Aging and orthopedics: how a lifespan development model can inform practice and research

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Accepted for publication Mar. 22, 2016

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DOI: 10.1503/cjs.008215

Orthopedic surgical care, like all health care today, is in flux owing to an aging population and to chronic medical conditions leading to an increased number of people with illnesses that need to be managed over the lifespan. The result is an ongoing shift from curing acute illnesses to the management and care of chronic illness and conditions. Theoretical models that provide a useful and feasible vision for the future of health care and health care research are needed. This review discusses how the lifespan development model used in some disciplines within the behavioural sciences can be seen as an extension of the biopsychosocial model. We posit that the lifespan development model provides useful perspectives for both orthopedic care and research. We present key concepts and recommendations, and we discuss how the lifespan development model can contribute to new and evolving perspectives on orthopedic outcomes and to new directions for research. We also offer practical guidelines on how to implement the model in orthopedic practice.

Comme tous les soins de santé, les soins orthopédiques sont en pleine évolution. En raison du vieillissement de la population et de la prévalence des maladies chroniques, un nombre accru de personnes sont en effet atteintes d'affections qui doivent être prises en charge pour le reste de leur vie. Résultat : une transition graduelle du traitement des maladies aiguës vers la prise en charge de maladies et d'affections chroniques. Il est donc essentiel de mettre au point des modèles théoriques offrant une vision utile et réaliste de l'avenir des soins de santé et de la recherche dans ce domaine. La présente revue examine en quoi le modèle développemental du cours de la vie utilisé par certaines disciplines des sciences du comportement peut être vu comme une extension du modèle biopsychosocial. Nous posons comme hypothèse que le modèle développemental du cours de la vie propose des perspectives utiles à la fois pour les soins orthopédiques et pour la recherche dans ce domaine. Nous présentons des concepts et des recommandations clés et nous nous penchons sur la contribution potentielle de ce modèle à l'apparition et à l'évolution de nouvelles perspectives quant aux résultats en orthopédie ainsi qu'à l'élaboration de nouvelles orientations de recherche. Enfin, nous formulons des lignes directrices sur l'implantation du modèle dans la pratique orthopédique.

In 2015, it was estimated that people aged 65 and older represented 15% of the population in the United States, 16% in Canada, 20% in Sweden and 26% in Japan.[1] This aging population is contributing to a health care landscape that is already in flux across the western world. New technologies, medications, treatments and procedures have greatly advanced medical knowledge, most notably in the last 50 years. As a result of these medical advancements, adults across the industrialized world are living longer, although many have chronic illnesses. Some of these chronic conditions are related to suboptimal lifestyle choices (e.g., diet and exercise), which are increasing the number of middle-aged and younger individuals coping with conditions that need to be managed, rather than cured, over a portion of the lifespan. This has particular relevance for clinicians and researchers in orthopedics, where the number of people seeking care will increase exponentially in the coming decades. It could be said that orthopedics is both a field of medicine that deals with trauma and injury and one that directly addresses issues of aging within the context of function and mobility.

In the present review, we propose that looking beyond some of the theoretical models that underlie the entire system of health care can contribute to a

useful and feasible vision for the future of health care that accommodates the needs of our aging population. Specifically, we propose that the lifespan development approach already being used in some disciplines within the behavioural sciences can play a role in setting the direction for a vision of orthopedic care and research.

Biomedical and biopsychosocial models

The biomedical model of illness has informed medical practice and health care for more than 2 centuries and still holds considerable prominence today.[2,3] As the dominant explanatory model of illness and health, the biomedical model conceptualizes health and illness as physiologic processes. Illness and disease are explained as a disruption of these processes caused by injury, biochemical imbalances, or infection.[4] The model's widespread appeal comes from its linear cause and effect explanation of illness as either a failure or breakdown of human physiology.

