International Journal of Innovative Research and Scientific Studies, 8(3) 2025, pages: 858-865

IJIRSS
International Journal of Innovative Research & Scientific Studies

ISSN: 2617-6548

URL: www.ijirss.com

Experience in designing protective workwear for patients with thermal injury

Gulnar Shaizadanova[1*], Kaldigul Kucharbaeva[2], Natalia Mokeeva[3], Mira Yeraliyeva[4], Galiya Toremuratova[5]

[1,2,3,4,5]*Almaty Technological University, Almaty, Republic of Kazakhstan.*

Corresponding author: Gulnar Shaizadanova (*Email: shaizadanovaagulnar@mail.ru*)

Abstract

The use of information technology is an integral step in the creation of automation systems in medical institutions for the selection of special-purpose clothing in an automated mode. In this work, a computer program "MedicalApp" was developed using analysis, systematization, and research of medical procedures carried out in the treatment of burns and topographic zones of their conduct. The purpose of this work is to base it on the database containing the classification of the degree and depth of thermal damage to the human body, the developed topography of medical procedures, taking into account the schemes of dynamic poses of patients with thermal lesions, and developed sets of special-purpose clothing for patients with thermal lesions, to automatically calculate the area of thermal damage to the surface of the human body, determine the degree and depth of the burn, taking into account the severity of the thermal lesion, and ensure the selection of the developed sets of special-purpose clothing for patients with thermal lesions. Special-purpose clothing sets are designed taking into account the requirements of functionality, specific features of medical procedures, and provide comfort and freedom of movement to the patient, as well as convenience to medical personnel during medical procedures. In solving this problem, studies of antibacterial tissue, systematization and distribution of therapeutic procedures by topographic zones, and development of schemes of dynamic poses of patients with thermal lesions were used.

Keywords: Information technology, medical procedures, special-purpose clothing, thermal lesions, topography.

DOI: 10.53894/ijirss.v8i3.6655
Funding: This study received no specific financial support.
History: Received: 3 March 2025 / **Revised:** 4 April 2025 / **Accepted:** 7 April 2025 / **Published:** 2 May 2025

Competing Interests: The authors declare that they have no competing interests.
Authors' Contributions: All authors contributed equally to the conception and design of the study. All authors have read and agreed to the published version of the manuscript.
Transparency: The authors confirm that the manuscript is an honest, accurate, and transparent account of the study; that no vital features of the study have been omitted; and that any discrepancies from the study as planned have been explained. This study followed all ethical practices during writing.
Publisher: Innovative Research Publishing

1. Introduction

According to the World Health Organization, burns rank third among other injuries [1]. The problem of designing special-purpose clothing for patients with thermal lesions is quite new and relevant. In medical institutions, when choosing hospital clothes, patients prefer casual clothing dressing gowns, pajamas, and tracksuits. Such clothing is not comfortable, hygienic, and does not meet the requirements of medical institutions for medical treatment procedures.

2. Materials and Methods

The lack of specialized hospital clothing increases the likelihood of infection in wounds, prolongs the time of medical procedures due to the absence of structural elements that facilitate medical manipulations, and creates discomfort for the patient.

Designing comfortable, aesthetically attractive, meeting the complex of specific properties and requirements of clothing for patients with thermal lesions, allowing them to provide a high level of comfort and vital activity, is a complex problem, the solution of which is at the junction of such industries as medicine, biomechanics, materials science, confection, construction, anthropology, psychology, etc. [2-5].

The quality of special-purpose clothing for patients with thermal lesions and its properties depend on the properties of the materials from which it is made. In accordance with the regulatory and technical documentation, it is recommended to make such clothes from mixed materials (GOST 11209-85) [6, 7]. In this regard, for the manufacture of special-purpose clothing for burn patients, the fabric of Tchaikovsky Textile LLC "Panacea PP 180 AntiBacterial" with antibacterial finish AntiBacterial CleanOK, with a fibrous composition of 70% viscose, 30% polypropylene, intended for the manufacture of antibacterial medical clothing was investigated [8, 9]. The physico-mechanical characteristics of the selected fabric "Panacea PP 180 AntiBacterial" were investigated in the "Research Laboratory of Textile Materials Safety Technology" of the Almaty Technological University.

