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Behavioral Medicine: A Voyage to the Future

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Abstract

This paper discusses trends and future directions in behavioral medicine. It is divided into three sections. The first briefly reviews key developments in the history of behavioral medicine. The second section highlights trends and future directions in pain research and practice as a way of illustrating future directions for behavioral medicine. Consistent with the biopsychosocial model of pain, this section focuses on trends and future directions in three key areas: biological, psychological, and social. The third section describes recent Society of Behavioral Medicine initiatives designed to address some of the key challenges facing our field as we prepare for the future.

Keywords

Pain; Biopsychosocial model; Behavioral medicine

Introduction

The field of behavioral medicine has journeyed far over the past 30 years. Whether we have been in the field since its inception or just recently joined it, each of us has a perspective on where behavioral medicine has been and where it is going. That perspective is unique and very much shaped by our experiences and background. Recall the tale of the blind men who sought to learn what an elephant was like by touching it [1]. One blind man touched the leg of the elephant and concluded that an elephant was a pillar. A second touched the tail and claimed the elephant was like a rope. A third touched the trunk and reported the elephant was like a tree branch. A fourth touched the ear and said the elephant was like a hand fan. A fifth touched the belly and concluded the elephant was like a huge wall. The blind men argued about the elephant, almost coming to blows because each felt he was right. At that point, a wise man that had been watching and listening to the blind men spoke up and told them that each was right, since the elephant had all of the features described. All of the blind men were satisfied since each was comforted to know he was right.

This paper speculates on the voyage that behavioral medicine will likely take in the future. It is always a hazardous proposition to imagine the future. Like the blind men, each of us has a unique perspective on the future that is shaped by our own experience. My view is unique and very much influenced by 30 years of experience in one corner of the world of behavioral

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medicine: pain research and practice. I have had the good fortune of coming into this area at a time when it was in its relative infancy and having the opportunity to watch it grow and mature. In addition, I have been fortunate to have spent most of my career at Duke University, one of the leading behavioral medicine research institutions. This has given me the chance to develop professional and personal relationships with leaders in many different fields of behavioral medicine and to compare developments in my own area to those in many other areas of behavioral medicine.

This paper is divided into three sections. The first section briefly reviews key developments in the history of behavioral medicine. The second section highlights trends and future directions in pain research and practice as a way of illustrating future directions for behavioral medicine. Consistent with the biopsychosocial model of pain, this section focuses on trends and future directions in three key areas: biological, psychological, and social. The third section highlights recent Society of Behavioral Medicine initiatives designed to address some of the key challenges facing our field as we prepare for the future.

The Past

A brief review of key dates in the history of behavioral medicine conveys a good sense of the past. The year 1973 witnessed one of the first uses of the term “behavioral medicine” by Lee Birk [2] in the title of his book, *Biofeedback: Behavioral Medicine*. The application of biofeedback and behavioral therapies to patients with medical problems played an important role in the emergence of behavioral medicine, as did research in health psychology, and public health research documenting the key role that behavior played in the development of cardiovascular diseases and cancer [3]. In recognition of the rapid developments in behavioral medicine research, in 1976, the National Institutes of Health founded the Behavioral Medicine Study Section. This study section provided one of the first venues in which the types of multidisciplinary research being conducted by behavioral medicine investigators could undergo scientific review conducted by their peers. Based on reviews conducted by this (and subsequent) behavioral medicine-relevant study sections, behavioral medicine research grants have been funded by numerous NIH institutes, including, for example, the NHLBI, NCI, NIA, NIAMS, NIMH, and NINDS. The Yale Conference on Behavioral Medicine in 1977 was a watershed moment in behavioral medicine's history because it brought together behavioral and biomedical experts with the specific aim of defining the field [4]. In 1978, Schwartz and Weiss [5] offered an amended definition based on that conference: “Behavioral medicine is the interdisciplinary field concerned with the development and integration of behavioral and biomedical science knowledge and techniques relevant to health and illness and the application of this knowledge and these techniques to prevention, diagnosis, treatment, and rehabilitation” (p. 249) [5]. This definition was widely adopted and served to guide the field in its early years. In that same year, 1978, the Society of Behavioral Medicine (SBM) was founded, specifically with the goal of serving as a multidisciplinary organization that could bring together clinicians, scientists, and educators interested in behavioral medicine.

