



HHS Public Access

Author manuscript

Health Psychol. Author manuscript; available in PMC 2020 September 01.

Published in final edited form as:

Health Psychol. 2019 September ; 38(9): 772–782. doi:10.1037/hea0000762.

Multimorbidity: Implications and Directions for Health Psychology and Behavioral Medicine

Jerry Suls,

National Cancer Institute

Paige A. Green,

National Cancer Institute

Cynthia M. Boyd

Johns Hopkins University

Abstract

The increasing prevalence of multimorbidity in the United States and the rest of the world poses problems for patients and for health care providers, care systems, and policy. After clarifying the difference between comorbidity and multimorbidity, this paper describes the challenges that the prevalence of multimorbidity presents for well-being, prevention and medical treatment. We submit that health psychology and behavioral medicine have an important role to play in meeting these challenges because of the holistic vision of health afforded by the foundational biopsychosocial model. Furthermore, opportunities abound for health psychology/behavioral medicine to study how biological, social and psychological factors influence multimorbidity. This paper describes three major areas in which health psychologists can contribute to understanding and treatment of multimorbidity: (1) etiology; (2) prevention and self-management; (3) clinical care.

Keywords

multimorbidity; comorbidity; biopsychosocial model; integrated models of care; patient-centered care

Multimorbidity, which refers to the conjoint presence of multiple (physical and mental) health conditions, is an increasing public health problem for which health psychology and behavioral medicine can make important contributions. ¹ Although multimorbidity tends to

Address Correspondence to: Jerry Suls, Behavioral Research Program, 3E-138 MSC 9761, Division of Cancer Control & Population Sciences, National Cancer Institute, 9609 Medical Center Drive, Bethesda, MD 20850. (Ph) 240-276-6811, (FACS) 240-276-7907, jerry.suls@nih.gov.

Author Notes

Jerry Suls, Behavioral Research Program, Division of Cancer Control and Population Sciences, National Cancer Institute; Paige A. Green, Basic Biobehavioral and Psychological Sciences Branch, Behavioral Research Program, National Cancer Institute; Cynthia M. Boyd, School of Medicine, Johns Hopkins University.

The views and opinions expressed in this article are those of the authors and do not necessarily represent the views of the National Institutes of Health or any other governmental agency.

¹In the interests of space, efficiency, and because our arguments apply equally to both, the term “health psychology,” henceforth will be used to refer to both behavioral medicine” and “health psychology.”

be overlooked in medicine and psychology, a sizable segment of the population lives with multiple concurrent health conditions. The U.S. Department of Health and Human Services (HHS) (2010) has estimated that one in four Americans has two or more (Parekh, Goodman, & Koh, 2011). An analysis of National Health and Nutrition Examination Survey data (King, Xiang, & Pilkerton, 2018) from 2013–2014 found 60% of the samples had more than two health conditions, almost 40% had three or more, and 23% had four or more. It was also found that the prevalence of multiple health conditions has also markedly increased since 1988. Notable racial, ethnic, and gender disparities exist in the prevalence of multiple health conditions; for example, patients who identify as either black/African-American or white have higher prevalence than patients, who identify their ethnicity as Hispanic (King et al., 2018). Women have more chronic conditions than men (King et al., 2018).

A review by Fortin et al. (2012) described several relevant epidemiological studies. Most found that by 30 years of age, approximately 10 to 18% of the population had more than one health condition. By age 50 to 60, the rate was 30 to 50%; by age 70, 60 to 75%; and by age 80, about 80%. In the 1994–2004 NHANES cohort, nearly 50% of those with cardiac disease also had arthritis and 25% had diabetes (Boyd et al., 2011). A systematic review of studies of aging with multiple conditions, based on clinical diagnoses, found older people, women, and people who were socioeconomically deprived to be affected by multimorbidity with increasing disability and functional decline, worse quality of life, and higher health care costs (Marengoni et al., 2011; see also Barnett et al., 2012 and King et al., 2018).

Multimorbidity also carries economic impacts beyond the individual level. In one study, per-capita Medicare costs were shown to increase with the number of conditions, from \$211 per year for beneficiaries without a chronic condition to \$13,973 for beneficiaries with four or more conditions (Wolff, Starfield, & Anderson, 2002). Multimorbidity takes a toll on employment: Population studies of U.S. adults 18–64 years of age indicate that relative to the probability of employment of someone with one chronic condition, those with two or more conditions had a reduction in probability of employment that ranged from 11 to 29% (Ward, 2015). In sum, evidence of several different kinds indicates a high and increasing prevalence of multimorbidity that already has a significant impact on public health.

Before we proceed further, clarification about the difference between multimorbidity and comorbidity, probably the more familiar term, should be provided (van den Akker, Buntinx, & Knottnerus, 1996). Comorbidity, introduced by Feinstein (1970), refers to the combination of additional diseases beyond an index condition. As an illustration, the comorbidity-minded clinician treating a patient for cancer (“the index condition”) acknowledges other health conditions the patient presents, but they are not the clinician’s primary interest; the possible effects of any other conditions figure mainly in terms of their effects on the prognosis of cancer (Marengoni et al., 2011). Multimorbidity, as defined by the World Health Organization (WHO) (2008), refers to the conjoint presence of multiple chronic health conditions (i.e., physical and mental) treated with the intention to consider all conditions in one individual that could affect that individual’s global health status (i.e., with regard to all of the medical procedures, devices, medications, etc. recommended for each condition and their potential interactions).

Le Reste et al. (2013) observed that in the WHO definition, "...the word 'condition' is not sufficiently clear for practical purposes" (p. 320), with some researchers and clinicians considering both chronic and acute conditions while others only include the former. Some researchers also exclude mental health conditions. Whereas some prefer narrower criteria, the U.K. National Institute for Health and Care Excellence (NICE) Guidelines (2016) also include ongoing conditions, such as learning disability, symptom complexes, such as frailty or chronic pain; sensory impairment, such as sight or hearing loss; and alcohol and substance misuse. Some researchers also find it useful to distinguish between concordant co-occurring conditions (i.e., ones that represent parts of the same overall pathophysiologic risk profile and are more likely to be the focus of the same disease management plan; e.g., diabetes and obesity) and discordant co-occurring conditions (i.e., ones not directly related in either their pathogenesis or management and not sharing an underlying predisposing factor; e.g., esophageal disorder and rheumatoid arthritis) (Piette & Kerr, 2006; Magnan et al., 2015).

Clinical medicine and epidemiology have devoted attention to refining the definition, scope, and measurement of multimorbidity (e.g., Fortin, Stewart, Poitras, Almirall, & Maddocks, 2012; Goodman, Posner, Huang, Parekh, & Koh, 2013; Johnston, Crilly, Black, Prescott, & Mercer, 2019). Health psychology also has a role to play in this endeavor because it recognizes the overlap and interaction of concurrent mental/behavioral problems and physical maladies. The current reality, however, is that researchers and health care providers vary in how they define and assess multimorbidity (e.g., some assessments consider substance use a condition, while others do not), as will be evident in the other papers in this Special Issue. The present authors think the appropriateness of particular definitions and assessment tools depends on the purpose for which the measurement of multimorbidity is intended to serve (see also Griffith et al., 2018). Medicine, epidemiology, and health psychology should move toward a shared understanding about what constitutes a "good match" between purpose and assessment tool and what constitute multimorbidity "conditions."

