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Novel methods in preference-based health outcome measurement

Zhang, Xin

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CHAPTER 1

General Introduction

Definition of Health

The ultimate goal of medical science and healthcare is to maintain, restore and promote health of patients or general populations. The concept of health has been defined in different ways and influenced by diverse visions throughout the development of modern medical science. In keeping with the biomedical perspective, early definitions of health focused on the theme of the body's ability to function, health was seen as a state of normal functioning that could be disrupted by disease or injury.¹ In 1948, the World Health Organization (WHO) proposed a new definition that seemed ground-breaking because of its breadth and ambition. The WHO's definition sought to elevate the concept of health by linking it to well-being, defined as "a state of complete physical, mental, and social well-being and not merely the absence of disease and infirmity."² While this innovative definition gained popularity among many scholars and health professionals, it faced criticism for its perceived lack of precision and overly expansive scope, making it difficult to quantify or measure. For a long time, it was considered an impractical ideal. Another source for defining health can be referred to Maslow's hierarchy of needs theory. This hierarchy expresses the fulfilment of basic physiological and safety needs to higher-level needs such as social connection, esteem, and self-actualization.³ From this perspective, health is seen as the ability to meet one's basic needs and pursue personal growth and fulfilment. Notwithstanding criticisms that Maslow's theory is overly individualistic and neglects the importance of social determinants,⁴ it could be valued as presenting an important indication for defining health as ever-changing rather than static. This indicates that health should be adapted to the changes of individuals' daily life needs, as well as align with the evolution of medical science and healthcare.

The various definitions of health from different perspectives reflect the complex and diverse nature of health, with each definition emphasizing different aspects of health, and having their own advantages and limitations. It's worth noting that the concept of health isn't immutable; rather, it is constantly evolving and adapting. Moreover, it is important that the contemporary way of conceptualizing health should comprise a comprehensive range of dimensions and dynamic features. Additionally, the definition should be operational and measurable in order to facilitate health outcome measurement and research in healthcare.

Health outcome measurement

Any empirical science must measure and quantify its objects of interest, health science is no exception. Therefore, to support the progress in healthcare, health outcome measurement is imperative. Health outcome measurement encompasses measuring and monitoring the health status of specific populations, comparing the health status across different populations, evaluating the effectiveness of healthcare interventions, as well as facilitating the decision-making for clinical practice, identifying areas for healthcare delivery improvement and resource allocation.⁵

Historically, clinical trials and healthcare evaluations relied heavily on objective measures, such as mortality, morbidity, laboratory values (e.g., cholesterol, blood pressure).⁶ Along with the progress of modern medical science, there has been a shift from the traditional biomedical model to the more comprehensive biopsychosocial models. Biopsychosocial models are a class of trans-disciplinary models which look at the interconnection between biology, psychology, and socio-environmental factors.⁷ Consequently, the construction of health and health outcome has expanded to encompass not only physiological factors but also psychological and social. Subjective outcomes from patients' perspectives have been increasingly acknowledged as important other than objective clinical indicators in health outcome measurement.

The concept of quality of life (QoL) is the primary term which incorporates subjective outcomes to health assessment. As defined by the WHO, QoL is an individual's perception of their position in life in the context of the culture and value systems in which they live and in relation to their goals, expectations, standards and concerns.⁸ It encompasses personal health (physical, mental, and social), relationships, education, work environment, social status, wealth, a sense of security and safety, freedom, autonomy in decision-making, social-belonging and physical surroundings.⁹ Health-related quality of life (HRQoL) is a restricted definition of QoL, which has been designed to exclude factors that, strictly speaking, lie outside the area of healthcare, such as housing, neighborhood and financial matters.¹⁰ HRQoL specifically refers to the physical, psychological, and social domains of health, seen as distinct areas (or domains) that are influenced by a person's experiences, beliefs, expectations, and perceptions.¹¹ Another commonly-used term in measuring the overall quality of health is "health status". However, health status should be distinguished from QoL and HRQoL since it just measures physical, mental and social functioning, but bears no relationship to the perception of the individual and his or her values and expectations.¹² To ensure greater comprehensiveness, it is advisable to say

perceived (or subjective) health status when emphasizing on individual's own perspective on their health status. In literature, these terms are usually used interchangeably.^{13,14} Different from objective outcomes which are standard to measure, subjective outcomes are more complicated to measure. Special methods and instruments (health outcome measures) are required to measure these subjective health outcomes.

A variety of health outcome measures have been developed for measuring health status. Three components may vary between measures. Firstly, the measurement frameworks they are founded on can be different. Secondly, their content, involving aspects like health items (also termed attributes) and the levels of those items, often vary. Finally, they may differ in the persons who report the health outcomes: patients, clinicians, caregivers or persons who are not related to the patients under study.