Although the biomedical model has led to many great achievements in health care and the cure of disease, it has been criticized for being overly reductionist; illness is viewed as a linear cause and effect process, with the body separate and distinct from psychological and social influences. Too often, what cannot be explained by cellular or molecular pathology is disregarded or downplayed.[4] Under the biomedical model, the role of the patient was that of a submissive recipient of medical intervention, not a co-contributor to his or her own health outcomes.[5]

A shift in the valuation of the role of the patient is one of the hallmarks of the biopsychosocial (BPS) model. In his seminal 1977 paper, George Engel[6] argued for a more holistic view of the patient, one that would "reverse the dehumanization of medicine and disempowerment of patients."[4] Thus, the BPS model expands on the biological explanation of illness to include psychological and social factors, which can differentially impact the outcomes of a number of well-known orthopedic interventions.[7] For example, psychological factors, such as anxiety and depression, have been identified as mediating variables in pre- and postoperative knee function[8] and functional outcomes of total knee arthroplasty.[9] In addition, social factors, such as race and socioeconomic status, have been implicated in functional outcomes of total knee arthroplasty and patient satisfaction.[10] Clearly, biopsychosocial variables are important in determining patient outcomes. We propose that the lifespan development theory can be viewed not only as a logical extension of the biopsychosocial approach, but also may add particularly useful perspectives to orthopedics care and research.

Lifespan development theory

The lifespan development theory was originally viewed as part of developmental psychology and was focused on the study of human development from conception to death.[11,12] Studied empirically since the 1960s and '70s, the lifespan development approach proposes an "integrative perspective on development as a multidimensional, multidirectional, context-specific and malleable phenomenon that goes beyond classic conceptions of a linear, unidirectional growth or differentiation."[13]

In 1987 Baltes[11] identified and later adapted a number of key concepts that compose lifespan theory. We summarize these briefly here and propose some implications of these views that are particularly pertinent to orthopedics.

Lifespan development is a lifelong process of changes in adaptive capacity

Researchers and clinicians need to focus on how patients adapt throughout their lives and, in particular, must assume that change is ongoing and that adaptation is possible until the moment of death. For a patient experiencing accumulating losses in mobility, a clinician who takes into account the patient's willingness and ability to adapt to change in circumstances may be particularly effective in offering optimal clinical care.

Change is multidimensional and multidirectional

It is important to be constantly aware that many or all aspects of a person's life are affected by an illness or medical condition and that, at any point, there can be gains and losses in functioning and in adaptation that may co-occur. Development also comprises gains and losses throughout the lifespan rather than increasing gains until mid-adulthood followed by slow declines into old age. This challenges the views held by many that only improvements occur until maturation and that only losses occur after maturation is reached. We already see how orthopedic interventions contribute to gains in functioning even among the oldest and frailest patients. This focus on within-person modifiability implies 2 key issues. First, the end point of a disease or condition (at least in terms of some multidimensional outcomes) is not predetermined and can be influenced by interventions. Second, the effectiveness of such interventions is determined not only by the disease itself, but also by the life events and experiences of the individuals, thus emphasizing the individual nature of how patients will progress through their diseases and their treatments. The clinician cannot depend solely on the person's age, or even on objective measures of joint performance, to determine which patients will benefit from interventions.

All human development is embedded within a historical and cultural context

As stated, the lifespan perspective emphasizes that the past experiences of the individual affect how he or she reacts to a situation. However, this does not discount the likelihood that individuals of the same culture, the same race and the same historical era experience relatively similar events and

influences on at least some levels. Thus, interventions, treatments and interpretations of individuals' behaviours must take into account the person's generation and culture. For example, while educated baby boomers may want and need to be equal partners in making decisions about their health, those from earlier generations, particularly if low literacy is present, may want and need to have their health care providers take the lead, or even make the decisions.

The lifespan development model identifies 3 types of influence to underline the biopsychosocial nature of change: influences linked to chronological age, influences associated with one's cohort or generation and changes due to random biological and environmental events (e.g., accidents).[11] Realizing that these influences constantly work together interactively to explain the developmental paths of individuals, generational cohorts and societal trends can help researchers and clinicians move between case studies, clinical research and epidemiological studies. For example, a number of epidemiological studies have reported that the onset of knee osteoarthritis (OA) is influenced not only by the biological processes of aging, but also by secular trends, such as the prevalence of sedentary work and middle-age obesity, and by traumatic injury, such as sport injury or a motor vehicle crash.[14] Understanding all 3 types of contextual influences provides an alternate lens for examining different health outcomes within and across age cohorts and individuals.