Although multimorbidity is a fuzzy category, efforts to understand the etiology of clusters of concurrent or staggered health conditions and their implications for prevention, clinical care and health policy are ongoing. Health psychology is equipped to address these issues because instead of following the classic biomedical model, which focuses on pathophysiology and biological causes of disease, health psychology is founded on the biopsychosocial model (BPSM), which considers the "whole person" as the object of study and treatment. George Engel (1977), an internist and psychiatrist who articulated the BPSM, found the biomedical model wanting because it did not systematically consider biological, psychological, and social factors and their complex interactions in understanding health, illness, and health care delivery. Recently, critics also have faulted the biomedical model for contributing to an overemphasis on technology and hyperspecialization in contemporary medicine (Vetrano et al., 2018). The BPSM represents a holistic perspective, which recognizes the permeable boundaries between mind and body and between the organism and its social and physical environment. Although the BPSM has been criticized for being too vague about disease pathways and specific practice application (e.g., McLaren, 1998), it emphasizes that scientists and practitioners should not focus solely on the biological/

physiological domains to understand, prevent, and treat health conditions (see McClintock, Dale, Laumann & Waite, 2016).

Despite its holistic vision, health psychology has tended to adopt a “one-condition-at-a-time” focus, except with respect to the co-occurrence of psychological and medical conditions, a success worthy of reinforcement and modeling. Co-occurrence of physical health conditions has understandably received less attention from health psychologists because of the effort and resources they must expend to acquire biological and clinical expertise about a single condition, let alone about multiple conditions. Also, a large portion of the health psychology community identify themselves by disease focus. Such specialization and “siloining” are reinforced by funding institutes, academic departments, journals, etc., but are contrary to the spirit of the BPSM and may be counterproductive to the public health in the long run. The consequence is that health psychology mimics the specialization of conventional medicine, where co-occurring health conditions have received less attention, despite their increasing prevalence both in the United States and globally (e.g., Academy of Medical Sciences, 2018; King et al., 2018).

Multimorbidity, often considered only a problem of the aged, occurs in all age strata (Violan et al., 2014), with multifactorial causes or risk factors. These include shared genes with Crohn’s Disease and ulcerative colitis (Klor & Xavier, 2011), as an example. Another set of causes consists of traditional medical risk factors, such as high blood pressure (Dawber, Moore & Mann, 1957). A third set comprises certain psychological disorders, such as depression and anxiety (Carney, Rich, Freedland, Saini, teVelde, Simeone, & Clark, 1988; Kubzansky, Cole, Kawachi, Vokonas, & Sparrow, 2006). Finally, there are behavioral risk factors, including tobacco (O’Keefe et al., 2018) and sedentary behavior (Proper, Singh, van Mechelen, & Chinapaw, 2011).

Single conditions also can lead to successive conditions, via downstream pathogenic processes (Goh, Cusick, Valle, Childs, & Barabasi, 2007; Suls, Green & Davidson, 2016). These can stem from the original disorder. For example, hyperinsulimnia, associated with diabetes, can cause cell-proliferation and inhibit apoptosis, thereby encouraging tumor growth (Renehan, Smith, & Kirkman, 2010). A subsequent health condition can be the unintended consequence of medical treatment. Radiotherapy for cancer can lead to cardiomyopathy (Curigliano, Mayer, Burstein, Winer, & Goldhirsch, 2010) is an illustration. Also, an unhealthy behavioral practice for an initial condition can predispose another (e.g., chronic overeating of obese persons can contribute to cardiac disease risk; Khan, Ning, Allen, Carnethon, Berry...& Lloyd-Jones, 2018).

Despite the prevalence of multimorbidity, the one-condition-at-a-time focus is evident in research when the co-occurring conditions presented by a patient or a study population are ignored or treated as exclusion criteria, covariates, or nuisance variables (e.g., Fortin, Dionne, Pinbo, Gignac, Almirall, & Lapointe, 2006). In clinical practice, patients with co-occurring conditions are often referred to multiple medical specialties, leading to fragmented care, miscommunications, and other complications. The commonness of multimorbidity, however, challenges medicine and health psychology to go beyond a single-condition focus. Health psychology’s holistic vision can help because the BPSM recognizes that people

rarely experience health conditions in isolation and are situated in an interactive, multilevel biological, psychological, social, and environmental matrix. On occasion, the co-occurrence of conditions might only add to the existing burden of having a single condition. However, we suspect that in the majority of cases an interactive synergy among conditions influences their etiology, course, treatment, and outcomes.

The Challenges of Addressing Multimorbidity

Because multimorbidity increases with age and America's 65-years-and-older population likely will double from 48 million to 88 million by 2050 (He, Goodkind, & Kowal, 2016), the demands on older adults, their caregivers, the health care system, and society at large will be substantial. However, the problem is not restricted to older adults; even by age 30, 20 to 30% of individuals live with co-occurring conditions (e.g., Academy of Medical Sciences, 2018).

According to Struckmann et al. (2018; see also van der Heide et al., 2018), U.S. and European medical centers and clinics mainly rely on health care models formulated for patients with single health conditions (see Grembowski et al., 2014). Making integrated cross-specialty care to address multimorbidity a reality requires more research, a multilevel conceptual framework, and innovations in the structure of health care delivery systems (e.g., Bierman & Tinetti, 2016).

Health care professionals also lack evidence-based clinical guidelines to treat patients with concurrent conditions. Most guidelines focus on the management of single conditions and may even be impractical or harmful if applied to patients with multimorbidity (e.g., Boyd et al., 2005; Uhlig et al., 2014). Those exceptional cases where the guidelines recognize multimorbidity, such as in treatment of hypertension and diabetes or kidney disease, have not as yet served as models for treating many other health conditions.

To illustrate the potential cumulative impact of applying single-disease recommendations to people with multiple conditions, Hughes, McMurdo, and Guthrie (2013) extracted information from the U.K. NICE clinical guidelines for some common health conditions (e.g., myocardial infarction and osteoarthritis) and then created medical regimens for hypothetical patients assumed to have multiple conditions. The authors found that following the recommendations would lead to high treatment burden and self-care that were likely to create problems for patient compliance and increase polypharmacy. For example, a 75-year-old male smoker with Type 2 diabetes and COPD would be recommended five medications, local muscle-strengthening exercise, limitations for alcohol consumption, weight loss, self-monitoring of plasma glucose integrated with an educational program, smoking cessation medication (nicotine replacement, varenicline, or bupropion), and appropriate footwear for diabetes. How should clinicians and patients best prioritize these recommendations? The current absence of multiple-condition guidelines means that most patients with co-occurring conditions are shuttled from one specialty to the next, which often leads to fragmented, inefficient, and high-cost care (e.g., Salisbury, 2012).

Evidence-based guidelines tend to focus on single conditions partly because guidelines depend upon the design and results of randomized clinical trials, which most often recruit narrowly-focused patient populations to reduce confounding, side effects, and extraneous factors (Fortin et al., 2006). Such rigor in participant selection increases internal validity but limits generalizability. Systematic reviews report underrepresentation of multiple chronic conditions in RCTs published in high-impact medical journals (Jadad, To, Emara, & Jones, 2011). For example, RCTs relevant to cancer have historically excluded patients with other medical conditions (e.g., Beaver, Ison, & Pazdur, 2017; see also Kronish et al., in press), and excluded older adults, who tend to have more concurrent conditions. The number of clinical trials with explicit age exclusions has decreased, an encouraging sign (Lee, Alexander, Hammill, Pasquali, & Peterson, 2001), and trial enrollment of older patients has increased in recent decades, but it is still below levels at which older patients are affected (Van Spall, Toren, Kiss, & Fowler, 2007). Younger populations with concurrent conditions also need to be included because such concurrent conditions occur in 20–30% of younger populations. Fortunately, the paucity of clinical trials that recruit persons with multiple conditions across the life span has been recognized by new NIH guidelines on participant recruitment across the life span. (See <https://grants.nih.gov/grants/guide/notice-files/NOT-OD-18-116.html>). Although conventional RCTs will continue to be very important, they should be complemented with higher external validity studies (e.g., Levit, Singh, Klepin & Hurria, 2018).

