ACTA FACULTATIS
MEDICAE NAISSENSIS

UDC: 614.2:616-001.17:004
DOI: 10.5937/afmnai40-45800

Original article

The Effect of Self-Care Training Program Based on Digital Health on the Quality of Life of Burn Patients: A Systematic Review and Meta-Analysis

Kolsoum Deldar[1], Farnoosh Khodabandelool[2], Mahdieh Arian[3,5], Seyed Javad Hosseini[4], Razieh Froutan[3,5]

[1]*Department of Information Technology, School of Allied Medical Sciences, Shahroud University of Medical Sciences, Sharoud, Iran*
[2]*Faculty of Medicine, Mashhad University of Medical Sciences, Mashhad, Iran*
[3]*Nursing and Midwifery Care Research Center, Mashhad University of Medical Sciences, Mashhad, Iran*
[4]*Department of Pediatric Nursing, School of Nursing and Midwifery, Mashhad University of Medical Sciences, Mashhad, Iran*
[5]*Department of Medical-Surgical Nursing, School of Nursing and Midwifery, Mashhad University of Medical Sciences, Mashhad, Iran*

SUMMARY

Background/Aim. The present systematic review and meta-analysis aimed at evaluating the impact of self-care training programs based on digital health on the quality of life of burn patients.
Methods. Electronic databases such as Science Direct, Medline/PubMed, Web of Science, Scopus, ProQuest, Google Scholar, and Cochrane library were searched independently by two researchers using the relevant keywords. The random effects model meta-analysis was carried out to compute the influence of common effect size, the standardized mean difference (SMD) on health-related quality of life (HRQOL) as the primary aim of the study. Funnel plots were drawn to assess the publication bias and I-squared index was utilized to assess the heterogeneity. Subgroup analyses were carried out accordingly. From a total of 105 studies, six studies were eligible to attend in the final meta-analysis.
Results. The results showed a significant effect of digital health compared to normal care on the overall quality of life (QOL) in burn victims (SMD 1.2, (95% CI 0.58, 1.8), P = 0.0001, I^2 = 92%). The I^2 index shows a high level of heterogeneity with a value of 92%. Subgroups analysis shows a significant effect of telemedicine compared to normal care on the overall QOL in burn victims between weeks 7 - 12 (SMD 1.7 (95% CI 0.43, 3), P = 0.009, I^2 = 93%), and between weeks 2 - 6 (SMD 1.4 (95% CI 0.5, 2.3), P = 0.002, I^2 = 89%) and > 13 weeks (SMD 0.09 (95% CI -0.17, 0.35), P = 0.5, I^2 = 0%).
Conclusion. According to the presented results, it seems that new digital technologies have brought benefits including a positive impact on the quality of life score of burn victims.

Keywords: rehabilitation, digital health, burn patient, self-care, education program

Corresponding author:
Razieh Froutan
e-mail: froutanr@mums.ac.ir

INTRODUCTION

Burns belong to the most devastating injuries and public health concerns in the world (1, 2), affecting approximately 486,000 people in the United States and 11 million people worldwide (3, 4). The survival rate in severe burn patients has improved significantly in the last few decades (5, 6). As a result, the care of burn victims has shifted from lifesaving to rehabilitative issues, such as normal function and return to the community. During the rehabilitation period, the most important clinical complication in patients with deep and full-thickness skin burns is a contracture, which can cause the loss of joint mobility, difficulty in movement and performance of fine motor tasks and daily activities (7 - 9). In the process of burn care, patient participation is considered an important component for faster recovery (10). In this regard, one of the solutions offered to improve the level of knowledge of burn patients is self-care training (11, 12). Self-care helps people to live healthier lives and overcome challenges resulting from social, emotional, and psychological needs (13). The World Health Organization has defined self-care as the ability of the individual, family, and community to improve the health status, prevent disease, and cope with disease and disability with or without receiving support from a health care provider (14).

Information technology is considered a powerful tool, being the most important factor in increasing the efficiency and effectiveness of organizations. The health care industry is not an exception, so different countries, considering the role and importance of the health care industry and its direct and indirect impact on the various aspects of society's development, employ information technology to expand health information and improve the consequences of the health care system. Employing information technology in areas such as self-care training and providing better health services has also been suggested. In America and England, the direct interaction of patients with health information technology leads to an increase in the quality of care (15, 16).

Information and communication technology is employed in medicine and other health professions - in the sense of digital health - to manage diseases and health risks and promote health. Having a wide scope, this tool can improve the quality of care, reduce health care costs, and improve access to health care. Digital health can be seen as the integration of digital technologies and the field of health and hygiene. The World Health Organization believes that in many countries, digital health will play a unique and central role in achieving a universal health coverage (16, 17). The organization emphasizes that digital health can help patients to achieve sustainable development goals by making health and well-being services available with high standards for all people globally (18). Despite the important role of digital health in supporting self-care and helping to achieve high standards of health and well-being at the global level, the utilization rate of this tool is lower than desired (19).

Digital health technologies are known to enhance communication between health care providers and patients and encourage ordinary people to participate in preventive health activities and improve patient adherence to treatment protocols and self-management of chronic diseases. A new systematic review reported a positive impact of mobile-based health applications on health outcomes and health-related behaviors, and it showed that users of the applications were more satisfied with their health management than conventional care (20). Such programs can potentially play an important role in supporting personal health management (21) and increasing access to health care services (22). One of the fields in which mobile health programs have been widely and effectively used for prevention and improvement of diagnosis and treatment management is the field of burns (23). However, we could not find a study that comprehensively reports the results of studies related to the impact of self-care training programs based on digital health on the quality of life of burn patients. Therefore, there is a need for a comprehensive review of the available evidence, so that through it, the introduction of subsets of digital health and the impact of their use in

the self-care training program on the quality of life of burn patients can be realized.

METHODS

The present study is a systematic review and meta-analysis, which was conducted to evaluate the impact of self-care training programs based on digital health on the quality of life of burn patients.

Search method

Electronic databases such as Science Direct, Medline/PubMed, Web of Science, Scopus, ProQuest, Google Scholar, and Cochrane library without restrictions on publication time until October 20, 2022, were searched by two researchers separately with the keywords: rehabilitation, burn patient, e-health, self-care training program, m-health, digital health, virtual rehabilitation. In order to conduct the present study, PRISMA items were applied.

Scope of the review

In order to clarify the purpose of the study, the PICO framework from PRISMA was applied. Accordingly, the following items were considered:

Population

Research papers in which people aged 18-65 were examined.

Intervention

Applying digital health, augmented reality, mobile applications, social networks, and multimedia for the rehabilitation of burn patients.

Comparison

Comparison of rehabilitation using digital health methods with face-to-face methods.

Outcome

Average score of quality of life and subgroups related to the quality of life.

Inclusion/Exclusion Criteria

The inclusion criteria were articles studying patients between 18 and 65 years old, using digital health approaches for rehabilitation care, investigating the impact of digital health on the quality of life of burn patients, comparing the impact of digital health with a control group, the language of the article being English or Farsi, giving the quality of life score as the outcome of the study. The exclusion criteria were unrelated articles, lack of access to the full text of the article, articles investigating the impact of digital health on the quality of life of patients with other diseases such as heart problems or spinal cord injuries, as well as review articles or letters to the editor and quasi-experimental ones.

The search and screening process was done by two people. In case of conflicting results at each stage of the screening, the problem was solved using a third person's comments or discussing the issue among the group. Finally, after quality assessment, six studies that reported on HRQOL were included in the analysis (Figure 1).

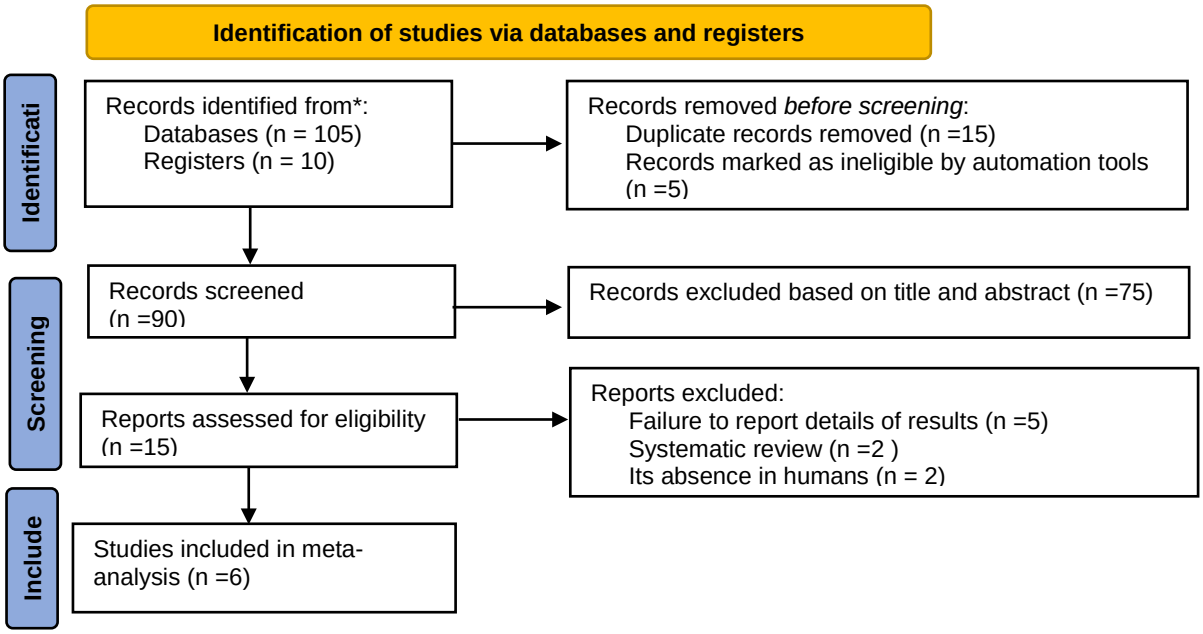


Figure 1. *PRISMA flow diagram*

Analysis

The primary outcome was HRQOL, which was evaluated as Overall QOL and in several dimensions including effect, body image, face and neck, hand function, heat sensitivity, personal relationships, sexuality, simple abilities, treatment regimen, work. If in a study the results were reported with two questionnaires, their results were applied for comparison. If a study reported the average of the components of each dimension of a questionnaire separately, first the average of each dimension was calculated and then by summing the dimensions of each questionnaire, the overall QOL was obtained.