The study of development is intrinsically multidisciplinary

The study of development encompasses a variety of perspectives, with each having the potential to influence and be influenced by the others. Thus, not only research teams, but also care teams will be more effective and more successful if the perspectives, knowledge and skills of people trained within different disciplines are used and respected.

Heckhausen and colleagues[15] recently proposed the lines of defence model, which provides an example of an application of the lifespan model. Although empirical testing is still in progress, this model in particular offers a deeper exploration of how goal engagement and disengagement can change over the course of an illness and over the lifespan. The lines of defence model proposes that individuals use control strategies of goal engagement, disengagement and new goal re-engagement across 4 disease states: disease-free, subclinical disease, chronic disease and terminal illness.[15]

The first line of defence is to engage in goals that will promote patients' disease-free state until their genes, environment, or behaviour makes a disease-free state impossible. The second line of defence is subclinical, and the focus is avoiding chronic disease by engaging in goals that facilitate a return to a disease-free state or that delay progression to a chronic disease state. When this is no longer possible, the third line of defence is breached, and chronic disease becomes the health state. At this point, the goal is to maintain patients' activities of daily living (e.g., eating, bathing, dressing, walking) and those activities that allow people to live independently. The control strategies used here show a shift from primary control strategies (action-oriented) to secondary control strategies (inner-directed) and include a gradual dependence on assistive devices and support from others. For example, a person with knee OA may use anti-inflammatory medications to accomplish activities of daily living, but when the condition progresses beyond what medication can ameliorate, a cane or walker is required to accomplish basic activities of daily living.[15] The fourth line of defence is end of life, which involves one of the most challenging tasks in all of human development: disengaging from goals that cannot be achieved and focusing solely on "minimizing physical and psychological suffering, coming to terms with the end of life, minimizing burden on others, and shaping the legacy one leaves behind."[15]

From an orthopedic care perspective, the second and third lines of defence are central because orthopedic interventions are most often in response to trauma, pathology, or chronic conditions. For example, with a traumatic injury, the health goals at the second line of defence would include recovering to an injury-free state, and the control strategies to achieve those goals are engagement, disengagement, and re-engagement.[15] For a patient with a meniscal tear sustained while playing soccer, for example, goal engagement would involve adhering to a postoperative physiotherapy regime in order to improve physical functioning and regain preinjury health status. Once injury-free status is attained, the patient may then re-engage in first line of defence control strategies to avoid similar injuries in the future (e.g., wearing a brace or playing a different sport).

In the third line of defence, a progressive and chronic disease state, such as OA, the health goals are returning to a subclinical state of the second line of defence through an orthopedic intervention, or to avoid or delay progression of the disease. Similar to the second line of defence, there are cycles of control strategies of engagement, disengagement and re-engagement, but here they span 5 sublevel functioning goals that reflect the progression of the disease from lesser to greater disability: regaining or maintaining physical abilities, such as undergoing physiotherapy or losing weight to slow the progression of OA; using assistive devices and making modifications to the living and working environments to maintain independence; obtaining assistance from others when assistive devices and environmental modifications are no longer effective; determining which activities of daily living are most important; and minimizing physical suffering, especially through the management of pain.

For orthopedic care providers (and researchers), understanding the lines of defence from the perspective of the patient means recognizing that every patient must navigate

the lines of defence and that patients' age and life experiences have an impact. How and when the lines of defence are navigated and the relative psychological resilience required for goal engagement, disengagement and re-engagement is very subjective. For example, an otherwise healthy 80-year-old with knee OA may not be ready to adopt assistive devices until she has disengaged from the goals of the second line of defence, and presenting such devices to her before she is ready (i.e., before she has disengaged from goals linked to returning to a disease-free state), may create frustration and even distrust of the care provider. Conversely, a comorbidly ill 55-year-old with knee OA may welcome and appreciate the suggestion of assistive devices, which would increase trust and rapport with the care provider.

In sum, the tenets of lifespan psychology propose that development is "a lifelong process of adaptation to physical, social and psychological changes as well as the active role of the individual."[16] This illustrates how lifespan development theory is the logical extension of the BPS model of health care. Not only does lifespan development theory provide a more comprehensive understanding of older persons, which is lacking in other health care models, but it can also lead to new avenues for research and ways of interpreting the findings for people of all ages and developmental stages. More importantly, it can provide valuable insights on what interventions are appropriate throughout the patient's journey.