The recognition of challenges associated with multimorbidity has increased in recent years. Medical and public health journals have devoted more attention to the subject (e.g., Guthrie, Payne, Alderson, McMurdo, & Mercer, 2012). The HHS (Parekh, Goodman, Gordon, & Koh, 2011) formed a working group of representatives from relevant federal agencies and issued a strategic framework for multiple chronic conditions, and international panels (AMS, 2018; NICE, 2016) have issued calls for more research, treatment, and health care policy that recognize the growing problem of multimorbidity for public health. Incidentally, the increasing interest of researchers and health care providers is reflected in the recent decision by PubMed, a U.S. National Library of Medicine-maintained resource that comprises more than 29 million citations for biomedical literature to have “multimorbidity” and “comorbidity” as separate (MESH) search terms (Tugwell & Knottnerus, 2019). Health psychology has been ahead of the curve in its recognition of the relationship between psychiatric/psychological factors and physical well-being. The co-occurrence of physical health conditions has not been a central focus, however. We think it is time for health psychology to step up to that challenge.

Why Multimorbidity Needs More Attention in Health Psychology

A recent editorial in *The Lancet* noted, “The majority of health-care systems are organized to treat single conditions. For patients with multimorbidity, that can mean interfacing with multiple health-care providers, increased risk of inappropriate polypharmacy from lack of provider communication, and potentially suboptimal care” (p. 1,637). The editorial goes on to propose, “...the increasing burden of multimorbidity will require a shift for physicians from specialists to generalists...”

A segment of health psychologists, similarly, needs to shift to becoming generalists, which should be facilitated by training in our field that bridges the biological, psychological, social, and cultural aspects of health and illness. Even for co-occurring health conditions where psychological factors may play a minimal role in etiology (e.g., hypertension and cancer; Goh et al. 2007), health psychology can contribute basic and applied knowledge relevant to patient-physician communication, clinical decision-making, and patient adherence — all of which become more complicated when patients are diagnosed with multiple conditions. In addition, behavioral and psychological risk factors and outcomes are implicated in the most prevalent clusters of co-occurring conditions reported in the literature, which are the cardiometabolic, neuropsychiatric, and musculoskeletal disorders (Prados-Torres, Calderón-Larrañaga, Hanco-Saavedra, Poblador-Plou, & van den Akker, 2014). For example, 20% of patients with arthritis also have cardiac problems and 16% percent have Type 2 diabetes (Caughey et al., 2009). Mental disorders of all kinds also are associated with increased risk of a wide range of chronic physical conditions (Scott et al., 2016); Gunn et al., 2012; and Katon et al., 2010). The co-occurrence of depression is conspicuous: An estimated one-third of individuals with a chronic illness or condition experience symptoms of depression (<https://my.clevelandclinic.org/health/articles/9288-chronic-illness-and-depression>). One Scottish study of 2 million people found that older adults mainly exhibited physical comorbidities, but almost two-thirds of people younger than 65 years of age had physical-mental health conditions, particularly those living in deprived areas (Taylor et al., 2010). Recognition of the impact of psychological and behavioral risk factors and adversity on multimorbidity across the life span is consistent with the skills and integrative vision of health psychologists.

In the next three sections, we describe major areas in which health psychology has the potential to engage more with the problem of multimorbidity and contribute to the public health: (1) understanding the complex etiology of multimorbidity; (2) patient self-management and prevention of multimorbidity, and (3) multimorbidity in clinical practice and the health care system. Table 1 provides some illustrations of specific topics for which health psychology is relevant.

Health Psychology's Potential Contribution to Understanding the Complex Etiology of Multimorbidity

Allostatic load theory, one of the most popular models of stress-illness pathways, posits that repeated or prolonged exposure to stressors results in “wear and tear” that interferes with the body’s ability to maintain stability in the face of environmental changes (e.g., McEwen, 1998). The wear and tear, mediated by exaggerated sympathetic and hypothalamic-pituitary-adrenal axis arousal and immune system changes, affects many organ systems. Empirical evidence indicates that psychosocial stress, adversity, and (lower) socioeconomic status serve as risk factors for the premature onset of diabetes, cardiovascular disorders, dementia, depression, etc. However, behavioral epidemiological studies of the prospective effects of acute and chronic stressors tend to focus on either single conditions (e.g., cardiac disease incidence) or all-cause (i.e., undifferentiated) mortality/morbidity as health outcomes. As

noted above, when baseline or co-occurring health conditions are measured in studies of the effects of stress or adversity, they are treated generally as covariates or nuisance variables.

The consequence is that we lack information about (a) whether the risk and temporal emergence of particular clusters of co-occurring or temporally overlapping health conditions are differentially affected by stress or adversity (see Sinnott, McHugh, Fitzgerald, Bradley, & Kearney, 2015); (b) whether stress and adversity are associated with behavioral risk factors that commonly occur with chronic conditions known to cluster into multimorbidity patterns (Mounce et al., 2018); and (c) whether stressors and adversity—in early, mid- or late life—increase the incidence of particular disease clusters. Beyond life stress and adversity, being newly diagnosed with a significant health condition and subsequently undergoing medical treatment produces stress. All these factors, additively or interactively, may promote the etiology and exacerbation of other conditions. The relationship of stress to multiple health conditions remains understudied. This gap impedes the identification of populations at greatest risk, anticipation of their needs, and development or implementation of appropriate behavioral interventions, as adjuncts to preventive or medical treatment of co-occurring conditions.

Although these gaps are significant, the holistic vision of health psychology can build upon insights from the network sciences and systems biology, which share with our field a multiple levels–multiple systems orientation (e.g., Sturmberg, Bennett, Martin, & Picard, 2017; Suls et al., 2016). As an illustration, computational models, using “big data,” have mapped the genome network (Goh et al., 2007) and the metabolome network (Lee, Park, Christakis, Oltvai, & Barabasi, 2008), which match disease phenotypes with underlying genome-linked and metabolome-linked diseases. These maps clarify how and why certain diseases occur in clusters within the same person, beyond the random association of health problems. Identifying causal multimorbidity (i.e., shared pathophysiological mechanisms underlying disease clustering) affords the potential for secondary disease prevention (Prados-Torres et al., 2014).

However, the biological “omics” cannot provide a complete understanding of multimorbidity because the individual is part of a larger social and physical environment, as emphasized by the BPSM. To balance what was perceived to be too much weight given to the genome, Wild (2012) proposed the concept of the “exposome,” which refers to life-course social and environmental exposures, including social stressors and lifestyle factors. Recognition of all the “omes” is consistent with the BPSM and offers an integrative approach to the person with multiple conditions.

In fact, health psychology may be optimally suited to explore such integration because of the development of new methodological tools to assess chronic and acute forms of stress (e.g., ambulatory monitoring, ecological momentary assessment) and their psychophysiological (e.g., personal sensors) and physiological correlates (e.g., biomarkers). It remains for health psychologists to apply these tools to multiple health conditions. One can envision, for example, a new generation of studies involving stress-induced laboratory or ambulatory reactivity to naturalistic stressors in patients with co-occurring health conditions to identify distinctive cardiovascular, neuroendocrine, and immune profiles. Likewise, longitudinal

studies could be launched that assess the emergence of single-, co-occurring, and staggered physical and mental health conditions, along with a full complement of “omics” (e.g., genomics, proteomics, metabolomics), stress measures, biomarkers, and psychosocial moderators, such as social support and affective temperament. In so doing, health psychologists should play a crucial role in the research team. Such exciting efforts as the Pioneer Wellness Project are in their formative stages (Price et al., 2017; Trachana et al., 2018). The All Of Us initiative (<https://allofus.nih.gov/>) also offers the opportunity for such an effort, although attention to multiple conditions, rather than single conditions or global, undifferentiated health outcomes, should be a priority.

