

Are Exercise Interventions Effective in Promoting Recovery of Adults in the Burn ICU?

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Description of CAT Portfolio

The final portfolio contains four research articles from both national and international journals. Study designs include one systematic review and meta-analyses, one retrospective cohort study, and two randomized controlled trials. All studies relate directly to components of the evidence-based practice question and will be used as evidence for implementing exercise interventions for adults with burn injuries in the ICU.

All four of the articles were level I-III studies. Two of the articles were reviewed by one student each, with the remaining two reviewed by two students. Two of the articles looked at effectiveness of resistance training as an early intervention. One of the remaining articles looked at mobility training and the last looked at early physiotherapy as an exercise intervention for burn patients in the ICU. Quality forms from Law & MacDermid (2014), were used for each individual article to determine the quality score. The biases and limitations of all the articles were identified and explained. Factors that could influence the efficacy of studies were identified as well.

CRITICALLY APPRAISED TOPIC

Evidence-Based Practice Question

Are exercise interventions effective in promoting recovery of adults in the burn ICU?

Clinical Scenario

In the burn ICU at Regional One Health the occupational therapy department is interested in examining the effect of exercise as an intervention in promoting recovery for adults in the early burn rehabilitation phase. Our mentor believes that in this phase there may be a connection between muscle fatigue from exercise and overall improvement in recovery, LOS, mobility, and sleep.

Search Methodology and Terms

PICO Question Categories	Search Terms Used
Population	Burn, burn ICU, burn injury
Intervention	Exercise, early rehabilitation, occupational therapy, physical exercise
Comparison	n/a
Outcomes	n/a

Databases and Sources Searched	Search Terms	Limits Used
OVID MEDLINE, CINAHL, Science Direct, PubMed, EMBASE, SCOPUS, Google Scholar	(burn* AND exercise), (physical exercise AND burns), (burn AND exercise), (burns AND occupational therapy), (exercise AND burn ICU), (exercise AND burn injury), ("burn injury" AND exercise)	<ul style="list-style-type: none"> ● Dates 2011-2021 ● Subject: Major Heading: burns, burn patient ● Meta-Analysis, Randomized Controlled Trial, Systematic Review

Inclusion Criteria for Articles:

- Burn injury, ages 13 and older, ICU or acute setting, published in English, Levels I-III studies

Exclusion Criteria for Articles:

- Level V studies, publications prior to 2010, and outpatient settings

Review Process

- In Zoom meetings with our practitioner-mentor we developed a PICO question that the mentor thought would be beneficial to her setting.
- We decided to broaden the search criteria and do an extensive search which included several databases both within and outside the UTHSC library resources. These decisions were made based upon our meetings with our mentor, course professor and the UTHSC research and learning services librarian.
- We first analyzed the titles and abstracts of the articles generated from our searches to determine if they were relevant to our PICO question. Once we determined the title and abstracts were relevant, we then further analyzed the individual articles to verify that our inclusion and exclusion criteria were met.
- As a team and with the guidance of our professor, we agreed which articles were applicable to our PICO question and criteria. We then critically appraised the articles and extracted relevant data using a standardized evaluation of study design to yield a total quality score (QS) (Law & MacDermid, 2014). Two of the four studies were individually appraised by two students each. The CAPs were reviewed by our EBP professor. We then summarized the findings of the CAPs

into a comprehensive appraisal of the topic, which was then peer reviewed, before we developed the final CAT.

Search Results by Level of Evidence		
Level of Evidence	Study Design	Number of Articles Included
I	Systematic Review and Meta-analyses	1
II	Randomized Controlled Trial (2)	2
	Retrospective Cohort Study	1

TOTAL ARTICLES REVIEWED: 4

Main Findings	
Level I	Gittings et al. (2018) (QS: 94%) <ul style="list-style-type: none"> ● Muscle strength: Significant effect favored resistance training in adult burn patients ● Quality of life: Significant effect noted for the psychological domain of the (BSHS-A)
Level II	Gittings et al. (2021) (QS: 88%) & Deng et al. (2016) (QS: 88%) <ul style="list-style-type: none"> ● Resistance training (Gittings et al., 2021) and mobility training (Deng et al., 2016) are feasible interventions in the burn ICU. Resistance training group (Gittings, et al. 2021) demonstrated greater UE recovery compared to control group. Deng et al. (2016) (QS: 88%) & Çınar et al (2019) (QS: 86%) <ul style="list-style-type: none"> ● Mobility training and walking shortened the length of stay (Deng et al., 2016), improved ROM (Deng et al., 2016), and reduced the effects of chronic inflammation (Çınar et al., 2019.)

Limitations	
Level I	Gittings et al. (2018) (QS: 94%) <ul style="list-style-type: none"> ● Presence of bias: selection, performance, detection, attrition and reporting bias ● Small sample sizes
Level II	Gittings et al. (2021) (QS: 88%) <ul style="list-style-type: none"> ● Closed earlier than anticipated ● Number of subjects enrolled did not meet the pre-planned recruitment target ● Presence of bias: detection, attrition, performance Deng et al. (2016) (QS: 88%) <ul style="list-style-type: none"> ● Exclusion criteria excludes pulmonary infection, pulmonary function, muscle strength, psychological status and functioning ● ROM and ADL data not included from case records Çınar et al (2019) (QS: 86%) <ul style="list-style-type: none"> ● Small sample size

