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The Effects of the Inclusion of a Bobath Based Approach in the Rehabilitative Treatment of Patients Post Stroke Resulting in Hemiparesis

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CRITICALLY APPRAISED TOPIC

The Effects of the Inclusion of a Bobath Based Approach in the Rehabilitative Treatment of Patients Post Stroke Resulting in Hemiparesis

Clinical Scenario: The patient of interest was a 63 year old male who presented to the hospital with right sided weakness, dysarthria, and headache. Imaging revealed an acute ischemic cerebrovascular accident (CVA) involving the left middle cerebral artery. He received a physical therapy evaluation within 24 hours of his stroke and presented with less than 3/5 strength in his right upper extremity and 3-3+/4 strength in his right lower extremity. Prior to the stroke, the patient was independent with activities of daily living and lead an active lifestyle. He lived alone in a single level house.

Introduction: The Bobath, or Neurodevelopmental approach (NDT), is a rehabilitative treatment approach for patients with neurological conditions. It was established by Berta and Karel Bobath in the 1950s and focuses on recovery rather than compensation. Treatments are individualized and focus primarily on improving postural control and coordination throughout movement sequences. Sensory input and manual facilitation is provided throughout treatment to enhance motor control and motor learning. Treatment also focuses on the efficiency of movement and often aims to limit compensatory movement patterns. Other current treatment approaches may be impairment based or focus on early accomplishment of tasks regardless of movement sequence. Additionally, many current treatment approaches include repetitive task practice to increase function. It is important to note that the Bobath approach has evolved over the decades to adapt to contemporary neurological and rehabilitative sciences. The focus of the Bobath concept used to be in reducing spasticity in order to minimize compensatory movements and to facilitate any missing components or positions of a normal developmental sequence.[1,12] The Bobath concept has developed and spasticity is now considered a contributing factor to movement dysfunction instead of being the primary cause. Clinicians work with patients to improve muscle contraction and activation patterns, but do not limit functional progression if tone is still present.[1] Additionally, reflexes are now understood as reactions to support movement rather than primitive movement patterns.[12] Task specific practice in different contexts and environments is now included in accordance with modern principles of motor learning. Research on the Bobath approach does not often reflect the developments made to the theory and clinical trials do not usually provide a detailed account of therapeutic interventions. Therefore, it is difficult to ascertain what version of a Bobath based approach is being implemented. The focus on sensory input and manual facilitation to enhance postural control is still a tenet of the approach and separates it from other treatment approaches. The aim of this critically appraised topic is to decipher if the inclusion of the Bobath approach in stroke rehabilitation provides any substantial benefit to the patient with the understanding that there may be some overlap in treatment approaches due to the modernization of the theory.

Clinical question: Does the inclusion of the Bobath/Neurodevelopmental Approach in treating hemiparetic patients post cerebrovascular accident improve gait and function more than interventions without it?

Clinical Question PICO:
Population – Older adults with hemiparesis post acute cerebrovascular accident

Intervention – Care that includes the Bobath/Neurodevelopmental Approach

Comparison – Care that does not include the Bobath/Neurodevelopmental Approach

Outcome – Gait speed, standardized functional outcome assessments

Overall Clinical Bottom Line: Based on the results of this critically appraised topic, there is moderate evidence to suggest that for patients post CVA resulting in hemiparesis an intervention based on the Bobath approach provides similar outcomes in function to other treatment approaches. In all four articles, subjects that received Bobath based treatment initiated in an acute care setting demonstrated statistically significant increases in function. However, the increases in function were either not statistically different than the improvements noted in comparison groups or Bobath group effect sizes were slightly lower than comparison groups. In Gelber et al., there was no difference found between the Bobath approach and the Traditional Functional Retraining group in regards to gait speed or the Functional Independence Measure. Wang et al. found the Bobath group improvement on the Berg Balance Scale was no different than subjects who received an orthopedic approach. Subjects in the Bobath group did have a greater improvement on the MAS, but the fair internal validity of this study slightly limited its usefulness. Van Vliet et al. had good internal validity and provided moderate evidence that the Bobath approach was similar to a Movement Science Based approach because there was no difference between group improvement on the Rivermead Motor Scale, Motor Assessment Scale, or gait speed. Lastly, Langhammer et al provided moderate evidence that the Bobath approach was slightly less favorable when compared to a Motor Relearning Program (MRP) on the Sodring Motor Evaluation Scale and Motor Assessment Scale. Between group analysis revealed a small effect size favoring the MRP group, but the lower end of the confidence interval crossed zero indicating that in future trials the Bobath approach could have been more effective. The MRP group did have a statistically significant shorter length of hospital stay. Therefore, the inclusion of a Bobath approach did not provide any additional increases in patient function than comparison treatments did.

As mentioned previously, the Bobath approach now includes task specific practice with a focus on normalizing tone and movement sequence. It is important to note that the four articles examined in this review focused on an earlier interpretation of the approach where task specific training is not included. Therefore, future research on the subject is required to ascertain as to how beneficial the Bobath approach is in combination with task specific practice.

Search Terms: Bobath, Neurodevelopmental Approach, stroke rehabilitation, cerebrovascular accident, hemiparesis, facilitation

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Rationale for your chosen articles: The following four articles all included a Bobath approach compared to a different treatment approach with subjects randomly allocated to either group.   All treatments were initiated in an acute care setting and included subjects post CVA specifically resulting in hemiparesis. Additionally, all four articles included valid and reliable tools to assess function. The comparison groups in all four articles were similar and were either based on task specific training or orthopedic approaches. Therefore, the similarity of study design between the articles and similarity to the patient of interest made these the best choices to examine the effectiveness of the Bobath approach.

Table 1. Comparison of PEDro Scores

	Gelber	Wang	Van Vliet	Langhammer
Random	1	1	1	1
Concealed allocation	0	1	1	1
Baseline comparability	0	0	1	1
Blind Subjects	0	0	0	1
Blind Therapists	0	0	0	0
Blind Assessors	0	1	1	1
Adequate Follow-up	1	1	1	1
Intention-to-Treat	0	1	1	0
Between Group	1	1	1	1
Point Estimates & Variability	1	1	1	1
Total Score	**4**	**8**	**8**	**8**

Article 1: Gelber DA, Josefczy PB, Herrman D, Good DC and Verhulst SJ. Comparison of two therapy approaches in the rehabilitation of the pure motor hemiparetic. *Journal of Neurological Rehabilitation* 1995; 9: 191–196.

