Journal of Bodywork & Movement Therapies 27 (2021) 113–126

Contents lists available at ScienceDirect

Journal of Bodywork & Movement Therapies

journal homepage: www.elsevier.com/jbmt

Fascia Science and Clinical Applications

Physical therapy for the treatment of respiratory issues using Systemic Manual Therapy protocols

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ARTICLE INFO

Article history:
Received 5 August 2020
Received in revised form
28 February 2021
Accepted 28 February 2021

ABSTRACT

Background: The emergence of the Coronavirus (COVID-19) pandemic increased the need for an effective treatment for respiratory conditions exponentially. To meet this challenge, we reevaluated the effectiveness of our physical therapy protocols for respiratory conditions. Protocols of interest were categorized as decongestive, neurogenic, mechanical, and immune modulating.
Objective: The objective of this study is to evaluate which of our existing treatment protocols or protocol combinations produce the best outcome. To do so, we analyzed which ones can meet the following criteria when compared to all other treatments: test statistic (>2.0) in parametric and non-parametric tests, [statistical significance ($p < 0.05$)], effect size larger than 0.2, difference in the Patient Identified Problem Scale (PIP) score above Minimal Clinically Important Difference (MCID), and sample size minimum 15 treatments.
Design: Retrospective multivariate analysis using a modified adaptive platform design.
Methods: A computerized sampling using respiratory related key words from a blinded dataset yielded 178 patients with respiratory complaints or pain in the chest area. Additional statistical analysis using parametric and non-parametric tests evaluated the difference between each treatment protocol and the rest of the treatments provided.
Results: Several protocol combinations and one individual protocol passed the study criteria. Cardiac vascular venous thoracic (CVVT) protocol was used most frequently within these combinations (7), followed by Urinary Drainage (UD) (4). Other protocols in this group were Cardiac Cervical Cranial Vascular (CCCV), Venous Thoracic Cardiopulmonary (VTCP), and Diaphragm Cranial Sinus (DCS). Among the respiratory specific protocols, CVVT was significantly better than VTCP (0.40, $p < 0.001$).
Discussion and conclusion: For the patient population studied, CVVT appears to be the primary protocol to consider, followed by UD, CCCV, VTCP, and DCS. Combining CVVT with Barral Abdominal Motility protocol (Barral) or VTCP with Lower Abdominal Urogenital (LAUG) on the same day might be required with acute patients.

1. Introduction

This study is a retrospective multivariate analysis using a modified adaptive platform design of specialized physical therapy treatment given to patients with a set of respiratory problems. To date, the outcomes of physical therapy for the treatment of patients with acute or chronic respiratory-related issues have been mixed. Treatment schemes range from respiratory exercises to postural drainage, positioning, and promotion of general mobility. Zadro et al. (2020) conclude that “a substantial percentage of physical therapists provided interventions that were of low value or unknown value, despite the availability of high-value interventions.”

To consider why specific interventions are more effective than others, we first need to discuss the possible mechanisms that help a distressed respiratory system recover. We can do so by looking at conventional medical and pharmacological approaches to the treatment of a respiratory condition such as asthma or chronic obstructive pulmonary disease (COPD). We can roughly divide the medical interventions into four categories:

1. **Decongestive therapies**: The most common agents used for this approach are corticosteroids (Tashkin and Strange 2018) and diuretics (Dharmarajan et al., 2016) with the intent of opening

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https://doi.org/10.1016/j.jbmt.2021.02.009

List of abbreviations

UD	Urinary Drainage
DCS	Diaphragm Cranial Sinus
Barral	Barral Motility Protocol
LAUG	Lower Abdominal Urogenital
CCCV	Cardiac Cervical Cranial Vascular
MET SI	Muscle Energy Technique Sacroiliac joint
VAS	Vascular
SLMG	Side-Lying Modified Glides
RMG	Reverse Modified Glides
LAUG	Lower Abdominal Urogenital
LEDJ	Lower Extremity Drainage Jones
SPDJ	Spinal drainage Jones
SCS	Strain Counterstrain
VTCP	Venous Thoracic Cardiopulmonary
CVVT	Cardiac Vascular Venous Thoracic
CP	Cardiopulmonary
UEDJ	Upper Extremity Drainage Jones
UEN	Upper Extremity Nerve
LEN	Lower Extremity Nerve
OST	Periosteum
SYMPN	Sympathetic Nerve

the airways by reducing fluid buildup to increase oxygen access to the airways.

2. **Immune regulation**: This approach includes medications such as antibiotics and antivirals that assist the immune system in fighting outside pathogens. It also includes drugs focused on regulating an excessive immune response, such as antihistamines and leukotriene receptor antagonists (Montgomery 2012).
3. **Neurogenic regulation**: This category includes medications that affect the respiratory system by targeting the central or autonomic nervous systems. For example, bronchodilators such as albuterol (Hsu et al., 2015) or respiratory stimulants such as doxapram (Henderson-Smart and Steer 2001).
4. **Mechanical clearance**: This category includes any approach that is designed to open an airway using a non-physiological approach. For example, mechanical ventilation, continuous positive airway pressure device (CPAP), airway suction, and percussion techniques.

To identify capabilities in achieving parallel effects in our physical therapy interventions, we first looked at several osteopathic and physical therapy methods that can potentially do so.

These methods include techniques developed by Laurence Jones et al. (1995), and later by Brian Tuckey 2018, 2019 under the category of Strain Counterstrain (SCS); Integrative Manual Therapy (IMT), developed by Sharon Weiselfish-Giammatteo, and Thomas Giammatteo (Weiselfish-Giammatteo 1997); visceral mobilization techniques developed by Jean-Pierre Barral (Barral and Croibier 2011); Muscle Energy Techniques (MET) initially introduced by Fred Mitchell, Sr. (Mitchell and Mitchell 2001); and several techniques original to our practice which include variations and modifications of the techniques mentioned above.

Then, over a time span of about 15 years, we grouped these techniques into multiple treatment protocols. While initially we relied on the mechanisms proposed by the originator of a technique, over time, these protocols underwent an extensive clinical refinement that was based on multiple anecdotal observations until we thought to observe a consistent and reproducible clinical effect. The protocols evaluated in this study are listed in Table 1.

However, prior to this analysis, we did not systematically compare the performance of each protocol or approach to all other treatments done in our practice.

We were specifically interested in protocols such as the Venous Thoracic Cardiopulmonary (VTCP), Cardiac Vascular Venous Thoracic (CVVT), Cardiopulmonary (CP), Lower Abdominal Urogenital (LAUG), Barral Abdominal Motility (Barral) and Urinary Drainage (UD) for their proposed decongestive and mechanical clearance capabilities, Muscle Energy Technique Sacroiliac joint (MET), Vascular (VAS), Side-Lying Modified Glides (SLMG), Periosteum (OST) and Reverse Modified Glides (RMG) for their possible immune regulatory effects, and Diaphragm Cranial Sinus (DCS), Diaphragm Cranial Dura (DCD), Cardiac Cervical Cranial Vascular (CCCV), Sympathetic Nerve (SYMPN), Lower Extremity Nerve (LEN), Upper Extremity Nerve (UEN) for their proposed neurogenic effects.

To accomplish this task, we utilized a software tool used recently for another investigation and retrofitted it to query information about patients with respiratory problems.

We hypothesized that this analysis should identify the treatment protocol or protocol combination that has a positive statistically significant difference in improving respiratory symptom over the average care. For this analysis, we defined the average care as all other treatments provided to the patients in the study sample. We consider statistical significance (the null rejection criteria) when a change in scores was above the Patient Identified Problem Scale (PIP) scale's Minimal Clinically Important Difference (MCID) confidence interval (MCID = 0.89, 95% CI 0.33–1.5). We also expected it to be statistically significant ($p < 0.05$) in a parametric and non-parametric test such as one-way analysis of variance (ANOVA) and Kruskal-Wallis, and that the test statistic for these was large enough to denote change ($F > 2.0$ and $H > 2.0$, respectively). Finally, we looked for sample and effect size large enough to make the analysis clinically meaningful ($n > 15$ and Glass's delta >0.20). Our null hypothesis was that no protocol or protocol combination would meet all seven criteria listed.