Patient Self-Management and Prevention of Multimorbidity

Estimates are that 40 percent of the variance in health outcomes results from behavioral and environmental risk factors (e.g., Mokdad, Marks, Stroup, & Gerberding, 2004). However, the contribution of these risk factors (vs. genetics) to particular clusters of health conditions remains unclear. Clearly, many health conditions have common behavioral risk factors, such as smoking, sedentary behavior, and poor diet (e.g., for cancer and heart disease), which contribute to co-occurring conditions. Mounce et al. (2018) observed that development of more efficient prevention strategies addressing common determinants of multimorbidity across a wide range of conditions should be both desirable and feasible. The pioneering efforts of health psychologists in weight control, smoking cessation, etc., provide the foundation for research, campaigns, and interventions to facilitate healthy practices to forestall the development of multiple health conditions. Health psychologists can contribute to designing and implementing multiple-behavior interventions for several lifestyle risk factors (shared and unique) for clusters of health conditions. This will involve, however, more than simply bundling health behaviors, which ignores the substitute and complementary relationships among health behaviors (Spring, Moller, & Coons, 2012). For example, some kinds of physical exercise are inappropriate for someone who has chronically elevated blood pressure or is obese (see Dekker, Burman, & van der Leenden, in press).

Health psychology also has an important role to play in secondary and tertiary prevention for people who live with multiple conditions. In the National Health and Aging Trends Study, participants were asked about how they manage their medicines, get tests and lab work done, watch weight and blood pressure, or have yearly exams (Wolff & Boyd, 2015). Almost 70% said they are primarily responsible, and another 20% said they co-manage with family or friends. Patients who have multiple conditions report increasing psychosocial burden and lower physical and psychological quality of life as the difficulty of health care tasks (e.g., following dietary restrictions, arranging and transporting to health care appointments, and managing medical bills) increases (Bayliss, Ellis, & Steiner, 2007; Boyd et al., 2014). Severe strains may be placed on older patients and their untrained caregivers (typically a spouse or other relative) who need to process information about disease diagnosis, prognosis, and possible treatments (often in an affect-laden environment), and after shared decision-making, among all relevant parties, begin the course of treatment. Then the patient and untrained caregiver must harness their self-regulatory skills—managing cognition and emotion to enable goal-directed actions such as organizing behavior, decision-making, controlling impulses, and solving problems constructively—to maintain a regimen while

creating a “new normal.” Imagine assisting a patient with multimorbidity who requires the changing of wound dressings, monitoring for signs of infection and determining when symptoms progress to the level of an ER visit. Implementation of a multilevel behavioral intervention at three levels of influence—the patient, the care-giver, and the health care provider—may be required. Health psychologists can make a significant contribution here because they are becoming increasingly knowledgeable about the design, testing, and implementation of multilevel interventions (Stange, Breslau, Dietrich, Glasgow, 2012).

The preceding comments notwithstanding, managing multiple health conditions does not pose problems for everyone (NICE Report, 2016). For some individuals, self- and health-care management are straightforward. The question of what individual or contextual variables make self-management of multiple health conditions difficult for some people and not others and what cognitive or behavioral strategies can be engaged by patients and caregivers to reduce difficulties are challenging issues, but integral to health psychology.

Clinical health psychologists are trained in primary, secondary, and tertiary prevention because the psychology of self-regulation is an integral element at all levels of prevention. For decades, research on self-regulation has been in behavioral scientists’ wheel-house (e.g., Bickel, Odum, & Madden, 1999; de Ridder & de Wit, 2006; Mischel, Shoda, & Rodriguez, 1989). Research has identified brain structures and functions that process emotion or sensations (the “hotter” aspects of reasoning and behavior) and those that play an executive role managing processes involved in planning (“cooler” aspects) (e.g., Williams et al., 2018). Acute and chronic sources of stress (including health threats) potentiate distraction, impaired planning, poor memory, poor coping behaviors and unhealthy practices, such as overeating and smoking (Park & Iacocca, 2014). Juggling the demands of co-occurring conditions, such as multiple medications, exercises, and special diets places greater demands.

The burdens of co-occurring conditions should not be assumed to be additive, however. Some health conditions *interact* in ways that could be uniquely challenging. For example, depression commonly occurs with diabetes (Nouwen et al., 2010; Uhlig et al., 2014)). This association may reflect the effect of the long-term burden of self-management on mental health and/or the effect of depression on the quality and consistency of management of diabetes. Or, consider people living with diabetes and arthritis: walking is beneficial to diabetes management, but because of the patient’s joint degeneration, some alternative probably will be needed. A final example comes from public health campaigns and physician recommendations for cancer screening (e.g., colonoscopy for colorectal cancer). If a patient has a second serious condition (e.g., end-stage chronic obstructive pulmonary disease), then the benefits of cancer screening might be small because detecting and treating the cancer would not “buy” any additional years of life (Feurer et al., 2012). How patients decide to pursue screening or treatment in the context of multiple medical conditions and competing risks can pose serious challenges for their medical decision-making.

Although understanding about medical decision-making and the psychology of self-regulation (Nielsen et al, 2018) has gaps, tools are available or under development. Health psychologists have created decision aids (e.g., “[Guide to Decide](#),” which provides women at high risk for breast cancer with a tailored Web-based decision aid characterizing the medical

risks and benefits of chemoprevention medication; Fagerlin et al., 2011). Instruments exist to assess self-regulation capacity (e.g., Brief Self-Control Scale; Tangney, Baumeister, & Boone, 2004) and the tendency to excessively discount delayed rewards; Bickel, Moody, Koffarnus, Thomas, & Wing, 2018; Sze, Stein, Bickel, Paluch, & Epstein, 2017). Health psychologists have the qualifications to contribute to the understanding of self-regulation as the number of patients with multimorbidity increases, along with their self-care requirements.

Patient self-management requires more than self-regulation skills. The NICE Report (2016) notes that symptom monitoring, interoception, illness perception, decision-making and meaning-making also play critical roles. These processes, like self-regulation, have a lengthy history in health psychological research (e.g., McAndrew et al., 2008). Extending and applying this knowledge to the multimorbidity context, where content and processes will, no doubt, fluctuate and interact, remains a priority.

Earlier, we described epidemiological evidence that disparities and multimorbidity are likely to be disproportionate where social determinants (such as poverty, racial discrimination) are major contributors to health. Health psychologists are better placed than some other health professionals to address the connection between disparities and multimorbidity because of their ability to bridge biological, psychological, social, and cultural aspects of health and illness.

Multimorbidity in Clinical Practice

Ironically, clinical health psychologists have for some time operated in specialty medical settings providing patients with tertiary care to help manage and reduce symptoms and sequelae of illness (Brown et al., 2002). In some cases, psychologists have a liaison role, but in some instances they function as integral parts of the medical team, such as in pain clinics. Health psychology professionals can capitalize on their experience with several different types of evidence-based behavioral treatments, including biofeedback, relaxation training, stress inoculation, and cognitive behavioral modification and techniques to facilitate smoking cessation, medication adherence, problem-solving, and coping skills. Despite the potential, a formal role for clinical health psychologists working *across sciences* with patients who have multiple health conditions has yet to be systematically formulated. Fortunately there have been promising developments (Fisher & Dickenson, 2014).