As a result of the study, the following qualitative indicators of the material with polypropylene fibers were identified, having a low density among chemical fibers (0.90 g / cm3), which reduces the mass of tissues, and, consequently, products made from them reduce pressure on the skin of patients. Polypropylene fibers also contribute to the healing of burn injuries, due to the ability to repel moisture [7], having low hydrophilicity, high resistance to bacteria, insects and mold [8], which minimizes the risk of bacterial transfer, prevents the appearance of odor on clothing. The addition of viscose fiber provides the fabric with high hygienic properties (removal of moisture and sweat), air permeability, which provides a healing effect to thermal burns. The proposed fabric is not electrified, has an air permeability of 40 dm3 / m2, hygroscopicity of at least 11%, and oil repellency of at least 5 points. When combining the above-mentioned fibers, the antimicrobial properties do not decrease [9].

Along with the choice of antibacterial fabric, when designing special-purpose clothing for patients with thermal lesions, it is necessary to take into account medical procedures and the topography of their conduct on the surface of the human body. The most common places of burns were determined from studies conducted in the burn department of the City Clinical Hospital No. 4 in Almaty. The distribution of medical procedures by topographic zones for patients with thermal lesions is presented in Table 1.

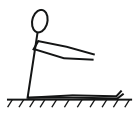
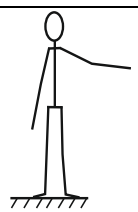
Table 1.
Distribution of medical procedures by topographic zones.

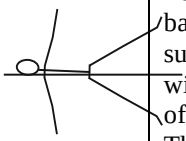
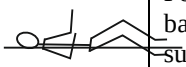
Code of the topographic site		Scope of the procedure	Name of the procedure
Digital	**Latin letters**		
1	A	Neck (Respiratory tract T27)	Central vein catheterization (internal jugular vein)
2	B	Chest upper section (Chest, chest walls T21)	Treatment, ligation, auscultation of the lungs, catheterization of the central veins (subclavian vein), ECG, ultrasound, chest X-ray
3	C	Chest lower section (Abdominal wall, side wall of the abdomen, T21)	Catheterization of the bladder, ultrasound
4	D	Inguinal region (Inguinal region, perineum)	Catheterization, urine collection and sampling
5	E	Shoulder (T22)	Blood pressure measurement, thermometry
6	F	Forearm (T22)	Peripheral vein catheterization, intravenous injections, droppers, and plasmapheresis
7	G	Wrists, Hands (Fingers, Palms T23)	Peripheral vein catheterization, heart rate measurement and pulse rate determination, and blood sampling for UAC
8	H	Hips in front (T24)	Treatment, ligation, catheterization of central veins (femoral vein)
9	I	Lower leg (T24)	Treatment, dressing
10	K	Feet (Ankle joint, feet T25)	Treatment, dressing Physiotherapy

11	L	Head (Ear, eyes, lips, nose, scalp T20)	Artificial lung ventilation (tracheal intubation), laryngoscopy, biopsy, fibrobronchoscopy, endoscopic laser photostimulation, nasopharyngeal catheter for oxygen therapy (or oxygen mask).
12	M	Head from behind	Treatment, dressing
13	N	Neck from behind	Treatment, dressing
14	O	Upper back (Interscapular area T21)	Treatment, dressing
15	P	Lower Back (T21)	Spinal epidural anesthesia, ultrasound
16	Q	Buttocks (Anus, buttock area)	Intramuscular injections, a smear on the eggs of worms, the introduction of candles, and enemas
17	R	Thighs Back	Treatment, dressing
18	S	Calves	Treatment, dressing