Clinical Bottom Line: Based on the results of this study, there is insufficient evidence to suggest that for subjects post acute stroke resulting in hemiparesis interventions based on the Neurodevelopmental (NDT) approach result in more favorable outcomes in gait and function when compared to a Traditional Functional Retraining approach (TFR). Subjects in both treatment groups surpassed the minimum clinically important difference (MCID) of 22 points on the Functional Independence Measure (FIM) between admission and discharge. The authors reported no statistically significant difference between groups when comparing change scores at discharge or at a 1 year. The effect size at both assessments favored the NDT group, but the lower value of the confidence interval for both effect sizes was negative demonstrating that if the study were repeated the outcome may have favored the other treatment approach. Although subjects in the NDT group did experience significantly greater increases in gait speed at discharge (p<0.04) change scores were not provided, so an effect size could not be calculated. Additionally, methodology regarding gait assessments limited the usefulness of this assessment. Groups were not similar in mean gait speed at baseline and a different number of subjects were included in gait assessments at each interval. Other significant threats to the internal validity in this study were lack of blinding of assessors, insufficient power, and lack of an intention to treat analysis for subjects lost before the 1 year follow-up. The lack of power presented a type 2 error where a difference that may have existed between groups was not illustrated. Although the study matched the population of interest, further research with a larger number of subjects and blinding is necessary to apply conclusions about which treatment method is preferable. Additionally, it may have been beneficial to use a functional outcome measure that provided insight into quality of movement versus accomplishment of tasks.

Article PICO:
- **Population:** 27 pure motor ischemic stroke survivors with hemiparesis no greater than 1 month post stroke
- **Intervention**: Neurodevelopmental approach
- **Comparison:** Traditional functional retraining approach
- **Outcome**: Gait speed and Functional Independence Measure

Blinding: Therapists, subjects, and assessors were not blinded during this study. It was not feasible to blind therapists to group allocation because physical and occupational therapists received specific training in order to ensure they provided consistent interventions. Outcome measures were assessed by therapists not blinded to group allocation. It was not specified whether the therapists conducting assessments were different from those providing treatments.

Controls: Controls included randomized group allocation, inclusion of a control group, similarity of subjects at baseline, and the use of valid outcome measures. The control group in this study received the TFR approach because it would have been unethical to not provide rehabilitation services to subjects post stroke. This served as an adequate control because subjects in the TFR group did not receive emphasis on quality of movement, inhibition of tone, and use of the hemiparetic side as in the NDT group. Additionally, only the TFR group received range of motion and progressive resistive exercises.

Subjects in both groups had a similar length of stay: 27.3 days for the NDT group and 25.2 days for the TFR group. The subjects in the TFR group were enrolled 2 days later than the NDT group resulting in a length of stay of roughly 25 days for both groups. Frequency and duration of treatments were not specified so it is possible that the amount of therapy was not consistent between groups.

Randomization: Subjects were randomly assigned to the NDT or TFR group. Randomization was successful because there were no significant differences between the two groups at baseline in terms of age, gender, side of stroke, or time since cerebrovascular accident.

Study: This study consisted of 27 subjects post pure motor ischemic stroke resulting in hemiparesis. The mean number of days post stroke was 12. Subjects consisted of a convenience sample from a single acute inpatient rehabilitation center. Inclusion criteria consisted of onset of stroke resulting in hemiparesis within the past month. Subjects were excluded if they had nonischemic strokes, cognitive or language deficits, visual or sensory deficits, bilateral motor deficits, history of a prior stroke, or history of regular use of an assistive device.

Fifteen subjects were randomized into the NDT intervention group and 12 were randomized into the TFR intervention group. The average age of subjects in the NDT groups was 73.8 years and 69.8 years in the TFR group. Treatment sessions in the NDT group aimed to decrease abnormal tone and associated reactions. The focus was to promote normal movement patterns and emphasize weight-bearing through the hemiparetic side before progression to functional tasks. Subjects did not participate in resistive exercises. Subjects in the TFR group participated in range of motion exercises, resistive exercises, and functional task practice without emphasis on whether or not reflexes or spasticity were present. Subjects in the TFR group also received early use of assistive devices and braces if applicable.

Both groups received treatments based on the designated approach from physical and occupational therapists throughout their stay. Additionally, nursing staff was trained in the various techniques to facilitate transfers in a similar manner to those during therapy sessions. Frequency and duration were not specified.

<u>Outcome measures:</u> The outcome measures related to function and gait speed were relevant to the clinical question. Function was rated by the FIM. Gait was measured if subjects were able to ambulate 50 feet with or without an assistive device. Gait velocity was averaged over three trials of ambulation with five minute rest periods in between. Subjects were rated at admission, discharge, six months post discharge, and 1 year post discharge.

The FIM is an assessment tool to measure independence with functional mobility and activities of daily living most often used during a hospitalization. It is composed of 18 specific tasks that are related to motor and cognitive abilities for a total of 126 available points. Each item is scored between 1 and 7 points with a score of 1 reflecting total assistance needed for that particular task and a score of 7 indicating complete independence. The motor subscale compromises 13 of the 18 items and includes activities of daily living and mobility. The mobility items most pertinent to this clinical question are transfers from a bed to a chair, toilet transfers, bath/shower transfers, ambulation, and stair navigation. Cognitive task items are related to comprehension, expression, social interaction, problem solving, and memory.

The authors did not address the reliability, validity, or minimal clinically important MCID with regards to the FIM or gait speed. Additionally, they did not comment on the inter/intra-rater reliability for either outcome measure. The FIM has been established as a reliable and valid tool to assess function in the stroke population and an MCID of 22 points has been established specifically for the stroke population.[2] Gait speed is also a valid and reliable mobility measurement tool in subjects with neurologic impairment and an MCID of 0.16 m/s has been established in the stroke population.[3,4] Additionally a gait speed of $< .56$ m/s is predictive of falls.[5]

<u>Study losses:</u> Before the six month follow up assessment, 1 member of the NDT group died and 3 members the TFR group died. Additionally, 7 subjects did not return for their 6 month and 1 year assessments and FIM scores were collected over the phone. The authors did not specify why the 7 subjects did not return or which treatment group they were from. An intention to treat analysis was not performed.

Summary of internal validity: Overall this study demonstrated poor internal validity. Strengths of the study were adequate definitions of inclusion and exclusion criteria, random allocation to treatment groups, subjects were similar at baseline, and inclusion of long term follow-up assessments.

