on the health of patients (data on experimental studies);
- literature review of evidence-based design practice (research contexts);
- creation of a database that integrates patient medical records, structured fund data CAFM *(Computer Aided Facilities Management)*, among them property projects chambers, and data evaluation of patients;
- laboratory experiments, built on a study of circadian rhythm patients, which explores the impact of lighting on the psychological and physiological state of patients' health;
- graphic interpretation of the results;
- disciplinary evaluation research model.

Developed database includes 100,000 patient and will be used to assess the impact of project data on patients in LK quality of recovery and patient satisfaction their stay at LK for data correlation with changes in the existing project of medical records of patients, etc. Laboratory experiments aimed at assessing the effect of light on the reaction of patients and subsequent adjustment of the project properties.

The study of literature has shown that the determination of how this evidence and relevant standards of research varies widely between different countries and within industries. Initiators of evidence based practice in the field of information technology, for example, involve balancing several types of evidence (material characteristics, ambiguity excluded and accepted facts) to substantiate the arguments for making decisions and further action. [8] In contrast, proponents of evidence-based practices in education place particular emphasis on "rigorous, systematic and objective method" to obtain data from randomized experiments [9].

Advocates of evidence-based policy, the recommendations for the U.S. Department of Education, expressed a preference for proven evidence developed and implemented randomized controlled trials in several experimental schools. [10] In another approach, the formation of rigor evidence in the library are based on quantitative and qualitative methods with regard to the nature and significance of research projects [11].

This ambiguity in the "taking" of evidence is one of the promises for the implementation of evidence-based practice. Associated and identified in the literature review problems include: lack of confirmation of researchers and / or practitioners in the applicability of the actual design decisions, the lack of confidence that the research methodology is well thought out, concerns about the role of professional judgment and experience, and fears that professional experience of architects and their judgment will be underestimated.

Solving the problem of implementing an evidence-based approach ergo-design includes the following: the acquisition of expertise and resources to assess the significance of evidence and transparency of the methodology, the availability of storage facilities for the collection, evaluation and dissemination; resistance to change practitioners and adjustable incentives to overcome them, evidence-based practice .

Latrobe research team considered many environmental factors that affect human behavior, including color, light, sound and location. Literature review provided the basis for the concentration of laboratory experiments on the study of the effect of light on health, which became the research base for the design.

The spectrum of light. Historically, that significant attention was directed to study the effect of color on mood, the functions performed and its potential impact on healing patients. Overview of activities in 3000 [11] revealed that the association "color-mood of" exist, but there is no direct evidence linking "one - to-one" between colors and emotions. "Researchers concluded that it is not set to" no direct Relationship between color and health and insufficient evidence in the literature to support a causal link between their characteristic color and emotional triggers. "Revision of the same results in terms of brightness and contrast of more consistent with the concept of visual study of color, and can lead to a deeper understanding of color perception and color preferences. Copyright [12] concluded that the brightness and contrast has a closer connection with the perception of colors. however, should take into account the internal state of each individual and the conditions of each individual test. medical or visual factors are as important to perception of color, as well as cultural and social factors. Methodological comparisons are also important in the review and critical analysis of existing literature.

Conditions under which the color samples tested differed in the studies reviewed. Reactions to the colors were tested in various conditions, from full-scale rooms to small pieces of mosaic tile. Most studies used small sample sizes with insufficient power for statistical analysis. Finally, the perception of color is directly related to reflective and absorptive properties of the environment and the time of observation of color.

*Chrono-biology and r*hythms**.** Wealth of empirical research in the field of chrono-biology shows the effect of light on the behavioral and physiological responses [13].Solar cycles associated with daily (circadian) rhythms and yearly in almost all animals, including humans. Many biological processes studied circadian models, such as cardiac, immune, endocrine, and cellular regeneration processes of brain activity [14]. Patterns of behavior similar agreement, including sleep,

activity, nutrition and pairing. Short-term lack of daylight has been associated with changes in the level of fatigue, disorientation and sleep. Long-term lack of natural daylight was associated with seasonal affective disorder, depression and psychiatric disorders [15]. Patients, visitors and medical staff showed improvement from exposure to light, as well as deterioration of orientation and cognitive functions that occur in the absence of natural light [16, 17,18].