Along with taking into account the topography of the treatment procedures, it should also be taken into account that during dressing the patient takes a certain position [10-12] depending on the location of the thermal lesion. According to the conditions of the dressing, special-purpose clothing for patients with thermal lesions should provide sufficient freedom of movement for both medical personnel and the patient himself. From observations of the dressing process, it was determined that access to a larger part of the body than the one that is affected is required. This is due to the application of a bandage and the need to fix it; carrying out medical procedures, the main of which, as determined from a survey of medical staff, are the installation of catheters for the administration of drugs, injections, and rehabilitation of affected areas [13]. The analysis of the patients' regime made in hospital conditions, the study of the peculiarities of medical procedures, monitoring of the treatment process, familiarization with the list of the most common affected areas, as well as taking into account the need for access to them during dressing, schemes of dynamic poses of patients with thermal lesions taken during medical manipulations have been developed. With the help of time-lapse observations [14], the most frequently repeated postures and movements of patients are established, as shown in Table 2. On the basis of this study, using the contactless method using a digital camera, data were obtained, the analysis of which identified the areas that most often change their parameters. The studied data were used in the development of the automated program "MedicalApp".

Table 2.
Characteristics of dynamic poses of patients with thermal lesions.

No.	Diagram of the position of patients	Description of the position of the pose	Variants of compositional and constructive solutions	Characteristics of medical procedures	Conditions for ensuring free access to the area of procedures
1		Sitting position, body at an angle of 60° to the vertical. The arms are lowered straight with emphasis on the knees, the legs are bent at the knees.	- The unbuttoning / buttoning detail of the back and shelves of the jacket.	- Wound treatment; - Installation of an intravenous catheter; - Measurement of human body temperature	Access to the upper part of the trunk (to the anterior abdominal wall) and upper limbs.
2		Position, sitting on a straight surface, the body at an angle of 90° to the horizontal. The arms are slightly bent at the elbows and raised at an angle of 90° to the vertical, the legs are stretched out in front of them.	- The unbuttoning/ buttoning detail of the jacket	- Wound treatment; -Laparoscopy, puncture liver biopsy; - Blood pressure measurement; -Intravenous injections; - Blood sampling for tests.	Access to the anterior abdominal wall, back, arms from all sides.
3		Standing position, one arm is slightly bent at the elbow and raised at an angle of 45° to the vertical, the other is lowered.	- Unbuttoning/ buttoning side section of trousers.	- Intramuscular injections; - Wound treatment; - laparoscopy, puncture liver biopsy; - Catheterization of the central veins (femoral vein).	Access to the upper quarter of the buttocks, the side of the trunk, upper and lower extremities from all sides.

4		Position: Lying on your back, on a straight surface. The arms are withdrawn at an angle of 90° from the torso. The legs are set at an angle of 45° from the vertical.	- Unbuttoning/ buttoning side section of the robe; - Unbuttoning/ buttoning the upper section of the robe.	- Wound treatment; - Blood pressure measurement; - Intravenous injections; - Blood sampling for tests; - Installation of an intravenous catheter.	Access to the subclavian artery, the anterior part of the chest, back, front and inside of the upper and lower extremities.
5		Position: Lying on your back, on a straight surface. The arms are bent at the elbows and raised at an angle of 60° to the vertical, the left arm is raised, the legs are bent at the knees with emphasis on the feet at an angle of 60° to the horizontal.	- Unbuttoning/ buttoning side section of the robe; - Unbuttoning/ buttoning the upper section of the robe.	Wound treatment; - Blood pressure measurement; - Intravenous injections; - Blood sampling for tests; - Installation of an intravenous catheter; -Catheterization of the central veins (femoral vein).	Access to the front of the trunk, forearms, hands from all sides, side and front of the legs.
6		Position: Lying on your stomach, on a straight surface. The right leg is straight and raised at an angle of 45° to the horizontal.	- Unbuttoning/ buttoning side section of trousers; - An unbuttoning/ buttoning section of the back of the robe.	- Wound treatment; - Installation of an intravenous catheter; - Intramuscular injections.	Access to the back of the lower limb, back, shoulders, lower torso.

