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Lisa Engel, Dorcas E. Beaton, and Zahi Touma

Clinicians, researchers, and outcome stakeholders have the crucial, albeit difficult, task of quantifying when a person or group experiences important change or difference on any given outcome measure, often in response to a specific intervention. The minimal clinically important difference (MCID) provides this quantified value of change/difference for a measure. There are many methods for MCID derivation, which can result in multiple values for the same measure. Thus, it is important for potential users of MCID values to be aware of the nuances of MCID development and cautions for interpreting values. This article outlines MCID-related definitions, methods, and guidelines.

**Alternative Design and Analytical Techniques for Longitudinal Rheumatology Studies: Improved Understanding of Outcomes** 189

Lily Siok Hoon Lim, Brian M. Feldman, and Lisa M. Lix

Longitudinal cohort designs (with three or more measurement occasions) are invaluable to investigate between- and within-individual variation in outcomes. However, traditional longitudinal designs require a lengthy implementation and data collection period and impose a substantial burden on participants and investigators. The authors discuss alternative longitudinal designs, including planned missing data designs and retrospective cohort studies with secondary data, which require a shorter period for data accrual and reduce participant burden while maintaining statistical power. They also discuss analysis strategies to maximize data use and produce unbiased estimates of treatment effectiveness, including models for recurrent or multistate events and time-varying covariates.

**Propensity Score Methods for Bias Reduction in Observational Studies of Treatment Effect** 203

Sindhu R. Johnson, George A. Tomlinson, Gillian A. Hawker, John T. Granton, and Brian M. Feldman

A challenge to the use of observational data to study treatment effects is the issue of confounding. Noncomparability of exposed and nonexposed subjects can lead to biased estimation of the treatment effect. The

propensity score is a balancing score that can be used to form matched groups, or pairs, that are not systematically different and enable nonbiased comparisons between groups. This article reviews propensity score methods with an illustrative example of the application of propensity score matching in an observational study of an uncommon disease (systemic sclerosis).

**US National Health and Nutrition Examination Survey Arthritis Initiatives, Methodologies and Data**

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Charles F. Dillon and Michael H. Weisman

The US National Health and Nutrition Examination Survey (NHANES) has collected population-based, nationally representative examination, laboratory, and radiographic data for arthritis and musculoskeletal diseases for more than 50 years. The resulting body of data and publications are substantial, yet much data remain unpublished. This article provides a basic understanding of the design and capabilities of the study, reviewing the major accomplishments in the area of arthritis and musculoskeletal diseases. Currently available NHANES arthritis-related datasets are identified. Guidelines for using these data and opportunities for data analysis and designing future studies are presented.

**Qualitative Methods to Advance Care, Diagnosis, and Therapy in Rheumatic Diseases**

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Lesley Ann Saketkoo and John D. Pauling

This article provides an overview of the basis, usefulness, and validity of qualitative methods in research. It is aimed to enhance the understanding of a broad spectrum of readers, ranging from those mystified by such approaches to those wanting a better critical knowledge to apply to literature review, and for health care providers considering developing an interest in the field. Qualitative research is crucial in augmentation of disease knowledge as well as the development of incremental care strategies and operational aspects of care that improves health outcomes.

**Similarity Network Fusion: A Novel Application to Making Clinical Diagnoses**

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Andréanne N. Zizzo, Lauren Erdman, Brian M. Feldman, and Anna Goldenberg

Similarity Network Fusion (SNF) is a novel methodological tool that integrates multiple different types of data to identify homogeneous subsets of patients in whom disease classification may be otherwise unclear or challenging. In this review article, the authors hope to provide insight into how SNF can be used in clinical decision making where the aim is to have little influence on the data before obtaining the results of the analysis.

**Randomized Trials, Meta-Analyses, and Systematic Reviews: Using Examples from Rheumatology**

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Janet E. Pope and Glen S. Hazlewood

This article introduces contemporary ideas and standards for clinical research in rheumatology for randomized trials, systematic reviews, and

meta-analyses. Examples of different randomized trials in rheumatic diseases are provided to understand the methods for trials and the rationale for outcomes within trials. Insights from meta-analyses and systematic literature reviews, including network meta-analyses within rheumatology treatment, are provided. Ethical considerations, sample size calculations, and types of randomized controlled trials are discussed.

