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Research Practice

Tracking Multimorbidity Changes in Diverse Racial/Ethnic Populations Over Time: Issues and Considerations

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Abstract

Multimorbidity is widely recognized as having adverse effects on health and wellbeing and may threaten the ability of older adults to live independently. Much of what is known about multimorbidity rests on research that has largely focused on one point in time, or from a static perspective. Given that there remains a lack of agreement in the field on how to standardize multimorbidity definitions and measurement, it is not surprising that analyzing and predicting multimorbidity development, progression over time, and its impact are still largely unaddressed. As a result, there are important gaps and challenges to measuring and studying multimorbidity in a longitudinal context. This Research Practice perspective summarizes pressing challenges and offers practical steps to move the field forward.

Keywords: Multimorbidity, Comorbidity, Multiple chronic diseases, Chronic diseases, Longitudinal

Multimorbidity—commonly defined as two or more coexisting chronic diseases—is a major clinical and public health concern because it is prevalent—approximately two-thirds of middle-aged and older adults in the United States have multimorbidity—costly, and burdensome (1). There has been a concerted effort to shift clinical practice away from solely focusing on individual diseases and instead consider multiple diseases as they co-occur in patients (2,3). Still, there is much to be uncovered and specified prior to developing clinical practice guidelines for managing patients with various types of multimorbidity presentation. A seminal report from the U.S. Department of Health and Human Services and the commentaries that followed identified multiple remaining gaps (2,4). These gaps involve several areas where clinical and research practice is tasked to: (a) increase the evidence based on the epidemiology of multimorbidity; (b) ensure that individuals with multimorbidity are included in clinical trials; (c) incorporate a patient-centered approach in assessing the impact of multimorbidity on patients' lives; and (d)

identify disparities in multimorbidity and multimorbidity-related impacts on quality of life among vulnerable population subgroups.

The association between escalating chronic disease burden and health outcomes has been widely documented (5–8), but not all combinations of illness have equal effects. Recent efforts center on identifying disease combinations with serious health-related consequences, such as premature disability and mortality (9–14). Still, the nature of multimorbidity progression over time is unclear; there has been comparatively little work done to understand the complex nature of changes in multimorbidity on important outcomes throughout the life span (15). Understanding how multimorbidity evolves into debilitation and identifying factors that accelerate or slow this progression is of practical, clinical, and methodological significance.

The field of multimorbidity research continues to grapple with important questions on standardizing multimorbidity measurement—for example, which chronic conditions should be included in the numerator? Or, should this inclusion list instead be flexible and contingent on the research question and aim of the study?—with no

consensus on how to define multimorbidity. Many, including ourselves, have adopted a useful framework to outline the scope of multimorbidity measurement and rationale for considering a core set of chronic conditions that are persistent, prevalent, and important age-related diseases (3). Separate, though related and important, are geriatric syndromes and the work yet to be done to parse the relationship between multimorbidity progression and syndromes such as frailty, incontinence, falls, and delirium (9,15).

Current lack of consensus should not preclude us from looking ahead and strategizing about the issues involved with assessing multimorbidity changes over time. A critical yet missing piece in the conversation is a discussion of the methodological challenges facing researchers who seek to study multimorbidity from a longitudinal perspective and devising strategies to make headway in this effort. Thus far, multimorbidity measurement—as a total count or as combinations or patterns of disease—has focused on cross-sectional, static measurement issues. Longitudinal approaches to studying multimorbidity may offer several opportunities and insights over cross-sectional approaches; however, measurement becomes more challenging when considering multimorbidity in a time-varying perspective (Table 1). In fact, the specific challenges and considerations for logically-consistent and reliable measurement are not evident until we begin to assess multimorbidity longitudinally. For instance, a full and consistent reporting and capture of diagnoses for a patient's entire health history (birth to death) is difficult to ascertain given the complexities of fragmented health care systems, differences in health care seeking behavior underlying "access" to diagnoses, and attrition in population surveys.

In order to advance the science and practice of studying multimorbidity development and progression, challenges to longitudinal multimorbidity assessment need to be outlined and effective strategies devised. Detailing these considerations and forming

standardized research practices to address these concerns is not only timely but it is also necessary. The next breakthrough in our understanding of multimorbidity will come from uncovering how chronic diseases accumulate and interact over time to affect different segments of our population to different degrees and with different consequences. In addressing the challenges of evaluating the longitudinal progression of multimorbidity, we identify three critical areas to prioritize: (a) consistent longitudinal assessment of multimorbidity component diseases and their accounting; (b) the relative severity of diseases, individually and together; and (c) the representativeness of studied populations. The last point is particularly crucial: to address clinical and policy needs, research must focus on high-risk populations, such as underrepresented racial and ethnic minorities and older adults, to overcome a variety of methodological biases and extend the generalizability of this research. These populations are currently not well represented in curated data sets, in particular those from clinical trials. Thus, to make progress, we must surmount data and methodological hurdles inherent to analyzing changes in multimorbidity over time. Below, we expand on these three pressing challenges to measuring, analyzing, and assessing the population impact of multimorbidity from a longitudinal perspective and offer insights to make headway.