2. Methodology

This analysis was done in a private, outpatient, neurologically focused physical therapy practice. During the study period between April 1, 2015 and March 27, 2020, treatment was provided by three physical therapists (PT) with five years or more of experience in performing the protocols investigated in this study. Treatment was also provided by a physical therapy assistant (PTA) with at least three years of experience performing the protocols, a PTA with less than one year of experience performing the protocols, a newly graduated PTA and 20 doctoral physical therapy interns with no prior experience or training in these techniques. Among the six licensed practitioners, four had training in Jones' Strain Counterstrain, Fascial Counterstrain, Barral, and craniosacral therapy. One PT had additional training in Integrative Manual Therapy, and one PTA had training in craniosacral therapy but not Barral or Strain Counterstrain.

Table 1
Protocol description.

Letter code	Full name	Origin	Frequent use and hypothesized mechanism
UD	Urinary Drainage	IMT	Uses inhibition of input to visceral organs in combination with the manipulation of arterial baroreceptors to create a combination of autonomic balancing and a diuretic effect. Common variations include **GU** (Genito-Urinary)**, GUOU** (Genito-Urinary Ovarian/Uterus), and **GUD** (Genito-Urinary Drainage) protocols.
DCS	Diaphragm Cranial Sinus	IMT, SCS combo	Uses inhibition of input of sympathetic and parasympathetic post-and preganglionic nerves as well as dural release techniques to achieve release of pressure from the cranium as well as normalization of autonomic function. Common variations include **DCD** (Diaphragm Cranial Sinus Dura), and **SIDJ** (Sinus Drainage Jones).
Barral	Barral Motility Protocol	Barral	A combination of visceral motility mobilization techniques for normalizing abdominal and pelvic visceral function.
CCCV	Cardiac Cervical Cranial Vascular	IMT	Uses manipulation of arterial baroreceptors to create a shunting of blood flow toward the neck and brain to help restore homeostasis.
MET SI	Muscle Energy Technique Sacroiliac joint	MET, IMT	A comprehensive sequence to address mechanical asymmetry in the SI joint usually combined in the same sequence with **VAS**.
VAS	Vascular	IMT	Uses manipulation of arterial baroreceptors to create a shunting of blood flow toward the spine to help restore homeostasis, usually used in combinations with **MET SI**. Common variations include **MOD VAS** (Modified Vascular), **REV VAS** (Reverse Vascular), **VASD** (Vascular Drainage), and **VASH** (Vascular Hesch).
SLMG	Side-Lying Modified Glides	In house	Nerve mobilization techniques that, in contrast to tensioner or slider techniques, mobilize the vertebrae around the nerve instead of direct mobilization of the nerve or nerve root itself. This protocol targets the lumbar and thoracic spine. Common variations include **SLMGT** (side-lying modified glides [top]) (cervical and upper thoracic), **SSMG** (speech and swallow modified glides [cervical]), and **seated and prone MG** (modified glides) which also target the lumbar and thoracic spine, but in a seated or prone position.
RMG	Reverse Modified Glides	SCS	A combination of nerve and vein techniques along the spine to help restore homeostasis in that region.
LAUG	Lower Abdominal Urogenital	SCS	A combination of visceral fascial release techniques to normalize abdominal and pelvic visceral function often used as an alternative to Barral.
LEDJ	Lower Extremity Drainage Jones	SCS	Uses **SCS** veins and lymph vessel techniques to create a drainage effect from the pelvis and lower extremity. Common variations include **LEDJH K** or **F** (H = hip, K = knee, F = foot).
SPDJ	Spinal drainage Jones	SCS	A combination of **SCS** techniques over spinal epidural veins and spinal ligaments. Common variations include **SPDJ C** (cervical).
SCS	Strain Counterstrain	SCS	Not an actual protocol but used to denote when **SCS** is applied more traditionally to address specific tender points. Usually, a more detailed description is added to describe body parts and points treated.
VTCP	Venous Thoracic Cardiopulmonary	SCS, IMT combo	Fascial release techniques to address rib cage and thoracic visceral dysfunction.
CVVT	Cardiac Vascular Venous Thoracic	IMT	Uses a combination of arterial and venous techniques to create a decongestive effect in the thoracic cavity.
CP	Cardiopulmonary	SCS	Fascial release techniques to address thoracic visceral dysfunction.
UEDJ	Upper Extremity Drainage Jones	SCS	Uses **SCS** techniques for veins and lymph vessels to create a drainage effect from the brachial area and upper extremity.
UEN	Upper Extremity Nerve	SCS	Uses **SCS** techniques for nerves, including the brachial plexus and upper extremity.
LEN	Lower Extremity Nerve	SCS	Uses **SCS** techniques for nerves including pelvis and lower extremity
OST	Periosteum	SCS	Uses **SCS** techniques around the periosteal fascia of the pelvis and lower extremity
SYMPN	Sympathetic Nerve	SCS	Uses **SCS** techniques for the vagus nerve, sacral, and cervical sympathetic nerves.

2.1. Standardization

As described in the introduction, the standardization process included grouping individual techniques into treatment protocols, and later, protocol sequences.

The standardization of these techniques into distinct stand-alone protocols was done for several reasons. One was the early recognition of the limitations in using more classic evaluation and treatment sequences for these techniques when treating patients with complex, multi-system dysfunction. Another historical reason was the impetus to facilitate a consistent level of care regardless of whether treatment was provided by an expert physical therapist, a doctoral physical therapy intern, or a more novice clinician.

To promote standardization, each clinician went through a three-step training process: First, they experienced a protocol being performed on them. Next, the clinician-in-training performed the protocol on an already-trained PT or PTA, and last, under the direct supervision of a trained PT, the clinician performed the protocol on a patient.

To ensure consistent application of the protocols, a written manual, later published as a textbook (Halili, 2020a) was created. It explained the exact sequence and manner of performing each technique in a protocol. A two-to-six letter code was assigned to each protocol. The code was recorded in the records when a protocol was done without variations. If variations occurred (for example, by adding or removing specific techniques or changing the manner a technique was done), this was documented in the records as well. Most of the treatments in this study, however, were done without such variations.

To evaluate the degree of standardization achieved, we conducted an analysis on two different occasions on December 31, 2018 and on March 27, 2020 (both tests including records starting on April 1st, 2015). Each time we measured the average one visit post-treatment change in PIP scores for each clinician or intern providing treatment. Each sample included a combination of PT, PTA and doctoral interns (3,2 and 14 respectively for the first test and 3,3 and 20 respectively for the second test). In both tests we found no statistically significant difference between the groups of clinicians when performing these protocols. The ANOVA for the first tested had an $F = 1.05$, $p = 0.38$ for PIP scale changes and $F = 0.38$ $p = 0.86$ for a single score. The ANOVA for the second test had an $F = 1.89$, $p = 0.08$ for PIP scale changes, and $F = 0.85$ $p = 0.53$ for specific changes for a single complaint score.

Based on these observations, we concluded that at least in this practice setting, the treatment protocols are performed in a similar manner each time regardless of the treating clinician.

2.2. Protocols and protocol combinations

We have identified 28 individual protocols, thirteen 2-protocol combinations, one 3-protocol combination, two 4-protocol combinations, and one 5-protocol combination that were done over consecutive visits. Individual protocols and protocol-combinations were chosen for analysis if they were found in a frequency >5 in the study period. The individual protocols are listed in Table 1.

The choice of which protocols to use was done during the physical therapy evaluation and re-evaluation by using the Hypothesis Oriented Algorithm for Clinicians model (HOAC) (Rothstein and Echternach 1986; Rothstein 2003). After developing a patient identified problem list and further examination, the physical therapist would create a differential diagnosis list for the respiratory problems as well as all other complaints included in that list. When establishing the plan of care, a protocol or protocol combinations are considered based on their hypothesized effect on a particular diagnosis or condition. During the period of this study, the plan of care was established based on the expertise of the clinician. As previously stated, one of the key goals of this investigation is to evaluate the efficacy of these past clinical judgment and minimize future bias.