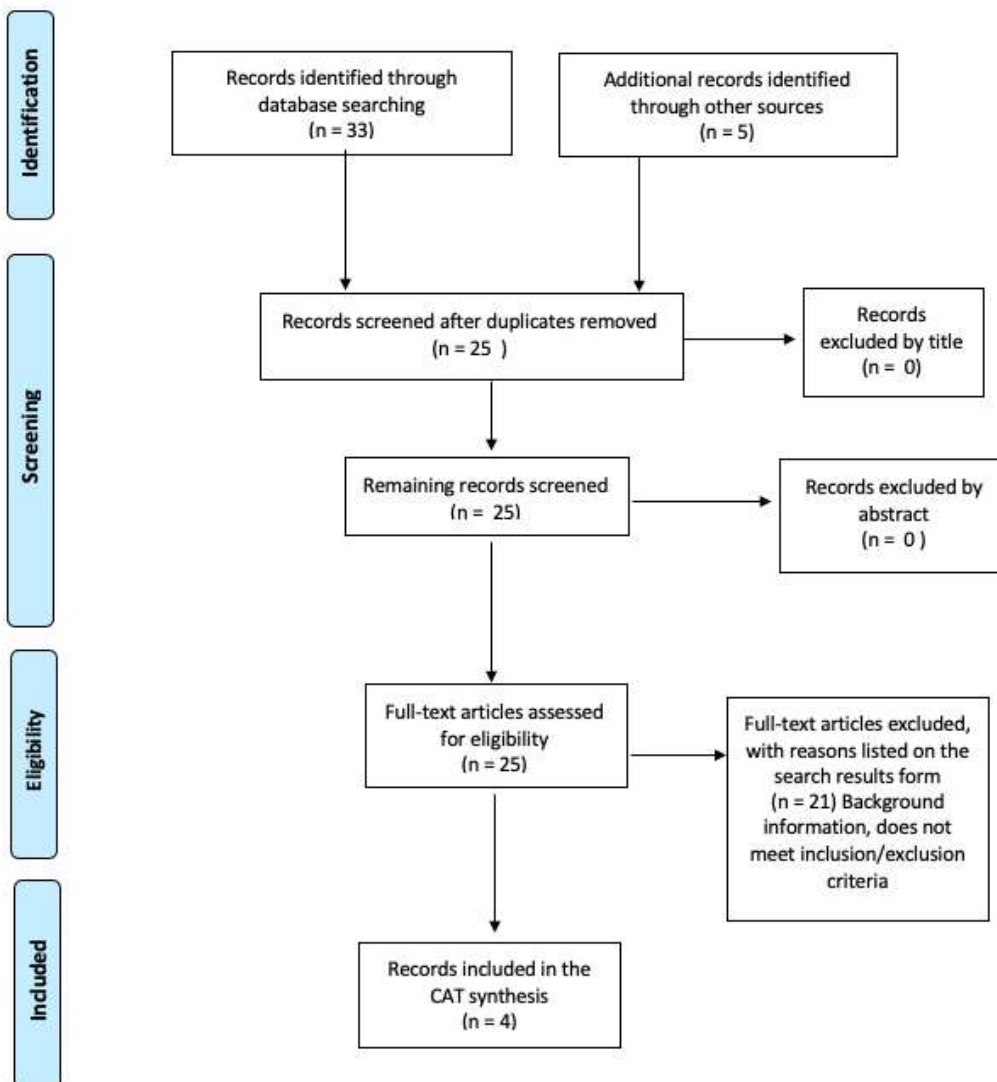
BOTTOM LINE AND RECOMMENDATIONS: We recommend using the exercise interventions in the adult burn ICU with caution. The evidence found suggests that resistance training, mobility training, and physiotherapy in early burn rehabilitation may be effective in increasing upper extremity function, muscle strength, improving quality of life and decreasing length of stay. However, TBSA, age, coexisting medical factors, and surgeries may influence the efficacy of the intervention. Our bottom line is that although there is limited evidence on the topic, the evidence is high level and high quality. Existing research recommends further investigation on the effects of early exercise interventions on burn patients.

Name of Appraiser(s): Liz Burton MOT/S, Carolyn Knight MOT/S, Brittney Malone MOT/S, Lexie Rivers MOT/S, Rachel Walker MOT/S & JT Wright MOT/S