Longitudinal Inconsistency of Chronic Disease Tracking

Identifying chronic disease patterns in a rigorous manner forms the most necessary condition in assessing multimorbidity burden or combinations, and changes over time. Evidence shows that patients, in particular those belonging to racial and ethnic minority groups, inconsistently report their chronic diseases over time in longitudinal health interview surveys and the degree of inconsistency

Table 1. How Pressing Challenges to Studying Multimorbidity Over Time Manifest in a Cross-sectional Versus Longitudinal Context

Main Challenges	Cross-sectional Context	Longitudinal Context
1. Longitudinal inconsistency	<p>(–) <i>Cannot measure:</i> May not be aware of inconsistent patterns if only examining one point in time.</p> <p><i>Implications:</i> Unclear consequences to prevalence estimates.</p>	<p>(+) <i>Can measure:</i> Aware of issue if data are examined before and after to assess rates and pattern of responses, and allows for clarification with possible algorithm development and validation.</p> <p><i>Implications:</i> May improve precision of prevalence estimates.</p>
2. Severity	<p>(+/-) <i>Limited measurement:</i> Can assess severity linked to function or another patient-centered health outcome at one point in time only.</p> <p><i>Implications:</i> No clarity on temporality: onset, timing, development, or progression.</p>	<p>(+) <i>Can measure:</i> Relationship between severity and multimorbidity becomes more evident as changes in multimorbidity can be linked to changes in function and other patient-centered changes in health.</p> <p><i>Implications:</i> Improves inference between timing of morbidity risks and health outcomes.</p>
3. Underrepresentation	<p>(–) <i>Cannot measure:</i> No way to identify who is excluded at any particular point-in-time assessment.</p> <p><i>Implications:</i> Unclear consequences to prevalence estimates, and evaluations of effectiveness of treatments.</p>	<p>(+) <i>Can measure:</i> Depending on length of follow-up, can examine data before and after to ascertain missingness, correlates with missingness, and multimorbidity patterns prior to loss or censoring.</p> <p><i>Implications:</i> Improves accuracy of population-level impact of programs and treatments.</p>

varies widely by disease and by race/ethnicity (16). Yet, population-based health interview surveys have long been used as dependable tools to track accumulation of disease burden at the individual level and monitor population health. Self-reporting of chronic diseases relies on consistent access to a usual source of care, as well as health literacy and comprehension of disease processes, which may vary by education, socioeconomic status, and cognitive ability. Thus, in follow-up interviews, individuals may not consistently report diagnoses due to fragmented or discontinuous health care coverage, poor recall, difficulty in understanding the chronic nature of their diseases, confusion between asymptomatic or well-controlled disease and no-disease status, or poor cognitive function.

Other sources of chronic disease ascertainment are similarly problematic: electronic health record data are typically not designed for research purposes, may not consistently record diagnoses in follow-up encounters, or may reflect changes in diagnostic criteria or diagnostic procedures ordered for suspected or unconfirmed diagnoses; thus, presenting difficulties in discerning disease status over time. The frequency of assessing chronic conditions also is not standardized and influences measures of rate and patterns of accumulation. As a result, longitudinal patterns of chronic disease for a given patient may be *clinically-consistent* (ie, always affirmative, always negative, or negative then affirmative) or *clinically-inconsistent* (ie, affirmative then negative), hindering, or at the very least complicating assessments of multimorbidity progression (16).

Opportunities to Make Headway

Because incontrovertible, valid, and reliable methods to “adjust” for inconsistent reporting of chronic disease status currently do not exist, marshaling data resources to triangulate information on chronic disease status are essential. In particular, these resources need to be enhanced in populations with higher rates of misreporting. With the integration of diverse sources of information—including medication use, laboratory values and other diagnostic tests, and practitioner- and patient-generated health data—consistent tracking can be achieved through assessments and adjustments for data quality, and through sensitivity analyses for the effects of inconsistent reporting. It is important to note that most clinical data sources may not be a gold standard for ascertaining a comprehensive record and history of a patient’s diagnoses. For instance, some chronic conditions, such as dementia, are defined by functional decrements; thus, function may be integrally linked to disease definition and may be difficult to ascertain in clinical data alone. Relying on one data source in isolation of complementary data sources limits us from leveraging a variety of information and perspectives into diagnoses. In the long term, there is a need to develop valid and reliable algorithms and procedures to maximize—through integration, consolidation, and evaluation—information from the patient, clinical record, and administrative data sources.