2.3. Outcome measures

The primary outcome measure used in this study was the Patient Identified Problem (PIP) scale (Halili, 2020b). The PIP scale is a 1 to 10 (half point permitted) scale. The patient can score between 1 (which denotes that the problem is not currently active) to 10 (indicating maximal intensity). The problems are looked at both individually and as a cumulative score. The cumulative score is calculated according to the following formula:

PIP = SUM (individual score/number of problems) x 10 (add the scores of all the individual problems, divide the number by the number of individual problems then multiply this number by 10).

Symptoms were graded by the patient, whenever possible, to decrease examiner bias. Scoring was always done on the next visit and not immediately after treatment.

The PIP scale has specificity and sensitivity of 91.46% and 64.45%, respectively, and an ICC score of 0.96. MCID for change observed in the whole scale is 3.8 (95% CI 1.4 to 8.2), and for an individual problem, score change is 0.89 (95% CI 0.33 to 1.5).

3. Sampling and testing

The sampling strategy meant to emulate an adaptive platform design (Kaizer et al., 2018). In this model, the protocol or protocol combinations were treated in the same manner that investigative drugs or drug combinations are treated in this design. The performance of each protocol or combination of interest was compared to the overall performance of all other interventions and the most effective ones are identified.

All sampling was done by automated queries in a Microsoft Access database. Testing was done using MedCalc software (https://www.medcalc.org) Fig. 1 provides a schematic illustration of the sampling and testing process.

3.1. Sampling

1. **Population sample**: The study population included 1551 patients with a total of 26,585 treatment visits (1015 female, 536 male, age range six months to 92 years, average age (calculated at the start date) was 58.1 years, SD 18.0). Records were imported from the primary database dating from April 1, 2015 to March 27, 2020 and were completely stripped of identifiable information.
2. **Study sample:** This sample was created by querying the population sample for patients that listed in their patient identified problem (PIP) items that included the keyword: "respiratory," "breathing," "COPD," "asthma," "breath," "chest," "ribcage," or "rib cage." Each patient record was individually evaluated and differentiation was done between chronic and acute presentation ($n > 1$ month = 126, $n < 1$ month = 49, unknown = 3) and respiratory problems ($n = 115$) vs. chest pain or other symptoms ($n = 63$). This sample yielded initially 178 patients with 2535 visits (125 females, 53 males, age range 7–92, average age 58 years, SD 19.1). Twelve patients were excluded from further analysis because they never had a follow-up visit. The trimmed average for days between visits was 7.63 days (Grubb's $n = 2395/2535$, 95% CI 7.49 to 7.76). In this sample, 145 (6%) of the treatments were provided by doctoral physical therapy interns, 902 (36%) by PTA staff, and 1488 (58%) by licensed physical therapists. Fig. 2 includes additional demographic, comorbidity, and length of symptoms information about this sample.
3. **Protocol and combination group:** This group of samples included the 45 protocol and protocol combinations discussed in the previous section (Table 1).
4. **Frequency samples 1–5:** This group had 11,412 samples comprising all 1, 2, 3, 4, and 5 combinations available from the study sample.
5. **Analysis group**: This group included 90 samples creating 45 dataset pairs, one pair for each of the samples in the protocol sample group (group 3). Each pair included data containing the samples from the frequency group (4) that had in it one of the 45 protocol or protocol combinations from group 3. The remainder of the 11,412 samples that did not contain the protocol or protocol combination formed the second part of each pair. See Fig. 1 for an illustration of this process.

We found Three distinct advantages using this sampling scheme. First, this strategy allowed us to compare the performance of a protocol against all the other types of treatments provided to the patient, creating a *de facto* comparison group despite the absence of a predesigned one. The second advantage was that by using the 2,3,4,5 sample measurements, we could account for delayed responses that otherwise would not be captured.

Finally, by combining these two concepts, we ended up comparing multiple measurements after a protocol was done to ones where a protocol was not done. And by doing so, we were able to isolate all other extraneous effects such as medications, and other interventions and comorbidities. Fig. 3 (Halili 2021) demonstrates how the treatment effect was isolated from other treatment as well as extraneous factors.

3.2. Testing

One-way ANOVA and Kruskal-Wallis tests provided both parametric and non-parametric test statistic (*F* ratio and *H* respectively) and the p values for this portion of hypothesis testing. The MCID confidence interval of both the PIP scale and the individual score within the PIP scale was used to determine if the observed difference exceeded this criterion. Calculating Glass's delta assessed the effect size, and the original frequency of a protocol or protocol combination in the study sample determined if sample size requirements were met.

3.3. Design consideration to minimize threats to internal validity

We identified six possible internal validity threats for this type of study (Langbein, 2015; Yu and Chen, 2015) instrumentation, confounding factors, repeated testing effects, maturation, regression to the mean, and increase in type I error. Control for the instrumentation threat was shown by repeating prior findings that there is no significant difference in performance between the type

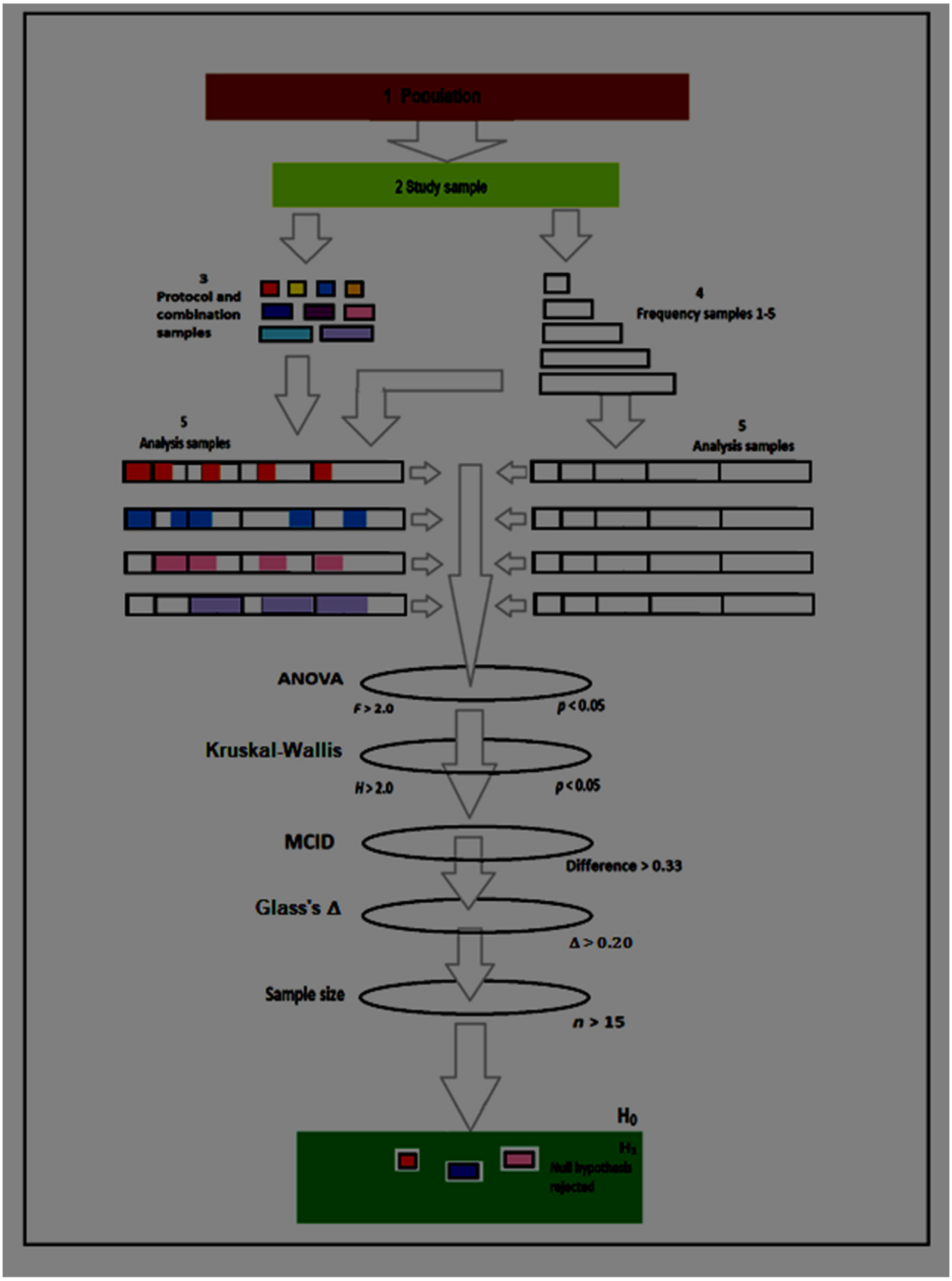


Fig. 1. Sampling and testing flowchart.

of clinicians. In this case, "instrumentation" is referring to the clinician performing a treatment, and to the treatment protocols themselves. The creation of the *de facto* comparison group provided control for confounding factors, maturation, and regression to the mean threats. We did, however, used Grubb's test for outliers and removed outliers and far-out values from the sample used to calculate the average days between visits since this sample was not controlled otherwise.