As can be seen from Table 2, during medical procedures, the patient takes certain poses, depending on the location of the lesion. Therefore, there is a need for special-purpose clothing for patients with thermal lesions. But we should not forget that burns are classified into 4 degrees according to the severity of the burn. In addition to determining the depth of the burn, to assess its severity, it is necessary to assess the area of the lesion, which are crucial in determining the algorithm for treating burn pain [15]. Assessment of the lesion surface is very different among doctors. It is not the absolute size of the burn area that is important, but the relative value, which is expressed as a percentage of the entire surface of the trunk. For today, the "Rule of Nines" (the method proposed by Wallace [16] the "Rule of the Palm" (the method of [17] a special Lund-Browder table for measuring the area of burns in children are known and applied [18]. Also known are Vilyavin [19] Schemes, Postnikov and Lomanovich [20] Method, "Measurement of the burn area proposed by Alekseev, et al. [21]. When formulating a diagnosis, it is necessary to reflect the type of burn (thermal, chemical, electrical), localization, degree, total area, and area of deep lesion.

The area and depth of the lesion are written in the form of a fraction, in the numerator of which the total area of the burn is indicated and next to it in parentheses is the area of the deep lesion (as a percentage), and in the denominator is the degree of the burn [22]. For greater clarity, a diagram is inserted into the medical history, on which the area, depth and localization of the burn are graphically recorded using symbols.

Currently, several special programs are known with the ability to determine the area of the burn using a graphical image in electronic form: SAGE II and EPRI 3D Burn Vision [23] Burn Case 3D [22] Burn Calculator [24, 25] Mersey Burns [26, 27] LiAo Burns Pro [26] Wound Flow [28, 29]. These programs are designed for skin transplantation and calculation of the volume of infusion therapy necessary for the treatment of a burn patient.

The determination of the area and depth of the lesion is necessary to determine the volume of infusion agents required by the patient in case of burn shock on the first day, calculated according to the Evans formula [30]:

$$V = M \times S \times 3 \quad (1)$$

where V is the volume of the infusion medium;

S is the area of the burn in %.

M - body weight in kg.

Currently, design is an integral step in the creation of automation systems at sewing enterprises for the development of processes for the formation of an assortment of products in an automated mode. The use of information technology is an integral step in the development of special-purpose clothing for patients with thermal lesions. The introduction of modern information technologies in the production of clothing is considered not just natural, it brings the garment industry to the latest degree, thus, operational access to data and its exchange significantly reduces the time spent on finding solutions to the problem. A database (DB) together with a system of methods and tools designed for centralized accumulation, storage, updating, searching and issuing information to the user during the design process is the basis of CAD information support. Starting to develop a database, it is necessary to define a block diagram and logic for obtaining and storing information that

will form the basis for automating the design of special-purpose clothing [29]. The organization of the database has different classifications by data model, by permanent storage environment, by content, by degree of distribution.

In this work, an automated program "MedicApp HBB" has been developed. The software was first introduced and tested in the Republic of Kazakhstan (Figure 1).