Outcome synthesis

Meta-analysis was performed separately for each dimension of HRQOL. The Q statistic and the I^2 index were applied to evaluate the heterogeneity of the studies. Random effects model and inverse variance weighting method (IV) were used to obtain the common effect size (ES). Considering the differences in questionnaires, SMD effect size was applied to compute the common effect size, and their 95% confidence intervals (CIs) were calculated and displayed in forest plots. Funnel plots were drawn to assess the publication bias. Heterogeneity were assessed by I-squared index, and the values higher than 75% indicated serious heterogeneity. To seek for the source of heterogeneities, only subgroups analysis was used, however, due to the variety of information and a small number of studies, meta-regression was not possible. Comprehensive meta-analysis v3 was employed for the analysis. In order to draw, a software was used.

RESULTS

Characteristics

Six clinical trial studies were included in the analysis, the details of which are included in Table 1. These studies were published between 2016 and 2021, and all of them were of high quality.

Table 1. *Basic characteristics of the included studies in the meta-analysis*

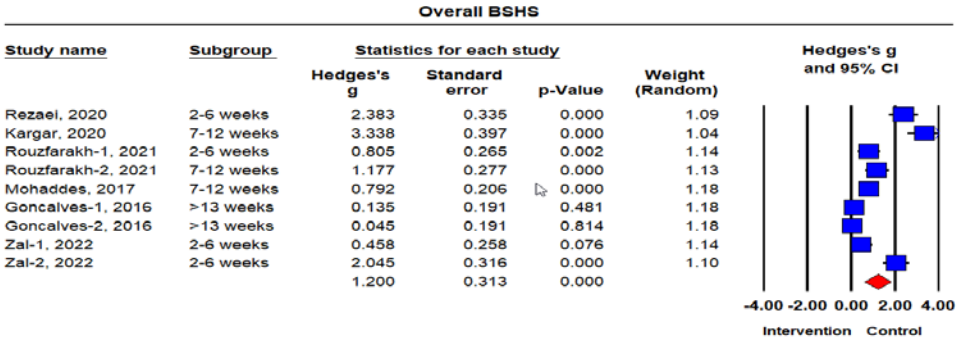
Author (Year)	Country	Aim	Burns victims	Groups	Type of media and duration	Tool	Quality
Rezaei, 2020	Iran	To compare the effect of telenursing and face-to-face training on the QOL of patients with a burn injury.	90	Telenursing:30 Face-to-face training:30 Control:30	Each intervention group received 1-on-1 telephone training or face-to-face training (2 sessions of 15 to 2 min/per week, totally 8 sessions during 4 weeks). The control group received only the routine care.	(BSHS-B)	High
Kargar, 2020	Iran	To assess the effect of a self-care educational mobile application on the QOL of victim patients with hand burns.	60	Hand burn self-care application: 30 Control:30	The intervention group used the hand burn self-care application upon their admission up to 2 months after their hospital discharge. The controls only received the ordinary training presented in the burn center.	(BSHS-B)	High
Rouzfarakh, 2021	Iran	To investigate the effect of rehabilitation education through social media on burn patients' QOL	60	WhatsApp channel:30 Control:30	The intervention group patients pursued their post-discharge education through WhatsApp for a month. The control group patients received their discharge education according to the ward's routine procedures through pamphlets and face-to-face training by the personnel. The QOL questionnaire in both groups were completed before intervention and after one and two months.	(BSHS-B)	High
Mohaddes Ardebili, 2017	Iran	To investigate the effect of multimedia self-care program on QOL in burn patients.	100	Multimedia self-care CD:50 Control:50	The experimental group received a multimedia self-care CD (the contents were designed for burn patients, CD-based educational books and educational resources). The control received self-care routine recommendations face to face. The QOL of life questionnaire in both groups were completed before intervention and after three months and were statistically analyzed.	(BSH-B)	High
Goncalves, 2016	Brazil	To compare health status, self-efficacy, symptoms of depression and anxiety and post-traumatic stress between two groups of burn victims receiving information on self-care through routine care or an educational program with telephone reinforcement.	108	Telenursing: 53 Control: 55	The experimental group received self-care tailored for burn victims according to the cognitive social theory and reinforcement by telephone every 4-6 weeks for 6 months after discharge. The control group received self-care routine recommendations face to face. During hospitalization, at discharge, at 6 and 12 months after discharge, they collected data.	BSHS-R	High
Zal, 2021	Iran	To investigate the effect of implementing rehabilitation programs using an Augmented Reality (AR) coupled pamphlet on the QOL of patients with face/neck burns.	60	AR coupled pamphlet:30 Control:30		BSHS-FN	High

Overall QOL (BSHS)

Considering that all studies were of high quality, none of the studies were excluded from the analysis. Analysis of six studies without considering moderator analyses shows a significant effect of digital health compared to normal care on the overall QOL in burn victims (SMD 1.2, (95% CI 0.58, 1.8), P = 0.0001, I^2 = 92%). The I^2 index shows a high level of heterogeneity with a value (92%). Due to the variety of information and a small number of studies, meta-regression was not possible, and only subgroups analysis was used. Subgroups analysis shows a significant effect of telemedicine compared to normal care on the overall QOL in burn victims between 7 - 12 weeks (SMD 1.7, (95% CI 0.43, 3), P = 0.009, I^2 = 93%), and between 2 - 6 weeks (SMD 1.4, (95% CI 0.5, 2.3), P = 0.002, I^2 = 89%) and > 13 weeks (SMD 0.09, (95% CI -0.17, 0.35), P = 0.5, I^2 = 0%). Cohen's thresholds were used to interpret the effect size which was not quantified with its significant or insignificant value. It is mostly concerned with type I error. Thus, Cohen (1988) gives the values for effect size as weak (0.02), moderate (0.15) and strong (0.35), respectively (24), according to which 1.7 for 7 - 12 weeks and 1.4 for 2 - 6 weeks show a strong effect and 0.09 for more than 13 weeks shows a weak effect. Table 2 and Figure 2-A show the details of the analysis.