The analysis sample group's design scheme controlled for the repeated testing effect by providing a comparison of delayed measurements.

The threat to the validity of type I error measurements was controlled by adding the Kruskal-Wallis non-parametric test to the one-way ANOVA. Halili (2021) provides an additional discussion about how these, as well as type II error threats, are mathematically controlled by the analysis tool used in this study.

Ethics approval: institutional review board approval was obtained by ARGUS IRB 6668 S Hidden Flower Way Tucson AZ 85756 www.argusirb.com on 04/23/2020.

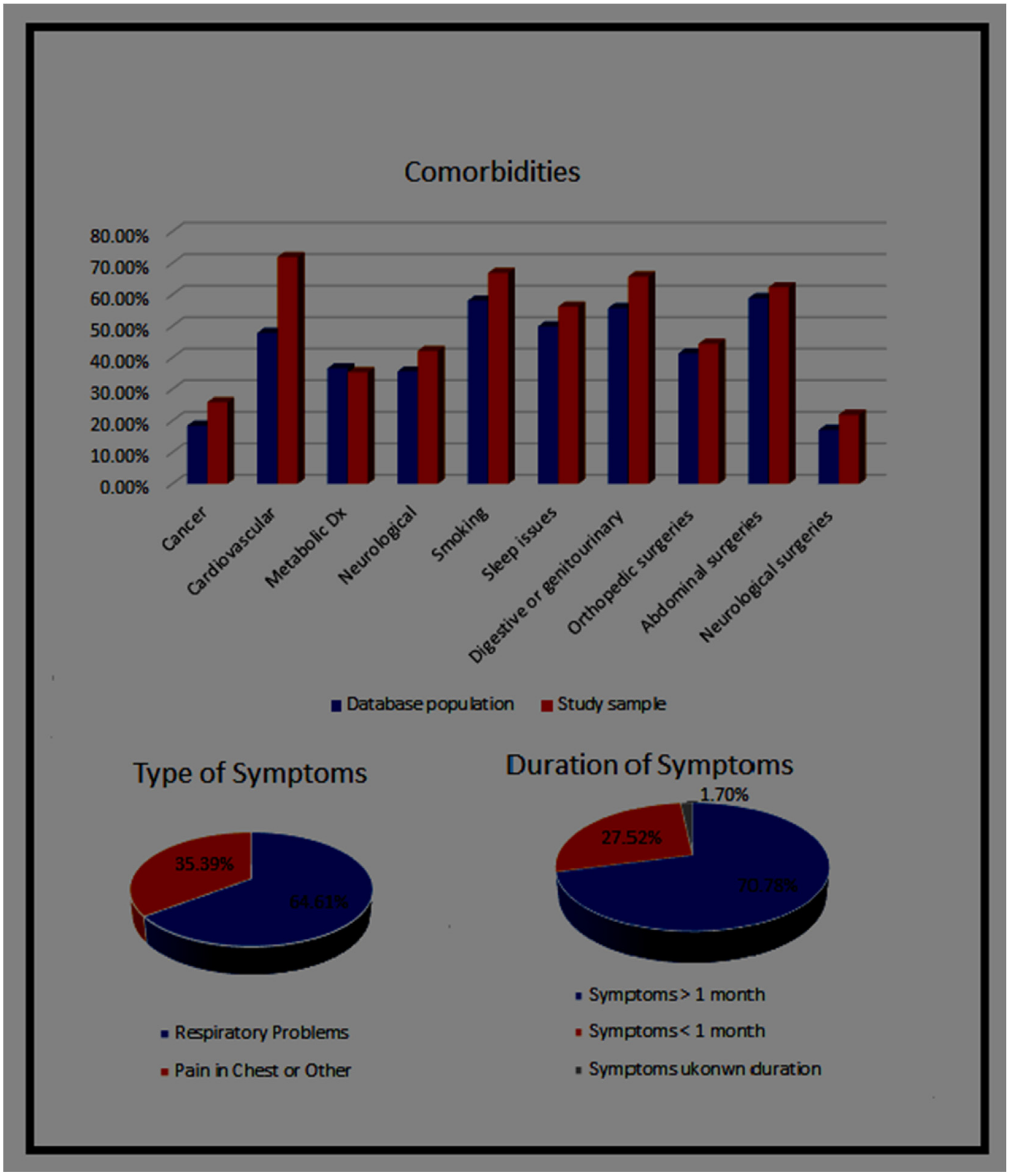


Fig. 2. Comorbidities, type and duration of symptoms.

4. Results

Tables 2 and 3 list the results of the combinations studied. Table 2 lists individual score differences between the protocols studied and the control group for respiratory type complaints, and Table 3 lists the overall change in the PIP scale for this population. The protocols highlighted in dark green are the ones that passed all seven null hypothesis rejection criteria. Six protocols and protocol combinations passed all criteria where the MCID measured the changes in individual respiratory complaints and three protocol combinations passed it using the overall changes in the PIP scale.

The most prevalent protocol in these two groups was the CVVT protocol with a frequency of 7, followed by UD protocol with a frequency of 4. Other protocols present in these groups are CCCV, VTCP, DCS, LAUG, and SLMG.

Post hoc Welch's *t*-test between the two protocols considered to have a direct effect on the respiratory system (CVVT and VTCP) showed significantly better performance by CVVT (average difference 0.40 $p < 0.001$).

The specific techniques in the CVVT protocol are described and illustrated in Appendix 1.

Five protocols (SYMPN, LEN, UEN, DCD, and CP) demonstrated adverse effects. Although the scores did not fully meet the null rejection criteria, the amplitude of the negative changes in respiratory complaint score is enough to raise concern. CP protocol has not been used for several years, though portions of it were incorporated into the VTCP protocol. DCD protocol is a fascial counterstrain variation of DCS, and prior to the endpoint of this study was largely abandoned due to the superior performance of the older DCS protocol. SYMPN, UEN, and LEN are protocols that use fascial counterstrain nerve techniques for the sympathetic nerve chains, the vagus nerve, and nerves in the upper, and lower extremity, respectively. It is not clear if this poor performance is because all three protocols are relatively new and not completely refined (it