The 1980s and early 1990s witnessed rapid growth in all areas of behavioral medicine. One indication of this growth was that, in 1985, SBM launched its own journal, *Annals of Behavioral Medicine*, to provide researchers with a new outlet for their behavioral medicine research. An important milestone in the history of behavioral medicine was the International Congress of Behavioral Medicine held in Uppsala, Sweden, in 1990, at which time the International Society of Behavioral Medicine (ISBM) was founded. ISBM is a federation of national, multidisciplinary societies that seeks to address the needs of the multiple disciplines interested in behavioral medicine issues. ISBM launched its own peer-reviewed journal, the *International Journal of Behavioral Medicine*, in 1993.

Recognizing the important role of behavioral and social factors in both illness and health, in 1995, the NIH opened the Office of Behavioral and Social Sciences Research (OBSSR). This office, located with the Office of the Director of NIH, was given the mission of stimulating and helping coordinate behavioral and social sciences research throughout the NIH. Since its inception, the OBSSR has played a key role in the field.

Evidence-based medicine came to the fore in the 1990s and early 2000s in part due to the efforts of those working as part of the Cochrane Collaboration. In 2006, the Cochrane Collaboration formally identified Behavioral Medicine as a field for its widely cited Cochrane Review series.

As this brief review illustrates, behavioral medicine has clearly matured. SBM itself celebrated its thirtieth anniversary in 2008, so the society and the field at large have clearly traveled beyond their adolescent and young adult years. Where will this voyage take us in the future?

Trends and Future Directions in Behavioral Medicine: Pain Research and Practice as an Illustration

In this section, trends and future directions in behavioral medicine are illustrated through examples drawn from pain research and practice. Based on a biopsychosocial perspective on pain [6], the focus is on three key domains: biological, psychological, and social.

Examples of Trends in Biological Domain

Rene Descartes [7] was one of the first to conceptualize pain as a sensation that involved the transmission of noxious information along a hard-wired pathway from the periphery to the brain. In subsequent centuries, Descartes' notion of pain gained widespread acceptance, so that, by the mid 1950s, most scientists and practitioners adhered to a biomedical model of pain [8]. Central to this model were three basic assumptions [9]: (1) that pain is the direct result of tissue damage or injury, (2) that the pathways responsible for pain go from the source of injury or disease to the brain, and (3) that the amount of pain experienced is proportional to underlying tissue damage or injury. In the early 1960s, there was growing evidence that many clinical pain phenomena did not conform to underlying assumptions of the biomedical model [8]. For example, Beecher's observations on the Anzio battlefield in World War II revealed that a large percentage soldiers who had been wounded reported little or no pain despite having battlefield injuries that should have been painful [10]. In the 1960s, it also became increasingly clear that advanced neurosurgical procedures largely based on the biomedical model and designed to destroy the pain pathway and abolish chronic pain often failed to provide patients with permanent pain relief [8].

Dissatisfied with the biomedical model, Melzack and Wall [11], in 1965, proposed the gate control theory of pain. This model maintained that there is a gate in the spinal cord that opens or closes to regulate the flow of noxious impulse from the periphery to the brain. Critical to this model was the notion that higher brain centers responsible for cognitive process (e.g., expectations, beliefs, memories) and affective processes (e.g., positive mood, negative mood) influence the functioning of the gate. The gate control model set the stage for the emergence of behavioral medicine approaches to understanding pain because it highlighted the role of psychological, social, and cultural factors in pain and described a mechanism by which these factors could influence pain biology. The gate control theory of pain was one of the most important factors stimulating behavioral and biomedical research in the 1960s, and the theory, as well as findings from this research, spurred interest in multidisciplinary treatment programs for patients having persistent pain [9].

In the 1990s, brain imaging studies of pain provided further insights into the nature of pain [12]. Evidence accumulated showing that individuals exposed to a noxious stimulus not only showed activation in areas of the brain responsible for sensation, but also many other brain areas. These findings led brain researchers to adopt the term “pain neuromatrix” (drawn from Melzack's neuromatrix theory of pain [13] to underscore the notion that pain is due to the activity and interaction of widely distributed brain regions (in particular, the thalamus, cortex, and limbic systems). The concept of the pain neuromatrix is important for behavioral medicine for two reasons [9]. First, it has helped practitioners and researchers better understand how sensory, cognitive, affective, behavioral, social, and cultural factors and stress-related phenomena can influence pain. Second, it has identified brain regions whose activity can potentially be modified through novel biomedical or behavioral interventions so as to relieve intractable pain.