The role of clinical health psychologists in the primary-care setting has until recently mainly served the mental health needs (e.g., depression, anxiety), rather than the health behavior needs, of patients who come to a hospital or clinic for physical problems (e.g., cardiovascular disease, cancer). Lay concerns about the stigma associated with mental health and substance abuse have made primary care the “de facto mental health system” (Regier et al., 1993). Approximately 30% of primary-care patients meet diagnostic criteria for anxiety, mood, or substance-use disorders (Serrano-Blanco et al., 2010), which often go undiagnosed. Primary-care physicians have recognized the need for behavioral providers on-site because physicians rarely have extensive training in mental health diagnoses and report difficulties accessing mental health services for their patients. Referring these patients to

clinical health psychologists on-site reduces the possibility of losing them, a motivation for including health care psychologists in primary care (Cubic & Beacham, 2014). The movement, referred to as “Integrated Primary Care” (IPC), has increased in adoption at medical centers and clinics (McDaniel et al., 2014). In its optimal form, IPC creates practice change in a single health system in which medical and mental and behavioral health care providers work in tandem to assess and treat a patient’s psychological, behavioral and medical needs with shared access to medical records.

A more recent innovation, the Patient-Centered Medical Home (PCMH), represents one type of IPC that also facilitates patients taking an active role in their health care (Agency for Healthcare Research and Quality, 2012). In a PCMH, the staff aims to meet the acute medical needs of the patient and to coordinate all aspects of his or her preventive, acute, and chronic needs (e.g., Kazak, Nash, Hiroto, & Kaslow, 2017). As the PCMH seeks to offer comprehensive care addressing behavioral and physical health from a team of inter-professional providers, the health psychologist serves as an integral part of that team within primary care.

IPC offers the opportunity to extend the reach of clinical health psychology to the patient with multiple health conditions. Health care psychologists possess the unique training to treat both mental and behavioral (tobacco, obesity) conditions, as well as the self-management of symptoms such as pain and fatigue. The development of PCMH recognizes the increasing need for health care psychologists to be involved in “integrated cross-specialty care” (Kazak et al., 2017) to bridge the “vertical silos” that have been created by medical specialties (Kessler, Stafford & Messier, 2009). Shuttling patients between specialty clinics will continue to be necessary and common, but a medical team, including clinical health psychologists, can provide the “connective tissue” that meets patients’ holistic needs that cross biological, psychological, and social domains. And when one condition requires focal attention for a period of time, specialists (including some health psychologists) can help patients with multiple conditions tolerate toxic treatments (e.g., for cancer) or complete treatment programs (e.g., pain rehabilitation, weight management). Doctoral-level clinical health psychologists should be acknowledged as experts, scientific researchers, and consumers, and should lead, with evidence, in the behavioral domain just as medical doctors lead medical teams. In short, health psychology can also help to facilitate high-level primary care that is capable of integrating specialty opinions to create effective care plans, rather than potentially harmful pursuit of independent care plans with potentially unrecognized contraindications.

Efforts should be made to address the paucity of evidence-based guidelines for mental and behavioral health interventions with patients with concurrent conditions. Clinical guidelines tend to resemble those for medical treatments, even though, unlike some medical interventions, they tend to have a low side-effect profile (unlike medications or surgery) — they focus on single conditions (see Stoll et al., in press). Testing which mental and behavioral health interventions produce complementary benefits to patients with multiple conditions and which interventions, in combination, may be harmful or counterproductive (“more may not always be better”) should be an important part of the clinical health

psychologist's research agenda (see Barker, Holland, Lee, Richie, & Boote, 2018, for an example).

In view of the increasing prevalence of multimorbidity, behavioral researchers need to broaden the eligibility criteria for clinical trials testing treatments. Pragmatic clinical trials (e.g., Johnson et al., 2014), which purposely recruit “all comers” with the relevant condition to increase generalizability, do not optimally solve this problem unless recruitment involves adequate patient numbers to identify sources of heterogeneity of effects (e.g., patient demographics, co-occurring conditions, etc.; Boyd & Kent, 2014). Another strategy to increase generalizability of clinical trials would be to add special behavioral treatment arms for patients with frequently co-occurring clusters of health conditions to clinical trials. If the prevalence of multimorbidity increases as projected, special treatment arms in both medical and behavioral clinical trials may need to become a research priority.

Conclusions

The increasing global prevalence of multimorbidity poses challenges to patients, health care providers, health care systems and society at large. Limited knowledge about the etiology, prevention, and treatment for people at risk of or living with multiple health conditions represents a current obstacle. The conventional silos of medicine can lose sight of the whole person and the significant interactive role of biological, psychological and social factors. Health psychologists, by definition, have an implicit or explicit holistic conception of physical and psychological health that can bridge these different levels and have an impact on health care.

A recent commentary (Vetrano et al., 2018) referred to multimorbidity as “the elephant in the room” because it is one of the main current and unaddressed challenges for clinicians, researchers, and policymakers. At the risk of straining the metaphor, the parable of the elephant and the ten blind men also has relevance. In it, each blind man touches a different part of the elephant, projects his partial experiences as the whole truth, and ignores other people's partial experiences. This resembles the current approach to the patient with multiple medical conditions in which each specialty sees a single disease as a whole. Multimorbidity is multi-sided; no single field will possess all of the information, and no condition exists in isolation. The holistic view promoted by the BPSM increases the likelihood of not only appreciating all the parts but also understanding the human system in which those parts operate with synergy.

Acknowledgments

C.M. Boyd is partly supported by 1K24AG056578-01 and receives a royalty for co-authoring a chapter on multimorbidity for UpToDate.

References

- Academy of Medical Sciences (2018). Multimorbidity: A priority for global health research. Retrieved from <https://acmedsci.ac.uk/policy/policy-projects/multimorbidity>
- Agency for Healthcare Research and Quality (AHRQ) (2012). Coordinating care for adults with complex care needs in the patient-centered medical home: Challenges and solutions. Retrieved from

<https://pcmh.ahrq.gov/page/coordinating-care-adults-complex-care-needs-patient-centered-medical-home-challenges-and>