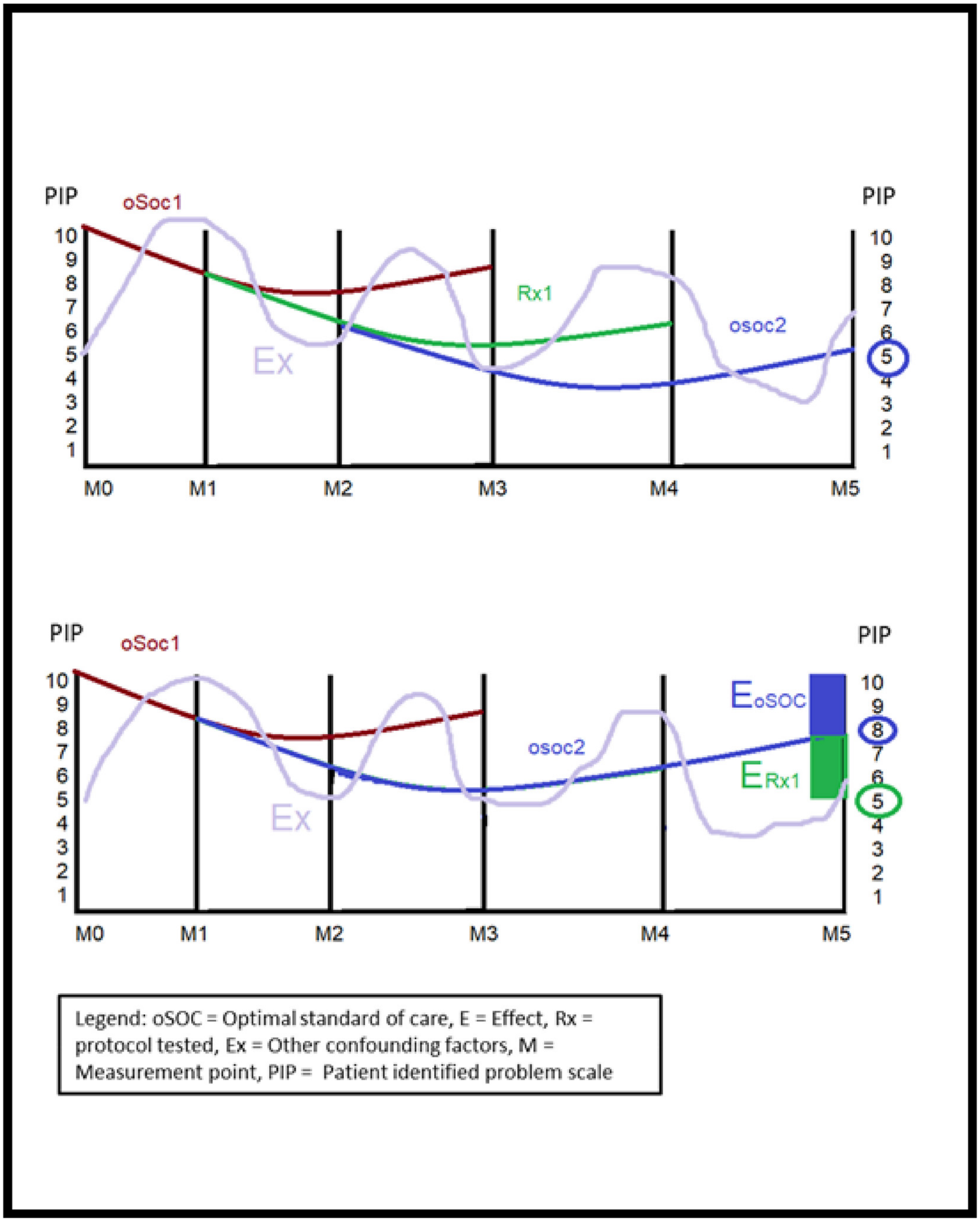


Fig. 3. Separation of Treatment Effect from other Treatment and Extraneous Factors.

usually requires several years of fine-tuning to produce a consistent effect) or that the effects of these protocols are truly detrimental to the respiratory system.

5. Discussion

The results of this study reject the null hypothesis as six of the protocols or protocol combinations exceeded all parameters set in the rejection criteria. Also, three protocol combinations exceeded all rejection criteria for overall improvement in patient symptoms. One protocol combination (CVVT) exceeded the rejection criteria for both the respiratory symptoms and overall progress.

The results of this study are also consistent with the findings of Zadro et al. (2020) that some interventions are efficacious, and some are not.

Although this study is not designed to identify the actual physiological mechanism of each of these protocols, we were able to measure the difference in performance of each of the protocols of interest we considered for their decongestive, immune regulation, neurogenic and mechanical effects.

Because of this fact, to enable further investigation into the physiological mechanisms, we feel it is important to discuss our hypothesis as to how these protocols work.

Decongestive effects: The CVVT protocol could have a primary decongestive effect. It is possibly doing so by optimizing venous and arterial blood flow to and from the cardiorespiratory system. The mechanism is hypothesized to be either by facilitation of fascial release around the vessel and/or a reflexive blood-shunting effect by modulation of a central reflex loop.

Table 2
Results by Individual Respiratory Complaint Score.

Protocol combination	*n* (frequency, control frequency)	score (control, difference)	SD	95% CI	ANOVA *F* ratio	*p* of *F*	Kruskal Wallis *H*	*P* of *H*	Glass's Δ
CVVT CCCV	19 (168, 11244)	**1.49 (0.14, 1.34)**	2.98	1.94 to 1.03	106.01	<0.001	22.4	<0.001	0.81
CVVT UD	19 (168, 11242)	**1.21 (0.15, 1.06)**	2.31	1.56 to 0.86	66.05	<0.001	30.41	<0.001	0.64
CVVT CVVT	17 (123, 11287)	**1 (0.15, 0.85)**	2.52	1.45 to 0.55	31.1	<0.001	11.11	<0.001	0.51
UD VTCP	21 (194, 11216)	**0.67 (0.15, 0.52)**	1.98	0.95 to 0.39	18.13	<0.001	11.31	<0.001	0.31
CVVT	114 (1109, 10301)	**0.62 (0.11, 0.51)**	2.42	0.77 to 0.48	93.31	<0.001	30.65	<0.001	0.32
CCCV DCS	40 (365, 11045)	**0.56 (0.15, 0.41)**	2.16	0.79 to 0.34	21.36	<0.001	8.31	0.002	0.25
OST	11 (106, 11304)	**1.21 (0.15, 1.06)**	1.5	1.50 to 0.92	41.29	<0.001	45.27	<0.001	0.63
Prone MG	12 (152, 11258)	**0.8 (0.15, 0.65)**	2.18	1.15 to 0.45	22.28	<0.001	4.61	0.018	0.39
RMG	9 (92, 11318)	**0.78 (0.16, 0.63)**	1.88	1.17 to 0.39	12.58	<0.001	9.87	0.001	0.37
UD LAUG	20 (185, 11225)	**0.43 (0.16, 0.27)**	0.99	0.57 to 0.29	4.74	0.029	9.65	0.001	0.16
DCS LAUG	25 (215, 11195)	**0.39 (0.16, 0.23)**	2.33	0.70 to 0.07	3.87	0.049	2.97	0.058	0.14
UD CCCV	45 (430, 10980)	**0.36 (0.15, 0.2)**	1.56	0.51 to 0.21	6.12	0.013	2.91	0.06	0.12
CCCV SCS	17 (167, 11243)	**0.34 (0.16, 0.18)**	1.2	0.52 to 0.15	1.79	0.181	4.02	0.027	0.1
SLMG	95 (1059, 10351)	**0.26 (0.15, 0.11)**	1.67	0.36 to 0.16	4.22	0.04	2.78	0.066	0.07
Barral	89 (1067, 10294)	**0.25 (0.15, 0.09)**	2.17	0.38 to 0.12	3.04	0.081	3.86	0.031	0.06
UD	417 (4556, 6750)	**0.21 (0.13, 0.08)**	1.87	0.27 to 0.16	6.72	0.01	0.41	0.48	0.05
VAS	6 (89, 11321)	**0.39 (0.16, 0.23)**	1.33	0.67 to 0.11	1.69	0.194	4.98	0.014	0.14
SLMG UD	16 (142, 11268)	**0.38 (0.16, 0.22)**	1.92	0.70 to 0.06	2.41	0.121	1.62	0.161	0.13
DCS Barral	28 (210, 11200)	**0.37 (0.16, 0.21)**	2.14	0.66 to 0.08	3.22	0.073	1.56	0.17	0.13
SIDJ	6 (76, 11334)	**0.36 (0.16, 0.19)**	0.92	0.57 to 0.15	1	0.316	4	0.028	0.12
VTCP UEDJ	19 (148, 11262)	**0.35 (0.16, 0.2)**	2.04	0.69 to 0.02	1.96	0.162	1.44	0.187	0.12
LAUG LEDJ UD	24 (117, 11293)	**0.32 (0.16, 0.16)**	1.93	0.67 to -0.04	0.99	0.32	0.76	0.336	0.09
CCCV METVAS	37 (355, 11055)	**0.29 (0.16, 0.13)**	1.72	0.47 to 0.11	2.11	0.146	0.01	0.916	0.08
seated MG	35 (377, 11033)	**0.23 (0.16, 0.07)**	1.29	0.36 to 0.10	0.62	0.431	0.23	0.595	0.04
VTCP	178 (1817, 9593)	**0.23 (0.15, 0.08)**	1.79	0.31 to 0.14	3.09	0.079	2.71	0.07	0.05
LEDJ	110 (1193, 10217)	**0.22 (0.16, 0.06)**	1.58	0.31 to 0.13	1.57	0.21	7.96	0.002	0.04
LAUG	173 (1725, 9685)	**0.18 (0.16, 0.02)**	1.56	0.25 to 0.11	0.21	0.65	0.32	0.531	0.01
CCCV	477 (4781, 6629)	**0.17 (0.16, 0.01)**	1.77	0.22 to 0.12	0.15	0.695	1.18	0.231	0.01
DCS	297 (2900, 8501)	**0.17 (0.16, 0.01)**	1.89	0.24 to 0.10	0.04	0.851	0.35	0.515	0.00
GUOU	38 (479, 10931)	**0.15 (0.16, -0.01)**	1.66	0.30 to 0.01	0.01	0.919	0.03	0.843	0.00
UD DCS Barral CCCV	19 (46, 11364)	**0.13 (0.16, -0.03)**	2.03	0.73 to -0.47	0.02	0.898	0.06	0.783	-0.02
UEDJ	57 (592, 10818)	**0.13 (0.16, -0.04)**	1.72	0.27 to -0.01	0.28	0.599	0.01	0.899	-0.02
GUD	53 (631, 10779)	**0.12 (0.16, -0.04)**	1.51	0.24 to 0.00	0.41	0.523	5.35	0.011	-0.03
SPDJ	67 (767, 10643)	**0.11 (0.17, -0.05)**	1.43	0.21 to 0.01	0.72	0.395	0.00	0.971	-0.03
METVAS	191 (2075, 9335)	**0.1 (0.17, -0.07)**	1.69	0.18 to 0.03	2.96	0.086	0.05	0.805	-0.04
GU	23 (172, 10015)	**0.07 (0.17, -0.1)**	1.28	0.27 to -0.12	0.53	0.467	1.03	0.262	-0.06
UD DCS LAUG CCCV	8 (20, 11390)	**-0.25 (0.16, -0.41)**	1.86	0.62 to -1.12	1.2	0.274	0.01	0.922	-0.24
SCS	66 (721, 10689)	**-0.03 (0.18, -0.21)**	1.43	0.07 to -0.14	10.2	<0.001	15.32	<0.001	-0.12
SSMG	25 (323, 11087)	**-0.06 (0.17, -0.23)**	1.86	0.14 to -0.26	5.71	0.017	2.08	0.112	-0.14
UD DCS Barral CCCV SYMPN	7 (7, 11405)	**-0.79 (0.16, -0.95)**	2.38	1.41 to -2.98	2.21	0.137	0.27	0.569	-0.56
DCD	38 (441, 10969)	**-0.09 (0.17, -0.26)**	1.53	0.05 to -0.24	10.42	<0.001	14.86	<0.001	-0.16
CP	16 (314, 11096)	**-0.12 (0.17, -0.29)**	1.82	0.08 to -0.32	9.12	0.003	8.16	0.002	-0.17
SYMPN	68 (723, 10687)	**-0.2 (0.19, -0.39)**	1.72	-0.08 to -0.33	36.12	<0.001	10.71	<0.001	-0.23
UEN	27 (305, 11105)	**-0.21 (0.17, -0.38)**	1.88	0.00 to -0.42	15.41	<0.001	10.17	<0.001	-0.23
LEN	16 (138, 11272)	**-0.34 (0.17, -0.51)**	2.21	0.03 to -0.71	12.44	<0.001	0.07	0.772	-0.3