Date Completed: 4/14/2021

Appendix

PRISMA

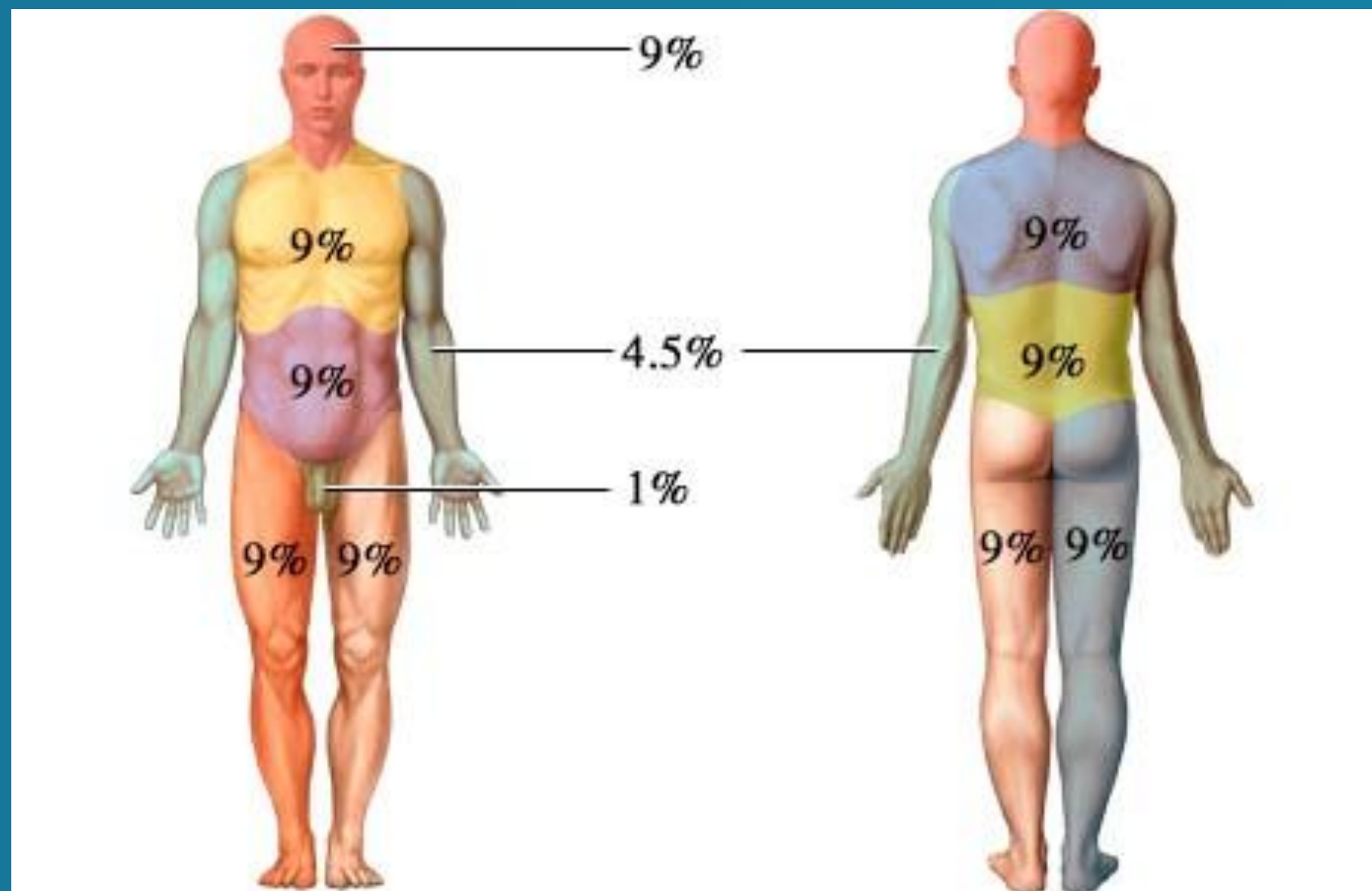


Exercise Interventions for Adults with Burn Injuries

Liz Burton, MOT/S, Carolyn Knight, MOT/S, Brittney Malone, MOT/S,
Lexie Rivers, MOT/S, Rachel Walker, MOT/S & JT Wright, MOT/S

Faculty Advisor: Anita Witt Mitchell, PhD, OTR, FAOTA

Clinical Mentor: Sandra Fletchall, OTR/L, CHT, MPA, FAOTA



Rule of Nines: Used to calculate TBSA



PICO QUESTION

Are exercise interventions effective in promoting recovery of adults in the burn ICU?