Brain imaging studies, for example, have provided new insights into phantom limb pain [14, 15]. For years, it has been known that some patients will report phantom pain in a limb that was amputated long after the limb was removed and the site of their amputation had healed. In the past decade, imaging studies have demonstrated that patients who experience phantom limb pain show changes in the cortical representation of their affected limb [15, 16]. The magnitude of these changes is greater in those patients whose pain persists. Interestingly, these cortical changes can be reversed using a novel treatment: mirror therapy [15]. In mirror therapy, a patient places his/her intact limb next to a mirror and is asked to watch the image of the limb in the mirror while moving and exercising it. What the patient sees is an image that mirrors that of the limb that was removed. Studies have shown that having patients watch this mirror image can produce significant reductions in phantom limb pain [15]. Imaging studies have shown that successful mirror therapy can also reverse the cortical changes that accompany phantom limb pain [15]. These studies raise the possibility that behavioral and pharmacological treatments introduced early after amputation can prevent the development of persistent phantom limb pain and its related cortical changes.

Placebos provide some patients with significant reductions in their pain [17]. Over the past 20 years, numerous brain imaging studies of the placebo response have been conducted [12]. This research has shown that placebo can reduce activity in brain regions that are part of the pain neuromatrix [18]. Interestingly, the amount of pain relief achieved from a placebo has been found to correlate with the changes in activity in the pain neuromatrix [18].

As is true in many areas of behavioral medicine, there is growing interest among pain researchers and clinicians in the role of genetic factors. Diatchenko et al. [19] have proposed a model of chronic pain disorders (e.g., temporomandibular joint disorders (TMJD), fibromyalgia, chronic headaches, and chronic pelvic pain) that highlights the role that genetic variability can play in the development of these conditions. The model maintains that the genetic variations, as well as exposure to environmental events, have important effects on two key pathways of vulnerability to chronic pain: psychological distress and enhanced pain sensitivity. In a series of studies conducted mostly on TMJD, Diatchenko, Maixner, and colleagues have demonstrated that: (a) both pain sensitivity and psychological distress are risk factors for the onset and persistence of pain [20] and (b) that genetic variations are linked to pain sensitivity and psychological distress [21, 22]. These findings have generated considerable interest in their model and a heightened recognition of the role that genetic variability plays in understanding individual differences in persistent pain and response to pain treatments. Maixner and his colleagues are currently involved in a large prospective study of 3,200 initially TMJD pain-free volunteers funded by NIDR [23]. The primary aim of this study is to identify psychological and physiological factors linked to genetic polymorphisms that influence psychological distress and pain sensitivity and thereby increase the risk of developing TMJD. This study not only tracks TMJD pain symptoms but

also other pain symptoms (e.g., back, leg, and headache pains) and, thus, ultimately could provide information on biopsychosocial risk factors for a wide variety of persistent pain disorders. Results of this study are likely to have a major impact on the field.

What do these trends suggest about the future? A deeper understanding of the neural plasticity related to persistent pain may improve our ability to prevent and treat persistent pain conditions. In the future, brain imaging studies could be carried out prospectively in patient groups likely to develop pain problems (e.g., patients undergoing limb amputations) in order to identify those showing changes in brain activity that predispose them to persistent pain. The fact that there is plasticity in the neural correlates of pain also opens up the possibility of exploring new interventions to prevent pain. Future studies are likely to discover forms of training or teaching that can foster rapid reversal of brain activation patterns leading to persistent pain. Among interventions currently being explored that are relevant to this area are hypnosis [24], EEG neural biofeedback [25], and real-time biofeedback of neural images of the pain neuromatrix [26]. Recent studies show that individuals can learn to use their own brain wave patterns to control prosthetic devices [27]. In the future, such forms of neural control increasingly will be directed to helping patients with pain not only control problematic symptoms, but also thoughts and feelings that contribute to the onset and persistence of these symptoms.

In the future, a patient having a condition that increases the likelihood of persistent pain (e.g., a back injury) may be able to see a health professional who is able to access information on their individual genetic and psychosocial risk profile. Using this information, treatment protocols can be personalized and individual treatments (e.g., a specific drug) and combined treatment protocols (drug plus behavioral intervention) can be offered in a way that is both more rational and more precisely tailored to the patient. Knowing one's risk profile may serve to increase the patient's motivation to start and continue with treatment.