Circadian cycles may vary according to various external influences, but the light that is the main variable, which stabilizes the day and night rhythms of people. Although researchers have studied the effects of decades of electric lighting on the circadian rhythm, but until 2001 was not detected in the retina a new class of cells that are considered "circadian" rather than visual receptors. This discovery revived the research aimed to study the spectrum, intensity and duration of light affecting the biological reactions.

Numerous studies have led to the development approach "dose-response curves" (describing the change effects on the body caused by different levels of exposure dose-stress after a certain exposure time) in the electric light, which show a peak sensitivity in the blue wavelengths (about 420-440nm) for modulation of melatonin, which regulates sleep. Bright white light is also demonstrated its influence in the modulation of mood, sleep cycles and activity [19]. Spectral range, affecting the circadian system has yet to be scrutinized. There are difficulties that if one (monochromatic) light source is used along with the other (polychromatic) light source, there are effects of the interaction, and the resultant spectrum may become less effective for the stimulation of circadian responses than using a light source separately. Thus, reference [20], the authors have shown that melatonin is suppressed by the influence of the polychromatic light, even when shortwave (436nm) light was monochromatic light is wavelength.

Lighting and Health **.** In addition to the importance of the light spectrum, and studies demonstrate the importance of light intensity. It was suggested that the level of a typical interior illumination is hardly enough to stimulate the circadian response and constant, dim lighting, typical of many objects of architectural environment LC may be insufficient to stimulate the circadian response, which leads to significant disruption of biological rhythms of sleep / activity cycles [21]. Recent epidemiological studies suggest that an increase in the incidence of cancer in the night nurses may be due to lack of light - dark cycles and constant low light, they experience at work and at home [22, 23, 24]. Studies demonstrate the link between immune function, sleep and treatment of conditions in support of the continuation of further studies of the effect of light on the health of patients.

Many studies show that stress also demonstrates changes in the circadian rhythm modulation of cardiac modulation and neuroendocrine responses, which are probably responsible for the higher incidence of cardiovascular diseases diagnosed in critically ill patients [25]. In addition, the cardiovascular system is the main mechanism associated with attention and memory. For example, in [26] it is shown that the heart rate was significantly modulated during constant attention. With the increasing interest in the role that stress plays in the development of cardiovascular diseases, the impact of the properties and

characteristics of the architectural environment LK can be directly related to patients' health, productivity and well-being of nurses.Accordingly, in [27] it is shown that the physical characteristics of working conditions, including changes in the characteristics of natural and artificial lighting, have been associated with the modulation of the day / night - the difference in the cardiac response, an important indicator of risk of stress and disease [28].

Experiment Latrobe **.** Need for further studies to confirm the connection between lighting and health of patients is still relevant and it served as the basis for the project experiment Latrobe. Multicenter study was conducted using an approach to the study of physiological and psychological reactions to controlled lighting conditions of the day and night. Researchers sought to determine the effect of Latrobe short "light shower" received during the day. The purpose of the study was to assess the transient response and the formation of the light activation, which can be used to modulate psychophysiological reaction patients inside buildings. Specific purpose of the research conducted at the department of psychology at Ohio State University, was to investigate the effect of light on heart rate variability - an important indicator of health risk and stress levels.

A parallel study was conducted at the Center for Computational Neuroscience Swartz University of California San Diego United States to assess the impact of the same protocol Lighting for cognitive response measured by electroencephalography (EEG) and the independent component analysis of brain waves [29]. Initial results indicated the EEG response to increased theta brain waves groups in one subject during the exposure of red light relative to white light. However, despite the lack of registration of fatigue, additional experiments are needed to confirm these findings [30]. Statistically significant differences in the reactivity of the heart - heart rate were observed in a bright white light with respect to red light. After the main events in daylight, 14 subjects were exposed to 15-minute period of aging in the dark and then change light on a bright white light with a peak in the blue and red light from the LED panels. Their memory is tested by using the working memory task in six minutes after changing the illumination condition in the ECG was recorded during the entire experiment. Red light exposure were associated with a significant decrease in heart rate, as well as a significant increase in high reactivity, which was confirmed by analysis of intervals between beats. In accordance with studies that show a link between memory and reactivity of the heart, there was a significant reduction of high reactivity during a working memory task, relative to the initial baseline and recovery period, which did not change significantly. In contrast to the reactivity of heart rate did not differ significantly impact in a bright white light [31,37].