Recommendations

We propose that the lifespan development model provides a useful and fertile guide for patient-centred care, orthopedic research and clinical practice. While this model was developed with an individualistic focus, as would be expected for a psychological theory, we contend that this focus can easily be widened to include broader issues. In this section, we discuss recommendations and implications for how the lifespan development model can contribute to new and evolving perspectives on orthopedic outcomes and to new directions for research. We offer practical guidelines on how to implement the model in orthopedic practice.

Lifespan development theory in the context of orthopedic outcomes

Determining ideal outcomes

Perhaps the biggest impact of using lifespan development theory as a guide to orthopedic care is the fact that it can identify new pathways of care that can emerge from using a multidimensional and multidirectional perspective. One issue of particular importance is the very basic notion of desired "outcomes." In a traditional biomedical model, an ideal outcome occurs when the patient is cured and returns to a state of health. However, with aging and chronically ill populations, the interplay of psychological well-being and physical status becomes complex. For example, if a total knee replacement surgery was a success from the surgeon's perspective but the patient still has ongoing pain, no significant change in range of motion, and regrets having the surgery, is the outcome positive? As younger patients undergo total knee replacement surgery, how can they prepare for the revision surgery that is likely to occur once, or maybe even twice in their lifetime? Thus, care pathways and research are needed to identify which patients will benefit from which treatments. This means not only providing the best care for each particular patient at a particular time, but also avoiding expensive interventions that will not lead to positive outcomes, however these are defined. This directly aligns with the concept of patient-centred care that is predominant in today's health care environment.

Functional age and optimal health care outcomes

Anecdotal data abound on individual differences in function and mobility among middle-aged and older adults in need of orthopedic care. A common distinction in orthopedics is the young, active patient and the frail, older patient; each may require different interventions reflective of their adaptive capacity and resilience. As with any such classification, there are outliers who may not respond the same as those in their chronological age groups; there are healthy, active 80-year-olds who may have more optimal outcomes than other patients their age, and there are patients in their 50s who are sedentary and have chronic illnesses. Optimal care is more subjective than ever. In lifespan theory, "functional age" (i.e., time until death) is often found to be more useful than chronological age (i.e., time since birth), and there is recognition that life stage is an integral part in understanding how a person experiences an event. Such notions may be an important element in addressing core issues for health care in general, specifically in orthopedics.

Lifespan development theory in the context of orthopedic research

Multifactorial approaches are needed

By its very nature, lifespan development theory suggests that research designs simultaneously consider multiple variables, and the complex interactions among all of these variables, in order to truly understand a phenomenon. Thus, interacting factors from the biological, psychological and sociological domains need to be considered. From a practical standpoint, particularly when doing quantitative analyses, this may mean that regression approaches and multivariate approaches are most useful.

Multidisciplinary approaches are needed

As emphasized earlier, lifespan development theory is inherently multidisciplinary. Thus, the use of research

teams (and care teams) consisting of multiple members is encouraged, particularly when these team members come from different academic and clinical traditions.

Mixed-methods research designs are optimal

Quantitative research usually takes a nomothetic approach, whereby the goal is to describe the general characteristics of a group of people, and the individual is considered as an exemplar of his or her group. In quantitative research, the central aim is therefore generalizability of findings, which is achieved by using the criteria of validity, reliability and objectivity.[17] In contrast, qualitative research usually takes an idiographic approach, with the aim of describing individuals' unique experiences and behaviours. Within qualitative research, the central aim is often described as trustworthiness, a quality that emerges when results are seen as credible, transferable and confirmable.[17–20] Quantitative and qualitative approaches tend to address very different research questions and topics. Traditionally, health care research has made a greater use of quantitative research designs, but an increasing awareness of the important contribution of qualitative research to health research is evident.[21–24] Mixed methods, where data from quantitative and qualitative methods are integrated, are increasingly being used across the social sciences. We propose that the adoption of the tenets of lifespan development theory, while not requiring mixed methods, does highlight the usefulness of this approach to truly recognize and appreciate the multidimensionality of human experience.