Several threats to internal validity were maturation, testing effect, selection and lack of blinding. Maturation was a minor threat because subjects who experience pure motor lacunar infarcts usually experience spontaneous recovery.[6] Therefore, it is likely that a certain level of recovery occurred regardless of rehabilitation intervention. However, it is reasonable to expect that subjects across groups had a comparable rate of natural recovery due to similarities in stroke type and onset of stroke. Testing effect was also a minor threat since subjects likely performed better each time they received a particular assessment. Selection was a minor threat to the study since subjects were a

convenience sample chosen from a single inpatient rehabilitation clinic. Lastly, lack of blinding introduced a moderate threat of rater bias.

This study presented poor statistical validity. First, the authors used valid and reliable assessment tools, but did not provide specific motor subscale scores for the FIM. Although subjects with cognitive deficits were excluded, it is still possible that the inclusion of cognitive scores made it possible that improvements in mobility were not reflected if subjects experienced a simultaneous decline in cognition. Secondly, a straightforward comparison between the groups in regards to change in gait speed was not possible for several reasons. Gait speed was not similar at baseline between groups and subjects were assessed as they were able to ambulate. Thus, the mean speed at discharge included data for subjects not analyzed upon admittance. Lastly, the largest threat to statistical validity was the lack of adequate power. A total of 27 subjects were randomized into groups of 12 and 15. However, a power analysis revealed that a minimum of 26 subjects per group were necessary to reach 80% power. This introduced a type 2 error where a potential existing difference between groups was not discovered because there weren't enough subjects to demonstrate it.

All subjects in this study were included in the baseline and discharge assessments. These findings are most pertinent to the clinical question because the patient was encountered in an acute care setting. However, 4 subjects died before the follow- up assessments and an intention to treat analysis was not performed. Therefore, long term follow- up assessments do not reflect how the scores would have changed if the subjects had an unfavorable response to the treatment. Additionally, seven subjects that did not return for the follow-up assessments were evaluated on the FIM over the phone introducing bias.

Evidence:
The outcomes of the FIM and gait speed at admission and discharge were of particular interest to this clinical question. The FIM score was rated at admission for all subjects and data was assessed with a Student's t-test.

Table 2: FIM admission scores, FIM mean change scores at discharge, and MCID.

Group	Mean FIM Score at Admission	Mean Change of FIM Score after Discharge	Met MCID
NDT Group (n=15)	77.9 (± 3.8)	23.3 (± 1.9)	yes
TFR Group (n=12)	82.1 (± 5.8)	22.5 (± 2.3)	yes

The authors reported that groups were not different at baseline in regards to the FIM. Both groups met the MCID of 22 points.

Table 3: Mean difference and effect size between the NDT and TFR groups at discharge

Mean difference between groups (95% CI)	Effect Size (95% CI)
0.8 (-0.90 to 2.50)	0.38 (-0.38 to 1.15)

Table 3 shows the calculated mean difference between the change scores and the effect size. The author's reported there was no significant difference in change scores between groups suggesting that both treatments had an equitable effect. The between group effect size was small (0.38) and favored the NDT treatment. However, the lower end of the 95% confidence interval crossed zero indicating that if this study were repeated the results could have favored the TFR group. Therefore, there is less confidence the NDT approach is a superior treatment.

Table 4: FIM score at admission, mean change scores on the FIM after 1 year and MCID

Group	Mean FIM Score at Admission	Mean Change of FIM Score after 1 year	Met MCID
NDT Group (n=14)	77.9 (± 3.8)	31.9 (± 4.0)	yes
TFR Group (n=9)	82.1 (± 5.8)	28.9 (± 4.7)	yes

Table 4 illustrates FIM changes scores at 1 year follow-up. There was no statistical difference noted between groups although both demonstrated continued improvements post discharge.

Table 5 : Calculated mean difference and effect Size between the NDT and TFR groups at 1 year

Mean difference between groups (95% CI)	Effect Size (95% CI)
3 (-0.79 to 6.79)	0.70 (-0.16 to 1.56)

Table 5 shows the mean difference between the change scores and the effect size of the difference. The effect size was medium and once again favored the NDT group. However, the lower end of the confidence interval was negative indicating if the study were repeated the results would not necessarily favor the NDR group.

Table 6 : Authors' Reported Measurements of Gait Speed on Admission and at Discharge

Group	Mean Gait Speed at Admission (m/s)	Mean Gait Speed at Discharge (m/s)	MCID (m/s)
NDT	(n=3) 0.55 (± 0.12)	(n=6) 0.52 (± 0.09)	0.16
TFR	(n=7) 0.18 (± 0.6)	(n=6) 0.21 (± 0.4)	0.16

Table 6 shows the authors provided mean gait speeds at admission and discharge. Mean change scores for gait speed were not provided. Therefore, it was not possible to calculate an effect size. Subjects were not similar at baseline in gait speed and subjects were added as they were able to ambulate. Although the authors did report a significant difference between discharge gait speed favoring the NDT group (p=0.04), the inconsistency between subjects included in assessments and small power make these results unreliable.

Applicability of study results:

Benefits vs. Costs: The length of stay during hospitalization was similar for both intervention groups as mentioned previously. A large part of discharge planning for subjects post stroke is assessment of functional level. Since there was no difference between groups in FIM change scores, there is insufficient evidence to say that including the Bobath approach is any more or less beneficial than a traditional functional retraining approach. The authors did not report on the specific amount of time each group received therapy so there is no evidence as to which intervention was more time efficient However, both treatment groups benefited from therapy services and had clinically meaningful changes in functional outcomes. However, the FIM does not capture quality or ease of movement, but rather the amount of assistance a person needs with a task. It is possible that the Bobath approach resulted in more typical movement patterns which would theoretically conserve energy for the subject, but this study did not explore that potential benefit.

Feasibility of treatment: The principles behind both of the treatment approaches were described by the authors. However, specific details describing treatment sessions and frequency were not provided. Therefore, it would not be possible to specifically replicate the treatments provided to patients in this particular study. However, both treatments approaches were appropriate in terms of increasing independence with activities of daily living and functional mobility.

Summary of external validity: The patient population in this study matched the population of interest in acuity of stroke, age, and resulting motor impairments. Additionally, the interventions were feasible to perform in a rehabilitation setting and the authors included a long term follow-up. However, the internal validity of this study was poor which compromises the ability to generalize these results to the larger population

of patients post stroke resulting in hemiparesis. Additionally, a minor threat to the external validity was that the subjects were a sample of convenience from a single clinic.