Assessing Disease Severity

Another complex issue involves ascertaining disease severity across the multitude of chronic disease patients with multimorbidity have—that is, assessing overall severity for a particular multimorbidity combination (17). Capturing time-varying disease severity in the context of multimorbidity is far more complicated than for single diseases because (a) valid and reliable systems to classify severity vary by disease and disease-stage; (b) sequelae/

complications may be attributable to multiple conditions; (c) interactions between diseases may increase severity/acuity and symptom burden, as well as complicate the treatment of other diseases in the combination; and (d) severity may not be monotonically increasing, as patients who engage in interventions may experience reductions in the severity of one or multiple component diseases. Given the much earlier onset of multimorbidity in minority patients, the severity of similar combinations of diseases may likely be higher (due to lead time to diagnosis, disease duration, and likelihood of treatment) among minority patients compared with white patients of similar age.

To date, it has proven operationally and conceptually prohibitive to assess severity for diseases, individually and then in combination, and determine changes in severity over time. However, assessing severity of each individual disease may not provide as much clinical clarity as assessing the continuum of impairments, and subclinical/clinical diseases representing loss of homeostasis (17). In addition, the concept of severity in and of itself is important to ascertaining progression of multimorbidity: deleterious progression of multimorbidity may not be captured by simply specifying nominal changes in disease counts over time or newly added diagnoses to a particular multimorbidity combination. This is because multimorbidity may worsen or progress with no changes in total disease count and may occur with further worsening of one or more diseases already in combination.

Opportunities to Make Headway

Assessing severity in the context of multimorbidity should account for the continuum of disease accumulation and subsequent impairments that presage loss of homeostatic equilibrium, and this may differ between racial and ethnic groups. In the long term, we need to have to a consistent and valid way to assess severity for individuals with multimorbidity and understand how multimorbidity combinations of varying severity affect patient’s lives. The way forward may be to develop and validate population-sensitive proxy measures of multimorbidity “severity” that assess the functional, self-rated health, or health-related quality of life consequences of diseases added onto multimorbidity combinations. For example, a recently developed and validated multimorbidity index weighted to physical functioning measures links functional consequences to specific multimorbidity combinations and could provide valuable insights into changes in multimorbidity severity over time and across populations (18).

Underrepresentation

Inadequate population representation may be the most difficult issue. Whether in the form of not capturing underrepresented minority participants who die prior to study entry (left censoring and healthy survivor effects), losing minority patients/participants who no longer interact with the health care system or survey (immortal time bias or right censoring), or restricting inclusion in prospective studies based on language, access, or cognition, the implications are vast and problematic. Without more complete population representation in studies, clinical complexity cannot be reflected. Thus, very different recommendations to address health disparities may result. For example, many population-based longitudinal surveys start in midlife or later, past the point of chronic disease onset in high-risk populations; thus, missing critical periods for multimorbidity onset and progression in these groups.

Opportunities to Make Headway

Studies should strive for close representativeness, by race/ethnicity and beyond, to the true population and consider whether patient databases reflect populations with access to care rather than the target population. In the conduct of survey studies, advancing efforts to maximize response rates and account for nonrandom attrition are also critical to counteracting this issue. New policies, such as those applied to NIH-sponsored human subject's research, encourage inclusion of individuals across wider ages of the life span and will help to mitigate problems stemming from lack of observation during critical periods of chronic disease onset (19).

In Summary

Progress on studying multimorbidity development and progression in clinically-meaningful and methodologically-reliable ways remains challenging. This discussion is not a comprehensive list of all of the issues involved with examining multimorbidity in a longitudinal fashion, but represents a core set of issues to begin to formulate responsive and logical approaches. We discuss and identify ways to move the field forward, so that we can meet the challenges of caring for clinically-complex and vulnerable segments of our population. Recommendations include studies to explore both better consistency in multimorbidity reporting over time, standardize frequency and timing of assessments to ascertain rates, and assess problems with data quality, inaccuracies, and reporting biases; to improve the assessment of clinical and functional severity in the context of multimorbidity; and to enhance the representativeness of populations studied. These will help provide better assessments and predictions for the impact of multimorbidity over the life span and may uncover ways to improve our tailoring of care to clinically-complex patients and their priorities, rather than solely to individual conditions.

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Conflict of Interest

None reported.

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