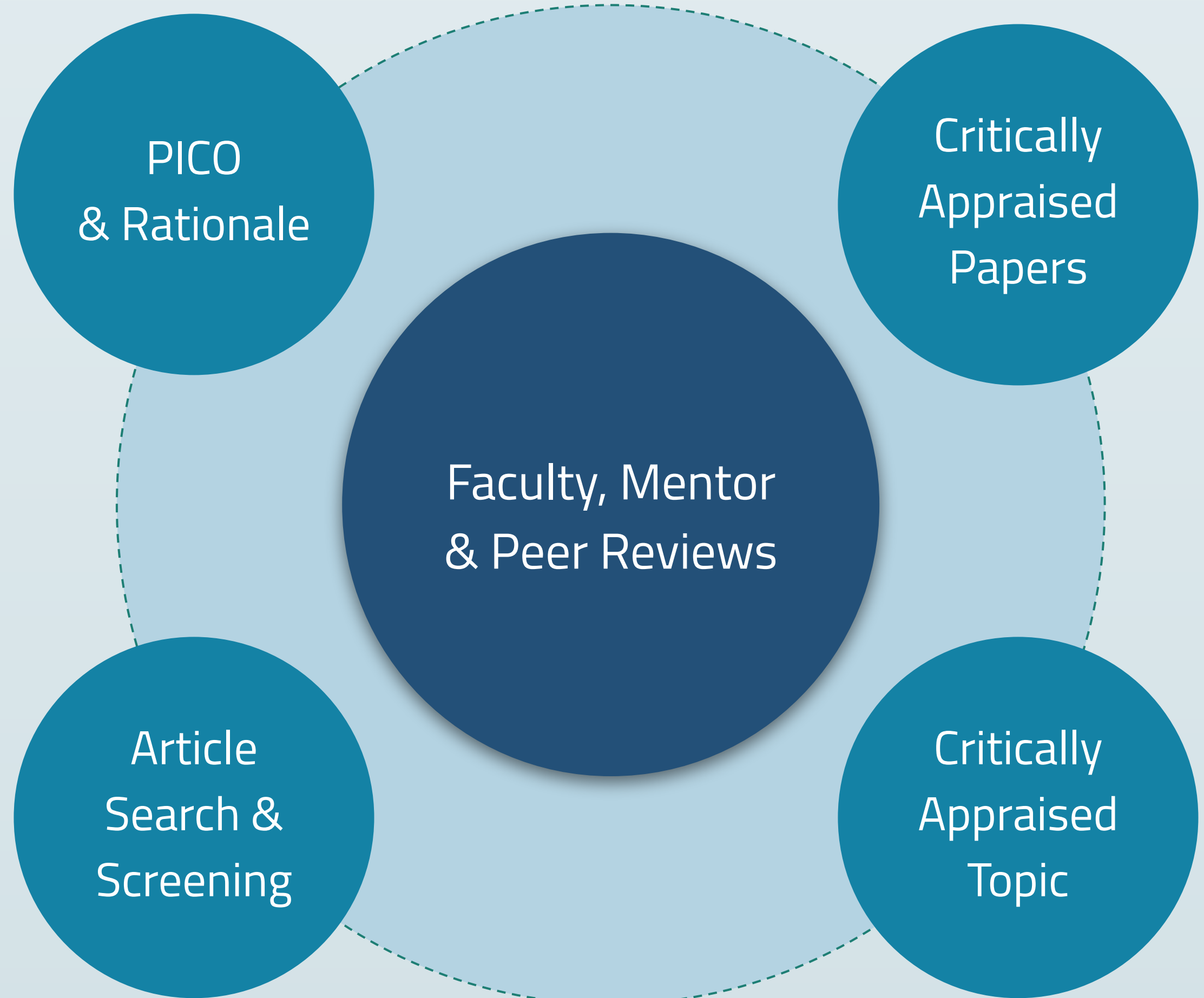
EXERCISE INTERVENTIONS

Resistance Training	Free weights, isokinetic dynamometer, and cable weights
Mobility Training	AROM, transfer training, tilt table training, and ambulatory training
Physiotherapy	AROM, PROM, early mobilization, chest physiotherapy, and ambulatory training

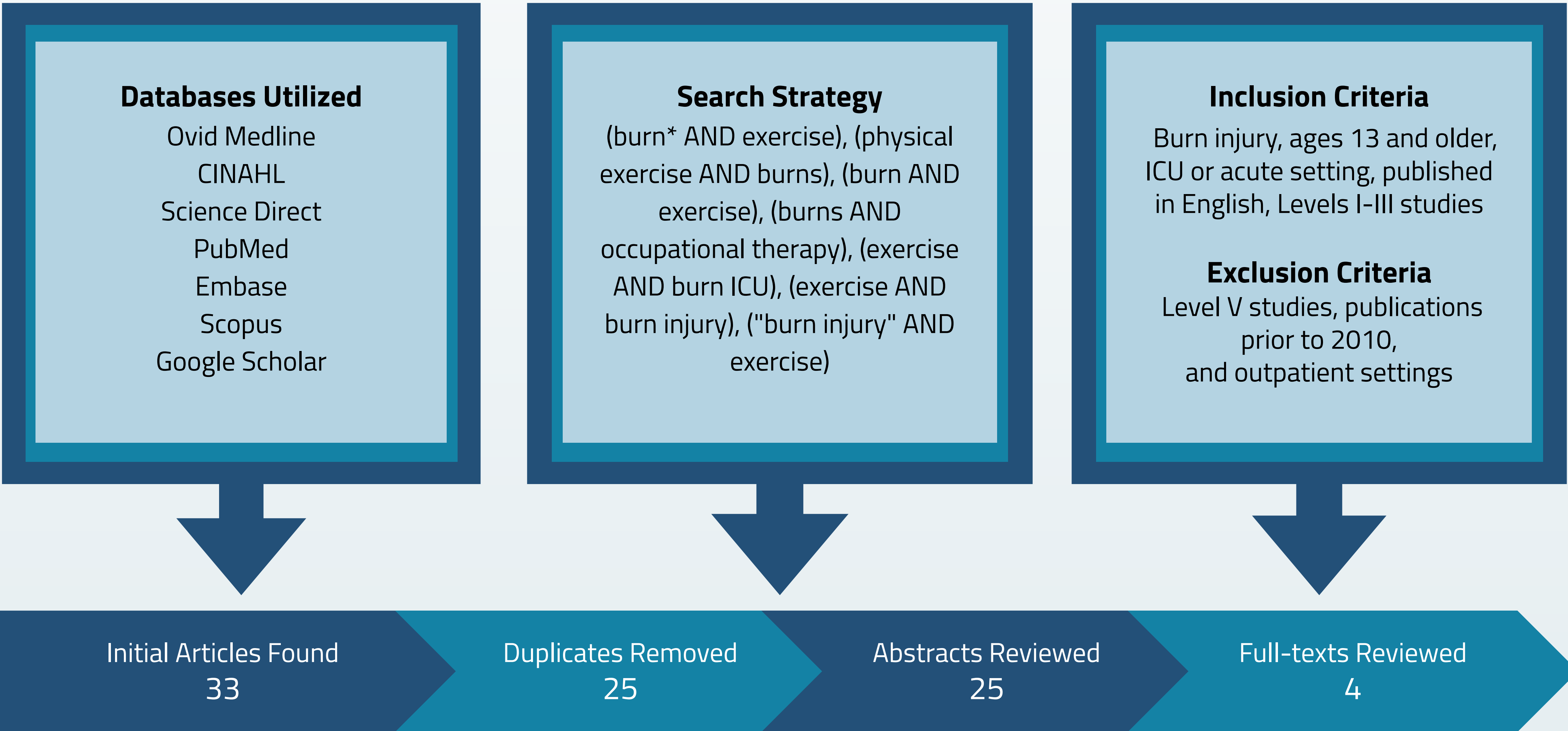
BACKGROUND & RATIONALE

→ Exercise interventions in the early burn rehabilitation phase may significantly improve recovery.