- All of Us Research Team (2017). All of Us Research Program. Retrieved from <https://allofus.nih.gov/>
- Barnett K, Mercer SW, Norbury M, Watt G, Wyke S, & Guthrie B (2012). Epidemiology of multimorbidity and implications for health care, research, and medical education: A cross-sectional study. *Lancet*, 380, 37–43. [PubMed: 22579043]
- Barker K, Holland AE, Lee AL, Ritchie K, Boote C, Lowe S, ... Skinner EH (2018). A rehabilitation programme for people with multimorbidity versus usual care: A pilot randomized controlled trial. *Journal of Comorbidity*, 8, 2235042X18783918.
- Bayliss EA, Ellis JL, & Steiner JF (2007). Barriers to self-management and quality-of-life outcomes in seniors with multimorbidities. *Annals of Family Medicine*, 5, 395–402. [PubMed: 17893380]
- Beaver JA, Ison GI, & Pazdur R (2017). Reevaluating eligibility criteria—balancing patient protection and participation in oncology trials. *New England Journal of Medicine*, 376, 1504–1505. [PubMed: 28423289]
- Bickel WK, Moody LN, Koffarnus M, Thomas JG, & Wing R (2018). Self-control as measured by delay discounting is greater among successful weight losers than controls. *Journal of Behavioral Medicine*, 41, 891–896. [PubMed: 29766471]
- Bickel WK, Odum AL, & Madden GJ (1999). Impulsivity and cigarette smoking: Delay discounting in current, never, and ex-smokers. *Psychopharmacology*, 146, 447–454. [PubMed: 10550495]
- Bierman AS, & Tinetti ME (2016). Comment: Precision medicine to precision care: Managing Multimorbidity. *Lancet*, 388, 2721–2723. [PubMed: 27924764]
- Boyd CM, Darer J, Boulton C, Fried LP, Boulton L, & Wu AW (2005). Clinical practice guidelines and quality of care for older patients with multiple comorbid diseases: Implications for pay for performance. *Journal of the American Medical Association*, 294, 716–724. [PubMed: 16091574]
- Boyd CM, & Kent DM (2014). Evidence-based medicine and the hard problem of multimorbidity. *Journal of General Internal Medicine*, 29, 552–553. [PubMed: 24442331]
- Boyd CM, Wolff JL, Giovannetti E, Reider L, Weiss C, Xue Q, ... Rand C (2014). Healthcare task difficulty among older adults with multimorbidity. *Medical Care*, 52, S118–S125. [PubMed: 24561750]
- Boyd CM, Leff B, Wolff JL, Yu Q, Zhou J, Rand C, & Weiss CO (2011). Informing clinical practice guideline development and implementation: Prevalence of coexisting conditions among adults with coronary heart disease. *Journal of the American Geriatrics Society*. 59, 797–805. [PubMed: 21568950]
- Brown RT, Freeman WS, Brown RA, Belar C, Hersch L, Hornyak LM, ... Reed G (2002). The role of psychology in health care delivery. *Professional Psychology: Research and Practice*, 3, 536–545.
- Caughey GE, Ramsay EN, Vitry AI, Gilbert AL, Luszcz MA, Ryan P, Roughead EE (2009). Comorbid chronic diseases, discordant impact on mortality in older people: A 14-year longitudinal population study. *Journal of Epidemiology & Community Health*, 64, 1036–1042. <https://my.clevelandclinic.org/health/articles/9288-chronic-illness-and-depression> [PubMed: 19854745]
- Cubic BA, & Beacham AO (2014). Preparing the next generation for integrated care in medical settings In Hunter CM, Hunter CL & Kessler R (Eds.), *Handbook of clinical psychology in medical settings* (pp. 41–76). New York: Springer.
- Curigliano G, Mayer EL, Burstein HJ, Winer EP, & Goldhirsch A (2010). Cardiac toxicity from systemic cancer therapy: A comprehensive review. *Progress in Cardiovascular Diseases*, 53(2), 94–104. [PubMed: 20728696]
- Dawber TR, Moore FE, & Mann GV (1957). Coronary heart disease in the Framingham Study. *American Journal of Public Health*, 47(4), 4–24.
- Dekker J, Buurman B, & van der Leeden M (in press). Exercise in people with comorbidities or multimorbidities. *Health Psychology de Ridder DTD, & de Wit JBF (Eds.). (2006). Self-regulation in health behavior*. New York: John Wiley & Sons.
- Engel GL (1977). The need for a new medical model: A challenge for biomedicine. *Science*, 196(4286), 129–136. [PubMed: 847460]

- Fagerlin A, Dillard AJ, Smith DM, Zikmund-Fisher BJ, Pitsch R, McClure JB,...Ubel PA (2011). Women's interest in taking tamoxifen and raloxifene for breast cancer prevention: Response to a tailored decision aid. *Breast Cancer Research and Treatment*, 127, 681–688. [PubMed: 21442198]
- Feinstein AR (1970). The pre-therapeutic classification of co-morbidity in chronic diseases. *Journal of Chronic Disease*, 23, 455–468.
- Feuer EJ, Lee M, Mariotto AB, Cronin KA, Scoppa S, Penson DF, ... Hankey BF (2012). The Cancer Survival Query System: Making survival estimates from the Surveillance, Epidemiology, and End Results program more timely and relevant for recently diagnosed patients. *Cancer*, 118, 5652–5662. [PubMed: 22569947]
- Fisher L, & Dickenson WP (2014). Psychology and primary care: New collaborations for providing effective care for adults with chronic health conditions. *American Psychologist*, 69, 355–363. [PubMed: 24820685]
- Fortin M, Dionne J, Pinho G, Gignac J, Almirall J, & Lapointe L (2006). Randomized controlled trials: Do they have external validity for patients with multiple comorbidities? *Annals of Family Medicine*, 4, 104–108. [PubMed: 16569712]
- Fortin M, Stewart M, Poitras ME, Almirall J, & Maddocks H (2012). A systematic review of prevalence studies on multimorbidity: Toward a more uniform methodology. *Annals of Family Medicine*, 10, 142–151. [PubMed: 22412006]
- Goh KI, Cusick ME, Valle D, Childs B, Vidal M, & Barabasi A-L. (2007). The human disease network. *Proceedings of the National Academy of Sciences*, 104(21), 8685–8690.
- Goodman RA, Posner SF, Huang ES, Parekh AK, & Koh HK (2013). Defining and measuring chronic conditions: Imperatives for research, policy, program, and practice. *Preventing Chronic Disease*, 10, 120239.
- Grembowski D, Schaefer J, Johnson KE, Fischer H, Moore SL, Tai-Seale M, ... LeRoy L (2014). A conceptual model of the role of complexity in the care of patients with multiple chronic conditions. *Medical Care*, 52, Suppl 2, S7–S14. [PubMed: 24561762]
- Griffith LE, Grunier A, Fisher KA, Nicholson K, Panjwani D, Patterson C, ... Upshur R (2018). Key factors to consider when measuring multimorbidity: Results from an expert panel and online survey. *Journal of Comorbidity*, 8, 1–9. [PubMed: 29492397]
- Gunn JM, Ayton DR, Densley K, Pallant JF, Chondros P, Herrman HE, & Dowrick CF (2012). The association between chronic illness, multimorbidity and depressive symptoms in an Australian primary care cohort. *Social Psychiatry and Psychiatric Epidemiology*, 47, 175–184. [PubMed: 21184214]
- Guthrie B, Payne K, Alderson P, McMurdo MET, & Mercer SW (2012) Adapting clinical guidelines to take account of multimorbidity. *British Medical Journal*, 345, e6341. [PubMed: 23036829]
- He W, Goodkind D, & Kowal PR (2016). An aging world: 2015: International population reports. Washington, D.C.: United States Census Bureau <https://www.census.gov/content/dam/Census/library/publications/2016/demo/p95-16-1.pdf>
- Hughes LD, McMurdo MET, & Guthrie B (2013). Guidelines for people not for diseases: The challenges of applying UK clinical guidelines to people with multimorbidity. *Age and Ageing*, 42, 62–69. [PubMed: 22910303]
- Jadad AR, To MJ, Emara M, & Jones J (2011). Consideration of multiple chronic diseases in randomized controlled trials. *Journal of the American Medical Association*, 306, 2670–2672.
- Johnson KE, Tachibana C, Coronado GD, Dember LM, Glasgow RE, Huang SS, ... Larson EB (2014). A guide to research partnerships for pragmatic clinical trials. *BMJ*, 349, g6826. [PubMed: 25446054]
- Johnston MC, Crilly M, Black C, Prescott GJ, & Mercer SW (2019). Defining and measuring multimorbidity: A systematic review of systematic reviews. *European Journal of Public Health*, 29, 182–189. [PubMed: 29878097]
- Katon WJ, Lin EHB, Von Korff M, Ciechanowski P, Ludman EJ, Young B, ... McCullough D (2010). Collaborative care for patients with depression and chronic illness. *New England Journal of Medicine*, 363, 2611–2620. [PubMed: 21190455]