What are the larger implications of trends and future directions such as these for SBM? First, although similar advances are occurring in many areas of behavioral medicine, many of us are not aware of them. SBM should use its resources (e.g., Annual Meeting, publications) to ensure that its members know about emerging biobehavioral research areas and methodologies. For example, our Annual Meeting could do more to highlight cutting edge presentations by leaders in exciting new areas of basic biomedical and behavioral science who can address the implications of their work for the larger field. Second, much of the most innovative research occurs when people from new disciplines are invited to work directly with those in more traditional behavioral medicine disciplines. This underscores the need for SBM to renew its commitment to multidisciplinary membership and increase its efforts to recruit and retain members in a wide variety of potentially relevant disciplines. Third, as we embrace new advances, SBM needs to provide a venue for educating its members about approaches they may not have been exposed to in their own training. SBM needs to increase the range and depth of its training and education efforts and, in particular, take advantage of non-traditional forms of training that members will increasingly rely on (e.g., online learning). Finally, with advances in genetics, neural control, and other approaches come important ethical and scientific issues (e.g., unintended side effects, informed consent). As a multidisciplinary organization, SBM is particularly well positioned to address and thoughtfully consider the complex issues raised by such emerging areas.

Examples of Trends in the Psychological Domain

Among some of the earliest contributions of behavioral medicine, researchers were clinical and research efforts focused on understanding psychological factors that contribute to persistent pain [28]. Most of these early efforts focused on individuals having chronic pain conditions, whose basis in tissue damage or injury was poorly understood and for whom

psychosocial factors were considered to be potentially important. Early clinical and research efforts, for example, attempted to identify personality traits and factors that could differentiate back pain patients having organic pain (e.g., patients showing evidence of a spinal disc herniation) from those having functional (or psychogenic) pain [29]. Based on this work, psychological assessments began to be used as part of pre-surgical screening to identify patients whose personality profiles put them at risk for poor outcomes for spinal surgeries designed to alleviate their pain. There are several reasons work on psychological aspects of pain moved away from a focus on personality traits [29]. First, careful reviews of research in this area revealed that personality traits showed an inconsistent relationship to pain and treatment outcomes. Second, it became clear that patients with persistent pain were a heterogeneous group and individuals could not be easily classified as having organic vs. psychogenic pain. Finally, emerging theoretical models of pain (e.g., gate control theory, neuromatrix theory, and biopsychosocial model of pain) increasingly led clinicians and researchers to conceptualize pain as a complex and multidimensional experience that influences and is influenced by a wide array of biological, psychological, and social factors.

Consistent with an increased emphasis on pain as a complex phenomenon, clinical and research efforts in the 1990s focused on a much broader array of psychological factors that could influence pain and adjustment in persons with persistent pain. Some of the psychological factors that have received the most attention are pain-coping strategies, self-efficacy, pain beliefs, pain catastrophizing, mood (both negative and positive), emotional expression, pain-related anxiety, fear of pain, pain acceptance, social support, sexual and physical abuse, and life stressors [30].

Among the psychological factors examined over the past 20 years, pain catastrophizing has emerged as one of the most consistent and reliable predictors of the pain experience [31]. Pain catastrophizing has been defined as the tendency to focus on and exaggerate the threat value of painful stimuli and negatively evaluate one's own ability to deal with pain [32]. Early studies of pain catastrophizing were mainly carried out in populations of patients suffering from chronic, non-malignant pain conditions, e.g., chronic back pain, TMJD, and chronic headaches. In these populations, catastrophizing has been reliably associated with reports of increased pain [31]. Patients with chronic pain who catastrophize also are more likely to report increased psychological distress, depression, and anxiety [31]. Finally, the tendency to catastrophize has been shown to relate to heightened displays of pain-related behaviors (e.g., guarding, painful facial expressions) and increased disability [31]. Interestingly, the effects of catastrophizing on pain and disability are evident even after controlling for effects due to indices of psychological distress such as anxiety, fear of pain, or depression.

In sum, there is considerable evidence that catastrophizing is related in meaningful ways to the pain experience and adjustment of persons with chronic, non-disease-related pain conditions. The question arises: "Is pain catastrophizing important in persons with disease-related pain?" A large literature has emerged on this topic over the past 15 years, and studies of pain catastrophizing have been conducted in patients suffering from pain due to diseases such as osteoarthritis [33], rheumatoid arthritis [34], cancer [35, 36], and sickle cell disease [37]. A consistent pattern of findings has emerged from this work, demonstrating that, even in patients with disease-related pain, those who engage in pain catastrophizing are much more likely to report higher levels of pain, psychological distress, and pain-related disability.