Article 2: Wang RY, Chen HI, Chen CY and Yang YR. Efficacy of Bobath versus orthopedic approach on impairment and function at different motor recovery stages after stroke: a randomized controlled study. *Clinical Rehabilitation* 2005; 19: 155–164.

Clinical Bottom Line: Based on the results of this study, there is weak evidence to suggest that for subjects with hemiparesis post acute stroke in Brunstrom stages 2-3 rehabilitation based on the Bobath approach results in significantly greater increases in function according to the Motor Assessment Scale (MAS) when compared to an orthopedic approach. The Bobath group of subjects with spasticity had a statistically significantly greater improvement in change on the MAS with a large effect size of 1.17 (95% CI 0.24 to 2.10). There was no difference in change between groups in regards to the Berg Balance Scale (BBS) although both groups improved significantly and surpassed the minimum detectable change (MDC) of 6.9 points.

Although the assessors were blinded, the outcome measures were scored according to subjective rankings which introduce some rater bias. Additionally, it was unclear if subjects were similar in baseline on the BBS. Both outcome tools were reliable and valid, but neither has an established meaningful clinically important difference (MCID) making it difficult to determine how relevant improvements in function were. It would be beneficial to have future research on this subject with larger group sizes, outcome measures with established MCID's, and inclusion of assessment tools with continuous data such as gait speed.

Article PICO:
- **P**opulation**:** 44 stroke survivors with hemiparesis
- **I**ntervention: Bobath treatment program
- **C**omparison: Orthopedic treatment program
- **O**utcome measures: Motor Assessment Scale, Berg Balance Scale

Blinding: Therapists and subjects were not blinded. Therapist blinding was not possible because therapists adhered to strict protocols according to Bobath and Davis textbooks and had received advanced training in these techniques. Additionally, therapists treating in the orthopedic group had extensive experience working with stroke survivors and providing orthopedic based treatments. Assessors were blinded to group allocation and not involved in treatments.

Controls: Controls included randomized group allocation, blinding of assessors, use of valid outcome measures, and stratification into groups based on Brunnstrom stages of

motor recovery. The comparison group in this study received an orthopedic approach because it would have been unethical to not provide rehabilitation services to subjects post stroke. This served as an adequate control because subjects in the orthopedic group did not receive manual or proprioceptive facilitation or exercises to increase postural control which are the basic tenants of the Bobath approach. Additionally, subjects in the orthopedic group did not have techniques provided to reduce tone or inhibit spasticity during movement. Subjects also followed a strict protocol and had the same frequency and duration of treatment.

Randomization: Subjects were allocated to groups via sealed envelopes administered by an independent study participant. Subjects with were similar in demographics. It was unclear if subjects with spasticity were similar at baseline in regards to the BBS and, therefore, it is not clear if randomization was successful.

Study: This randomized, controlled trial compared the effectiveness of the Bobath treatment approach to an orthopedic approach in the rehabilitation of stroke survivors. Subjects were a convenience sample of 44 stroke survivors from a single inpatient rehabilitation center. Inclusion criteria were hemiparesis resulting from a recent cerebrovascular accident, lower extremity Brunnstrom stage 2-5 of motor recovery, and the ability to communicate. Twenty-one subjects in Brunnstrom stages 2 or 3 were stratified into a "spasticity" group and twenty-three subjects in Brunnstrom stages 4 or 5 were stratified into a "relative recovery" group. Subjects were then randomized into either a Bobath or orthopedic treatment group.

The subjects with spasticity were relevant to this clinical question because they were the most similar to the demographics of the patient of interest. Subjects in the Bobath group had a mean age of 53.9 ($\pm$ 11.8) and were 21.9 ($\pm$ 7.4) days post stroke. Subjects in the orthopedic group had a mean age of 59.3 ($\pm$ 12.2) and were 20.7 ($\pm$ 5.9) days post stroke.

Subjects in both groups received 40 minute treatments 5 times a week for 4 weeks. Subjects in the Bobath group had treatments based on retraining normal movement patterns and received manual, sensory, and proprioceptive facilitation.   Efforts were made to reduce tone and train postural control for dynamic balance activities and functional movement patterns. Subjects in the orthopedic group received impairment based treatments including range of motion exercises, resistive exercises and multiple repetitions of functional activities such as transfers and gait.

Outcome measures: Subjects were assessed at baseline and after the treatment. Outcome measures pertinent to this clinical question were MAS and the BBS. Assessments were taken by physical therapists who did not treat the groups and who were blinded to group allocation.

The MAS is a clinical scale involving 8 areas of motor function. The authors in this study only assessed the five areas that were pertinent to functional mobility which included rolling, supine to sit transfers, static sitting, sit to stand transfers, and gait. Each item is scaled from 0 to 6 for a total of 30 available points. The authors cited that the MAS is a reliable scale. It has also been demonstrated as a valid outcome assessment tool in the stroke population.[7] There is no MCID or minimum detectable change (MDC) established in the literature for this assessment tool.

The BBS assesses a subjects ability to perform 14 tasks including sitting, standing, turning, reaching, and stepping. Subjects are rated from 0 (cannot perform) to 4 (normal performance) for a total of 56 available points. The authors cited that the BBS has excellent reliability and validity. An MCID has not been established in the literature, but a MDC of 6.9 points has been identified for the stroke population.[8]

Study losses: All subjects completed the trial.

Summary of internal validity: Overall this study demonstrated fair internal validity. Strengths of the study were adequate definitions of inclusion criteria, stratification, random allocation to treatment groups, blinding of assessors, and adherence to a strict protocol. Additionally, all subjects completed the trial and authors used valid and reliable outcome tools. However, neither assessment tool had an MCID established in the literature making it more difficult to discern how meaningful the improvements were to actual function. It is important to note that the MAS and BBS are scored on an ordinal scale that require a subjective judgment from the assessor. The evidence would have been stronger if the authors included continuous data, such as gait speed, to eliminate subjectivity.

Several minor threats to internal validity were lack of exclusion criteria, maturation, testing effect, selection, and lack of blinding of subjects and therapists. It is possible that subjects were included with cognitive deficits because they were not explicitly excluded. Thus, the ability to follow commands may have differed between subjects and decreased the efficacy of treatments. Maturation was a minor threat. Subjects post stroke may experience spontaneous recovery, but it was likely equitable between groups since they were similar in number of days post stroke. Testing effect was a minor threat since subjects likely performed better each time they received a particular assessment. Selection was a minor threat since subjects were a sample of convenience. Lack of blinding of subjects and therapists introduced the Hawthorne and Rosenthal effects. A moderate threat to internal validity was that although subjects were similar in demographics, they appeared different at baseline on the BBS.