- Kazak AE, Nash JM, Hiroto K, & Kaslow NJ (2017). Psychologists in patient-centered medical homes (PCMHs): Roles, evidence, opportunities, and challenges. *American Psychologist*, 72, 1–12. [PubMed: 28068134]
- Kessler R, Stafford D, & Messier R (2009). The problem of integrating behavioral health in the medical home and the questions it leads to. *Journal of Clinical Psychology in Medical Settings*, 16, 4–12. [PubMed: 19219628]
- King DE, Xiang J, & Pilkerton CS (2018). Multimorbidity trends in United States adults, 1988–2014. *Journal of the American Board of Family Medicine*, 31, 503–513. [PubMed: 29986975]
- Khor B, Gardet A, & Xavier RJ (2011). Genetics and pathogenesis of inflammatory bowel disease. *Nature*, 474, 307–317. [PubMed: 21677747]
- Kronish IM, Fenn K, Cohen L, Hershman DL, Green PA, & Suls J (in press). Extent of exclusions for chronic conditions in breast cancer trials. *Journal of the National Cancer Institute: Cancer Spectrum*.
- Lancet (2018). Editorial: Making more of multimorbidity: An emerging priority. *Lancet*, 391, 1637. [PubMed: 29726322]
- Lee D-S, Park J, Kay KA, Christakis NA, Oltvai ZN, & Barabasi A-L (2008). The implications of human metabolic network topology for disease comorbidity. *Proceedings of the National Academy of Sciences*, 105, 9880–9885.
- Lee PY, Alexander KP, Hammill BG, Pasquali SK, & Peterson ED (2001). Representation of elderly persons and women in published randomized trials of acute coronary syndromes. *Journal of the American Medical Association*, 286, 708–713. [PubMed: 11495621]
- Le Reste JY, Nabbe P, Manceau B, Lygidakis C, Doerr C, Lingner H, ...Lietard C (2013). The European General Practice Research Network presents a comprehensive definition of multimorbidity in family medicine and long term care, following a systematic review of relevant literature. *Journal of the American Medical Directors Association*, 14, 319–325. [PubMed: 23411065]
- Levit LA, Singh H, Klepin HD, & Hurria A (2018). Expanding the evidence base in geriatric oncology: Action items from an FDA-ASCO workshop. *Journal of the National Cancer Institute*, 110, 1163–1170. [PubMed: 30329076]
- Magnan EM, Gittelsohn R, Bartels CM, Johnston HM, Pandhi N, Jacobs EA, & Smith MA (2015). Establishing chronic condition concordance and discordance with diabetes: A Delphi study. *BMC Family Practice*, 16, 42. [PubMed: 25887080]
- Marengoni A, Angleman S, Melis R, Mangialasche F, Karp A, Garmen A, ... Fratiglioni L (2011). Aging with multimorbidity: A systematic review of the literature. *Aging Research Reviews*, 10, 430–439. [PubMed: 21402176]
- McAndrew LM, Musumeci-Szabo TJ, Mora PA, Vileikyte L, Burns E, Halm EA, ... Leventhal H (2008). Using the common sense model to design interventions for the prevention and management of chronic illness threats: From description to process. *British Journal of Health Psychology*, 13, 195–204. [PubMed: 18331667]
- McClintock MK, Dale W, Laumann EO, & Waite L (2016). Empirical redefinition of comprehensive health and well-being in the older adults of the United States. *Proceedings of the National Academy of Sciences*, 113, E3071–E3080.
- McDaniel SH, Grus CL, Cubic BA, Hunter CL, Kearney LK, Schuman CC, ...Johnson SB (2014). Competencies for psychology practice in primary care. *American Psychologist*, 69, 409–429. [PubMed: 24820690]
- McEwen BS (1998). Protective and damaging effects of stress mediators. *New England Journal of Medicine*, 338, 171–179. [PubMed: 9428819]
- McLaren N (1998). A critical review of the biopsychosocial model. *Australian & New Zealand Journal of Psychiatry*, 32, 86–92. [PubMed: 9565189]
- Mischel W, Shoda Y, & Rodriguez MI (1989). Delay of gratification in children. *Science*, 244, 933–938. [PubMed: 2658056]
- Mokdad AH, Marks JS, Stroup DF, & Gerberding JL (2004). Actual causes of death in the United States, 2000. *Journal of the American Medical Association*, 291, 1238–1245. [PubMed: 15010446]

- Mounce LTA, Campbell JL, Henley WE, Tejerina Arreal MC, Porter I, & Valderas JM (2018). Predicting incident multimorbidity. *Annals of Family Medicine*, 16, 322–329. [PubMed: 29987080]
- National Institute for Health and Care Excellence (2016). Multimorbidity: Clinical assessment and management. Retrieved from <https://www.nice.org.uk/guidance/ng56>
- Nielsen L, Riddle M, King JW, Aklın WM, Chen W, Clark D, ... Weber W (2018). The NIH Science of Behavior Change Program: Transforming the science through a focus on mechanisms of change. *Behaviour Research and Therapy*, 101, 3–11. [PubMed: 29110885]
- Nouwen A, Winkley K, Twisk J, Lloyd CE, Peyrot M, Ismail K, & Pouwer F (2010). Type 2 diabetes mellitus as a risk factor for the onset of depression: A systematic review and meta-analysis. *Diabetologia*, 53, 2480–2486. [PubMed: 20711716]
- O’Keefe LM, Taylor G, Huxley RR, Mitchell P, Woodward M & Peters SAE (2018). Smoking as a risk factor for lung cancer in women and men: A systematic review and meta-analysis. *BMJ Open*, 8:e021611. doi: 10.1136/bmjopen-2018-021611.
- Parekh AK, Goodman RA, Gordon C, & Koh HK (2011). Managing multiple chronic conditions: A strategic framework for improving health outcomes and quality of life. *Public Health Reports*, 126, 460–471. [PubMed: 21800741]
- Park CL, & Iacocca MO (2014). A stress and coping perspective on health behaviors: Theoretical and methodological considerations. *Anxiety, Stress, & Coping*, 27, 123–137.
- Piette JD, & Kerr EA (2006). The impact of comorbid chronic conditions on diabetes care. *Diabetes Care*, 29, 725–731. [PubMed: 16505540]
- Prados-Torres A, Calderón-Larrañaga A, Hanco-Saavedra J, Poblador-Plou B, & van den Akker M (2014). Multimorbidity patterns: A systematic review. *Journal of Clinical Epidemiology*, 67, 254–266. [PubMed: 24472295]
- Price ND, Magis AT, Earls JC, Glusman G, Levy R, Lausted C, ... Hood L (2017). A wellness study of 108 individuals using personal, dense, dynamic data clouds. *Nature Biotechnology*, 35, 747–756.
- Regier DA, Narrow WE, Rae DS, Manderscheid RW, Locke BZ, & Goodwin FK (1993). The de facto US mental health and addictive disorders service system: Epidemiologic catchment area prospective 1-year prevalence rates of disorders and services. *Archives of General Psychiatry*, 50, 85–94. [PubMed: 8427558]
- Renahan A, Smith U, & Kirkman MS (2010). Linking diabetes and cancer: A consensus on complexity. *Lancet*, 375, 2201–2202. [PubMed: 20609959]
- Salisbury C (2012). Commentary: Multimorbidity: Redesigning health care for people who use it. *Lancet*, 380, 7–9. [PubMed: 22579042]
- Scott KM, Lim C, Al-Hamzawi A, Alonso J, Bruffaerts R, Caldas-de-Almeida JM, ...Kessler RC (2016). Association of mental disorders with subsequent chronic physical conditions: World Mental Health Surveys from 17 countries. *JAMA Psychiatry*, 73, 150–158. [PubMed: 26719969]
- Serrano-Blanco A, Palao DJ, Luciano JV, Pinto-Meza A, Lujan L, Fernandez A, ...Haro JM (2010). Prevalence of mental disorders in primary care: Results from the Diagnosis and Treatment of Mental Disorders in Primary Care study (DASMAP). *Social Psychiatry and Psychiatric Epidemiology*, 45, 201–210. [PubMed: 19452110]
- Sinnott C, McHugh S, Fitzgerald AP, Bradley CP, & Kearney PM (2015). Psychosocial complexity in multimorbidity: The legacy of adverse childhood experiences. *Family Practice*, 32, 269–275. [PubMed: 25900675]
- Spring B, Moller AC, & Coons MJ (2012). Multiple health behaviours: Overview and implications. *Journal of Public Health*, 34, Suppl 1, i3–i10. [PubMed: 22363028]
- Stange KC, Breslau ES, Dietrich AJ, & Glasgow RE (2012) State-of-the-art and future directions in multilevel interventions across the cancer control continuum. *Journal of the National Cancer Institute Monographs*, 44, 20–31.
- Stoll C, Izadi S, Fowler S, Philpott S, Green P, Suls J ... Colditz GA (in press). Multiple chronic conditions in randomized controlled trials of behavioral health interventions: A systematic review. *Health Psychology*.