**“Big Data” in Rheumatology: Intelligent Data Modeling Improves the Quality of Imaging Data**

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Robert B.M. Landewé and Désirée van der Heijde

Analysis of imaging data in rheumatology is a challenge. Reliability of scores is an issue for several reasons. The signal to noise ratio of most imaging techniques is rather unfavorable (too little signal in relation to too much noise). Optimal use of all available data may help increasing the credibility of imaging data, but knowledge of complicated statistical methodology and the help of skilled statisticians are required. Clinicians should appreciate the merits of sophisticated data modeling and liaise with statisticians to increase the quality of imaging results, as proper imaging studies in rheumatology imply more than a supersensitive imaging technique alone.

**Strategies for Dealing with Missing Accelerometer Data**

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Samantha Stephens, Joseph Beyene, Mark S. Tremblay, Guy Faulkner, Eleanor Pullnayegum, and Brian M. Feldman

Missing data are a universal research problem that can affect studies examining the relationship between physical activity measured with accelerometers and health outcomes. Statistical techniques are available to deal with missing data; however, available techniques have not been synthesized. A scoping review was conducted to summarize the advantages and disadvantages of identified methods of dealing with missing data from accelerometers. Missing data pose a threat to the validity and interpretation of trials using physical activity data from accelerometry. Imputation using multiple imputation techniques is recommended to deal with missing data and improve the validity and interpretation of studies using accelerometry.

**Use of Administrative Databases to Assess Reproductive Health Issues in Rheumatic Diseases**

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Evelyne Vinet, Eliza F. Chakravarty, Julia F. Simard, and Megan Clowse

Administrative databases, registers, and other sources of big data can be interesting sources to address important research questions on reproduction in women with rheumatic diseases. There are many different types of administrative datasets worldwide, and it is important to understand the type of data present and unavailable in each dataset, validity and potential misclassification of data, and the ability to link maternal data with infant data. This article discusses the advantages and methodological issues associated with administrative database use for the conduct of observational studies on reproductive issues in women with rheumatic diseases.

**Measuring Patient Preferences: An Overview of Methods with a Focus on Discrete Choice Experiments**

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Glen S. Hazlewood

There is increasing recognition of the importance of patient preferences and methodologies to measure them. In this article, methods to quantify patient preferences are reviewed, with a focus on discrete choice experiments. In a discrete choice experiment, patients are asked to choose between 2 or more treatments. The results can be used to quantify the relative importance of treatment outcomes and/or other considerations relevant to medical decision making. Conducting and interpreting a discrete choice experiment requires multiple steps and an understanding of the potential biases that can arise, which are reviewed in this article with examples in rheumatic diseases.

**Cluster and Multiple Correspondence Analyses in Rheumatology: Paths to Uncovering Relationships in a Sea of Data**

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Lu Han, Susanne M. Benseler, and Pascal N. Tyrrell

Rheumatic diseases encompass a wide range of conditions caused by inflammation and dysregulation of the immune system resulting in organ damage. Research in these heterogeneous diseases benefits from multivariate methods. This article describes and evaluates the current literature in rheumatology regarding cluster analysis and correspondence analysis. A systematic review showed an increase in studies making use of these 2 methods. However, standardization in how these methods are applied and reported is needed. Researcher expertise was determined to be the main barrier to considering these approaches, whereas education and collaborating with a biostatistician were suggested ways forward.

**Applied Bayesian Methods in the Rheumatic Diseases**

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Sindhu R. Johnson, George A. Tomlinson, John T. Granton, Gillian A. Hawker, and Brian M. Feldman

The use of applied Bayesian methods is increasing in rheumatology. Using the Bayes theorem, past evidence is updated with new data. Preexisting data are expressed as a prior probability distribution. New observations are expressed as a likelihood. Through explicit incorporation of preexisting data and new data, this process informs how this new information should change the way we think. In this article, the authors highlight the use of applied Bayesian methods in the study of rheumatic diseases.