Table 2. *Summary of meta-analysis*

Variable	Time of Follow-up	Number studies	Point estimate	Lower limit	Upper limit	P-value	Q-value	df	P-value	I-squared	Tau-squared	Egger-test
Overall BSHS	Total	9	1.2	0.58	1.8	0.0001	109.8	8	0.0001	92.7	0.8	0.0001
	>13 Weeks	2	0.09	-0.17	0.35	0.5	0.11	1	0.74	0	0.001	
	2-6 Weeks	4	1.4	0.5	2.3	0.002	29.9	3	0.001	89	0.75	
	7-12 Weeks	3	1.7	0.43	3	0.009	32.5	2	0.001	93	1.2	
Simple abilities	Total	8	1.08	0.29	1.8	0.007	133	7	0.0001	94.7	1.2	0.0001
	>13 Weeks	2	-0.12	-0.38	0.14	0.36	0.84	1	0.35	0	0	
	2-6 Weeks	4	0.8	0.15	1.6	0.036	25.6	3	0.001	88	0.55	
	7-12 Weeks	2	2.8	1.8	3.9	0.001	4.2	1	0.38	76	0.45	
Hand function	Total	6	2.5	1.4	3.5	0.0001	78.6	5	0.0001	93.6	1.6	0.0001
	2-6 Weeks	4	1.7	0.8	2.7	0.0001	29.4	3	0.001	89	0.82	
	7-12 Weeks	2	4	2.3	5.7	0.0001	6.9	1	0.008	85	1.25	
Affect	Total	8	2.35	1.2	3.48	0.0001	232	7	0.0001	96.9	2.4	0.001
	>13 Weeks	2	0.07	-0.2	0.4	0.65	1.6	1	0.21	38.8	0.02	
	2-6 Weeks	4	2.6	0.7	4.5	0.007	107	3	0.001	97.2	3.56	
	7-12 Weeks	2	4.7	-1.3	10.8	0.12	57.2	1	0.001	98.5	18.92	
Body image	Total	8	0.7	-0.12	1.5	0.09	148	7	0.0001	95.3	1.34	0.3
	>13 Weeks	2	0.09	-0.16	0.36	0.46	0.53	1	0.46	0	0	
	2-6 Weeks	4	0.18	-1.17	1.5	0.79	73	3	0.001	95	1.8	
	7-12 Weeks	2	2.36	1.33	3.4	0.001	5.08	1	0.02	80	0.47	
Personal relationships	Total	8	1.6	0.82	2.5	0.0001	144	7	0.0001	95	1.42	0.001
	>13 Weeks	2	0.2	-0.2	0.6	0.32	2.4	1	0.11	59.1	0.05	
	2-6 Weeks	4	1.6	0.6	2.6	0.001	33.7	3	0.001	91	0.9	
	7-12 Weeks	2	3.6	-0.8	8	0.11	47.3	1	0.001	97	10.1	
Sexuality	Total	6	1.7	0.75	2.8	0.001	88	5	0.0001	94	1.5	0.001
	2-6 Weeks	4	1.5	0.19	2.9	0.02	66	3	0.001	95	1.9	
	7-12 Weeks	2	2.1	0.6	3.6	0.005	11	1	0.001	90	1.1	
Heat sensitivity	Total	8	0.89	-0.32	2.1	0.14	274	7	0.0001	97	2.99	0.36
	>13 Weeks	2	-0.08	-0.4	0.25	0.63	1.66	1	0.19	39	0.02	
	2-6 Weeks	4	0.18	-2.16	2.5	0.87	161	3	0.001	98	5.6	
	7-12 Weeks	2	3.3	0.35	6.3	0.002	26	1	0.001	96	4.5	
Treatment regimen	Total	8	2.3	1.07	3.5	0.0001	257	7	0.0001	97	3	0.0001
	>13 Weeks	2	0.07	-0.1	0.3	0.6	0.2	1	0.6	0	0	
	2-6 Weeks	4	2.6	0.5	4.7	0.01	116	3	0.001	97	4.5	
	7-12 Weeks	2	4	2.2	5.7	0.001	7.5	1	0.006	86	1.3	
Work	Total	8	2.3	1.1	3.6	0.0001	261	7	0.0001	97	3.1	0.0001
	>13 Weeks	2	-0.04	-0.3	0.22	0.73	0.11	1	0.73	0	0	
	2-6 Weeks	4	3.2	0.98	5.4	0.005	112	3	0.001	97	4.9	
	7-12 Weeks	2	3.3	2.2	4.4	0.001	3.9	1	0.04	74	0.48	
Face and neck	2-6 Weeks	2	1.38	-0.8	3.5	0.21	27	1	0.0001	96	2.3	



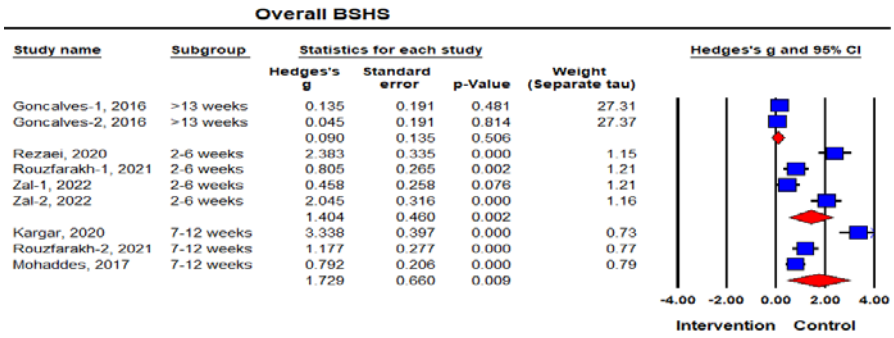


Figure 2-A. *Effect of digital health on the overall BSHS in burn victims*

Simple abilities

Subgroups analysis shows a significant effect of telemedicine, compared to normal care, on simple abilities domain in burn victims between 7 - 12 weeks (SMD 2.8, (95% CI 1.8, 3.9), P = 0.001, I^2 = 76%), and between 2 - 6 weeks (SMD 0.8, (95% CI 0.15, 1.6), P = 0.036, I^2 = 88%), according to which 2.8 for 7 - 12 weeks and 0.8 for 2 - 6 weeks show a strong effect (Table 2 and Figure 2-B).

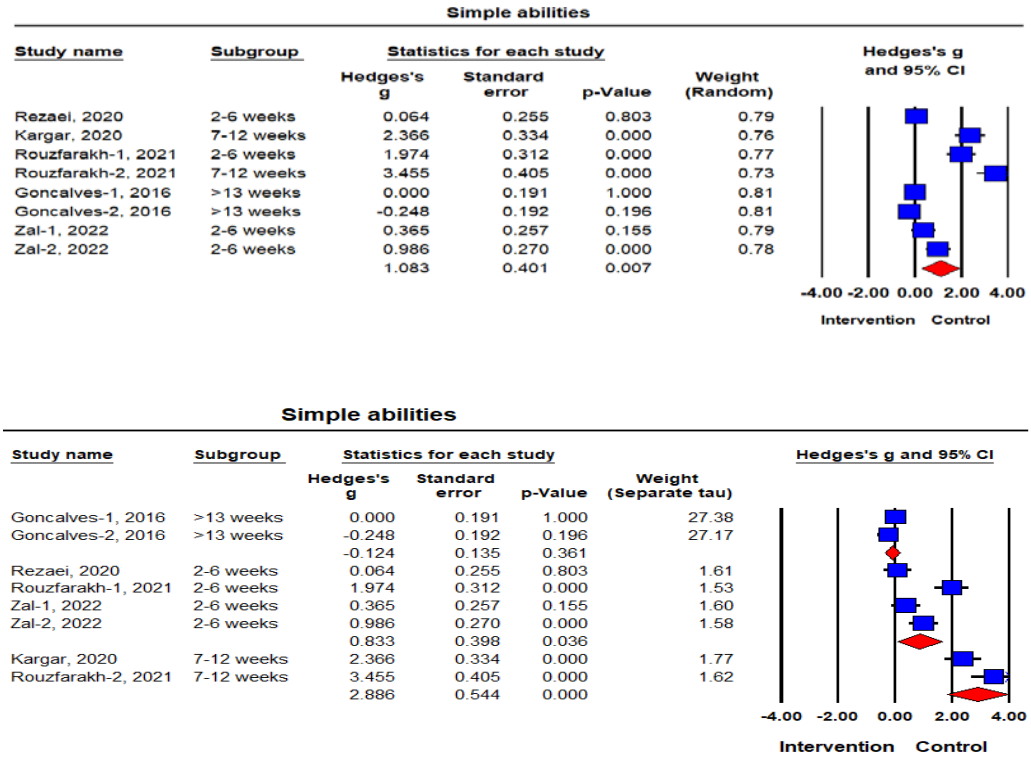


Figure 2-B. *Effect of telemedicine on simple abilities domain in burn victims*

Hand function

Subgroups analysis show a significant effect of telemedicine compared to normal care on hand function domain in burn victims between 7-12 weeks (SMD 4, (95% CI 2.3, 5.7), P = 0.0001, I^2 = 85%), and between 2 - 6 weeks (SMD 1.7, (95% CI 0.8, 2.7), P = 0.0001, I^2 = 89%), according to which 4 for 7 - 12 weeks and 1.7 for 2 - 6 weeks show a strong effect (Table 2 and Figure 2-C).