- Struckmann V, Leijten FRM, van Ginnekin E, Kraus M, Reiss M, Spranger A ... Rutten-van Molken M (2018). Relevant models and elements of integrated care for multi-morbidity: Results of a scoping review. *Health Policy*, 122, 23–35. [PubMed: 29031933]
- Sturmberg JP, Bennett JM, Martin CM, & Picard M (2017). “Multimorbidity” as the manifestation of network disturbances. *Journal of Evaluation in Clinical Practice*, 23, 199–208. [PubMed: 27421249]
- Suls J, Green PA, & Davidson KW (2016). A biobehavioral framework to address the emerging challenge of multimorbidity. *Psychosomatic Medicine*, 78, 281–289. [PubMed: 26867072]
- Sze YY, Stein JS, Bickel WK, Paluch RA, & Epstein LH (2017). Bleak present, bright future: Online episodic future thinking, scarcity, delay discounting, and food demand. *Clinical Psychological Science*, 5(4), 683–697. [PubMed: 28966885]
- Tangney JP, Baumeister RF, & Boone AL (2004). High self-control predicts good adjustment, less pathology, better grades, and interpersonal success. *Journal of Personality*, 72, 271–324. [PubMed: 15016066]
- Taylor AW, Price K, Gill TK, Adams R, Pilkington R, Carrangis N, ... Wilson D (2010). Multimorbidity—Not just an older person’s issue: Results from an Australian biomedical study. *BMC Public Health*, 10, 718. [PubMed: 21092218]
- Trachana K, Bargaje R, Glusman G, Price ND, Huang S, & Hood LE (2018). Taking systems medicine to heart. *Circulation Research*, 122, 1276–1289. [PubMed: 29700072]
- Tugwell P, & Knottnerus JA (2019). Editorial: Multimorbidity and comorbidity are now separate MESH headings. *Journal of Clinical Epidemiology*, 105, vi–viii. [PubMed: 30522770]
- Uhlig K, Leff B, Kent D, Dy S, Brunnhuber K, Burgers JS, ... Boyd CM (2014). A framework for crafting clinical practice guidelines that are relevant to the care and management of people with multimorbidity. *Journal of General Internal Medicine*, 29, 670–679. [PubMed: 24442332]
- U.S. Department of Health & Human Services (2010). Multiple Chronic Conditions: A Strategic Framework: Optimum Health and Quality of Life for Individuals with Multiple Chronic Conditions [PDF file]. Retrieved from https://www.hhs.gov/sites/default/files/ash/initiatives/mcc/mcc_framework.pdf. Accessed February 28, 2013.
- van den Akker M, Buntinx F, & Knottnerus A (1996). Comorbidity or multimorbidity: What’s in a name? A review of literature. *European Journal of General Practice*, 2, 65–70.
- van der Heide I, Snoeijis S, Quattrini S, Struckmann V, Hujala A, Schellevis F, & Rijken M (2018). Patient-centeredness of integrated care programs for people with multimorbidity: Results from the European ICARE4EU project. *Health Policy*, 122, 36–43. [PubMed: 29129270]
- Van Spall HGC, Toren A, Kiss A, & Fowler RA (2007). Eligibility criteria of randomized controlled trials published in high-impact general medical journals: A systematic sampling review. *Journal of the American Medical Association*, 297, 1233–1240. [PubMed: 17374817]
- Vetrano DL, Calderón-Larrañaga A, Marengoni A, Onder G, Bauer JM, Cesari M, ... Fratiglioni L, (2018). An international perspective on chronic multimorbidity: Approaching the elephant in the room. *The Journals of Gerontology: Series A: Biological Sciences & Medicine Sciences*, 73, 1350–1356.
- Violan C, Foguet-Boreu Q, Flores-Mateo G, Salisbury C, Blom J, Freitag M, ... Valderas JM (2014). Prevalence, determinants and patterns of multimorbidity in primary care: A systematic review of observational studies. *PLoS One*, 9, e102149. [PubMed: 25048354]
- Ward BW (2015). Multiple chronic conditions and labor force outcomes: A population study of U.S. adults. *American Journal of Industrial Medicine*, 58, 943–954. [PubMed: 26103096]
- Wild CP (2012). The exposome: From concept to utility. *International Journal of Epidemiology*, 41, 24–32. [PubMed: 22296988]
- Williams LM, Pines A, Goldstein-Piekarski AN, Rosas LG, Kullar M, Sacchet MD, ... Ma J (2018). The ENGAGE study: Integrating neuroimaging, virtual reality and smartphone sensing to understand self-regulation for managing depression and obesity in a precision medicine model. *Behaviour Research and Therapy*, 101, 58–70. [PubMed: 29074231]
- Wolff JL, & Boyd CM (2015). A look at person-centered and family-centered care among older adults: Results from a national survey. *Journal of General Internal Medicine*, 30, 1497–1504. [PubMed: 25933625]

- Wolff JL, Starfield B, & Anderson G (2002). Prevalence, expenditures, and complications of multiple chronic conditions in the elderly. *Archives of Internal Medicine*, 162, 2269–2276. [PubMed: 12418941]
- World Health Organization (2008). *The World Health Report 2008: Primary health care (N)ow more than ever*. New York: World Health Organization Retrieved from <https://www.who.int/whr/2008/en/>

Author Manuscript

Author Manuscript

Author Manuscript

Author Manuscript

Table 1

Illustrations of How Health Psychology Is Relevant to Multimorbidity

Multimorbidity significantly affects quality of life, which is a dominant outcome across fields.
Most of the conditions are associated with behavioral risk factors that are known to have psychological antecedents and consequences.
Depression, anxiety, and other affective and behavioral conditions are known to be part of the multimorbidity constellation, and multimorbidity is known to predict the emergence of depression, anxiety, and other psychological conditions.
Multimorbidity impacts medication and treatment adherence.
Most clinical guidelines for the treatment of chronic disease include some lifestyle or behavioral recommendation (e.g., smoking cessation, change in diet, weight loss, physical activity prescription). In a multimorbidity context, such recommendations are often contradictory, or can be managed more synergistically.
Multimorbidity requires self-management, which can be affected by cognitive and affective factors, such as motivation, risk perception, illness perception, self-efficacy, social context and support, heuristics, and biases.
Multimorbidity affects the way an individual interacts with their social network.

Author Manuscript

Author Manuscript

Author Manuscript

Author Manuscript