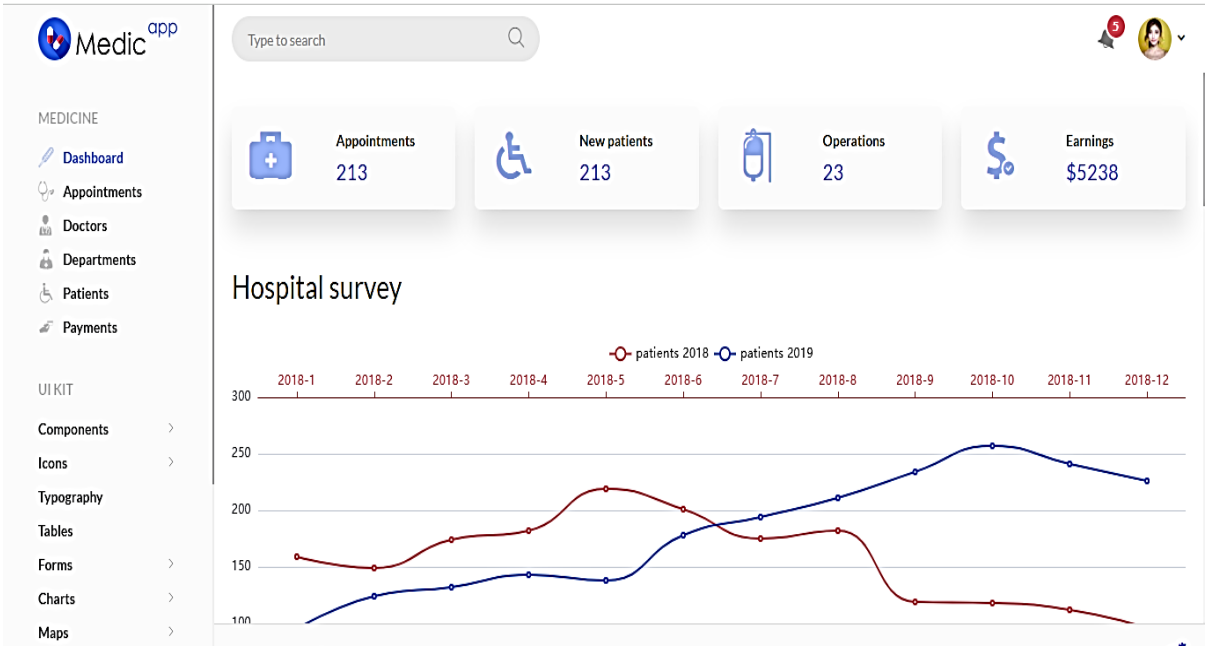


Figure 1.
Appearance of the form of the main window "MedicApp HBB".

The form of the start window "Home", where the push-button menu is located, contains the developed forms "Doctors", "Departments", "Dashboard", "Appointments", "Patients". To build a logical model, an open-source PHP MyAdmin web application was used. It is written in PHP and is a web interface for MySQL database administration. PHP MyAdmin allows you to view the contents of tables and databases. The program consists of components interacting with each other, lying in a specially formed database. To begin work on the automated selection of a set of special-purpose clothing, you need to open the main menu of the program, log in to your personal account, enter the weight, height, body type of the patient, then on the figure template, front view, back view, mark the places and depth of lesions (Figure 2), and depending on the severity, the area of the lesion, a combination of sets of special-purpose clothing appears on the display screen providing access to all the necessary topographic zones necessary for carrying out medical procedures.

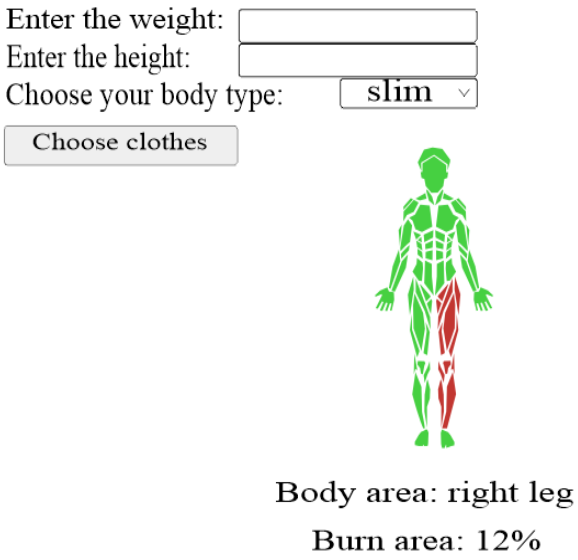


Figure 2.
Automatic determination of the percentage of thermal damage depending on the weight, height, physique of the patient.

To calculate the absolute area of the lesion (as a percentage), the formula of the total body area is used, which takes into account the height, weight and body type of the body. This program is intended for the adult male and female population.

There are no standard methods for determining the areas of complex geometric shapes, which are the areas of the human body. It is known from mathematics that for a region bounded by a closed line (Fig. 3), described by a parametric equation

$x= \varphi(t)$,

$y= \psi(t)$,

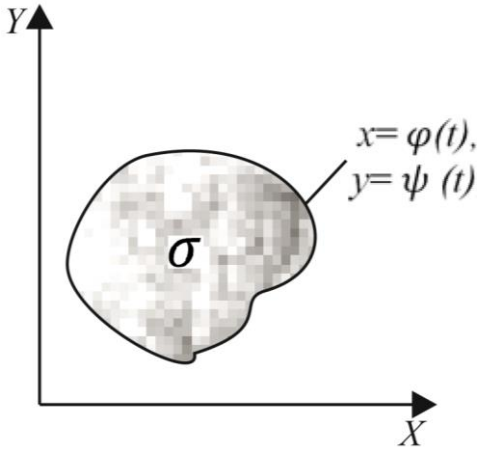


Figure 3.
The area of a geometric object.

