

# The Substantial Clinical Benefit Threshold for SRS-22R Domains After Surgical Treatment of Adult Spinal Deformity

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## Abstract

**Study Design:** Longitudinal cohort.

**Objectives:** To determine Substantial Clinical Benefit (SCB) thresholds for the SRS22R domains in patients undergoing adult spinal deformity surgery.

**Summary of Background Data:** The Scoliosis Research Society 22R (SRS22R) has been shown to be reliable, valid, and responsive to change in adult spinal deformity patients. Although the minimal clinically important difference (MCID) is commonly used to quantify a threshold of improvement, it could be considered a floor value rather than a goal.

**Methods:** Patients enrolled in a prospective database of adult spinal deformity undergoing surgery with complete SRS22R preoperation and the SRS30 one-year after surgery were identified. One-year postoperative answers to the last 8 questions of the SRS30 were used as anchors to determine the SCB for the Appearance and Activity domains, Subtotal and Total Score using ROC Curve analysis.

**Results:** The sample population consisted of 1,422 patients; 83% were females. Mean age was  $53 \pm 16$  years. Mean preoperative SRS22R Appearance score was  $2.50 \pm 0.73$  improving to  $3.62 \pm 0.84$  at one year postoperative. Mean preoperative SRS22R Activity score was  $2.96 \pm 0.59$  improving to  $3.33 \pm 0.80$  at one year postoperative. Mean preoperative SRS22R Pain score was  $2.73 \pm 0.92$  improving to  $3.60 \pm 0.93$  at one year postoperative. Mean preoperative SRS22R Subtotal was  $2.56 \pm 0.66$  improving to  $3.11 \pm 0.80$  at one year postoperative. There was a statistically significant difference in domain scores among the responses to the anchors ( $p < .001$ ). Based on ROC analysis, SCB was 1.60 for Appearance, 0.87 for Activity, 0.69 for Subtotal, and 0.94 for Total score.

**Conclusion:** The results of the current study in an adult spinal deformity population undergoing surgical treatment show SRS22R SCB values of 1.60 for Appearance, 0.87 for Activity, 0.69 for Subtotal, and 0.94 for Total score. These SCB thresholds can be used to quantify the clinical significance of health status change in the surgical management of adult spinal deformity.

**Level of Evidence:** Level II.

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**Keywords:** Adult spinal deformity; SRS-22R; Clinical outcomes; Substantial clinical benefit

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**Introduction**

The Scoliosis Research Society-22R (SRS-22R) [1-4] is a commonly used [5] patient-reported outcome (PRO) that has been shown to be reliable, valid, and responsive to change in adult spinal deformity patients [6-9]. Although the minimal clinically important difference (MCID) has been previously reported for the SRS-22R in an adult spinal deformity patient population [10], it could be considered a floor value rather than a goal (ie, MCID is commonly used to quantify a threshold of improvement that is noticeable to the patient, but a barely noticeable improvement may not justify the risks and costs associated with spinal surgery). For this reason, the concept of substantial clinical benefit (SCB) was introduced [11] and previously published for patients undergoing single-level posterior lumbar fusion for degenerative lumbar spine conditions. The purpose of the current study was to calculate SCB for surgically treated adult spinal deformity patients using data from a large sample of surgically treated adult deformity patients with preoperative and postoperative PROs.

**Methods**

The sample (n = 1,422) included patients who were enrolled in a prospective multicenter database of adult spinal deformity, who underwent surgical treatment, and who had completed the SRS-22R preoperative and SRS-30 one-year postoperative. One-year postoperative answers to the last eight questions of the SRS30 were used as anchors to determine the SCB for the Appearance domain, Activity domain, Subtotal, and Total Score using ROC Curve analysis.

*Patient Reported Outcome Measures*

The SRS-22 [1-4] is a scoliosis-specific health-related quality of life questionnaire with 22 items and five domains—Pain, Appearance, Activity, Mental, and Satisfaction—and an SRS Total score. Each domain score ranges from 1 to 5, with higher scores indicating preferred responses (ie, less pain, less anxiety, less depression, more activity, more satisfied). The Total score is a numeric average of all responses to the 22 questions. The Subtotal score is calculated similarly to the Total score, except that the two satisfaction questions are excluded before calculating the Subtotal (only includes Pain, Appearance, Activity, Mental domains). The SRS-22R has been shown to be responsive, reliable, and valid in the adult spinal deformity population [7-9]. The SRS-30 consists of the 22 items from the SRS-22R with an additional 8 postoperative questions [12]. Item 23 is a global self-image rating whereas items 24 to 30 are questions that pertain to patient perceptions regarding pain, appearance, and activity after surgery.

*Anchor-Based SCB Calculation*

One-year postoperative answers to the last 8 questions of the SRS-30 (Table 1) were used as anchors for the Appearance domain (Items 24, 28, 29 and 30) and Activity domain (Items 25 and 26). None of the anchor questions relates to the Mental or Satisfaction domains. SCB for the Pain domain could not be determined because the anchor question for the Pain domain (Item 27) had only three possible choices, such that delineation of patients who responded that their pain had markedly decreased from those that decreased could not be made. Answers to each of the items were assigned ordinal values with 1 assigned to the worst response and, depending on the number of possible responses, 3, 5 or 9, to the best response.

Answers to questions 23, 24, 28, 29, and 30 were summed to produce an Appearance Anchor score, with a range of scores from 5 to 25. The Appearance Anchor scores were then classified as 1–5, much worse; 6–10, worse; 11–15, unchanged; 16–20, better; and 21–25, much better. Answers to questions 25 and 26 were summed as the Activity Anchor score, with a range of scores from 2 to 6. These scores were then classified as 2, decreased; 3 and 4, same; 5, increased; and 6, much increased. SCB anchor questions for the Pain domain was not available because Question 27, which was used as the Pain Anchor in the MCID analysis [10], had only three possible responses: 1, increased; 2, same; and 3, decreased. One-way analysis of variance with Bonferroni post hoc tests were used to compare change in domain scores between groups classified according to responses to the anchor question.

Responses to the items that comprise the Satisfaction (Items 21 and 22) were used as anchors to determine the

Table 1  
Items on SRS-30 completed postoperation and not included in SRS-22.

23. On a scale of 1 to 9, with 1 being very low and 9 being extremely high, how would you rate your self-image	1 2 3 4 5 6 7 8 9	Low  —○—○—○—○—○—○—○—○—○—  High
24. Compared with before treatment, how do you feel you now look?	<input type="radio"/> Much Better	<input type="radio"/> Worse
	<input type="radio"/> Better	<input type="radio"/> Much worse
	<input type="radio"/> Same	
25. Has your back treatment changed your function and daily activity?	<input type="radio"/> Increased	<input type="radio"/> Not changed <input type="radio"/> Decreased
26. Has your back treatment changed your ability to enjoy sports/hobbies?	<input type="radio"/> Increased	<input type="radio"/> Not changed <input type="radio"/> Decreased
27. Has your back treatment _____ your back pain?	<input type="radio"/> Increased	<input type="radio"/> Not changed <input type="radio"/> Decreased
28. Has your treatment changed your confidence in personal relationships with others	<input type="radio"/> Increased	<input type="radio"/> Not changed <input type="radio"/> Decreased
29. Has your treatment changes the way others view you?	<input type="radio"/> Much Better	<input type="radio"/> Worse
	<input type="radio"/> Better	<input type="radio"/> Much worse
	<input type="radio"/> Same	
30. Has your treatment changed your self image?	<input type="radio"/> Increased	<input type="radio"/> Not changed <input type="radio"/> Decreased

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