Measurement Framework

Health outcome measures have been developed using different measurement frameworks. One frequently used type of framework is questionnaire-based and is used to generate profile measures. This category of measures usually covers one or more health domains, with multiple items bundled together to measure a specific health domain. Profile measures typically quantify the frequency or intensity of distinct health domains as separate scores. Examples of profile measures include the SF-36,¹⁵ NHP,¹⁶ and EORTC-QLQ-C30.¹⁷

A second category of health outcome measures are referred to as index measures, they are developed within a measurement framework which assigns a single score (index) for an overall health state. A health state is often defined as a structured description of perceived health status based on a set of items with a limited number of severity levels. This is different from the separate scores assigned to distinct health domains in profile measures. In the case of index measures, a cumulative score is obtained by summing up individual scores assigned to each of the health items. Examples of index measures include the Barthel Index¹⁸ and the neonatal Apgar score.¹⁹

A third type of measurement framework entails the use of preference methods to construct the measures, these measures are so called preference-based measures.²⁰ Preference-based measures generally are comprised of multiple health domains, with each domain involves only one item. One major benefit of using preference-based measures is that weights (importance) are assigned to each level of each item (technically called weights of attribute levels). These weights of individual health items can be further combined to generate a single index that

expresses the (social) value of a health state.²¹ This value quantifies the overall quality of a health state. Such weights are not obtained from either the index measure or profile measure. Therefore, preference-based measures, in addition to sharing similar functions with profile and index measures, such as monitoring patients' health conditions, evaluating healthcare interventions, they especially enable more robust and direct comparison of health status across different diseases or populations. This is because they produce single metric values of health states. A "value" is called a "utility" if it is anchored on a unidimensional scale that ranges from 0.0-1.0, where 0.0 = dead, 1.0 = full health. Preference-based measures generating utilities enable the calculation of quality-adjusted life years, which are typically useful for conducting cost-effectiveness in the context of health economic evaluation. A representative of preference-based measure is the EQ-5D,²² other instances of preference-based measures involve HUI-3,²³ SF-6D.²⁴ The instruments used in this thesis are preference-based measures.

Within the preference-based measurement framework, special methods are needed to elicit preferences of health states, so called preference-based methods. Preference-based methods originate from a variety of scientific fields, including decision science, health economics, marketing, psychometrics, public health, and clinimetrics. Some well-known and commonly used preference-based methods involve the standard gamble (SG) and the time trade-off (TTO) technique stemming from the field of health economics; the visual analogue scale (VAS) from the field of psychometrics; the discrete choice experiment (DCE) from the marketing field. However, many of these conventional preference methods are associated with theoretical and empirical drawbacks. The TTO technique for example is cognitively demanding to complete and is limited by interviewer effects and time preference.²⁵ The VAS is susceptible to biases of anchor points, context, and end aversion.²⁶ All of these methods including SG, TTO and DCE are susceptible to loss aversion. Consequently, enhanced preference-based methods are called for.

Patient-centered content

The acknowledgement and emphasis on patient-centeredness in medical science have been firmly established for decades. In 1969, Edith Balint first proposed to possibilities of "patient-centered medicine". Different from the conventional "illness-orientated medicine", which primarily aims to identify a specific health issue, diagnose it as an illness and then treat it. Patient-centered medicine advocates for including everything that the doctor knows and understands about his patient; the patient, in fact, has to be understood as a unique human-being.²⁷ Patients

General introduction

are known as persons in context of their own social worlds, listened to, informed, respected, and involved in their care, and their wishes are honored (but not mindlessly enacted) during their health care journey.²⁸ After a half-century evolution, the concept of patient-centeredness has become a fundamental principle associated with high-quality healthcare. Despite that there is no consensus on the definition of patient-centeredness, various definitions shared similar recognition that patient centeredness emphasize on encouraging patient's involvement in health care, empowering patients to be active participants in their care, promoting shared decision-making between patients and clinicians.^{29,30,31}

Due to the widespread acceptance of patient-centered care, there is growing recognition that the process of selecting items should actively incorporate input from patients. The inclusion of health items into the content of a health outcome measure, is another vital component alongside the measurement framework. The choice of which health items to incorporate is crucial in the development of a new health outcome measure. Health outcome measures should be constructed to ensure that prominent health concerns of the target population are captured. However, a limited number of existing health outcome measures were designed and selected with patient input to ensure that they measure what matters to patients. Instead, the content (items) of many existing health outcome measures were mainly decided by experts like clinicians or researchers.^{32,33} This could result in the omission of health items which are of high relevance to patients, or an overemphasis on items that are less relevant.³⁴ Studies have highlighted that what matters to patients differs from what matters to other stakeholders.³⁵ For example, regulatory agencies may focus on physical symptoms and functioning to inform licensing and labeling claims, whereas patients and health policy makers may be more interested in other domains of health status, such as participation in social activities and emotional wellbeing.³⁶