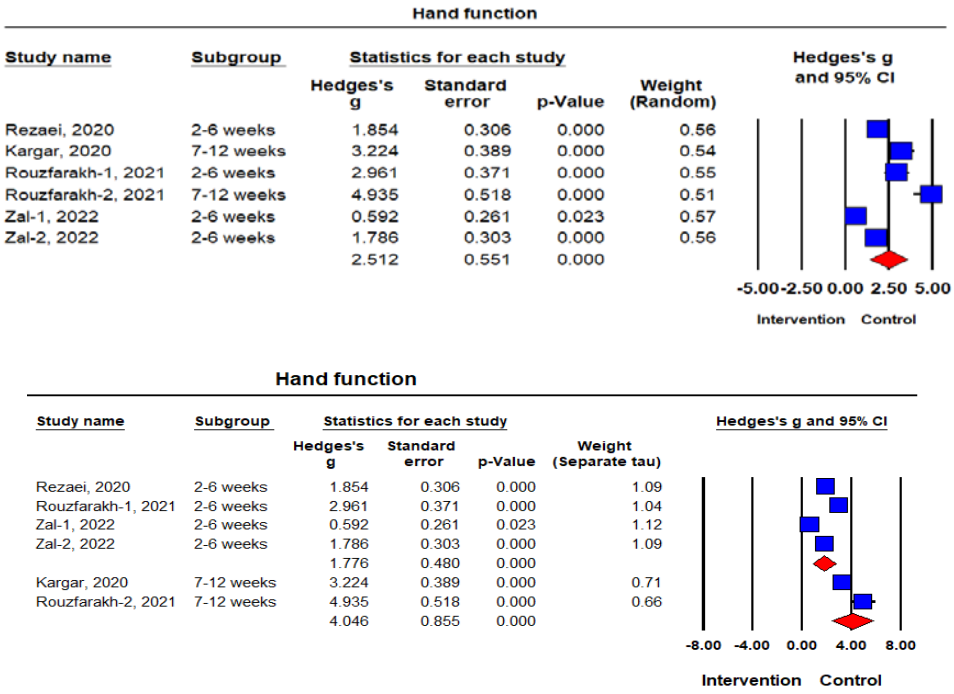
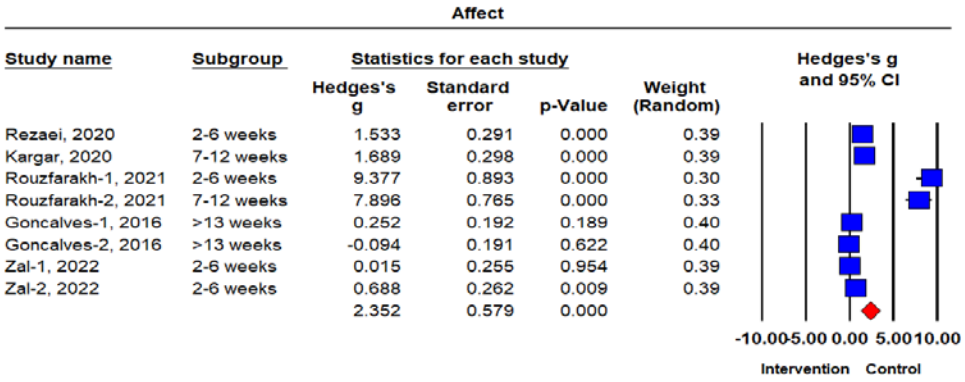


Figure 2-C. *Effect of telemedicine on hand function domain in burn victims*

Affect

Subgroups analysis shows a good effect of telemedicine compared to normal care on affect domain in burn victims between 7 - 12 weeks (SMD 4.7, (95% CI -1.3, 10.8), P = 0.12, I^2 = 98.5%), and between 2 - 6 weeks (SMD 2.6, (95% CI 0.7, 4.5), P = 0.007, I^2 = 97.2%) and > 13 weeks (SMD 0.07, (95% CI -0.2, 0.4), P = 0.65, I^2 = 38.8%), according to which 4.7 for 7 - 12 weeks and 2.6 for 2 - 6 weeks show a strong effect, while 0.07 for more than 13 weeks shows a weak effect (Table 2 and Figure 2-D).



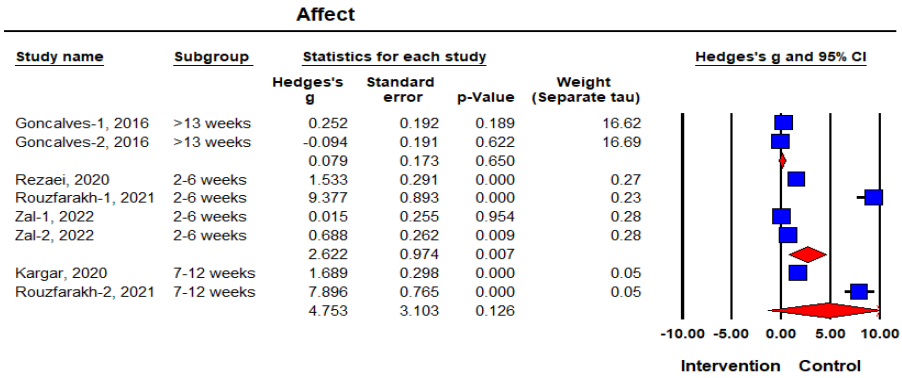


Figure 2-D. *Effect of telemedicine on hand affect domain in burn victims*

Body image

Subgroups analysis shows a significant effect of telemedicine, compared to normal care, on body image domain in burn victims between 7 - 12 weeks (SMD 2.36, (95% CI 1.33, 3.4), P = 0.001, I^2 = 80%), and not a significant effect between 2 - 6 weeks (SMD 0.18, (95% CI -1.17, 1.5), P = 0.79, I^2 = 95%) and > 13 weeks (SMD 0.09, (95% CI -0.16, 0.36), P = 0.46, I^2 = 0%), in case of which 2.36 for 7 - 12 weeks, 0.18 for 2 - 6 weeks, and 0.09 for more than 13 weeks show a strong, moderate and weak effect, respectively (Table 2 and Figure 2-E).

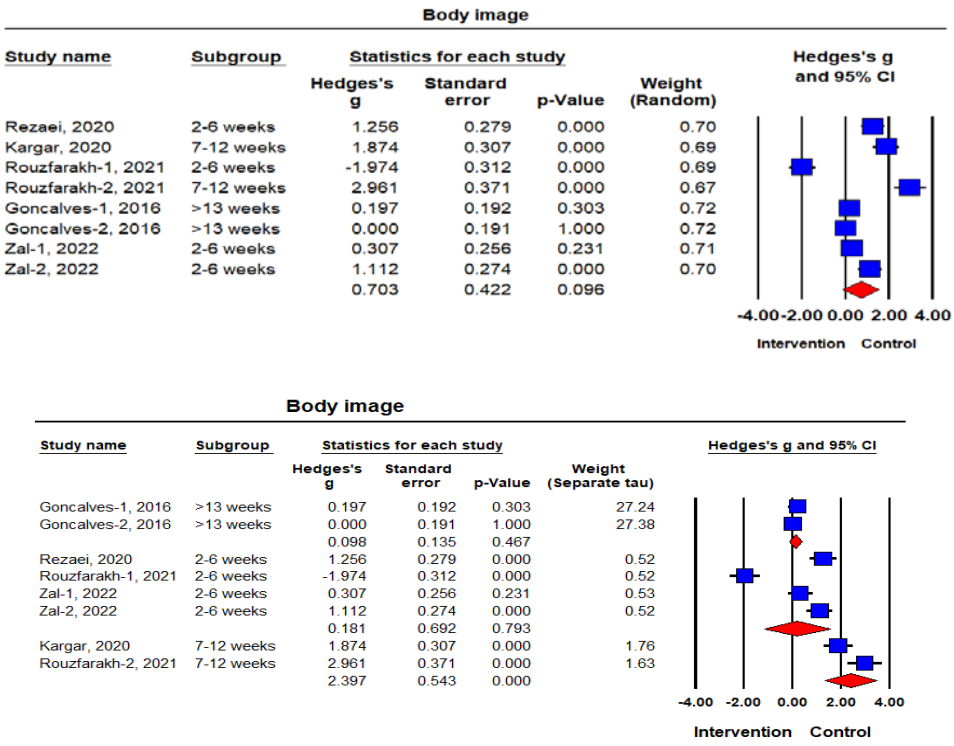


Figure 2-E. . *Effect of telemedicine on body image domain in burn victims*

Personal relationships

Subgroups analysis shows a good effect of telemedicine, compared to normal care, on personal relationship domain in burn victims between 7 - 12 weeks (SMD 3.6, (95% CI -0.8, 8), P = 0.11, I^2 = 97%), and between 2 - 6 weeks (SMD 1.6, (95% CI 0.6, 2.6), P = 0.001, I^2 = 91%) and > 13 weeks (SMD 0.02, (95% CI -0.2, 0.6), P = 0.32, I^2 = 59.1%), according to which 3.6 for 7 - 12 weeks and 1.6 for 2 - 6 weeks show a strong effect, whereas 0.02 for more than 13 weeks shows a weak effect (Table 2 and Figure 2-F).