Legend:
- Pass all criteria
- Pass all but one criteria
- Pass all but two criteria
- Pass all but three criteria
- Criteria failed
- Negative response 2 critiria or less failed

List of abbreviations: **UD:** Urinary Drainage, **DCS:** Diaphragm Cranial Sinus, **Barral:** Barral Motility Protocol, **CCCV:** Cardiac Cervical Cranial Vascular, **METSI:** Muscle Energy Technique Sacroiliac joint, **VAS:** Vascular, **SLMG:** Side-Lying Modified Glides, **RMG:** Reverse Modified Glides, **LAUG:** Lower Abdominal Urogenital, **LEDJ:** Lower Extremity Drainage Jones, **SPDJ:** Spinal drainage Jones, **SCS:** Strain Counterstrain, **VTCP:** Venous Thoracic Cardiopulmonary, **CVVT:** Cardiac Vascular Venous Thoracic, **CP:** Cardiopulmonary, **UEDJ:** Upper Extremity Drainage Jones, **UEN:** Upper Extremity Nerve, **LEN:** Lower Extremity Nerve, **OST:** Periosteum, **SYMPN:** Sympathetic Nerve

Table 3
Results by PIP Scale Score.

Protocol combination	*n* (frequency, control frequency)	PIP scale score (control, diff)	SD	95% CI	ANOVA *F* ratio	*p* of *F*	Kruskal Wallis *H*	p of *H*	Glass's Δ
CVVT CVVT	17 (123, 11287)	**5.95 (1.31, 4.64)**	8.63	7.49 to 4.41	33.79	<0.001	35.49	0	0.53
SLMG UD	16 (142, 11268)	**3.94 (1.33, 2.61)**	9.93	5.59 to 2.3	12.34	<0.001	12.79	0	0.3
LAUG LEDJ UD	24 (117, 11293)	**3.31 (1.34, 1.97)**	9.24	5 to 1.62	5.76	0.016	11.96	0.001	0.22
Prone MG	12 (152, 11258)	**5.71 (1.3, 4.41)**	15.28	8.16 to 3.26	37.6	<0.001	3.66	0.055	0.51
OST	11 (106, 11304)	**3.63 (1.34, 2.29)**	6.84	4.95 to 2.31	7.1	0.008	9.38	0.002	0.26
VTCP UEDJ	19 (148, 11262)	**2.98 (1.34, 1.64)**	9.9	4.59 to 1.37	5.05	0.025	6.75	0.009	0.19
UD LAUG	20 (185, 11225)	**2.97 (1.34, 1.64)**	7.88	4.12 to 1.83	6.28	0.012	7.67	0.006	0.19
GU	23 (172, 10015)	**2.76 (1.29, 1.47)**	7.61	3.9 to 1.61	4.74	0.029	11.7	<0.001	0.17
SPDJ	67 (767, 10643)	**2.66 (1.27, 1.39)**	6.59	3.12 to 2.19	17.74	<0.001	34.24	<0.001	0.16
SLMG	95 (1059, 10351)	**2.54 (1.24, 1.3)**	8.79	3.07 to 2.01	20.95	<0.001	44.65	<0.001	0.15
SSMG	25 (323, 11087)	**2.49 (1.33, 1.16)**	10.02	3.59 to 1.4	5.47	0.019	4.42	0.035	0.13
METVAS	191 (2075, 9335)	**2.14 (1.19, 0.95)**	9.21	2.54 to 1.74	19.85	<0.001	23.61	<0.001	0.11
LEDJ	110 (1193, 10217)	**2.07 (1.28, 0.79)**	8.62	2.56 to 1.58	8.55	0.003	14.13	<0.001	0.09
UD	417 (4556, 6750)	**1.72 (1.11, 0.61)**	9.76	2.01 to 1.44	13	<0.001	6.1	0.013	0.08
CVVT UD	19 (168, 11242)	**4.72 (1.31, 3.41)**	15.8	7.13 to 2.31	24.8	<0.001	0.25	0.619	0.39
UD DCS Barral CCCV	19 (46, 11364)	**4.65 (1.35, 3.3)**	13.97	8.8 to 0.5	6.44	0.011	1.54	0.214	0.38
DCS Barral	28 (210, 11200)	**3.37 (1.32, 2.05)**	11.89	4.99 to 1.75	11.13	<0.001	2.64	0.104	0.23
CVVT CCCV	19 (168, 11244)	**2.25 (1.35, 0.9)**	13.78	4.35 to 0.15	1.73	0.188	2.66	0.102	0.10
GUD	53 (631, 10779)	**1.87 (1.33, 0.54)**	9.16	2.59 to 1.15	2.22	0.136	4.65	0.031	0.06
DCS	297 (2900, 8501)	**0.96 (1.52, -0.56)**	9.3	1.3 to 0.62	9.05	0.003	9.31	0.002	-0.06
SCS	66 (721, 10689)	**0.54 (1.42, -0.87)**	6.34	1.01 to 0.08	6.63	0.01	7.49	0.006	-0.10
DCD	38 (441, 10969)	**0.47 (1.4, -0.93)**	8.42	1.26 to -0.32	4.7	0.03	23.63	<0.001	-0.11
seated MG	35 (377, 11033)	**0.25 (1.4, -1.15)**	6.47	0.91 to -0.4	6.15	0.013	17.85	<0.001	-0.13
CCCV METVAS	37 (355, 11055)	**2.93 (1.31, 1.62)**	11.33	4.11 to 1.74	11.56	<0.001	1.36	0.243	0.19
CVVT	114 (1109, 10301)	**2.28 (1.26, 1.02)**	12.47	3.02 to 1.55	13.4	<0.001	0.22	0.638	0.12
Barral	89 (1067, 10294)	**2.1 (1.28, 0.82)**	10.09	2.71 to 1.49	8.44	0.004	1.33	0.247	0.09
UEDJ	57 (592, 10818)	**1.71 (1.34, 0.36)**	9.2	2.45 to 0.97	0.96	0.327	6.3	0.012	0.04
LAUG	173 (1725, 9685)	**1.62 (1.32, 0.3)**	8.06	2 to 1.24	1.71	0.192	3.84	0.05	0.03
CCCV DCS	40 (365, 11045)	**2.04 (1.34, 0.7)**	10.37	3.11 to 0.98	2.26	0.133	0.11	0.74	0.08
CCCV SCS	17 (167, 11243)	**1.96 (1.35, 0.61)**	5.16	2.75 to 1.18	0.79	0.374	2.62	0.105	0.07
SIDJ	6 (76, 11334)	**1.76 (1.36, 0.4)**	4.98	2.9 to 0.62	0.16	0.691	2.74	0.097	0.05
UD CCCV	45 (430, 10980)	**1.23 (1.37, -0.14)**	9.7	2.15 to 0.31	0.11	0.744	6.19	0.013	-0.02
UD DCS Barral CCCV SYMPN	7 (7, 11405)	**3.57 (1.36, 2.21)**	15.2	17.63 to -10.48	0.44	0.507	0.45	0.504	0.25
VTCP	178 (1817, 9593)	**1.01 (1.43, -0.42)**	8.62	1.4 to 0.61	3.52	0.061	1.05	0.306	-0.05
RMG	9 (92, 11318)	**1.62 (1.36, 0.26)**	3.83	2.41 to 0.83	0.08	0.778	0.83	0.363	0.03
UD DCS LAUG CCCV	8 (20, 11390)	**1.4 (1.36, 0.04)**	5.91	4.16 to -1.36	0	0.985	0.07	0.796	0.00
CCCV	477 (4781, 6629)	**1.39 (1.34, 0.05)**	9.69	1.66 to 1.11	0.08	0.784	1.31	0.252	0.01
DCS LAUG	25 (215, 11195)	**1.38 (1.36, 0.02)**	7.37	2.37 to 0.39	0	0.98	0.39	0.532	0.00
GUOU	38 (479, 10931)	**1.26 (1.37, -0.1)**	8.94	2.07 to 0.46	0.06	0.802	0.19	0.659	-0.01
UD VTCP	21 (194, 11216)	**0.86 (1.37, -0.52)**	7.83	1.96 to -0.25	0.65	0.42	0.72	0.396	-0.06
VAS	6 (89, 11321)	**0.4 (1.37, -0.96)**	6.81	1.84 to -1.03	1.06	0.304	0.54	0.462	-0.11
LEN	16 (138, 11272)	**-0.05 (1.38, -1.43)**	9.63	1.57 to -1.67	3.59	0.058	6.14	0.013	-0.16