Evidence: The MAS and BBS scores were rated prior to treatment and after 4 weeks for all subjects. Within group comparisons were assessed with a paired t-test and between group comparisons were assessed with an independent t-test. Subjects

appeared similar at baseline in terms of the MAS. It is unclear if subjects were similar or different at baseline on the BBS.

Table 7 : MAS scores (out of 30) at baseline and at 4 weeks for subjects with spasticity and between group effect size.

Group	Mean MAS Score at Baseline	Mean MAS Change Score	Between Groups Effect Size (95% CI)
Bobath (n=10)	11.18 (± 4.02)	7.64 (± 4.03)	1.17 (0.24 to 2.10)
Orthopedic (n=11)	11.33 (± 4.62)	4.00 (± 1.95)	

Participants in both groups improved significantly on the MAS (p<0.001). Subjects in the Bobath group showed significantly greater improvements in terms of change scores (p=0.011). The effect size of 1.17 was large favoring the Bobath group, but was associated with a wide confidence interval of 0.24 to 2.10 suggesting that future treatment effects may vary from small to large.

Table 8: BBS scores (out of 56) at baseline and at 4 weeks for subjects with spasticity and effect sizes of within group changes.

Group	Mean BBS Score at Baseline	Mean BBS Change Score	Met MDC	Within Group Effect Size (95% CI)
Bobath (n=10)	6.09 (± 4.57)	14.55 (± 10.76)	yes	1.57 (.57 to 2.57)
Orthopedic (n=11)	10.67 (± 6.49)	9.75 (± 4.85)	yes	1.65 (.68 to 2.62)

Both groups demonstrated significant improvements on the BBS over the course of treatment (p ≤ 0.001) and both groups surpassed the MDC of 6.9 points. However, there was no difference between groups in terms of mean changes scores. The within group effect sizes were large for both groups with similar confidence intervals demonstrating both treatments had an equitable effect.

Applicability of study results:
Benefits vs. Costs: The Bobath and orthopedic approaches to therapy both demonstrated significant benefits to patients with hemiparesis. Both groups showed improvements on the BBS surpassing the effect size. Additionally, subjects in the

Bobath group demonstrated even greater change on the MAS with a large effect size. The Bobath approach does not require any additional cost or time than an orthopedic approach and both groups participated in the same amount of therapy.

Feasibility of treatment: Treatment was provided 5 times a week for 4 weeks for forty minutes which is feasible in acute care and inpatient rehabilitation centers. The Bobath approach involves different manual and sensory facilitation approaches which do not require any additional equipment. Therapists need to receive additional training in order to be proficient in these techniques, but there are numerous continuing education opportunities making this a feasible option.

Summary of external validity: The patient population in this study was similar to the population of interest in acuity of stroke, age, and resulting motor impairments. Additionally, the Bobath approach was feasible to perform and demonstrated benefit to the subjects. However, the authors did not include long term follow up data on the group with spasticity so it is unclear how effective the Bobath approach is in aiding subjects to maintain or further improve function. The internal validity of this study was fair and subjects were a convenience sample from a single clinic. This slightly compromises the ability to generalize these results to other subjects with hemiparesis post stroke.

Article 3: Van Vliet PM, Lincoln NB, and Foxall A. Comparison of Bobath based and movement science based treatment for stroke: a randomised controlled trial. *Journal of Neurology, Neurosurgery, & Psychiatry* 2005; 76: 503–508.

Clinical Bottom Line: Based on the results of this study, there is moderate evidence to suggest that for subjects post acute stroke resulting in hemiparesis an intervention of Bobath Based (BB) treatment results in similar outcomes when compared to a Movement Science Based (MSB) treatment. There were no statistically significant differences between groups on the Rivermead Motor Scale (RMS), Motor Assessment Scale (MAS), or gait speed with measurements utilizing area under the curve (AUC). Mann-Whitney U tests did reveal a statistically significant difference between supine to sitting scores on the MAS which favored the BB group. Results were reported in terms of median scores and inter-quartile ranges (IQR) so it was not possible to calculate numbers needed to treat or effect sizes.

Minor threats to validity were maturation, testing effect, convenience sampling, and lack of blinding of subjects and therapists. However, this study included blinding of assessors, adequate power, and an adequate control group. The population also matched the patient of interest to this clinical question in terms of age and onset of stroke. Therefore, it is reasonable to expect similar results across the population of stroke survivors.

It would be beneficial to see further research reporting on mean change scores and standard deviations in order to explore the efficacy of each treatment approach. Neither treatment approach demonstrated statistically significant within group change in terms of gait speed and the MSB within group change was significant on the RMS.

Article PICO:
- **P**opulation**:**120 stroke survivors less than 2 weeks post stroke
- **I**ntervention: Bobath based treatment
- **C**omparison: Movement Science based treatment
- **O**utcome measures: Rivermead Motor Scale, Motor Assessment Scale, Gait speed

Blinding: Subjects and therapists were not blinded. Therapist blinding would have been difficult since they were provided with detailed written instruction on the objectives for each treatment approach and those providing the MSB treatment received additional training. The assessor was blinded to group allocation.

Controls: Controls included randomized group allocation and blinding of assessors. The MSB treatment served as an adequate comparison group because the authors demonstrated in another article that the two approaches are significantly different in terms of content.[9] Frequency and duration of therapy was not standardized, but treatment time was not significantly different between groups.

Randomization: Subjects were screened for inclusion as they were admitted and then assessed. After assessment, the subjects were randomly allocated to a treatment group by a computer generated random sequence. Groups were similar at baseline in terms of age, gender, hemisphere of stroke, size and location of infarct, and cognition. Additionally, there was no statistical difference between groups at baseline in terms of the MAS, RMS, or gait speed.

Study: This study included 120 subjects from a single rehabilitation center. Inclusion criteria required subjects be post stroke with a physical therapy referral. Subjects were excluded if they were more than 2 weeks post stroke, unconscious when admitted to the hospital, not independent with activities of daily living prior to the stroke, lived more than 25 km from the hospital, were unable to tolerate more than half an hour of physical activity at evaluation, or did not provide informed consent.