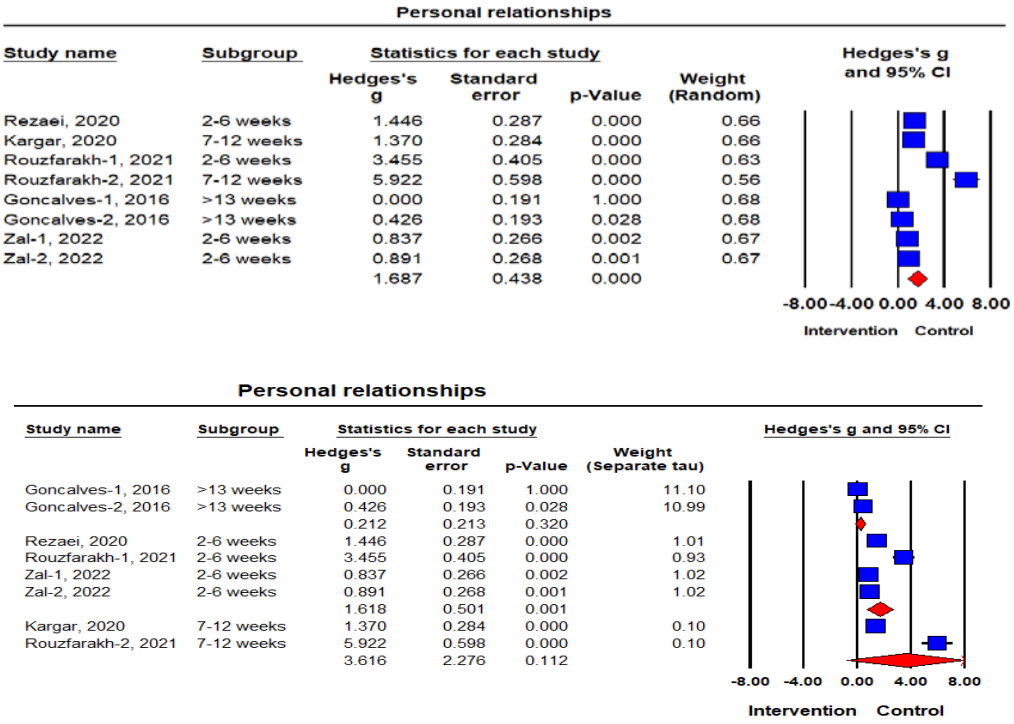
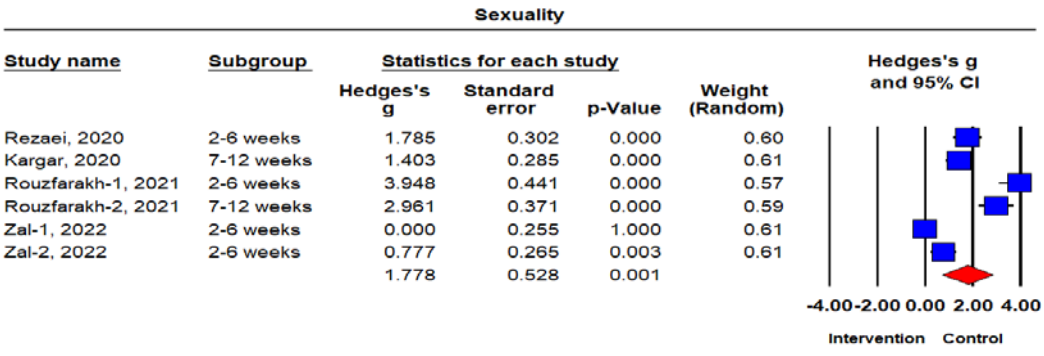


Figure 2-F. *Effect of telemedicine on personal relationship domain in burn victims*

Sexuality

Subgroups analysis shows a significant effect of telemedicine, compared to normal care, on sexuality domain in burn victims between 7 - 12 weeks (SMD 2.1, (95% CI 0.6, 3.6), P = 0.005, I^2 = 90%), and between 2-6 weeks (SMD 1.5, (95% CI 0.19, 2.9), P = 0.02, I^2 = 95%), in case of which 2.1 for 7 - 12 weeks and 1.5 for 2 - 6 weeks show a strong effect (Table 2 and Figure 2-G).



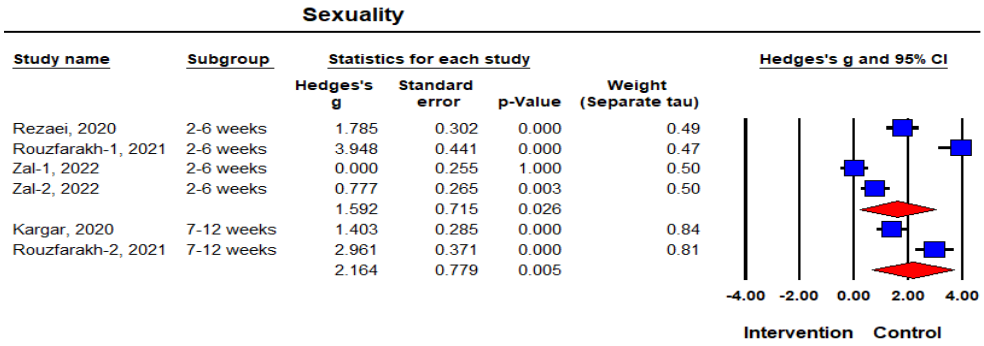


Figure 2-G. *Effect of telemedicine on sexuality domain in burn victims*

Heat sensitivity

Subgroups analysis shows a significant effect of telemedicine, compared to normal care, on heat sensitivity domain in burn victims between 7-12 weeks (SMD 3.3, (95% CI 0.35, 6.3), P = 0.002, I^2 = 96%), and not a significant effect between 2 - 6 weeks (SMD 0.18, (95% CI -2.16, 2.5), P = 0.87, I^2 = 98%). In line with that, 3.3 for 7 - 12 weeks and 0.18 for 2 - 6 weeks show strong and moderate effect, respectively (Table 2 and Figure 2-H).

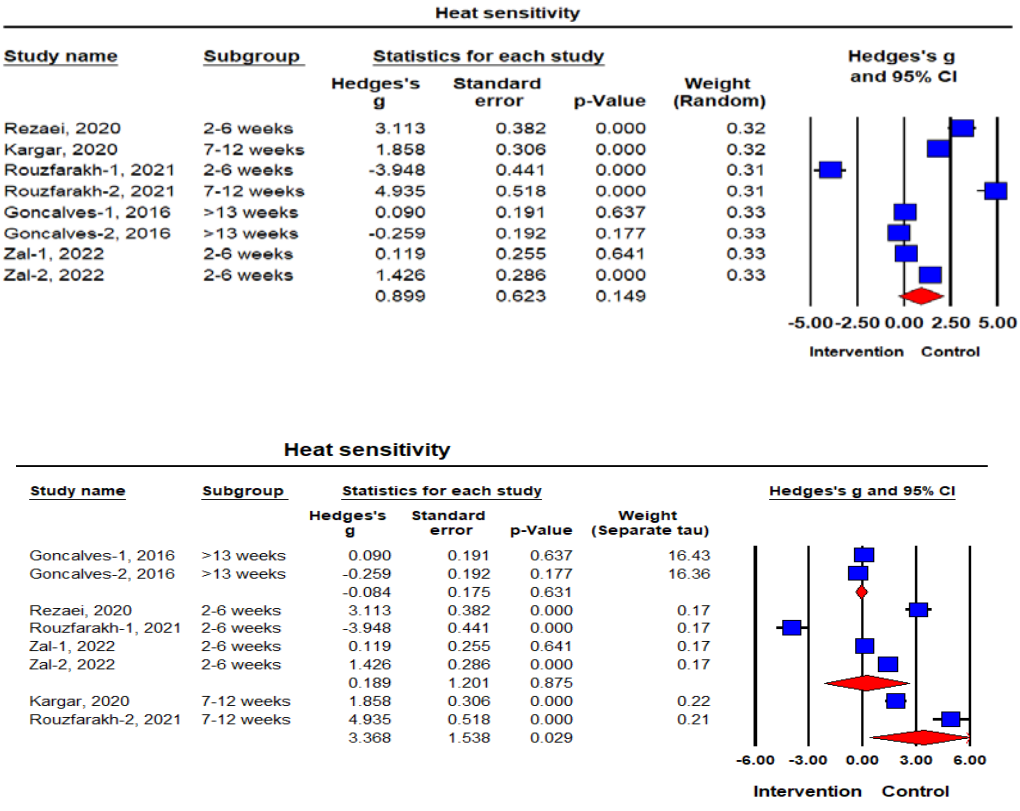


Figure 2-H. *Effect of telemedicine on heat sensitivity domain in burn victims*

Treatment regimen

Subgroups analysis shows a good effect of telemedicine compared to normal care on treatment regimen domain in burn victims between 7-12 weeks (SMD 4, (95% CI 2.2, 5.7), P = 0.001, I^2 = 86%), and between 2 - 6 weeks (SMD 2.6, (95% CI 0.5, 4.7), P = 0.01, I^2 = 97%) and > 13 weeks (SMD 0.07, (95% CI -0.1, 0.3), P = 0.6, I^2 = 0%), according to which 4 for 7 - 12 weeks and 2.6 for 2 - 6 weeks show a strong effect, while 0.07 for more than 13 weeks shows a weak effect (Table 2 and Figure 2-I).