UEN	27 (305, 11105)	**-0.16 (1.4, -1.56)**	10.68	1.04 to -1.36	9.36	0.002	0.87	0.351	-0.18
SYMPN	68 (723, 10687)	**-0.35 (1.48, -1.83)**	10.41	0.41 to -1.11	29.28	<0.001	5.37	0.02	-0.21
CP	16 (314, 11096)	**-0.65 (1.42, -2.07)**	10.53	0.52 to -1.82	16.89	<0.001	13.14	<0.001	-0.24

Pass all criteria
Pass all but one criteria
Pass all but two criteria
Pass all but three criteria
Criteria failed
Negative response 2 critiria or less failed

List of abbreviations: **UD**: Urinary Drainage, **DCS**: Diaphragm Cranial Sinus, **Barral**: Barral Motility Protocol, **CCCV**: Cardiac Cervical Cranial Vascular, **MET SI**: Muscle Energy Technique Sacroiliac joint, **VAS**: Vascular, **SLMG**: Side-Lying Modified Glides, **RMG**: Reverse Modified Glides, **LAUG**: Lower Abdominal Urogenital, **LEDJ**: Lower Extremity Drainage Jones, **SPDJ**: Spinal drainage Jones, **SCS**: Strain Counterstrain, **VTCP**: Venous Thoracic Cardiopulmonary, **CVVT**: Cardiac Vascular Venous Thoracic, **CP**: Cardiopulmonary, **UEDJ**: Upper Extremity Drainage Jones, **UEN**: Upper Extremity Nerve, **LEN**: Lower Extremity Nerve, **OST**: Periosteum, **SYMPN**: Sympathetic Nerve

Also, amplification of the decongestive effect could occur by facilitating the motion of fluids away from the respiratory system and outside the body. Protocols in this category are UD (facilitation of a diuretic reflex), and LAUG or Barral (by creating fascial release or increased motility in and around visceral organs used for elimination).

Neurogenic mechanisms: DCS and CCCV protocols are the most likely to have a positive effect via a central neurogenic mechanism. It is hypothesized that by facilitation of blood flow and cerebrospinal fluid through the central nervous system, a balancing effect on the autonomic nervous system takes place. It is important to note that the results of this study demonstrate that just because a protocol affects the central or autonomic nervous system, it does not mean that the effect is necessarily beneficial, and it might even be detrimental (For example, the effects observed with DCD, SYMPN, UEN, and LEN protocols).

Mechanical effects: It is hypothesized that the function of the respiratory system might improve with protocols that focus on mechanical fascial release around the respiratory and abdominal organs. VTCP is the primary protocol having this effect, followed by LAUG and Barral. The population of this study was primarily ambulatory with a moderate chronic presentation. This leads to an interesting question: would these more mechanical techniques rise in value when treating patients that are under more acute respiratory distress and who have a decreased capacity to return to homeostasis because of larger systemic involvement?

Immune regulation: While the design and type of this study preclude us from observing any direct effects on the immune system, a closer analysis might reveal an effect that is hiding in plain sight. In this study, we see several samples that are too small to pass the rejection criteria, but otherwise have a surprisingly significant treatment effect (OST, prone MG, and RMG). If we add to this observation the larger sample of SLMG protocol, which yielded a smaller but significant effect, we can make two observations: First, none of these protocols were previously considered to affect the respiratory system. And second, all these protocols should affect circulation to and from the periosteum and the bone marrow. SLMG, prone MG, and RMG are considered to have a direct effect on the spinal bones, and OST consists mainly of counterstrain techniques for the periosteal fascia of the lumbar spine, pelvis, and the long bones in the lower limb. Considering the robust presence of the immune system in the bone marrow, (Bartl and Bartl, 2016; Weitzmann, 2017) if these effects are reproducible in a more extensive sample set, or in a new protocol focusing on hemodynamics in bone, it might point to a plausible mechanism to facilitate an effect on the immune system.

Additional considerations: Several items need to be considered if we attempt to extrapolate the findings of this study to the treatment of patients with a high degree of acute respiratory distress. First: Treatments might need to be done more frequently instead of on a weekly basis because of the more acute state of the problem treated. Second: Primary and secondary decongestive protocols might need to be combined into one treatment. This might be needed because of the degree of systemic compromise. We hypothesize that additional techniques, to make up for impaired visceral function, would be needed. While under normal or less acute circumstances, our expectation is that after a protocol is performed, other systems in the body would respond to it and complete the treatment effect over several days. In the case of acute impairment, it is possible that this secondary response would not happen, thus the need to compensate by adding additional techniques.