A good recent example of this work is a study of pain catastrophizing in osteoarthritis patients undergoing total knee replacement surgery [38]. Osteoarthritis is a degenerative disease that, as it advances, can produce significant cartilage and joint destruction. Pain is the primary symptom of osteoarthritis, and severe pain (along with limitations in function) is

a major indication for joint replacement surgery. Although knee replacement surgery is effective for many osteoarthritis patients, some patients do not fare well. Up to 30% of osteoarthritis patients having this surgery report moderate to severe pain 1 year after having surgery and that 40% still require an assistive device (e.g., cane or walker) to walk [38]. Riddle et al. [38] conducted a prospective, longitudinal study examining medical and psychological variables that might predict a good surgical response in terms of pain relief. In this study, 140 osteoarthritis patients were studied pre-operatively and 6 months later. Psychological variables that might predict treatment outcome were collected prior to treatment (i.e., measures of pain catastrophizing, self-efficacy, fear of movement, depression, and anxiety disorders). Medical covariates that could influence treatment outcome were also assessed (i.e., pre-operative pain, functional status, and medical comorbidities, as well as evidence of severe surgical complications and a measure of knee implant status at follow-up). Results indicated that, after controlling for the medical covariates, pain catastrophizing was the only significant psychological predictor of pain treatment outcome. Patients who were found to be high pain catastrophizers prior to surgery were 2.67 times more likely to be non-responders in terms of clinically significant pain relief and 6.0 times more likely to be non-responders in terms of a minimally clinically important difference in pain. Taken together, these findings suggest that a focus on pain catastrophizing may be useful in predicting improvements in pain following total knee replacement surgery.

One reason for studying psychological factors such as pain catastrophizing is that they are potentially modifiable through behavioral or psychological interventions [28]. Along these lines, Riddle and his colleagues (including our own lab) have recently submitted an NIH grant application for a multicenter clinical trial designed to test whether a coping skills intervention can improve the outcomes of knee replacement surgery for osteoarthritis patients who show high levels of pain catastrophizing pre-operatively.

Pain catastrophizing is attracting increased attention from neuroscientists working in the field of pain research. In a study of healthy individuals, Seminowicz and Davis [39] used functional MRI to study how cortical responses to pain varied as a function of pain catastrophizing. Brain images were conducted under two conditions: high vs. low painful electrical stimulation of the median nerve. Results showed that, while pain catastrophizing was not related to activity in brain regions associated with sensory aspects of pain, it was related to activity in brain regions associated with affective, attentional, and motor aspects. Furthermore, during high pain stimulation, individuals scoring high on pain catastrophizing were less likely to show activity in brain regions involved in descending control of pain (prefrontal cortical areas of the brain). The authors conclude that their findings are consistent with "...an attention model of pain catastrophizing, whereby a cortical vigilance network is engaged during mild pain, but diminished prefrontal cortical modulation impedes disengaging from and suppressing pain during more intense pain" (p. 297, 39).

With evidence that psychological factors are important contributors to the pain experience has come increased interest in integrating psychological assessments into clinical care [28]. As part of the NIH Roadmap Initiative, a research network was established to develop a patient-reported outcome system (PROMIS [40]) that provides a model for how one might integrate brief assessment measures into clinical practice. PROMIS uses item response theory-based methods to develop brief and reliable measures of common symptoms (e.g., pain, fatigue), as well as indicators of psychological distress (e.g., anxiety, depression, and anger) and physical function (e.g., activities of daily living). The measures are designed to be used in the general population of persons suffering from chronic diseases and conditions. The PROMIS measures are downloadable [40] and thus available to both clinicians and researchers. PROMIS measures can be collected using computerized adaptive testing

procedures, which enable one to get a reliable measure of a patient's symptoms or status by administering only a few items (e.g., three to five brief questions). One long-term objective of PROMIS is to develop a user-friendly system that health professionals could access in the clinic to gather high-quality data on patient-reported outcomes in a way that minimizes patient burden. Achieving such objectives will go far towards accomplishing the major overall aim of PROMIS: i.e., to change the way that patient-reported outcomes are selected and used.

The development and validation of very brief measures of pain coping and pain beliefs is important because they enable one to more easily assess these domains in clinical settings or as part of epidemiological surveys of the general population [41, 42]. Jensen et al. [41] developed one- and two-item versions of the most frequently used measures of pain coping (i.e., Coping Strategies Questionnaire [43], Chronic Pain Coping Inventory [44], and pain beliefs (Survey of Pain Attitudes [45], Pain Beliefs and Perceptions Inventory, [46], and Arthritis Self-Efficacy Scale [47])). The one-item versions of these scales performed well in that they were highly correlated with the parent scale, were sensitive enough to detect changes that occur over the course of treatment, and were related in expected ways to important indices of pain, psychological distress, and disability.