REVIEW PROCESS



SEARCH METHODOLOGY



MAIN FINDINGS & LIMITATIONS

Citation and Quality of Evidence	Intervention	Statistically Significant Findings	Limitations
Level I			
Gittings, P. M., et al. (2018). Quality Score 94%	Resistance Training	↑ Muscle strength ↑ QoL	Small sample sizes Bias within studies
Level II			
Çınar, M. A., et al. (2019). Quality Score 86%	Early Physiotherapy	↓ Inflammatory response	Small sample size
Deng, H., et. al. (2016). Quality Score 88%	Mobility Training	↓ LOS in BICU ↑ ROM	Measurement limitations Incomplete data
Gittings, P.M., et al. (2021). Quality Score 88%	Resistance Training	↑ Recovery of UE function	Closed early (funding) Recruitment not met Bias

Key: QoL = quality of life; LOS = length of stay; BICU = burn intensive care unit; ROM = range of motion; UE = upper extremity; ADL = activities of daily living; TBSA = total body surface area; AROM = active range of motion; PROM = passive range of motion

CLINICAL BOTTOM LINES & RECOMMENDATIONS

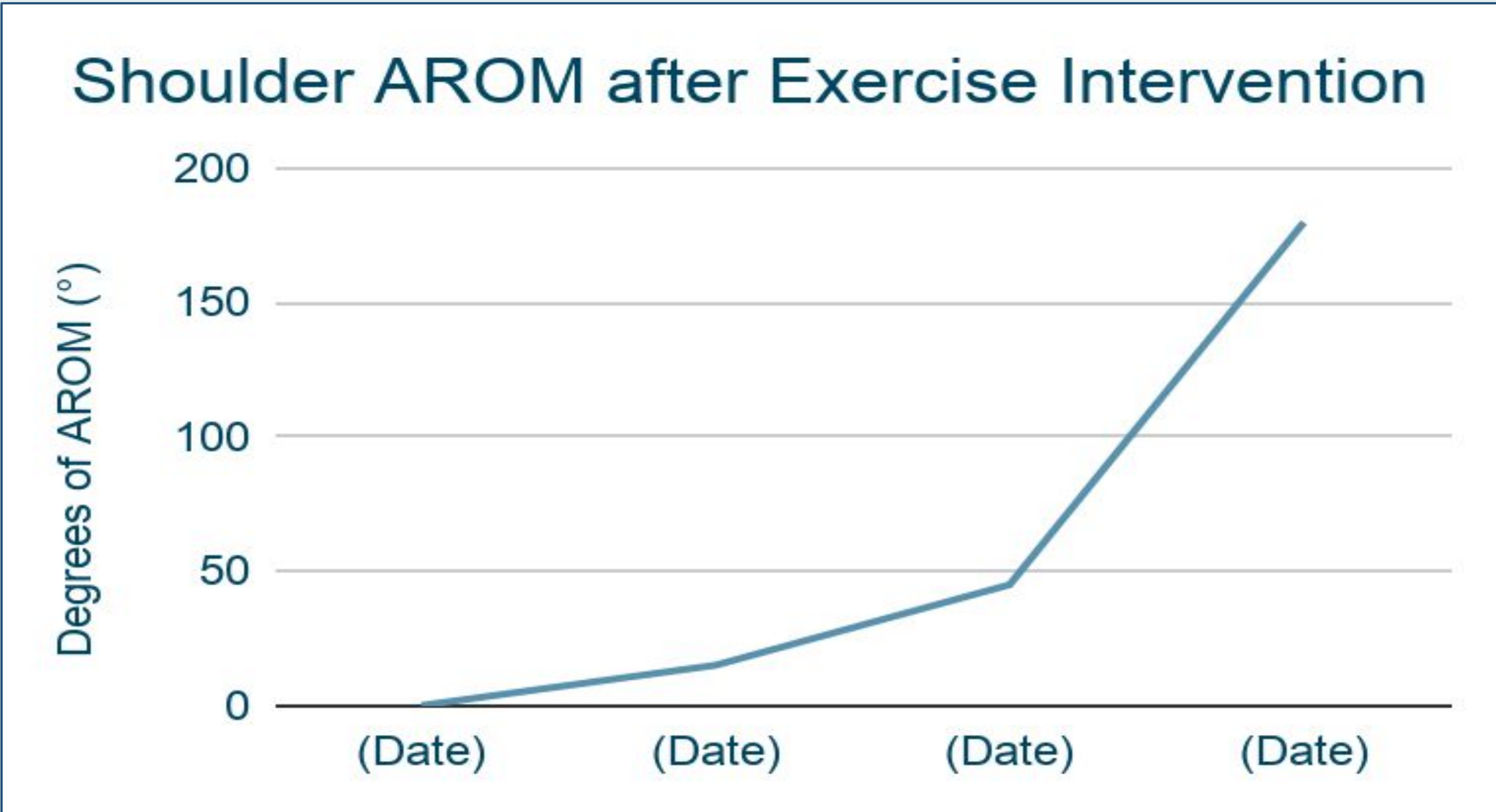
Clinical Bottom Lines

- High quality, limited evidence
- Exercise interventions in early burn rehabilitation may be effective in facilitating recovery and decreasing LOS