Lifespan development theory in the context of orthopedic practice

We propose that the first steps in integrating a lifespan development approach to orthopedic care involve enhancing patient–surgeon communication to ensure not only that patients are well informed about their care, but also that surgeons have the skills to elicit from each patient the information they require to develop appropriate and targeted care plans.

Enhancing communication training

Implementing lifespan development theory in orthopedic practice begins with introducing and integrating the tenets of the theory in the communication training of residents and in the continuing medical education of practising surgeons. Whether for residents or experienced orthopedic surgeons, "medical education should incorporate a lifespan perspective that emphasizes the physical, psychological and communication changes that occur throughout the aging process."[25] For residents, the CanMEDS Physician Competency Framework of the Royal College of Physicians and Surgeons of Canada[26] is an ideal platform through which to introduce the theory. The 7 physician competencies of CanMEDS (medical expert, communicator, collaborator, manager, health advocate, scholar and professional) would benefit from the contribution of lifespan development theory not only because it provides a more nuanced understanding of patients, but also because it can be applied to patients of all ages and stages. For practising surgeons, continuing medical education programs could incorporate the model in future curriculum development. For example, the American Academy of Orthopaedic Surgeons (AAOS) in partnership with the Institute for Healthcare Communication offers the Communication Skills Mentoring Program, which uses a clinical model known as the "4Es": engage, empathize, educate, enlist.[27] The curriculum uses peer mentors and training videos to help clinicians better understand the "4Es" model and how to apply it in the office or clinic.[27] The program could be enhanced with a lifespan development focus.

Multidisciplinary care teams

It is well established that emotional health can impact orthopedic surgical outcomes.[7,28] Perioperative care pathways that recognize and include the role of psychology are likely to be very beneficial. While multidisciplinary care teams exist in a number of orthopedic care pathways, the focus most often remains on the physical rather than the psychological well-being of the patient. Yet, "successful postoperative care may require different care pathways with different levels of support, depending on the patient's preoperative emotional health. Such pathways may involve teams of clinicians, including physical therapists, behavioural psychologists, and other support professionals."[7] A useful analogy for how best to integrate the lifespan model in orthopedic care is the professional sports team. While many sports teams now include psychologists as part of their organizations, this dimension is often missing in many orthopedic multidisciplinary care teams. More research is needed to define perioperative strategies that will simultaneously support the physical and emotional health of our patients to ensure optimal functional gain after technically successful surgery.[7]

Developing communication tools

Although quality communication contributes significantly to patient satisfaction,[29] it may be challenging to achieve in orthopedic clinics because of the expediency required in the fee for service structure of the medicare system in Canada. One possible solution is the use of checklists. Checklists are used in health care settings, such as surgical, intensive care and trauma units, and have been shown to decrease medical errors and improve overall standards of patient care.[30] However, no research exists, to our knowledge, that uses a checklist to enhance orthopedic surgeon–patient communication. A communication tool that improves the quality of time-limited surgeon–patient interactions could optimize the surgeon's role in helping patients set and manage postoperative expectations that are realistic and achievable, thus

increasing patient satisfaction with the surgery. We are currently developing and testing a checklist to be used as a postoperative communication tool for surgeons. Using a mixed methods approach that began with a qualitative exploration of patients' experience with recovery from total knee replacement surgery, we applied the findings in the creation of a communication checklist that will be tested quantitatively to determine if it contributes to greater patient satisfaction 6 months after surgery. We hope the tool is efficient enough to meet the surgeons' time constraints, but comprehensive enough to provide a forum for both patients and surgeons to exchange the information that will lead to optimal outcomes.

Conclusion

The aging of the population entails fundamental changes to the health care system in general and to orthopedics care and research in particular. We propose that the notions integral to the lifespan developmental approach may offer useful and generative pathways for exploring the future of health care in an aging world. Recognition of the multidirectionality and multidimensionality of change within and across individuals will enhance clinical orthopedic care and produce more far-reaching research, both of which will contribute to better patient outcomes overall.

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Competing interests: None declared.

Contributors: S. Gautreau and O. Gould designed the study. S. Gautreau acquired and analyzed the data, which M. Forsythe also analyzed. S. Gautreau and O. Gould wrote the article, which all authors reviewed and approved for publication.

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