6. Conclusion

1. The first protocol to consider in this patient population is CVVT, followed by UD and CCCV. Protocols such as LAUG, DCS, VTCP, and Barral should also be considered in the plan of care. Treatments should be provided about one week apart to replicate the conditions in this study.
2. Further study is needed to fully evaluate the possible beneficial effects of protocols such as OST, prone MG, RMG, and SLMG.
3. SYMPN, UEN, and LEN, as well as the now-discarded DCD and CP protocols, should not be used on patients with respiratory complaints until a further understanding of reasons for observed adverse effects is achieved.

Also, additional interventions or protocols should be considered to address the patient's other issues.

Generalizability: This study should provide immediate practical implications to clinicians who are already using these protocols. However, since all of the protocols discussed in this study are published (Halili, 2020a), the findings of this study could be imminently implemented by clinicians who has basic training in any of the osteopathic or physical therapy methods used to develop these protocols (Tuckey 2018, 2019; Weiselfish-Giammatteo 1997; Barral and Croibier 2011; Jones et al., 1995; Mitchell and Mitchell, 2001).

Limitations: Because this analysis was retrospective, despite controlling for most of the confounding factors, it was impossible to determine what were all of the factors and if they were fully controlled. Furthermore, Although Type I and Type II error threats were controlled in the manner described by Halili (2021) we cannot fully eliminate these threats in this type of an analysis. Further prospective work and replication of these findings is needed to better interpret the results of this study.

Funding source

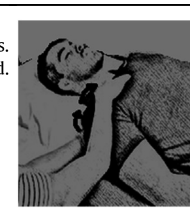
There were no external funding sources in this study.

Appendix B. Supplementary data

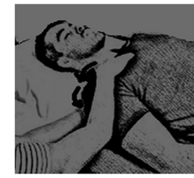
Supplementary data related to this article can be found at https://doi.org/10.1016/j.jbmt.2021.02.009.

Appendix 1. CVVT protocol

(excerpted from Halili A. (2020). Systemic Manual Therapy. Sun Bernardino, California: Kindle Direct Publishing).

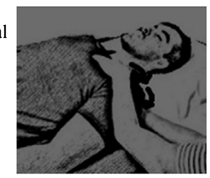
	Side	Technique (source) M = modified	description	Illustration
1	R	Superior Pulmonary Vein Anterior [4M]	**Patient** supine **Therapist** to right of the patient. Left hand over anterior upper ribs. Right hand over posterior upper ribs. Apply anterior medial compression with the left hand and anterior lateral compression with the right hand.	

(*continued*)

	Side	Technique (source) M = modified	description	Illustration
2	R	Superior Pulmonary Vein Posterior [(4M)]	**Patient** supine **The therapist** left hand over anterior upper ribs. Right hand over posterior upper ribs. Apply posterior lateral compression with the left hand and posterior medial compression with the right hand.	
3	R	Middle Pulmonary Vein Anterior [(4M)]	**Patient** supine **The therapist** left hand over lateral ribs between the scapula and the pectoral area. Right hand over posterior ribs medial to the scapula. Apply anterior medial compression with the left hand and anterior lateral compression with the right hand.	
4	R	Middle Pulmonary Vein Posterior [(4M)]	**Patient** supine **The therapist** left hand over lateral ribs between the scapula and the pectoral area. Right hand over posterior ribs medial to the scapula. Apply posterior lateral compression with the left hand and posterior medial with the right hand.	
5	R	Lower Pulmonary Vein Anterior [(4M)]	**Patient** supine **The therapist** left hand over the lower ribs. Right hand over posterior lower ribs. Apply anterior inferior medial compression with the left hand and anterior superior lateral compression with the right hand.	
6	R	Lower Pulmonary Vein Posterior [(4M)]	**Patient** supine **The therapist** left hand over the lower ribs. Right hand over posterior lower ribs. Apply posterior lateral superior compression with the left hand and posterior medial inferior with the right hand.	
7	R	Lower Intercostal Nerves Anterior [(14)]	**Patient** supine **The therapist** left hand over the abdominal area. Right hand over posterior upper lumbar area. Apply anterior inferior medial compression with the left hand and anterior superior lateral compression with the right hand.	
8	R	Lower Intercostal Nerves Posterior [(14)]	**Patient** supine **The therapist** left hand over the abdominal area. Right hand over posterior upper lumbar area. Apply posterior lateral superior compression with the left hand and posterior medial inferior with the right hand.	

(*continued on next page*)

(*continued*)

	Side	Technique (source) M = modified	description	Illustration
9	L	Superior Pulmonary Vein Anterior (4M)	**Patient** supine **Therapist** to the left of the patient. Right hand over anterior upper ribs. Left hand over posterior upper ribs. Apply anterior medial compression with the right hand and anterior lateral compression with the left hand.	
10	L	Superior Pulmonary Vein Posterior (4M)	**Patient** supine **Therapist**'s right hand over anterior upper ribs. Left hand over posterior upper ribs. Apply posterior lateral compression with the right hand and posterior medial compression with the left hand.	
11	L	Middle Pulmonary Vein Anterior (4M)	**Patient** supine **Therapist** right hand over lateral ribs between the scapula and pectoral area. Left hand over posterior ribs medial to the scapula. Apply anterior medial compression with the right hand and anterior lateral compression with the left hand.	
12	L	Middle Pulmonary Vein Posterior (4M)	**Patient** supine **Therapist** right hand over lateral ribs between the scapula and pectoral area. Left hand over posterior ribs medial to the scapula. Apply posterior lateral compression with the right hand and posterior medial with the left hand.	
13	L	Lower Pulmonary Vein Anterior (4M)	**Patient** supine **Therapist** right hand over lower ribs. Left hand over posterior lower ribs. Apply anterior inferior medial compression with the right hand and anterior superior lateral compression with the left hand.	
14	L	Lower Pulmonary Vein Posterior (4M)	**Patient** supine **Therapist** right hand over lower ribs. Right hand over posterior lower ribs. Apply posterior lateral superior compression with the right hand and posterior medial inferior with the left hand.	
15	L	Lower Intercostal Nerves Anterior (14)	**Patient** supine **Therapist**'s right hand over the abdominal area. Left hand over posterior upper lumbar area. Apply anterior inferior medial compression with the right hand and anterior superior lateral compression with the left hand.	
16	L	Lower Intercostal Nerves Posterior (14)	**Patient** supine **Therapist**'s right hand over the abdominal area. Left hand over posterior upper lumbar area. Apply posterior lateral superior compression with the right hand and posterior medial inferior with the left hand.	

(*continued*)

	Side	Technique (source) M = modified	description	Illustration
17		Intraventricular Coronary Artery [(4)]	**Therapist's** left hand under the patient's left elbow. Flex the patient's arm about 30° and slightly adduct—right hand over the second Sterno-chondral joint. Apply slight inferior medial compression.	
18		Left Coronary Artery [(4)]	**The therapist's** left-hand lift patient's left arm elevates shoulder about 50°. Right hand under the atlanto-occipital area. Apply a slight anterior lateral force to the left	
19		Left Anterior Descending Coronary Artery [(4)]	**Therapist's** left hand over the left tenth rib. Apply superior medial compression. Right hand under the occiput. Apply slight head flexion with rotation to the left.	
20		Posterior Descending Coronary Artery [(4)]	**The therapist** left hand over the seventh rib. Apply slight superior lateral compression, right hand over the left shoulder. Apply slight inferior medial compression.	
21		Marginal Coronary Artery [(4)]	**Therapist's** left hand under the left scapula. Apply anterior superior medial compression—the right hand over the left clavicle. Apply slight inferior lateral compression.	
22		Right Coronary Artery [(4)]	**Therapist's** left hand under the left scapula. Apply anterior superior medial compression—right hand over the right clavicle. Apply slight inferior medial compression.	
23	L	Subclavian Artery [(4)]	**Therapist's** left index and middle fingers over the left lateral clavicle. Right index and middle fingers over the medial left clavicle. Apply slight inferior compression.	
24	R	Subclavian Artery [(4)]	**Therapist's** right index and middle fingers over the lateral right clavicle. Left index and middle fingers over the medial right clavicle. Apply slight inferior compression.	

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