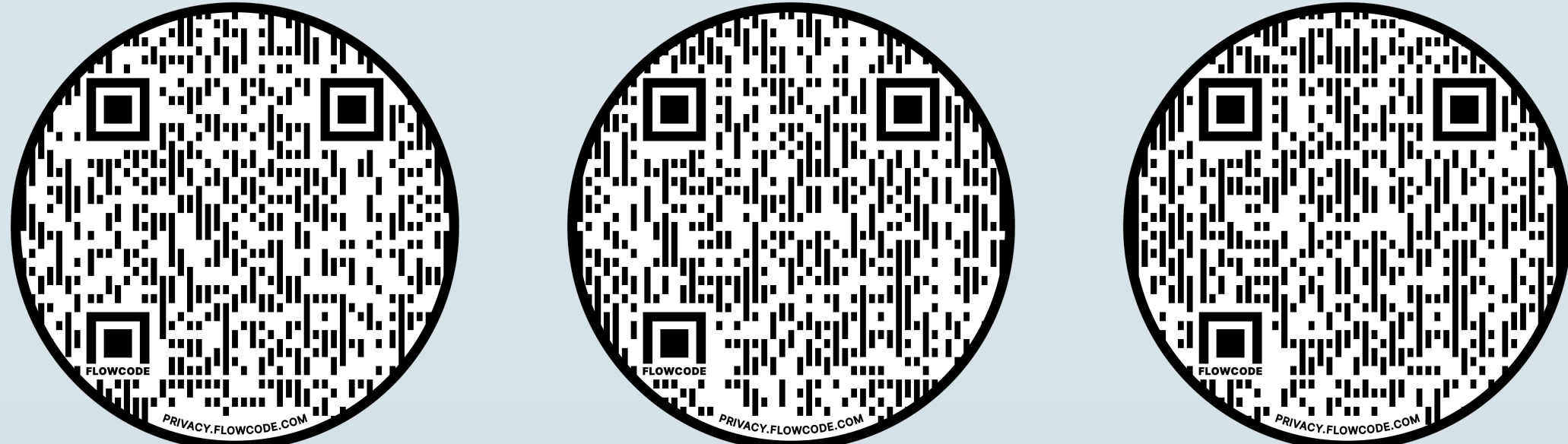
Recommendations

- Implementing & monitoring interventions with caution
- Factors to consider with implementation:
 - TBSA
 - Age
 - Coexisting medical conditions
 - Surgery
- Further research into the effects of early exercise interventions

CHARTING & EVALUATION OF OUTCOMES



REFERENCES HANDOUT PRISMA



Appendix A: Critically Appraised Papers

CRITICALLY APPRAISED PAPER #1

Gittings, P.M., Grisbrook, T.L., Edgar, D.W., Wood, F.M., Wand, B.M., & O'Connell, N.E. (2018). Resistance training for rehabilitation after burn injury: A systematic literature review & meta-analysis. *Burns*, 44(4) 731-751. <https://doi.org/10.1016/j.burns.2017.08.009>

Purpose of the Study:	<ul style="list-style-type: none">● To determine the effectiveness of resistance training (RT) on muscle strength, lean mass, function, quality of life and pain in children and adults after burn injury● This systematic review provides evidence to support the PICO question's specific intervention and outcomes.
Setting:	<ul style="list-style-type: none">● No limits were placed on the extent or agent of burn injury or the setting in which the RT occurred or the time after the injury in which training commenced.
Participants or Sample:	<ul style="list-style-type: none">● Studies of children (9) and adults (2) who experienced a burn injury were included.● Half of the adult burn studies commenced RT prior to six months after injury. Pediatric studies consistently commenced RT at six months post burn injury.● Range of mean TBSA: 29.9-62%
Study Design or Methodology:	<ul style="list-style-type: none">● A systematic review and meta-analysis was conducted using Medline & EMBASE, PubMed, CINAHL and CENTRAL. 1099 records were identified through database searching. 11 studies included in synthesis.● Studies were identified that implemented resistance training in rehabilitation. Data were combined and included in meta-analyses for muscle strength and lean mass.● Two authors independently reviewed the titles and abstracts generated by the literature search. Discussion between the two authors occurred to achieve consensus. When consensus was not reached a third reviewer was utilized to determine inclusion.● Data synthesis: Results were combined using a random effects meta-analysis with Review Manager v5.3● Assessment of heterogeneity: Statistical significance was assessed using the chi squared test and deemed significant where the p-value is <0.05. Amount of heterogeneity was estimated using the I squared test.● Sensitivity analysis: a post-hoc sensitivity analysis was carried out for the muscle strength outcome.
Level of Evidence:	<ul style="list-style-type: none">● Level 1: Systematic review and Meta-Analysis● Randomized and non-randomized controlled trials were included● Quality of evidence for each outcome was summarized and rated using the Grading of Recommendation, Assessment, Development and Evaluation (GRADE) framework. All outcomes were rated as having "low" to "very low" quality of evidence.