Subjects received initial BB treatment before randomization into groups and were then randomly allocated to a BB or MSB treatment group within two weeks of onset of stroke. Subjects in the BB group had a mean age of 73.3 years and a mean of 75 years in the MSB group. The BB approach focused on normalization of tone and manual facilitation techniques. The MSB approach focused on task specific practice, prevention of soft

tissue contracture, and cognitive strategies for movement planning. Subjects continued their allocated treatment approach throughout the duration of outpatient therapy services and when they worked with occupational therapists. There was no standardized duration or frequency of treatments and subjects received therapy based on individualized need. Subjects received a median of 23 minutes of treatment a day (IQR 13-32) and total therapy time was a median of 365 minutes (IQR 140-1160).

Outcome measures: Subjects were assessed at 1 month, 3 months, and 6 months post random allocation to a treatment group by a blinded assessor in a room separate from the ward. Assessments made at 1 month and 6 months were sufficient to analyze this clinical question.

RMA is an assessment tool of motor performance with 3 domains including gross function, leg and trunk movement, and arm movement. It has been established in the literature as a valid and reliable assessment tool of function in the stroke population.[10] Subjects are rated a 1 if they can perform a certain activity and 0 if they cannot for a total of 38 available points. Tasks include transfers, sitting balance, ambulation, stairs, running, hopping, and upper and lower extremity strength and range of motion.

As mentioned previously, the gait speed and the MAS are reliable and valid assessment tools in the stroke population.[3,4,7] The MAS assesses 8 areas of motor function and each item is scaled from 0 to 6 for a total of 48 available points.   There is no MDC or MCID established in the literature. The MCID for gait speed is 0.16 m/s.[3,4]

Study losses:
Table 9: Group losses at 1 month, 3 months, and 6 months

Group	Initial Group Size	Losses at 1 month	Losses at 3 months	Losses at 6 months
BB	60	8 (52 assessed)	17 (43 assessed)	15 (45 assessed)
MSB	60	13 (47 assessed)	18 (42 assessed)	18 (42 assessed)

60 subjects were included in each group. Subjects were lost for varying reasons at each time point including refusal to participate, administrative errors, illness, and death.

Summary of internal validity: Overall this study demonstrated good internal validity. Strengths of the study were adequate definitions of inclusion criteria, random allocation to treatment groups, blinding of assessors, adherence to a strict protocol, and inclusion of a long term follow-up. The authors performed a power calculation indicating 78 subjects were necessary to see a difference between groups on the RMS with 80% power. Group size varied from 45-52 subjects depending on study losses, but always surpassed the requirement of 78 total subjects to prevent a type 2 error. Additionally,

although the study had several subject losses, an intention to treat analysis was included in the statistics. Reason for study losses were defined for each group and none of them appeared secondary to poor tolerance of treatment sessions. Although there was no frequency and duration were not standardized, the authors reported no statistically significant difference between groups in terms of treatment time.

Assessment tools were reliable and valid for the stroke population. However, the MAS and RMS do not have MCID values established in the literature making it more difficult to discern how meaningful the improvements were to actual function. Additionally, the authors reported on differences between groups, but did not comment as to the significance of within group change. Therefore, it is unclear how effective the treatments were on function. It would have been valuable to include mean scores and standard deviations so that an effect size could be calculated to determine the effect treatment had on function.

Several minor threats to internal validity were maturation, testing effect, selection, and lack of blinding of subjects and therapists. Maturation was a minor threat because although subjects post stroke may experience spontaneous recovery, subjects were similar at baseline in demographics and function. Testing effect was a minor threat since subjects likely performed better each time they received a particular assessment. Selection was a minor threat since subjects were a sample of convenience. Lack of blinding of subjects and therapists introduced the Hawthorne and Rosenthal effects.

Evidence: The authors compared outcomes between groups with analysis of serial measurements utilizing area under the curve where outcome scores were plotted against time. The AUC values were then compared with Mann-Whitney U tests to get an appreciation of response of time. All statistical analyses were by intention to treat to account for study losses.

Table 10: Median gait speeds and IQR at 1 month and 6 months post treatment.

Group	Median Gait Speed at 1 month (m/s)	Median Gait Speed at 6 months (m/s)
BB	(n=52) **0.69** IQR (0.41 - 0.86)	(n=45) **0.76** IQR (0.5 – 0.9)
MSB	(n=47) **0.64** IQR (0.47 – 1.02)	(n=42) **0.64** IQR (0.37 – 0.91)

Table 10 demonstrates the reported median values for gait speed at 1 month and 6 months post treatment. The authors reported that there was no significant difference between groups at either time interval. The within group change was not significant for either group.

Table 11: RMS median scores (out of 38) and IQR at baseline, 1 month, and 6 months

Group	Median Score at Baseline	Median Score at 1 month	Median Score at 6 months
BB	(n=60) **2** IQR (1-6)	(n=52) **7** IQR (3-9)	(n=45) **8** IQR (6-10)
MSB	(n=60) **1** IQR (1-4)	(n=47) **6** IQR (2-9)	(n=42) **8** IQR (6-10)

Table 11 demonstrates the median scores on the RMS at baseline, 1 month, and 6 months post treatment. The authors reported there was no statistical difference between groups at any time interval. MSB within group change was statistically significant.

Table 12: MAS supine to sitting scores (out of 6) and IQR at baseline, 1 month, and 6 months

Group	Median Score at Baseline	Median Score at 1 month	Median Score at 6 months
BB	(n=60) **4** IQR (2-6)	(n=52) **6** IQR (5-6)	(n=45) **6** IQR (6-6)
MSB	(n=60) **2** IQR (2-6)	(n=47) **6** IQR (2-6)	(n=42) **6** IQR (4-6)

A Mann-Whitney U test showed that at 6 months there was a statistically significant difference on the supine to sitting scores on the MAS in favor of the BB group. No other difference were found on other items on the MAS. Additionally, the AUC found no difference between groups overall.

Applicability of study results:
Benefits vs. Costs: Treatment time was equitable between groups and there was no significant difference between number of days in the hospital or place of discharge. Therefore, there does not seem to be a clear benefit in terms of one treatment over the other. In terms of therapist training, either treatment approach may be emphasized over the other in a particular academic setting. Therefore, it is dependent on a particular therapist's background whether additional training would be necessary.