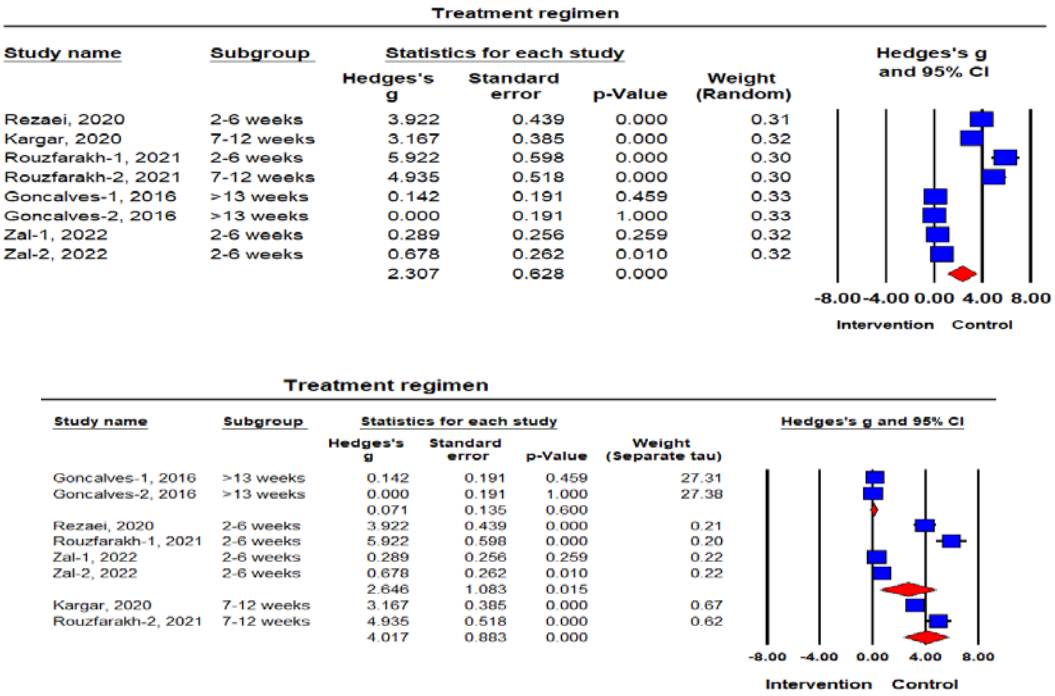
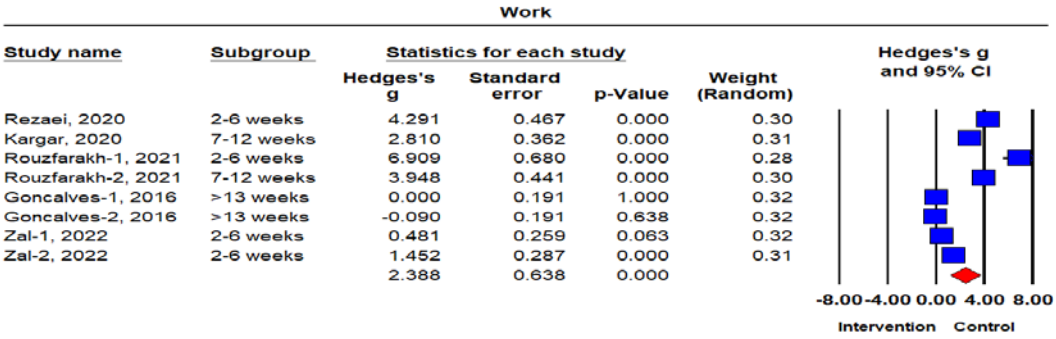


Figure 2-I. *Effect of telemedicine on treatment regimen domain in burn victims*

Work

Subgroups analysis shows a significant effect of telemedicine, compared to normal care, on work domain in burn victims between 7 - 12 weeks (SMD 3.3, (95% CI 2.2, 4.4), P = 0.001, I^2 = 74%), and between 2 - 6 weeks (SMD 3.2, (95% CI 0.98, 5.4), P = 0.005, I^2 = 97%) and > 13 weeks (SMD -0.04, (95% CI -0.3, 0.22), P = 0.73, I^2 = 0%). In line with that, 3.3 for 7 - 12 weeks and 3.2 for 2 - 6 weeks show a strong effect, while 0.04 for more than 13 weeks shows a weak effect (Table 2 and Figure 2-J).



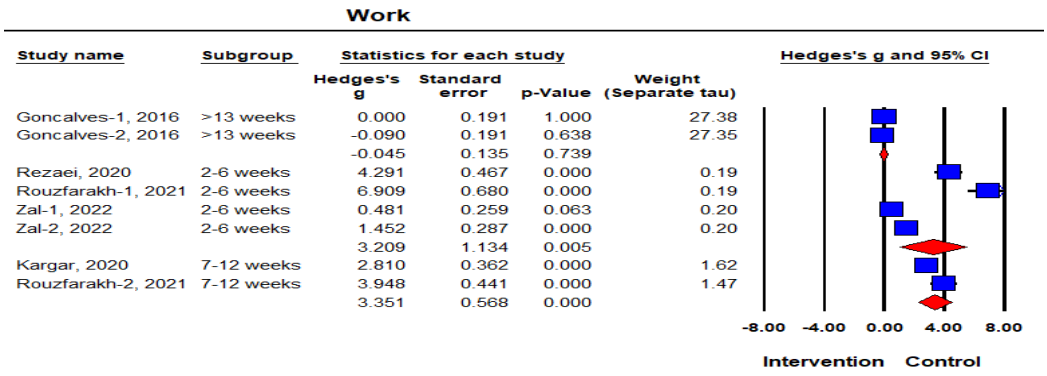


Figure 2-J. *Effect of telemedicine on work domain in burn victims*

Face and neck

Analysis does not show a significant effect of telemedicine compared to normal care on face and neck domain in burn victims between 2 - 6 weeks (SMD 1.38, (95% CI -0.8, 3.5), P = 0.21, I^2 = 96%), according to which 1.38 for 2 - 6 weeks shows a strong effect (Table 2 and Figure 2-K).

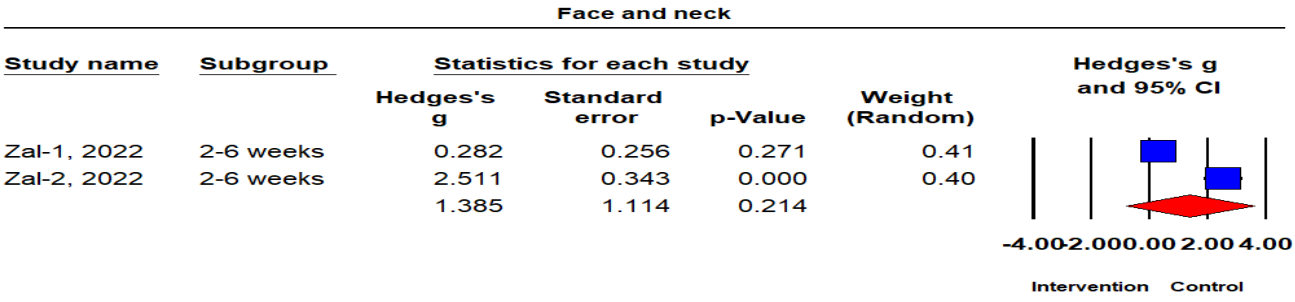


Figure 2-J. *Effect of telemedicine on work domain in burn victims*

Publication bias assessment

Publication bias was examined with Egger test (Table 2). In addition, Figure 3 shows graphic funnel plots for the overall QOL and domain.

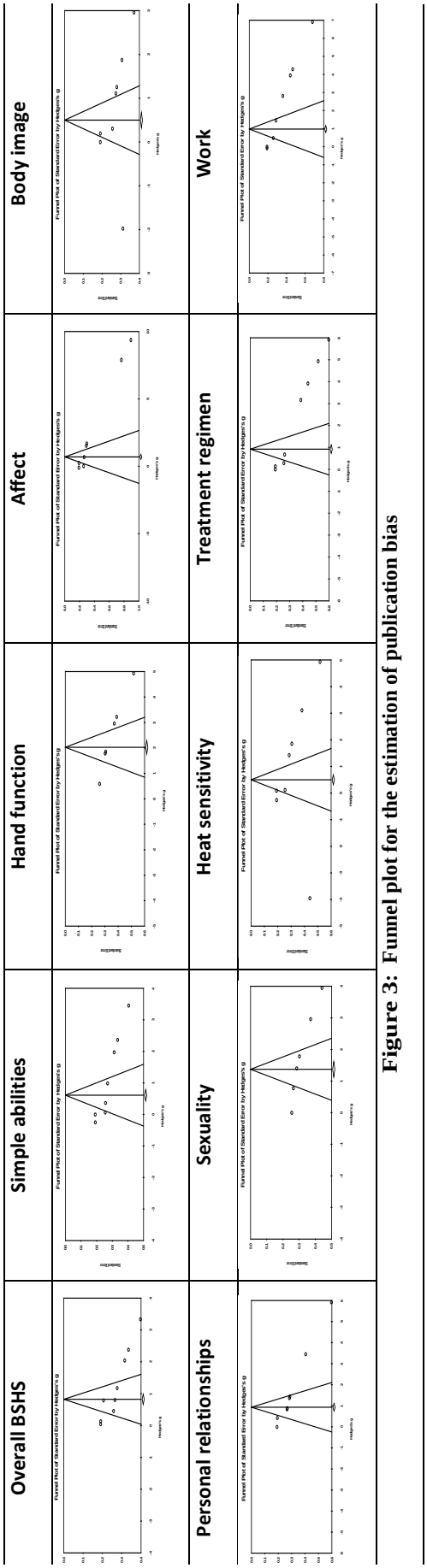


Figure 3: Funnel plot for the estimation of publication bias

DISCUSSION

The present systematic review with meta-analysis was conducted to investigate the effect of self-care training programs based on digital health on the quality of life of burn patients, and the results of six final studies showed that the use of digital health significantly improves the quality of life in burn patients. Due to the high heterogeneity, the subgroup analysis was performed based on the duration of the intervention. The results indicated that employing digital health approaches in the period of two to twelve weeks improves the quality of life of patients.