Patient-reported outcomes

A further consideration of health outcome measures is who reports the health outcomes. In the context of clinical practice or academic research, health outcomes can be reported by either patients themselves or by clinicians, caregivers, or even by a member of the general population who has no relation with patients who are studied. Driven by the movement towards patient-reported outcomes (PROs), there has been a widespread adoption and use of patient-reported outcome measures (PROMs) in clinical practice and research. The origin of patient-reported outcomes as a concept can be traced back to the early 1980s when studies began incorporating patients' perceptions of their general health and well-being, as well as their satisfaction with

treatment as medical outcomes,³⁷ in addition to traditional clinical outcomes. However, the term “patient-reported outcomes” itself did not gain widespread usage until 21st century.³⁸ PRO typically entails using PROMs. PROM is defined as a measurement based on a report that comes directly from the patient about the status of their health condition without amendment or interpretation of the patient's response by a clinician or anyone else.³⁹

Patient-reported outcomes have several advantages compared to clinician-reported or proxy-reported outcomes, such as providing valuable insights into the impact of the disease or treatment from the patients' perspective, enhancing communication between patients and healthcare providers, increasing patients' satisfaction, facilitating shared decision-making in healthcare.^{40,41}

Health outcomes collected by a preference-based measure consist of two parts, the description of health status and assigning a preference value to the health states. In the application of some preference-based measures, not both parts are performed by the by patients themselves. For instance, in the most widely used preference-based instrument, EQ-5D, the descriptions of health status are reported by patients themselves, while the preferences for health states were elicited in valuation studies among samples of general population. This might induce a question whether the preferences for health states reported by the general population truly reflect the views of patients, as the general population might have no experience about the health states presented for preference elicitation.

The relation between patient-centeredness and PROMs is intertwined. PROMs can be regarded as a special method aligning with the broader concept of patient-centered care. It is advocated that involve patients' input in the development of the measure thus can identify what matters to patients should be a priority of PROMs.⁴² The application of PROMs support and enhance the implementation of patient-centered care, by actively involving patients to assess their health status and report their health outcomes themselves. To our knowledge, few existing PROMs embody both aspects that constitute the merit of patient-centeredness.

The CS-Base founded on the MAPR model

To overcome some of the disadvantages of existing health outcome measures described above, a novel measurement framework has been developed and an innovative health outcome measure evolved accordingly. This new health outcome measure is named Château Santé-Base (CS-Base) and is grounded on the novel measurement framework named multi-attribute preference response (MAPR) model. The MAPR model is a probabilistic choice model that combines the

Rasch model (item response theory) and discrete choice model. Within the framework of the MAPR model, different preference-based methods are usable. There are now two new preference-based methods developed within the MAPR model and applied in the instrument (Chapter 2). The CS-Base instrument is fully patient-centered in its development and construction. First of all, its health items were selected out by patients from a pool of candidate items drawn from a broad range of existing generic health outcome measures.⁴³ When it comes to health assessment tasks, both the description of health status and the preference elicitation are responded by patients. Within the framework of MAPR model, both tasks involving the patients' description of health status and their preferences elicitation are integrated, no separate valuation studies are needed.

Overview of the thesis

All studies in this thesis use the CS-Base instrument founded on the MAPR model. The **first chapter** provides an overview of the background information related to research topics of all the studies presented in this thesis. The **second chapter** reports the study results of comparing two new preference-based methods which are both developed within the MAPR model. The previously developed Better-Worse (BW) method and an expanded Drop-Down (DD) method are compared head-to-head regarding their produced coefficients and health-state values. In the **third chapter**, we present the findings of the study which compared the CS-Base parallelly with the widely used EQ-5D-5L, to explore the effects of their different measurement frameworks and different descriptive systems. We specifically compared those aspects involving the statistical robustness and the face validity of estimated coefficients, the differentiation between health states based on health-state values. The **fourth chapter** is a comprehensive report on the use of the CS-Base in comparing the overall health status of patients affected by one or more health conditions. This chapter aimed for a preliminary clinical application of the CS-Base and to bring some new insights into the health status research by using the patient-centered, preference-based electronic PROM. In the **fifth chapter**, we demonstrate the process of generating utilities using a two-step approach and provided a first utility set for the CS-Base, to facilitate its application in health economic evaluation. The **sixth chapter** serves as a comprehensive discussion about the major findings revealed by all the studies in this thesis.

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