The area Q is equal to the curvilinear integral:

$$Q = \frac{1}{2}\int_L^O (\varphi(t)\psi'^{(t)} - \psi(t)\varphi'(t)dt = \frac{1}{2}\int_O^T (\varphi(t)\psi'(t) - \psi(t)\varphi'(t))dt, \quad (2)$$

where 0 is the initial value of parameter t; T is the final value of parameter t.

3. Results and Discussion

The use of the developed software "MedicalApp" is an effective tool for choosing special-purpose clothing for patients with thermal lesions, taking into account the area, depth of damage to the human body, and the degree of burn, which, according to the results of the systematization of performed medical procedures and the topography of their conduct, provides access to all necessary topographic zones required for carrying out medical procedures and satisfying both the patient and medical personnel. Additional advantages of the introduction of information technologies include the determination of the severity of the burn and the choice of special-purpose clothing for patients with thermal lesions, taking into account the healing of the burn surface. Thus, this data can be included in the patient's medical history for further study, which allows for the registration and tracking of the dynamics of healing of burn wounds of the patient and the selection of appropriate special-purpose clothing. The use of special programs helps to solve the following tasks:

1. In automatic mode, calculate and display the affected area of the human body to determine the degree and depth of the burn;

2. Reduce the number of errors that can be made in calculations, assessment of the severity of burns, planning of medical and other procedures;

3. To ensure the selection of sets of special-purpose clothing for patients with thermal lesions, taking into account the topography of medical procedures;

4. A graphic image of a person's body with certain data can be sent to other specialists, relatives of the patient via e-mail. This is more effective than using a descriptive form and schematic images of the affected areas.

The software "MedicalApp" was tested in the city clinical hospital of Almaty, received positive feedback from both medical staff and patients and their relatives, who had access to the medical history, treatment process and doctor's appointments. They also noted the ease of use and many functions are useful for patient care. Digital technologies improve the accuracy and analysis of data, which allows for each degree of thermal damage to set a certain set of necessary access zones, which forms a combination of sets of special-purpose clothing with functional and constructive solutions that provide access to specified zones. Patient images are stored locally on the personal computer of the attending physician and can be opened at any time using this software. This ability allows you to document the progression and treatment of burn injury in the form of a series of diagrams contained in a single file. Special clothing for patients is necessary at all stages of burn treatment. In this regard, taking into account the topography of medical procedures, Table 2, and the poses of patients, special-purpose clothing can be grouped into specialized clothing and general-purpose clothing. The choice of clothing should be carried out depending on the type of burn. General purpose clothing is used for 1st, 2nd degree burns and at the rehabilitation stage. Specialized clothing is necessary in the acute period of the 3rd degree of burn and at all stages of the 4th degree burn [30-32]. After determining the area, the depth of the lesion, the type of burn, the automated program "MedicalApp", taking into account the topography of the affected areas of the human body, displays special-purpose clothing recommended for this patient. Taking into account these requirements, a dressing gown with detachable parts of the shelf and back along the shoulder seam was developed for specialized clothing [33] for general–purpose clothing - a set of clothes for burn patients [34]. The developed sets of special-purpose clothing for patients with thermal lesions are suitable for both women and men.

After analyzing the data obtained in the experiment, it can be concluded that the developed sets of special-purpose clothing for patients of medical institutions with thermal lesions are more comfortable for clinic patients than household ones, provide psychological and operational comfort to the patient and convenience to medical personnel during medical procedures, have a great impact on the medical services provided in the burn surgery department of a medical institution, taking into account the zones of lesions, poses and movements of patients during medical procedures.

4. Conclusion

As a result of the study, an automated program "MedicalApp" was developed and tested, which made it possible to more accurately determine the area of thermal damage to the human body, taking into account the topography of medical procedures, the type, degree, and depth of the burn from the developed sets of special-purpose clothing in the shortest possible time to provide the patient with special clothing for rehabilitation.

References

[1] V. A. Sizonenko, A. A. Alekseev, A. P. Biryukov, and M. G. Golubkova, *Atlas of thermal lesions*. Moscow: GEOTAR-Media, 2016.