Employing technologies based on digital health in burn patients is one of the areas that have received attention from health care providers (25, 26). In recent years, due to the limited number of specialized burn centers, the lack of sufficient medical experience to deal with this critical condition among doctors and nurses, and considering the importance of caring for the burn patient in the first 24 to 48 hours after the injury, telemedicine and other approaches based on technology have been applied in the evaluation process, initial diagnosis, triage, decision-making regarding the transfer of patients, and facilitating the care of burn patients (27). VR technology, for example, has been used to improve job performance, increase joint ROM, reduce anxiety and pain intensity, as well as to increase the attractiveness of rehabilitation programs (28). In addition, employing other similar technologies has resulted in improving the quality of life of burn victims and access to health care and compliance with treatment, solving many rehabilitation challenges (such as high cost, the necessity of commuting, and time limitations (29).

The positive impact of using digital health is evident primarily to provide more effective interventions, especially through improvements in health-related behaviors. The results of several systematic review studies have shown that digital health technologies have been applied to improve nutritional behaviors (30), stress monitoring and management (31), and self-care in hypertensive patients (32). The impact of using such technologies (such as telephones, instructional CDs, mobile applications, and social networks) on various aspects of the quality of life has also been measured in various studies. The use of telenursing (using telephone calls to provide instructional content and answer patients' questions) in the study by Rezaei et al. improved the quality of life in all aspects compared to the control group (33). These phone calls were made two times a week with an average of 20 minutes per call for four weeks. According to the positive results of this study, the authors believe that telenursing can be applied as a way to improve the quality of life of burn patients. However, the results of the Gonçalves (34) study, which was conducted to compare the quality of life in two groups of burn patients who received self-care information through a routine method and a training program reinforced by telephone, are contrary to the results of the study by Rezaei et al. (33). In the aforementioned study, despite the reduction of anxiety and stress symptoms after the accident in the intervention group, no significant difference was observed in the quality of life score of 6 months after the follow-up between the two groups (34). Such a result may be due to the lack of technology's role (use of booklets, PowerPoint files, and phone calls to strengthen the provided training) in training and long intervals between phone calls (every 4 - 6 weeks).

The positive results of using multimedia self-care training programs and their impact on the quality of life of burn patients was reported in the study by Mohaddes Ardebili (35). In this study, patients in the intervention group were provided with self-care training programs on CDs for six months. The evaluation was done using the hidden growth curve model, and it indicated an increasing trend in the average quality of life score in all dimensions in the intervention group compared to the control group.

The use of cell phone-based approaches such as self-care mobile applications for hand burn patients has also been able to improve their quality of life, so that in two months (eight weeks) after using the mobile application of burn self-care, the mean and standard deviation of the total quality of life score of burn patients in the intervention group improved from 80.4 ± 17.9 to 182.5 ± 15.6 (statistically significant), and this increase was significant in all dimensions of quality of life (36). The use of AR coupled pamphlet of Pattern Recognition type in patients with face and neck burns significantly improved hand function two weeks after the intervention. However, six weeks after the intervention, a significant increase in the average score of all dimensions of quality of life was observed in the intervention group (37). The use of social networks

and messaging applications such as WhatsApp has also been investigated in the rehabilitation of burn patients and its impact on the quality of life of these victims. Roozfarakh et al.'s study in this area indicates an increase in the average score of all dimensions of the quality of life of burn patients in the time interval of one month and three months after the intervention in the group using WhatsApp messenger (38). The methods based on digital technologies, such as the telephone or the internet, are more accessible and probably more affordable especially compared to face-to-face methods of providing services (39). Most importantly, these innovative technologies allow patients to take a more active role in self-care (40).

This study has some limitations. The most important limitation of the present study was a small number of final studies in the meta-analysis, which limits the possibility of relying on the results of the subgroup analysis, and more research in this field is required. Due to a small number of pieces of evidences, it was not possible to separate the types of TM methods; therefore, future studies may identify and compare the results of each type of TM separately, so that it will be possible to make appropriate decision-making about using the best method of eburn patients.

CONCLUSION

According to the presented results, it seems that new technologies have brought benefits including a positive impact on the quality of life score of burn victims. However, it seems that despite the increasing popularity of products based on new technologies, we should apply these methods only to fill the gaps in the health care systems, and they should not be considered a complete replacement for the current care methods.

Conflict of interest

The authors declare no conflicts of interest.

Funding/Support

No funding

Acknowledgment

None

References

1. Dehghani M, Hakimi H, Mousazadeh S, et al. The Relationship between Pain and Anxiety throughout dressing among burn patients. J Holist Nurs Midwifery 2014; 24(4):30-7.

2. Mehrabi A, Falakdami A, Mollaei A, et al. A systematic review of self-esteem and related factors among burns patients. Ann Med Surg (Lond) 2022; 84:104811. https://doi.org/10.1016/j.amsu.2022.104811

3. Yakupu A, Zhang J, Dong W, et al. The epidemiological characteristic and trends of burns globally. BMC Public Health 2022; 22(1):1596. https://doi.org/10.1186/s12889-022-13887-2

4. Smolle C, Cambiaso-Daniel J, Forbes AA, et al. Recent trends in burn epidemiology worldwide: A systematic review. Burns 2017; 43(2):249-257. https://doi.org/10.1016/j.burns.2016.08.013

5. Smolle C, Hutter MF, Kamolz LP. Life after Burn, Part II: Substance Abuse, Relationship and Living Situation of Burn Survivors. Medicina (Kaunas) 2022; 58(5):563. https://doi.org/10.3390/medicina58050563

6. Hodgman EI, Subramanian M, Arnoldo BD, et al. Future Therapies in Burn Resuscitation. Crit Care Clin 2016; 32(4):611-9. https://doi.org/10.1016/j.ccc.2016.06.009

7. Schouten H, Nieuwenhuis M, Van Zuijlen P. A review on static splinting therapy to prevent burn scar contracture: do clinical and experimental data warrant its clinical application? Burns 2012; 38(1):19-25. https://doi.org/10.1016/j.burns.2011.06.003

8. Garcia LP, Huang A, Corlew DS, et al. Factors Affecting Burn Contracture Outcome in Developing Countries: A Review of 2506 Patients. Ann Plast Surg 2016; 77(3):290-6. https://doi.org/10.1097/SAP.0000000000000856

9. Richard R, Santos-Lozada AR, Dewey WS, Chung KK. Profile of Patients Without Burn Scar Contracture Development. J Burn Care Res 2017; 38(1):e62-e69. https://doi.org/10.1097/SAP.0000000000000856

10. Finlay V, Davidoss N, Lei C, et al. Development and evaluation of a DVD for the education of burn patients who were not admitted to hospital. J Burn Care Res 2012; 33(2):70-8. https://doi.org/10.1097/BCR.0b013e318239d555

11. Litchfield I, Jones LL, Moiemen N, et al. The role of self-management in burns aftercare: a qualitative research study. Burns 2019; 45(4):825-34. https://doi.org/10.1016/j.burns.2018.10.020

12. Zolfagharzadeh H, Esfandiari M, Taheri Otaghsara SM, et al. How to manage ongoing post-discharge challenges of burn survivors. Burns 2023; 49(5):1229-30. https://doi.org/10.1016/j.burns.2023.01.004

13. Kennedy A, Rogers A, Bower P. Support for self care for patients with chronic disease. Med J Cairo Univ 2007; 335(7627):968-70. https://doi.org/10.1136/bmj.39372.540903.94

14. Boulos MN, Wheeler S, Tavares C, Jones R. How smartphones are changing the face of mobile and participatory healthcare: an overview, with example from eCAALYX. Biomed Eng Online 2011; 10:24. https://doi.org/10.1186/1475-925X-10-24

15. Zahmatkeshan M, Safdari R. M-health Technology, New evolution in health promotion. Hospital 2015; 1(7).

16. Karkhah S, Javadi-Pashaki N, Farhadi Farouji A, et al. Artificial intelligence: Challenges & opportunities for the nursing profession. J Clin Nurs 2023; 32(13-14):4197-8. https://doi.org/10.1111/jocn.16455

17. Dewsbury G. Use of information and communication technology in nursing services. Br J Community Nurs 2019; 24(12):604-7. https://doi.org/10.12968/bjcn.2019.24.12.604

18. Awad A, Trenfield SJ, Pollard TD, et al. Connected healthcare: Improving patient care using digital health technologies. Adv Drug Deliv Rev 2021; 178:113958. https://doi.org/10.1016/j.addr.2021.113958

19. Wannheden C, Åberg-Wennerholm M, Dahlberg M, et al. Digital Health Technologies Enabling Partnerships in Chronic Care Management: Scoping Review. J Med Internet Res 2022; 24(8):e38980. https://doi.org/10.2196/38980

20. Han M, Lee E. Effectiveness of Mobile Health Application Use to Improve Health Behavior Changes: A Systematic Review of Randomized Controlled Trials. Healthc Inform Res 2018; 24(3):207-26. https://doi.org/10.4258/hir.2018.24.3.207