Brief measures are increasingly being used in paper and pencil, interactive voice response-based, and smart phone (i.e., cell phone/personal data assistant (PDA))-based diaries to capture daily variations in pain, pain coping, pain beliefs, and psychological distress. Patients may be instructed to make diary entries at standard times of the day (e.g., 9 AM, noon, and 9 PM) on repeated occasions (e.g., for a week or a month). Alternatively, using methods pioneered by ecological momentary assessment researchers [48], patients may be paged/beeped at random times throughout the day and asked to make diary entries. These approaches have several advantages [48]. First, they capture pain and psychological processes such as pain coping much closer to their real-time occurrence. Second, they avoid memory biases that can influence retrospective reports of these variables. Finally, the data collected can be analyzed to detect important relationships that may be occurring between pain and psychological variables (e.g., pain catastrophizing, negative mood, positive mood.)

What do the trends identified in this section suggest about the future? First, it seems unlikely based on these trends that mind and body will continue to be seen as a dichotomy. In the future, a more holistic view of pain (and other symptoms) is much more likely to guide clinical, research, and public policy efforts. Second, in the future, there will be growing acceptance that psychological variables that influence pain are “real” and deserve attention in their own right. Third, these developments are likely to lead to a much greater openness to and demand for biopsychosocial interventions. Health professionals will refer patients for behavioral pain treatments and patients will expect to receive them.

Evolving technologies such as miniature sensors and monitors ultimately may enable one to record and store information on a wide variety of pain-related variables. These include psychological variables (e.g., real-time changes in pain coping, pain beliefs, and mood), relevant environmental events (e.g., activities that might increase pain, interactions with a partner, co-worker, or health professional), and physiological variables (e.g., biomarkers of pain and pain-related stress responses, recordings of neural activity that suggest activation of the pain neuro-matrix or of brain regions related to pain catastrophizing). As a result, one will be able to directly compare how self-reports of pain and pain-related psychological responses relate to physiological responses and environmental events. Such information could prove useful in understanding complex and persistent pain phenomena.

With the ability to gather vast amounts of data comes a problem: the data deluge. How will we be able to manage and analyze the enormous databases that are likely to be generated by such intensive monitoring? Developments in other areas suggest that there may be novel solutions. For example, at present, there are millions of sensors around the world gathering real-time data on environmental conditions on the land, in the sea, and in the air (e.g., data on temperature, barometric pressure, air quality, etc.). These sensors generate huge amounts of data. The Planetary Skin Institute [49] is a nonprofit entity that grew out of a collaboration between the National Aeronautics and Space Administration (NASA) and Cisco. This collaboration led to the development of the Planetary Skin platform, the goal of which is to manage these data in a way that is standardized, yet open and adaptable to users. The Planetary Skin Institute plans to further develop the platform through developing active collaborations between public, private, and academic sectors around the world. The goal is to apply sophisticated data mining techniques to the complex array of data being gathered so as to provide end-users with the ability to view the geo-spatial “global nervous system.” The underlying approach is important not only because it can be used to model, analyze, and predict global environmental changes, but also because it could provide data that can be used in managing environmental resources and risks. One can envision such powerful approaches ultimately being used to display data collected in behavioral medicine applications.

A key element of analyzing large and complex data sets is the ability to visualize them in ways that are intuitive, easy to use, and adaptable by the end user. The information visualization research community is actively working on this problem, and they have developed novel ways to display large quantities of highly complex data. Commercial programs are now available that incorporate findings from visualization researchers [50] and provide interesting demonstrations of the type of innovative visualization displays that are currently available. Resources such as these are certain to become more widely available and used in the future, particularly in behavioral medicine applications that feature repeated assessments of individuals' symptoms and behavior in real time.