Detected heart rate variability is an important indication that even brief exposure to light during the day can affect the cardiac reactivity. They confirm the influence of shortwave blue light on the reaction of melatonin and provide additional information about the effect of light in the red range.

Red light is rarely tested, as many researchers have speculated that the effect of red light on the circadian neuroendocrine system or virtually absent. However, the authors [32,38] found that in healthy people exposed to 630nm and 700nm

frequencies it caused a slight decrease in plasma melatonin. These findings are consistent with other studies that also show the influence of long-wavelength light on the cardiac response [33,39].

Conclusions. Original Research Latrobe, complementing existing research can change the lighting concept in architectural environment LK. Recent evidence suggests that short-term experiments on light (natural or artificial) can be used for health effects and possibly mental functions. Because biological systems in various disease states have different reactions to light, only the lighting conditions will be suitable for all patients' illnesses, the disabled and the elderly. By providing daily coverage for all patients, the health of each patient and the length of their stay will dictate diurnal potrebnosti.Potrebnosti day and night medical staff contradict the needs of patients. It is therefore proposed that the project daily coverage should include not only the choice of the spectral characteristics, intensity and timing schedule described in the literature, but also contain elements that take into account the individual needs of patients. Interaction between architectural characteristics and electrical characteristics of light sources affecting the size, geometry, location of Chambers and the materials used shall be provided directly in the design solutions. Latrobe research results have shown that natural light is on distributed and central positions of nurses was limited when patients in the wards used screens and window blinds were closed. As a result of medical staff totally dependent on artificial lighting, which is usually included during day and night shifts. This is quite different from the preliminary draft placement, which provides both adequate illumination levels and post distance nurses from daylight. Natural lighting is dependent on the orientation of the building, but showed large differences and depending on the finishing materials and distances from windows.

Prospects for further research. These original studies should be tested under realistic conditions LK. They can be easily tested by a mobile cardiac function and mental workload demonstrated in a study Latrobe. Manufacturers and researchers are currently exploring the possibility of producing lamps that take into account this evidence base, and make the current study to test the potential impact of design decisions in the real conditions of their exploitation.

Using evidence from Latrobe and evaluation experts, can be constructed hierarchy of priorities applicable to the draft of informed choice. Along with the analysis of the cost of materials, installation, maintenance, energy use, and also takes into account the properties of the project, affecting the health of patients, satisfaction with medical staff and others to assign a score for each variant of the project [35].

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Анотація

Мироненко В.П., Бодня С.В. Особенности дизайн–проектирования оечебных компдексов. У статті розглядається ерго–дизайнерський підхід до проектування архітектурного середовища лікувальних комплексів за принципами науково–обгрунтованого проектування (EBD) шляхом інтеграції досвіду архітекторів, строгої методології вчених–дослідників і розуміння потреб пацієнтів, та з урахуванням дії світла і кольору.
Ключові слова: лікарняні заклади, предметно–просторове середовище, ерго–дизайнерський підхід.

Аннотация

Мироненко В.П., Бодня С.В. Особенности дизайн-проектирования оечебных компдексов. В статье рассматривается эрго-дизайнерский подход к проектированию архитектурной среды лечебных комплексов на принципах научно обоснованного проектирования (EBD) путем интеграции опыта

архитекторов, строгой методологии ученых-исследователей и понимание потребностей пациентов, и с учетом действия света и цвета.

Ключевые слова: больничные учреждения, предметно-пространственную среду, эрго-дизайнерский подход.