21. Wantland DJ, Portillo CJ, Holzemer WL, et al. The effectiveness of Web-based vs. non-Web-based interventions: a meta-analysis of behavioral change outcomes. J Med Internet Res 2004; 6(4):e40. https://doi.org/10.2196/jmir.6.4.e40

22. Biswas M, Tania MH, Kaiser MS, et al. ACCU3RATE: A mobile health application rating scale based on user reviews. PLoS One 2021; 16(12):e0258050. https://doi.org/10.1371/journal.pone.0258050

23. Patel B, Edwards T, Schrire T, et al. Is the Quality of Mobile Health Applications for Burns Being Adequately Assessed? J Burn Care Res 2022; 43(4):814-26. https://doi.org/10.1093/jbcr/irab197

24. Ialongo C. Understanding the effect size and its measures. Biochem Med (Zagreb) 2016; 26(2):150-63. https://doi.org/10.11613/BM.2016.015

25. Juengst SB, Osborne CL, Holavanahalli R, et al. Feasibility Study of Problem-Solving Training for Care Partners of Adults With Traumatic Brain Injury, Spinal Cord Injury, Burn Injury, or Stroke During the Inpatient Hospital Stay. Arch Rehabil Res Clin Transl 2019; 1(3-4):100009. https://doi.org/10.1016/j.arrct.2019.100009

26. Mamashli L, Mohaddes Ardebili F, Najafi Ghezeljeh T, et al. Investigating the Psychosocial Empowerment Interventions through Multimedia Education in Burn Patients. World J Plast Surg 2019; 8(3):372-81. https://doi.org/10.29252/wjps.8.3.372

27. Hoseini F, Ayatollahi H, Salehi SH. Systematized review of telemedicine applications in treating burn patients. Med J Islam Repub Iran 2016; 30:459.

28. Lan X, Tan Z, Zhou T, et al. Use of Virtual Reality in Burn Rehabilitation: A Systematic Review and Meta-analysis. Arch Phys Med Rehabil 2023; 104(3):502-13. https://doi.org/10.1016/j.apmr.2022.08.005

29. Basha MA, Aboelnour NH, Aly SM, Kamel FAH. Impact of Kinect-based virtual reality training on physical fitness and quality of life in severely burned children: A monocentric randomized controlled trial. Ann Phys Rehabil Med 2022; 65(1):101471. https://doi.org/10.1016/j.rehab.2020.101471

30. Howarth A, Quesada J, Silva J, et al. The impact of digital health interventions on health-related outcomes in the workplace: A systematic review. Digit Health 2018; 4:2055207618770861. https://doi.org/10.1177/2055207618770861

31. Schell E, Theorell T, Hasson D, et al. Impact of a web-based stress management and health promotion program on neck-shoulder-back pain in knowledge workers? 12 month prospective controlled follow-up. J Occup Environ Med 2008; 50(6):667-76. https://doi.org/10.1097/JOM.0b013e3181757a0c

32. Watson AJ, Singh K, Myint-U K, et al. Evaluating a web-based self-management program for employees with hypertension and prehypertension: a randomized clinical trial. Am Heart J 2012; 164(4):625-31. https://doi.org/10.1016/j.ahj.2012.06.013

33. Rezaei M, Jalali R, Heydarikhayat N, Salari N. Effect of Telenursing and Face-to-Face Training Techniques on Quality of Life in Burn Patients: A Clinical Trial. Arch Phys Med Rehabil 2020; 101(4):667-73. https://doi.org/10.1016/j.apmr.2019.10.197

34. Gonçalves N, Ciol MA, Dantas RA, et al. A randomized controlled trial of an educational programme with telephone reinforcement to improve perceived health status of Brazilian burn victims at 6-month post discharge. J Adv Nurs 2016; 72(10):2508-23. https://doi.org/10.1111/jan.13003

35. Mohaddes Ardebili F, Najafi Ghezeljeh T, Bozorgnejad M, et al. Effect of Multimedia Self-Care Education on Quality of Life in Burn Patients. World J Plast Surg 2017; 6(3):292-7.

36. Kargar N, Deldar K, Ahmadabadi A, et al. Can a Self-care Educational Mobile Application Improve the Quality of Life of Victims With Hand Burns? A Randomized Controlled Trial. Crescent J Med Biol Sci 2020; 7(4):497-502.

37. Zal M, Deldar K, Froutan R, et al. Rehabilitation of Burn Victims: Improving Quality of Life in Victims With Face and Neck Burn Through an Augmented Reality Coupled Pamphlet. J Burn Care Res 2023; 44(2):311-9. https://doi.org/10.1093/jbcr/irac070

38. Rouzfarakh M, Deldar K, Froutan R, et al. The effect of rehabilitation education through social media on the quality of life in burn patients: a randomized, controlled, clinical trial. BMC Med Inform Decis Mak 2021; 21(1):70. https://doi.org/10.1186/s12911-021-01421-0

39. Reeder B, Chung J, Stevens-Lapsley J. Current Telerehabilitation Research With Older Adults at Home: An Integrative Review. J Gerontol Nurs 2016; 42(10):15-20. https://doi.org/10.3928/00989134-20160201-02

40. Mair F, Whitten P. Systematic review of studies of patient satisfaction with telemedicine. BMJ 2000; 320(7248):1517-20. https://doi.org/10.1136/bmj.320.7248.1517

Article info
Received: August 2, 2023
Revised: October 26, 2023
Accepted: November 6, 2023
Online first: December 20, 2023

Efekti koje program obuke o brizi o sebi baziran na upotrebi digitalnih tehnologija ima na kvalitet života bolesnika sa opekotinama: sistematični pregled i metaanaliza

Kolsoum Deldar[1], Farnoosh Khodabandelool[2], Mahdieh Arian[3,5], Seyed Javad Hosseini[4], Razieh Froutan[3,5]

[1]*Departman za informacione tehnologije, Fakultet udruženih medicinskih nauka, Univerzitet medicinskih nauka Shahroud, Shahroud, Iran*
[2]*Medicinski fakultet, Univerzitet medicinskih nauka u Mašhadu, Mašhad, Iran*
[3]*Istraživački centar za negu u sestrinstvu i akušerstvu, Univerzitet medicinskih nauka u Mašhadu, Mašhad, Iran*
[4]*Departman za sestrinstvo u pedijatriji, Fakultet za sestrinstvo i akušerstvo, Univerzitet medicinskih nauka u Mašhadu, Mašhad, Iran*
[5]*Departman za medicinsko-hirurško sestrinstvo, Fakultet za sestrinstvo i akušerstvo, Univerzitet medicinskih nauka u Mašhadu, Mašhad, Iran*

SAŽETAK

Uvod/cilj. Cilj ove sistematične studije i metaanalize bio je proceniti uticaj koji program obuke o brizi o sebi baziran na upotrebi digitalnih tehnologija za dobijanje informacija o zdravlju ima na kvalitet života bolesnika sa opekotinama.

Metode. Dva istraživača su, nezavisno jedan od drugog, pretraživala elektronske baze poput *Science Direct, Medline/PubMed, Web of Science, Scopus, ProQuest, Google Scholar* i *Cochrane library*. Sprovedena je metaanaliza modela nasumičnih efekata kako bi se izračunao uticaj veličine efekta, standardizovane srednje razlike (engl. SMD) na kvalitet života povezan sa zdravljem (engl. HRQOL) što je bio primarni cilj studije. Urađeni su dijagrami levka da bi se procenila pristrasnost publikovanja, dok je I^2 indeks primenjen za procenu heterogenosti. U skladu sa tim, urađena je analiza podgrupa. Od ukupno 105 studija, u finalnu metaanalizu ušlo je šest studija.

Rezultati. Rezultati su ukazali na značajan efekat koji upotreba digitalnih tehnologija za dobijanje informacija o zdravlju, u poređenju sa uobičajenom negom, ima na ukupan kvalitet života (engl. QOL) kod bolesnika sa opekotinama (SMD 1,2, (95% CI 0,58, 1,8); P = 0,0001, I^2 = 92%). I^2 indeks ukazuje na visok nivo heterogenosti, sa vrednošću od 92%. Analiza podgrupa ukazuje na značajan efekat koji telemedicina, u poređenju sa normalnom negom, ima na ukupan kvalitet života kod bolesnika sa opekotinama između 7. i 12. nedelje (SMD 1,7 (95% CI 0,43, 3); P = 0,009, I^2 = 93%), između 2. i 6. nedelje (SMD 1,4 (95% CI 0,5, 2,3); P = 0,002, I^2 = 89%) i nakon 13. nedelje (SMD 0,09 (95% CI -0,17, 0,35); P = 0,5, I^2 = 0%).

Zaključak. Prema prikazanim rezultatima, stiče se utisak da su digitalne tehnologije donele benefite bolesnicima sa opekotinama, uključujući i pozitivan uticaj na skor o kvalitetu života.

Ključne reči: **rehabilitacija, upotreba digitalnih tehnologija za dobijanje informacija o zdravlju, bolesnici sa opekotinama, briga o sebi, program edukacije**