[2] V. V. Kholostova, "Development and research of everyday adaptive clothing for women with disabilities," Doctoral Dissertation, Candidate of Technical Sciences, Specialty 05.09.04. Shakhty, Russia, 2016.

[3] A. Doshibekova *et al.*, "Effect of technological parameters on the process of copper deposition on chemically and chemical-galvanically nickel-plated fibers," *Research Journal of Textile and Apparel*, vol. 29, no. 1, pp. 162-183, 2025. https://doi.org/10.1108/RJTA-03-2023-0037

[4] N. Y. Savel'eva, S. V. Kurenova, and A. A. Saveliev, "The development of targeted method of designing adaptive clothing for people with reduced mobility with the use of 3D technologies," *Sewing Industry*, vol. 5, pp. 22–24, 2012.

[5] O. Prikhodchenko, "Development and research of adaptive clothing for people with disabilities," Doctoral Dissertation, Dissertation Abstract, Candidate of Technological Sciences: 05.19. 04/OV Prikhodchenko.-Mines, 2007.

[6] S. Nurbay, Z. Usenbekov, B. Seitov, L. Sarttarova, and N. Seitova, "Identifying factors affecting comfort workwear for mountain tourism," *Eastern-European Journal of Enterprise Technologies*, vol. 121, no. 1, pp. 14–24, 2023. https://doi.org/10.15587/1729-4061.2023.272741

[7] G. Iskhojanova, I. Zayats, and L. Sarttarova, "Typological aspects of urban architecture design based on the principle of hybridity," *Innovaciencia*, vol. 10, no. 1, pp. 1-8, 2022. https://doi.org/10.15649/2346075X.2976

[8] GOST 11209-85, *Cotton and mixed protective fabrics for workwear. Technical conditions (Introduced 07.01.1986)*. Moscow: IPK Publishing House of Standards, 1999.

[9] Tchaikovsky Textiles, "Electronic resource," Retrieved: https://www.textile.ru/products/speccloth/med/pp. [Accessed January 20, 2021], 2020.

[10] Chemist's Handbook 21, "Chemistry and chemical technology. Polypropylene fibers application," Retrieved: https://chem21.info/info/1000236. [Accessed January 20, 2024], 2020.

[11] Chemical Fibers, "Electronic resource," Retrieved: https://www.yaneuch.ru/cat_90/himicheskie-volokna/128679.1832032.page1.html. [Accessed January 20, 2024], 2020.

[12] G. S. Shaizadanova, K. Z. Kucharbayeva, and N. S. Mokeeva, *Research and selection of materials for special-purpose clothing for burn patients. In Innovative development of food, light industry and hospitality industry: MNPC materials*. Almaty, Kazakhstan: Kazakh National University of Technology and Business, 2019.

[13] HELPIKS.ORG., "Types of the patient's position in bed," Retrieved: https://helpiks.org/7-44112.html. [Accessed January 19, 2024], 2020.

[14] G. P. Zaretskaya, T. V. Butko, E. N. Rodichkina, S. G. Dembitsky, and T. V. Mezentseva, *Influence of dynamic poses of patients of burn centers during dressings on the design and technological characteristics of special medical devices*. Russia: Design and Technology, 2018.

[15] T. G. Agievich, *Labor rationing and organization of wages at the enterprise. Study guide*. Volgograd: Volgograd State Technical University, 2016.

[16] A. Wallace, "The rule of the palm method for estimating burn area," *Journal of Burn Care*, vol. 3, no. 1, pp. 12-15, 1951.

[17] I. I. Glumov, "The rule of the palm: A method for estimating burn surface area," *Soviet Medical Journal*, vol. 42, no. 4, pp. 95-99, 1953.

[18] C. Lund and N. Browder, "A classification of burn injury in children and adults: The lund-browder chart," *Burns and Trauma Journal*, vol. 5, no. 2, pp. 10-15, 1944.

[19] G. D. Vilyavin, "G.D. Vilyavin's schemes for estimating burn area," *Journal of Trauma Care*, vol. 20, no. 3, pp. 140–145, 1984.