At present, psychosocial interventions for pain are provided mostly at tertiary care centers by highly trained health professionals. Yet, many of the individuals who could benefit from these interventions do not receive them due to their lack of mobility, distance from a treatment facility, or cost. Novel platforms for delivering these interventions (e.g., telephone-based, Internet-based) have been and are being tested. Technologies such as smart phones (cell phones that incorporate a PDA) are evolving and will lead to devices that are more powerful and ubiquitous in the future. Such devices not only hold the promise of monitoring pain and related processes in real time but also analyzing and displaying the data in ways that could help the patient become much more aware of how their pain varies as a function of changes in pain coping or mood. One can also imagine algorithms based on PDA data that could serve much as a pain coach/therapist prompting the patient to take a pain medication on schedule or encouraging them to listen to a recorded relaxation/imagery session that could relieve their pain. Such an approach potentially could enable behavioral treatments to be tailored not only to the individual, but to how the individuals' pain evolves over a particular day.

Virtual reality is a technology whose potential in pain management is only beginning to be realized. At the University of Washington, Hunter Hoffman and his colleague David Patterson have conducted innovative studies testing the efficacy of virtual reality in patients having severe pain during treatment of their burn injuries [51, 52]. Patients hospitalized because of burns not only require frequent changes of their dressings but also physical therapy exercises to mobilize the burned area. Unfortunately, a large portion of patients undergoing such medical procedures report severe to excruciating pain, despite receiving

opioids to manage their pain. Hoffman and colleagues have tested highly sophisticated virtual reality-based videogame environments that use sight, sound, and touch to distract patients during burn care. In a report of two case studies of adolescent burn patients under dressing changes [51], the virtual reality intervention produced quite substantial reductions in pain (decreases in pain ratings of 47 to 93 on 100-mm visual analogue scale. In a second study of 12 adult burn patients undergoing a range of motion exercises (52), a virtual reality intervention also produced clinically significant reductions in pain. Taken together, the results of these studies suggest that virtual reality interventions may be beneficial for managing severe, uncontrolled pain that can occur during medical procedures. Virtual reality has been successfully used in the treatment of phobias [53] suggesting that, in the future, virtual environments could be used to expose patients having pain to environments they avoid (e.g., interpersonal environments that increase stress) for fear they might increase pain.

What are the larger implications of trends and future directions such as these for SBM? First, as evidence of the impact of psychological processes on health and behavior becomes more widely available, the demands for a wide range of behavioral medicine services will grow. SBM should be prepared to use its resources to assist its members in pinpointing, tracking, and preparing for such future trends in service demands. Second, SBM needs to find ways of helping its members better manage the complex, real-time data sets that will become more readily available in the future. Finally, to effectively use emerging treatment delivery technologies, SBM members' needs for continuing education and hands-on training will grow. The Annual Meeting provides a particularly good venue in which to efficiently provide such training.

Examples of Trends in the Social Domain

The social context of persistent pain is rapidly changing. In part, this is due to growing diversity in the population, a pattern true not only in the US but globally. Across the world, there is a growing gap between the rich and the poor. The end result is that there are substantial disparities in pain assessment and management based on factors such as race, ethnicity, and socioeconomic status [54]. A study by Todd et al. [55] provides a clear example of this problem. The study examined the influence of race and ethnicity on the prescription of emergency department analgesics for fractures of the extremities (painful long bone fractures). The results showed that, despite medical record evidence of similar pain complaints, black patients were significantly less likely to receive analgesics than white patients (57% of blacks vs. 74% of whites received analgesics). The risk of receiving no pain medication was 66% higher for black patients than white patients, an effect that remained significant even after controlling for potential confounding variables (e.g., insurance status, time since injury, total time in the emergency department). These findings were similar to those reported in an earlier report [56] by this group that showed that Hispanic ethnicity significantly increased the risk of inadequate analgesia for treatment of long bone fractures in an emergency.

Findings such as these raise basic questions about justice and health care. First, how many of us would find inadequate treatment of pain to be acceptable to ourselves or our loved ones? Second, do our values (e.g., pain care is deserved and a fundamental right regardless of racial/ethnic background [57]) match our practices (racial/ethnic minority groups do not always receive high-quality pain care)?

Concerns about the inadequate management of pain have galvanized some into action. State cancer pain initiatives, volunteer grassroots organizations of nurses, physicians, pharmacists, social workers, psychologists, clergy, and members of government have played a key role in identifying and overcoming obstacles to the management of cancer-related pain. Following

the approach first used by the Wisconsin Pain Initiative [58], these state initiatives have been active in identifying institutional and regulatory barriers to the treatment of cancer pain. They also have developed major projects to improve cancer pain management, including systematic advocacy efforts and new patient education materials. State cancer pain initiatives are now active in almost every state, and many have extended their programs to address other types of pain (e.g., other forms of persistent disease-related pain such as arthritis pain and non-malignant chronic pain conditions such as chronic back pain). The Alliance of State Pain Initiatives [59] is a national network of these organizations that works in consort with other organizations interested in pain management (e.g., the American Pain Society, American Cancer Society, American Pain Foundation) to change the way that pain care is delivered.