Feasibility of treatment: The BB approach is a feasible in an inpatient or outpatient rehabilitation setting. A study of the differences of the two treatment approaches revealed that the BB group contained the use of more physiotherapy equipment

whereas everyday objects were used in the MSB group.[8] However, the equipment used were items regularly available in treatment settings including wheelchairs, cones, floor mats, and parallel bars.

Summary of external validity: The patient population in this study matched the population of interest in acuity of stroke, age, and resulting motor impairments. The interventions were feasible to perform in a rehabilitation setting, but were not detailed so it would be difficult to recreate the exact interventions. The overall internal validity of this study was good which allows the generalization of these results to the larger population of patients post stroke resulting in hemiparesis.

Article 4: Langhammer B and Stanghelle JK. Bobath or Motor Relearning Program? A comparison of two different approaches of physiotherapy in stroke rehabilitation: a randomized controlled study. *Clinical Rehabilitation* 2000; 14:361–369.

Clinical Bottom Line: Based on the results of this study, there is moderate evidence to suggest that for patients post CVA resulting in hemiparesis an intervention based on a Bobath approach results in slightly less favorable outcomes when compared to a Motor Relearning Program (MRP). Assessments pertinent to this clinical question were the Motor Assessment Scale (MAS) and Sodring Motor Evaluation Scale (SMES). Both scales are reliable and valid for the stroke population to assess function and are rated on an ordinal scale. Groups were assessed at baseline and three months post stroke. The authors reported the MRP group demonstrated statistically significant greater improvements on the MAS (p=0.016) than the Bobath group. However, the effect size was small (0.30) and the confidence crossed zero indicating future trials could have resulted in more favorable outcomes for the Bobath group. This was a similar finding on the SMES part 1 regarding leg function and SMES part 3 regarding trunk and gait. Between group analyses for both subscales demonstrated small effect sizes (0.18 and 0.10 respectively) with the lower range of the confidence intervals crossing zero. Therefore, both treatments were equitable. The MRP group did have a statistically significant shorter length of stay of 21 days compared to 34 days for the Bobath group (p= 0.008). This suggested that MRP approach was slightly more favorable than the Bobath approach in terms of conservation of resources.

This study had good internal validity and included subject and assessor blinding, random allocation to treatment groups, adequate power, and adherence to a strict protocol. However, an intention to treat analysis was not performed in regards to study losses and there was no inclusion of a long term follow-up. However, these threats do not limit the ability to generalize these results to a greater population of stroke survivors. Subjects had a mean age greater than the patient of interest, but included subjects in his age range. Additionally, subjects were evaluated soon after stroke and treatment was initiated in an acute care setting. It would be beneficial to see future research including continuous data such as gait speed and use of outcome tools with established MDCs to ascertain how relevant increases in function were.

Article PICO:
- **P**opulation**:** 61 stroke survivors with hemiparesis and first stroke
- **I**ntervention: Bobath
- **C**omparison: Motor Relearning Program
- **O**utcome measures: Sodring Motor Evaluation Scale, Motor Assessment Scale

Blinding: Subjects and assessors were blinded to group allocation. Therapists were not blinded.

Controls: Controls included blinding of subjects and assessors, adherence to a strict protocol, inclusion of a comparison group, use of valid and reliable assessment tools, and standardized frequency and duration of treatment. This is a list, not a complete sentence

Randomization: Subjects were randomly allocated to two treatments groups and stratified according to gender and hemisphere affected. Subjects were similar at baseline in terms of age and baseline scores on the MAS and SMES suggesting randomization was successful.

Study: This double-blind study included 61 subjects recruited from a single hospital. Inclusion criteria consisted of first time stroke resulting in hemiparesis that was verified by computerized tomography. Subjects were excluded if they had a previous stroke, subarachnoid hemorrhaging, tumors of the brain, severe comorbidities, or scored five or greater on each of the MAS items. Mean age of the subjects was 78 years.

Subjects were randomized to a Bobath group or MRP group and then stratified according to gender and hemisphere affected. Each subject received physical therapy 5 days a week for a minimum of 40 minutes for as long as they were hospitalized. The plan of care varied for subjects post discharge from the hospital. Most subjects continued their allocated treatment approach after discharge via home health therapy, rehabilitation centers, or outpatient physical therapy services. Inpatient physical therapists sent specific instructions to the therapists continuing treatment and also engaged in meetings to coordinate continuity of care. Subjects who were independent in activities of daily living at discharge or subjects who were deemed dependent in personal care did not receive follow-up physical therapy.

Outcome measures: Patients were assessed three days after hospital admission, two weeks after baseline assessment, and three months post stroke. Assessments pertinent to this clinical question were the MAS and SMES. All tests were tested by the authors for reliability and validity.

As mentioned previously, the MAS is a reliable and valid assessment tool in the stroke population.[2,3,6] It assesses 8 areas of motor function and each item is scaled from 0 to 6 for a total of 48 available points. Examples of items include turning, sitting, standing, and walking. There is no MDC or MCID established in the literature.

The SMES is a motor function scale which only assess unassisted performance of the subject and includes an assessment of quality of movement. It is a reliable and valid assessment tool for the stroke population.[10] It has 32 items with three subscales including leg function. arm function, and trunk/balance/gait function. There is limited information about administering this assessment in the literature and no information on scoring, MDC, or MCID.

Study Losses: A total of 4 subjects were lost from each of the treatments groups. Subjects were lost due to death or because subjects moved out of the area. Specifics were not given for each group's losses. There was not an intention to treat analysis.

Summary of internal validity:
Overall this study demonstrated good internal validity. Strengths of the study were adequate definitions of inclusion and exclusion criteria, random allocation to treatment groups, stratification of groups into age and hemisphere affected, blinding of subjects and assessors, and similarity of subjects at baseline. Additionally, subjects received the same frequency and duration of treatment while at the hospital and therapists adhered to a strict protocol.

Minor threats to internal validity were maturation, testing effect. Maturation was a minor threat because subjects were similar at baseline and the same level of spontaneous recovery would be expected. Testing effect was also a minor threat since subjects likely performed better each time they received a particular assessment. Selection was a minor threat to the study since subjects were a convenience sample chosen from a single hospital.

This study had good to fair statistical validity. The authors used valid and reliable assessment tools and appropriate statistical measures. However, both assessments are rated on an ordinal scale, requiring a subjective component to scoring. It would have been beneficial to include continuous data such as gait speed to eliminate any rater bias. A power calculation performed by the authors required 51 subjects be included in the study and 61 were recruited to prevent a type 2 error. However, both groups had a total of 4 subjects losses and authors did not perform an intention to treat analysis. Therefore, follow- up assessments do not reflect how the scores would have changed if the subjects had an unfavorable response to the treatment. Additionally, authors included a 3 month follow up, but no long term follow-up to decipher if the treatments had different lasting effects.

