Introduction

Your choice of measurements is essential to the success of your clinical practice or research. In fact, if you do not measure the status and change of your patients, there will be no evidence that the treatments you provide are actually effective. Furthermore, employing measurements in the clinical and research setting will help you identify areas that may be harmful. A desire to measure effectiveness and harm within the clinical and research setting is becoming paramount in the field of spine surgery. Given the increasing costs of health care, health care purchasers, payers, and hospital systems are adopting the concept of value-based purchasing. This is having a significant impact on low-quality providers and hospitals. Quality rankings are now being publicly reported. If treatment success is real, it will be based on what you measure, when you measure it, and how you measure it. Measurement is more than just outcomes. That is one important piece of the equation; however, outcomes alone are not helpful if not analyzed in the context of patient severity and other important factors that may influence the outcome independent of the treatment.

Categories of Measurement

Whether you measure patients for quality improvement in the clinical setting or comparative effectiveness and safety in the research setting, there are at least four important categories of measurement: (A) baseline factors, (B) treatment factors, (C) perioperative/immediate posttreatment events, and (D) outcomes. This “Science in Spine” article will cover the first three categories—what we call the ABCs of measurement because they are the foundation necessary to make sense of the outcomes we collect.

Baseline Factors

All studies require the collection and presentation of baseline patient factors for those subjects that meet your inclusion and exclusion criteria and are successfully enrolled or included in your study population. This is also necessary for large registries or local quality improvement databases. These first serve to help you and those interested understand your patient population so that you can determine the breadth and scope of the generalizability of your results. These factors may simply be descriptive in nature but can also be valuable data points in your data analysis. These baseline factors are also known as risk factors, prognostic factors, predictor variables, potential confounding variables, and a myriad other descriptive terms. Essentially, they represent the host of factors that the individual patient brings to the table that may be associated with or influence the treatment and/or the outcome. All potential factors that fall into the categories below (this list is not exhaustive) should be collected and listed based on a thorough literature review, pilot data (if available), and clinical experience with your patient population. For prospective studies, registries, or clinical quality improvement efforts, these can be built into the data collection procedures; for retrospective studies, only variables available in the source data (e.g., medical records, registry, administrative database) can be collected.

- Basic sociodemographics, institution, and geographic area
- Disease- or diagnosis-specific factors (e.g., previous surgery, degenerative disk disease, etc.)
- Other comorbidities (e.g., obesity, diabetes, heart disease, etc.)
- Concomitant medications
- General health behaviors (e.g., smoking, alcohol use, etc.)
- Other socioeconomic or psychosocial variables (e.g., litigation, workman's comp, depression, etc.)
- Physical status measures (these are often outcomes as well but should be measured at baseline to assess change; e.g., Pain Visual Analog Scale, Oswestry Disability Index, Roland Morris Disability Questionnaire, etc.)
- Relevant classification or specific disease severity measures (e.g., Kellgren and Lawrence Osteoarthritis Severity
Grade, modic changes, Carragee Lumbar Disc Herniation Classification \(^1\)

- Relevant disease-specific measurements (e.g., Harris basion-axial interval, Power’s Ratio, Lee X-line Method) \(^2\)

Depending on the purpose of the project, you may not need all these variables. For example, a clinical quality improvement program may not necessarily need concomitant medications documented. There may be little yield with too much burden (a topic covered in the final article in this series). However, some of these variables are very important and often overlooked. For example, disease severity measurements can allow you to stratify your outcomes by those patients whose conditions are more severe or less severe. Very sick or advanced spine disease may be more likely to experience complications and achieve poor outcomes, and therefore to include these findings with those from healthier patients is not helpful. Furthermore, having severity as a factor in your analysis may allow you to determine if some patients respond better to specific treatments than others. This will allow you to make patient-specific treatment recommendations rather than a “one-size-fits-all” approach. This is most certainly an important topic moving forward when it comes to health policy and reimbursement.

**Treatment Factors**

These will include the primary surgical procedures, additional procedures (e.g., bone graft), the devices used, and the postoperative management strategies to include nursing procedures (e.g., compression stockings) and medications as well as rehabilitation procedures. Most of these items are available in the patient medical records and are easy to access but need to be identified before embarking on a prospective data collection effort so that procedures can be created and followed. Postoperative management strategies may be standard operating procedures; however, it is important that these be controlled if necessary (for prospective studies) or bias will be possible in a comparison where treatment groups may not receive the same postoperative management. A common problem in many clinical studies is too much attention to describing the technique with little attention to reporting other factors associated with the treatment, which may influence the outcome. Similar to the baseline factor discussion, you need to be able to balance the burden and the yield of too much data.

**Perioperative/Immediate Posttreatment Events**

These include events that may influence the outcome such as procedure time, blood loss, peri- or immediate postoperative medications, and immediate postoperative complications. Others could include length of hospital stay and length of intensive care unit stay. Most of these items are available in the patient records and are easy to enter but important factors should be identified before starting data collection because these events may serve as outcomes or as variables that need to be controlled for in the final analysis. Again, burden must be balanced against benefit.

This concludes the first article on measurements. It is important to remember that though “outcomes” are the way of the future, they are useless without the ABCs of measurements. These are the building blocks that allow outcomes measurement to become useful and effective. The next “Science in Spine” article will zero in on outcomes where there are several more important nuances to consider. A final “Science in Spine” article from this series will address the anatomy of a quality outcomes instrument and the why and how you are collecting the measures you are. Measuring success is only as good as the measurements you collect. Too many or too complicated measurements may lead to a lack of data due to logistical burden, which will be addressed in that final article.

**References**

1. Chapman JR, Dettori JR, Norvell DC, eds. Spine Classifications and Severity Measures. 1st ed. Stuttgart, Germany, and New York, NY: Thieme Medical Publishers; 2009
2. Chapman JR, Dettori JR, Norvell DC, eds. Measurements in Spine Care. 1st ed. Stuttgart, Germany, and New York, NY: Thieme Medical Publishers; 2012