Outcomes and Main Findings:	<ul style="list-style-type: none"> ● MUSCLE STRENGTH: Significant effect favored RT in adult burn patients ● LEAN MASS: Overall effect non-significant in pediatric populations ● PHYSICAL FUNCTION: patient reported surveys were not sufficient for meta-analysis. ● QUALITY OF LIFE: Significant effect noted for the psychological domain of the (BSHS-A) ● PAIN: No studies investigated pain as the outcome variable ● ADVERSE EVENTS: No studies investigated whether RT produced adverse events.
Intervention Highlighted Through the Research:	<ul style="list-style-type: none"> ● RT was undertaken using free weights, cable weights and isokinetic dynamometer. ● Parameters of RT for inclusion: minimum of two RT sessions per week, training at an intensity of at least 40% of a one-repetition maximum for at least two sets of eight repetitions per individual exercise; minimum of two weeks of RT
Limitations:	<ul style="list-style-type: none"> ● Bias included: selection bias, performance bias, detection bias, attrition bias and reporting bias
This Study was Identified as the “Best” Evidence and selected for the Portfolio for the Following Reasons:	<ul style="list-style-type: none"> ● Provides evidence of exercise interventions during burn rehab. ● It is important to include this article because it shows some and no significance to the implementation of resistance training in regards to different outcomes.
Quality Score:	<ul style="list-style-type: none"> ● 94% ● MOOSE (Meta-analyses of Observational Studies in Epidemiology)

CRITICALLY APPRAISED PAPER #2	
<p>Gittings, P. M., Wand, B. M., Hince, D. A., Grisbrook, T. L., Wood, F. M., & Edgar, D. W. (2021). The efficacy of resistance training in addition to usual care for adults with acute burn injury: A randomised controlled trial. <i>Burns</i>,47(1), 84–100. https://doi-org.ezproxy.uthsc.edu/10.1016/j.burns.2020.03.015</p>	
Purpose of the Study	<ul style="list-style-type: none"> ● Test and assess the effects of an early, intensive resistance training program on quality of life in acute burn injury rehabilitation. The study also examined several physical, functional, and safety outcomes.
Setting	<ul style="list-style-type: none"> ● Adult burns unit

<p>Participants or Sample</p>	<ul style="list-style-type: none"> ● 48 participants (42 male; 6 female), ages 24-43 ● Recruited by primary investigator upon admission to burn unit; Convenience sampling ● Inclusion: Burn injury of 5-40% TBSA; admitted within 72h of burn injury, able to exercise within 72h of injury, 18 years+ ● Exclusion: surgery prior to recruitment, electrical burns, palmar hand burns, associated injuries or surgery affecting participation (fracture, amputation, acquired brain injury, peripheral neural injury), pre-existing medical conditions which may affect exercise participation
<p>Study Design and Methodology</p>	<ul style="list-style-type: none"> ● Parallel, randomized, controlled intervention trial ● Participants allocated to control group or intervention group (resistance training group) through concealed randomization process. ● Randomization tokens placed in sealed opaque envelopes-- independent staff member drew an envelope to allocate participants to CG or RTG ● CG received usual physiotherapy rehab plus sham RT (resistance training) 3x/week for 4 weeks ● RTG received usual physiotherapy rehab plus progressive RT 3x/week for 4 weeks ● Outcomes assessment planned to occur at six weeks, three months, and six months after burn injury at multidisciplinary review clinics
<p>Level of Evidence</p>	<ul style="list-style-type: none"> ● Level II (Small-scale RCT)
<p>Outcomes and Main Findings</p>	<ul style="list-style-type: none"> ● Study offers support for potential benefits associated with use of early RT as an adjunct to physiotherapy tx of acute burn injury ● No evidence of difference between RTG and CG for the total BSHS-B (Burn Specific Health Scale Brief survey) QoL score ● Length of inpatient hospital stay was the same for both groups ● Evidence of a significant difference in the fn domain in favor of the RTG ● RTG demonstrated significantly greater recovery of upper limb fn compared to CG ● No evidence of additional benefit of early RT on lower limb physical dysfunction ● Data did not find evidence that the addition of 4 weeks of RT to standard care leads to increases in muscle strength or cellular volume when compared to usual care alone
<p>Intervention Highlighted Through the Research</p>	<ul style="list-style-type: none"> ● Use of resistance training to improve QoL, physical, and functional outcomes

Limitations	<ul style="list-style-type: none"> • Study was closed earlier than anticipated • Number of subjects enrolled did not meet the pre-planned recruitment target • Therapists were not blinded to group allocation-- performance bias • Muscle strength and body composition secondary outcomes were collected by a non-blinded assessor--detection bias • Evidence of attrition bias • Were not able to limit fluid intake during exercise or assess hydration status prior to measurement of body composition using BIS
This Study Was Identified as the “Best” Evidence and Selected for the Portfolio for the Following Reasons:	<ul style="list-style-type: none"> • RCT • Met our inclusion criteria • Explored the effects of resistance/exercise training for adults with acute burn injury • Assessed multiple outcomes related to the use of resistance training for burn patients
Total Quality Score	88%

CRITICALLY APPRAISED PAPER #3	
<p>Deng, H., Chen, J., Li, F., Li-Tsang, C. W. P., Liu, Q., Ma, X., Ao, M., Chen, N., Zhou, Y., Zhong, X., Chen, Z., Cao, L., He, G., & Wu, J. (2016). Effects of mobility training on severe burn patients in the BICU: A retrospective cohort study. <i>Burns</i>, 42(7), 1404-1412. https://doi-org.ezproxy.uthsc.edu/10.1016/j.burns.2016.07.029</p>	
Purpose of the Study	Determine and assess effects of mobility training compared to passive training on patients with severe burns in the Burn Intensive Care Unit (BICU)
Setting	Early Rehab BICU
Participants or Sample	<ul style="list-style-type: none"> • Patients admitted to the BICU from January 2011- December 2013 and must have been within 7 days following the injury • TBSA more than or equal to 50% • Receiving Rehab in the BICU and was able to survive • BICU stay was not the same length of hospital stay
Study Design and Methodology	<ul style="list-style-type: none"> • Retrospective Cohort Study
Level of Evidence	<ul style="list-style-type: none"> • Level II