Evidence: Group results were assessed with Student's *t*-tests and ANOVAs where used for differences between repeated measurements. The authors did not provide mean change scores so mean scores at 3 months were compared to ascertain between groups differences. Subjects were not statistically different at baseline on the MAS or SMES subscales.

Table 13 : MAS mean scores (out of 48) at 3 months post stroke and between group effect size.

Group	Mean MAS Score at 3 months	Between Group Effect Size (95% CI)
Bobath (n=24 at 3 months)	33 (± 15)	0.30 (-0.25 to 0.84)
MRP (n=29 at 3 months)	37(± 12)	

Table 13 shows the mean MAS scores at 3 months for both the Bobath and MRP groups. The between group effect size was small (0.30) and favored the MRP group. However, the lower end of the 95% confidence interval crossed zero indicating that if this study were repeated the results could have favored the Bobath group. Therefore, there is less confidence the MRP approach is a superior treatment.

Table 14 : SMES part 1 sumscores at 3 months post stroke and between group effect size.

Group	Mean SMES Sumscore at 3 months	Between Group Effect Size (95% CI)
Bobath (n=24 at 3 months)	16 (± 6)	0.18 (-0.36 to 0.72)
MRP (n=29 at 3 months)	17(± 5)	

Table 14 shows the mean SMES part 1 sumscores regarding leg function at 3 months for the Bobath and MRP groups. The between group effect size was small (0.18) and favored the MRP group. However, the lower end of the 95% confidence interval crossed zero indicating that future trials could have resulted in more favorable outcomes for the Bobath group.. Therefore, there is less confidence the MRP approach is a superior treatment.

Table 15 : SMES part 3 sumscores at 3 months post stroke and between group effect size.

Group	Mean SMES Sumscore at 3 months	Between Group Effect Size (95% CI)
Bobath (n=24 at 3 months)	39 (± 21)	0.10 (-0.44 to 0.64)
MRP (n=29 at 3 months)	41(± 18)	

Table 15 shows the mean SMES part 3 sumscores regarding trunk function, balance and gait at 3 months for the Bobath and MRP groups. Similar to the previous two comparisons, the effects was small (0.10) and favored the MRP group. However, the lower end of the 95% confidence interval crossed zero indicating that future trials could have resulted in more favorable outcomes for the Bobath group. Therefore, there is less confidence the MRP approach is a superior treatment.

Applicability of study results:
Benefits vs. Costs: Between group differences demonstrated small effect sizes favoring the MRP group. However, since the lower range of the confidence interval crossed zero on all outcome measures, it is not clear which treatment provides more benefit to the patient. The authors did report the MRP group had a statistically significantly shorter length of stay with a mean of 21 days while the Bobath group had a mean stay of 34 days (p=0.008). Therefore, the MRP demonstrated a slight benefit in terms of patient function and conservation of resources.

Feasibility of treatment: Neither treatment approach was explicitly described by the authors. However, both approaches are consistently used in inpatient and outpatient rehabilitation settings. Both approaches are available via continuing education courses and neither require special equipment. Additionally, the frequency and duration of therapy was not excessive and similar to what is administered at current rehabilitation settings.

Summary of external validity: The patient population in this study matched the population of interest in acuity of stroke, age, and resulting motor impairments. The interventions were feasible to perform and had reasonable frequencies and durations. A minor threat to the external validity was that subjects were a sample of convenience from a single hospital. However, the internal validity of this study was good which supports the ability to generalize these results to the larger population of patients post stroke resulting in hemiparesis.

Synthesis/Discussion
Authors of all four studies examined the inclusion of a Bobath rehabilitative approach to determine its effectiveness on increasing function in patients post stroke resulting in hemiparesis as compared to other programs that did not include a Bobath approach. All four studies had similar populations which were adults encountered in an acute care setting with hemiparesis secondary to a stroke. Two studies excluded subjects with histories of previous strokes and three excluded subjects with some baseline functional deficits.

The four studies varied slightly in their methodological quality, but together provided moderate evidence to support the overall clinical bottom line. In all of the studies, subjects were randomly allocated subjects to groups. All groups were similar at baseline on functional outcome measures with the exception of the groups in Wang et al. where it was not explicitly stated. Assessors were blinded in the all of the studies except for Gebler et al., which decreased the risk of rater bias. Three of the studies had subject losses which surpassed 15% of the total number of subjects per group. Only Van Vliet et al. included an intention-to-treat analysis to identify what the change in scores on the functional outcome measures would have been had the subjects lost had unfavorable responses to the interventions.   Van Vliet et al. and Langhammer et al. demonstrated adequate power, including subject losses, to avoid a type II statistical error. Gebler et al.and Wang et al. did not meet adequate power, which introduced this error. Overall, Gebler et al. demonstrated poor internal validity, Wang et al. demonstrated fair internal validity, and Van Vliet et al. and Langhammer et al. demonstrated good internal validity, Therefore, the results of the latter three studies were more closely examined.

The Bobath intervention group was consistent across the four studies and all comparison groups excluded its principles. Therefore, it was possible to determine if the inclusion of a treatment based on the Bobath approach increased function as compared to other programs. In all four articles, patients who received Bobath physical therapy in an acute care setting demonstrated statistically significant increases in function. However, the increases in function were either not statistically different than the improvements noted in comparison groups or Bobath group effect sizes were slightly lower. Gelber et al., found no difference between the Bobath group and the Traditional Functional Retraining group in gait speed or scores on the FIM. This was similar to the outcomes in Wang et al. where improvement found in the Bobath group on the BBS was no different than subjects in the orthopedic group. Van Vliet et al. and Langhammer et al. both had good internal validity, Van Vliet et al. demonstrated the Bobath approach was no different than a Movement Science Based in terms of outcomes on the Rivermead Motor Scale, Motor Assessment Scale, or gait speed. Lastly, Langhammer et al provided moderate evidence that the Bobath approach was slightly less favorable when compared to a Motor Relearning Program (MRP). Although groups were similar on the SMES and MAS, the MRP group had a statistically significant shorter length of hospital stay. Therefore, the overall conclusion is that the

addition of a Bobath approach did not further increase patient function or provide additional benefits to patients.

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