[20] B. Postnikov and K. Lomanovich, "Effect of electric discharge plasma on self-oscillations in supersonic impact jets," in *AIP Conference Proceedings*, 2019, vol. 2125, no. 1: AIP Publishing.

[21] A. A. Alekseev, A. E. Bobrovnikov, M. G. Krutikov, Y. I. Tyurnikov, and S. B. Bogdanov, *Local conservative treatment of wounds at the stages of providing assistance to victims of burns: Clinical recommendations. The All-Russian public organization*. Moscow: Association of Combustiologists 'World without Burns, 2014.

[22] G. Shaizadanova, K. Kucharbaeva, K. Abilkalamova, Z. Baizhanova, and A. Sabitova, "Development of special clothing for burn patients," *Eastern-European Journal of Enterprise Technologies*, vol. 121, no. 1, pp. 6–13, 2023. https://doi.org/10.15587/1729-4061.2023.272742

[23] P. M. Lavreshin and O. V. Vladimirova, *Thermal and chemical damage. Electrical injury. Study guide*. Stavropol: Publishing House of StSMU, 2017.

[24] F. Z. Mirsaeva, E. I. Galieva, and R. G. Farkhutdinov, *Thermal lesions of the maxillofacial region. Complex treatment with the use of phytopreparations and bee products. Study guide*. Ufa: AN RB, Gilem, 2010.

[25] J. Neuwalder, C. Sampson, K. Breuing, and D. Orgill, "A review of computer-aided body surface area determination: SAGE II and EPRI's 3D Burn Vision," *Journal Burn Care Rehabilitation*, vol. 23, no. 1, pp. 55-59, 2002.

[26] J. Dirnberger, M. Giretzlehner, M. Ruhmer, H. Haller, and C. Rodemund, *Modelling human burn injuries in a three-dimensional virtual environment* (Medicine Meets Virtual Reality 11). Amsterdam: IOS Press, 2003.

[27] W.-b. Sheng, D. Zeng, Y. Wan, L. Yao, H.-t. Tang, and Z.-f. Xia, "BurnCalc assessment study of computer-aided individual three-dimensional burn area calculation," *Journal of ttranslational Medicine*, vol. 12, pp. 1-12, 2014. https://doi.org/10.1186/s12967-014-0242-x.PMID:25204349;PMCID:PMC4173062

[28] M. Berry, T. Goodwin, R. Misra, and K. Dunn, "Digitisation of the total burn surface area," *Burns*, vol. 32, no. 6, pp. 684-688, 2006. https://doi.org/10.1016/j.burns.2006.01.013.Epub2006Jul17.PMID:16844301

[29] S. S. Sofos, R. Pritchard-Jones, C. Seaton, J. Dingley, P. McArthur, and K. Shokrollahi, "Medical innovation—a starting point for plastic surgeons," *Annals of Plastic Surgery,*, vol. 69, no. 3, pp. 225-227, 2012. https://doi.org/10.1097/SAP.0b013e31826b13a9

[30] LiAo Burns Pro, "Omesoft technologies, Zhuhai, China," Retrieved: https://uk.formidapps.com/ios/app.liao-burns-pro-jFzjEiBi.aspx. [Accessed 01/21/2021], 2021.

[31] T. L. Wachtel, C. C. Berry, E. E. Wachtel, and H. A. Frank, "The inter-rater reliability of estimating the size of burns from various burn area chart drawings," *Burns*, vol. 26, no. 2, pp. 156-170, 2000.

[32] Thermal Damage, "Thermal damage," Retrieved: http://www.grsmu.by/files/file/university/cafedry/obshei-hiryrgii/files/lekcionnu-material/21.pdf. [Accessed 21.01.2024], 2020.

[33] N. S. Mokeeva and L. N. Bakanovskaya, "Development of a software module of an automated process design system," *Young Scientist*, vol. 3, pp. 38-41, 2009.

[34] G. S. Shaizadanova, K. Z. Kucharbayeva, N. S. Mokeeva, and N. O. Bikonurov, "Investigation of protective and specific properties of special-purpose clothing for burn patients. Izvestiya vuzov," *Technology of the Textile Industry*, vol. 5, no. 383, pp. 89-93, 2019.