<p>Outcomes and Main Findings</p>	<ul style="list-style-type: none"> ● Patients in the mobility training cohort had a significantly shorter stay in the BICU compared to patients in the passive training cohort ● Patients in the mobility training cohort had improvement of ROM ● in the following: shoulder, wrist, hip, knee, and joints of the ankle ● Mobility training is safe, feasible, and effective for patients in the BICU ● Mobility training provides better outcomes compared to passive training
<p>Intervention Highlighted Through the Research</p>	<ul style="list-style-type: none"> ● Passive training included anti-contracture positioning and splinting and PROM (provided from January 2011-April 2013) ● Mobility training consisted of AROM, transfer training, tilt table training, and progressive ambulation (provided from May 2013-December 2013) ● ROM of injured joints (goniometer), ADL (by Barthel Index and Functional Independence Measure) were all assessed within 7 days before being discharged from the BICU by therapist ● Therapist was blind to the early rehab provided (mobility training cohort vs passive training cohort)
<p>Limitations</p>	<ul style="list-style-type: none"> ● Some of the data recorded from ROM and ADL were not collected from case records ● Wound dressings affected ROM measurements ● BICU environment restricts patients from performing some of the tasks required by the Barthel Index and the Functional Independence Measure ● Some patients physical and psychological conditions may not have been stable enough to withstand ADL tasks ● Clinical parameters: pulmonary infection, pulmonary function, muscle strength, psychological status and functioning
<p>This Study Was Identified as the “Best” Evidence and Selected for the Portfolio for the Following Reasons:</p>	<ul style="list-style-type: none"> ● This article presents an intervention relevant to the population and PICO question in which we are looking for. ● It was approved by an ethical committee. ● Results and Discussion was detailed and seemed reliable and valid. ● Limitations were presented.
<p>Total Quality Score</p>	<p>87.5%</p>

CRITICALLY APPRAISED PAPER #4

Çınar, M. A., Bayramlar, K., Erkılıç, A., Güneş, A., & Yakut, Y. (2019). The effects of early physiotherapy on biochemical parameters in major burn patients: A burn center's experience. *Turkish Journal of Trauma & Emergency Surgery*, 25(5), 461–466. <https://doi-org.ezproxy.uthsc.edu/10.5505/tjtes.2018.05950>

Purpose of the Study	This study sets out to investigate the effects of early physiotherapy on biochemical parameters in major burn patients. It explores the effects of exercise in the acute phase of patients with major burns.
Setting	ICU of Aralık State Hospital Burn Center
Participants or Sample	<ul style="list-style-type: none"> • 20 major burn patients (10 women, 10 men aged between 21–47 years old) were included in this study. The inclusion criteria were: • Age ≥ 18 years • Major burn injury (according to ABA) • Conscious patients. (Patients with inhalation injury, various chronic disorders, organ dysfunctions, infection in the burn wound or the bloodstream and sepsis were all excluded from this study.) • This was convenience sampling due to patients that were burned and fit the inclusion criteria.
Study Design and Methodology	The study design was a Randomized Controlled Trial (RCT). The researchers divided 20 people into two groups in the hospital. One group received the treatment, while the other group was the control group. In the treatment group, patients were admitted to the physiotherapy program from the first day they have been hospitalized, in addition to their routine treatment (e.g., medical, surgery), for four days per week. The control group just received regular, routine treatment.
Level of Evidence	Level II Evidence
Outcomes and Main Findings	When the results obtained in this study were considered, there was a significant difference in favor of the treatment group for all biochemical parameters ($p < 0.05$). From the second week of the study, a significant increase was observed in prealbumin values in the treatment group ($p < 0.05$). A significant increase was observed in fibronectin after the fourth week ($p < 0.05$). Findings showed that physiotherapy reduces the effects of the inflammatory response, which is due to the major burn in the acute phase. The study's results suggested that early physiotherapy and exercise will shorten the wound healing period and prevent hypertrophic scar tissue formation.
Intervention Highlighted Through the Research	The physiotherapy program consisted of parameters, such as early mobilization and ambulatory training, chest physiotherapy, and both active and passive normal joint movement exercises. The days of treatment were determined as of Tuesday, Wednesday, Thursday and Friday. Patients could not be treated on a Monday because that was surgery day. Duration of the physiotherapy was 45–60 min for two times per day. It was done four days a week. Physiotherapy would start on the first day of hospitalization. If the patient needed grafting, it would start three days after.
Limitations	Further research should be conducted with a bigger population. It should also be conducted in the United States.

This Study Was Identified as the “Best” Evidence and Selected for the Portfolio for the following reasons:	<ul style="list-style-type: none">• Looked at burn patients in the ICU setting• Included exercise as a treatment• Listed the total body surface area percentage of burns• It was a control trial, so we are able to see how the intervention supports our PICO question.
Total Quality Score	86%

References

- Çınar, M. A., Bayramlar, K., Erkılıç, A., Güneş, A., & Yakut, Y. (2019). The effects of early physiotherapy on biochemical parameters in major burn patients: A burn center's experience. *Turkish Journal of Trauma & Emergency Surgery*, 25(5), 461–466. <https://doi-org.ezproxy.uthsc.edu/10.5505/tjtes.2018.05950>
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*These online sources were not appraised.