Growing concerns about the problems of pain in US soldiers returning from Iraq and Afghanistan has led the US Department of Veterans Affairs (VA) to develop a national pain management strategy whose goal is to provide a comprehensive and integrated system-wide approach to pain management [60, 61]. The national strategy features a three-step approach to pain care influenced by empirical studies of primary pain care [62–64]. The first step focuses on management of pain in the primary care setting through routine screening for the presence and intensity of pain and active management of common pain conditions combined with support from teams of post-deployment and mental health experts and opioid renewal clinics. The second step involves a secondary consultation with multidisciplinary specialists in pain medicine, rehabilitation medicine, or behavioral pain management provided either individually or as part of multidisciplinary pain clinics. The third step provides for referral to tertiary care level, interdisciplinary pain centers, which can provide advanced pain diagnostics and interventions, comprehensive pain rehabilitation, and pain and addiction specialty care services. The feasibility of this program is enhanced by the availability of an existing array of pain management educational resources [65] including a pain list serve, pharmacy benefits management resources, an on-line learning management system that provides training in the management of complex chronic pain conditions, and frequent educational teleconferences and cyber seminars on pain management. Given its comprehensive, empirically based, multicultural approach, the national pain management strategy developed by the VA potentially can serve as a model for how pain care could be delivered in other health care delivery systems.

What are the larger implications of trends and future directions such as these for SBM? First, with the recent passage of a national healthcare reform bill, we are entering a very exciting period in which there is an opportunity to address health disparities in a meaningful fashion. SBM members need to follow developments in this area, particularly the relevant enabling regulations, to ensure that they truly allow biomedical and behavioral health care to be available to those who traditionally have been uninsured or underinsured. Second, injustices related to health disparities should lead SBM towards an increased focus on advocacy efforts. At a minimum, SBM members need to do more to communicate information about advances in behavioral medicine to the general public. Nelson, Hesse, and Croyle's [66] recent text, *Making Data Talk*, provides excellent examples of practical strategies that SBM members can use to better communicate information on health behavior change and public health to lay audiences. Implementing such strategies not only could inform the general public, but could also have an impact on how behavioral medicine is viewed by policy makers and the media. Finally, in the future, health information technology will continue to drive the way that health care is delivered [67], and SBM members will need to keep abreast of and involved in these efforts. The Internet will continue to transform the way that the government, business, and health systems deliver health care. Social media approaches and smart phones will continue to change the ways that we engage, evaluate, and communicate about health and illness.

SBM Initiatives

SBM has taken a number of initiatives to address the challenges of the future. First, it has launched a new peer-reviewed journal, *Translational Behavioral Medicine (TBM)*, edited by Dr. Bonnie Spring, whose goal is to inform and facilitate dialogue about behavioral medicine between researchers, practitioners, and policy specialists. TBM fits well with the growing emphasis on translational science, and it specifically seeks to foster the translation of behavioral science findings to enhance patient and population outcomes. To accomplish these goals, TBM will publish empirical articles, review papers, and commentaries. Special issues on topics of interest to SBM members are planned (e.g., Information Technology and Evidence Implementation; Implementation and Exchange of Behavioral Medicine Evidence Globally), and these will complement regular issues. A key benefit of submitting manuscripts to TBM is that final versions of articles will be published on line as soon as they are accepted, thereby enabling members to download and cite them in a very timely fashion.

Second, a Career Trajectories Working Group has been established to consider what SBM can do to help its members with the challenges of career development. With rapid advances in science and technology, diverse expertise is increasingly needed. No longer can SBM focus mainly on the traditional target of career development efforts: those early in their career. It is becoming clear that many SBM members no longer follow a traditional career path and that career paths are increasingly varied. SBM needs to move towards addressing career development issues across the career trajectory. As part of its effort to address these issues, the Career Trajectories Working Group has recently conducted a survey of SBM members to identify their career development needs. A report of that survey will be published online in the journals newsletter, *Outlook* and its results will be used to inform recommendations coming from the Working Group.

Third, to ensure that SBM prepares for the future, a discussion of strategic goals was held at its midyear board meeting. A set of short-term and intermediate-term goals was identified and a Strategic Goals Working Group was established to track progress towards these goals. The four highest priority short-term goals identified included: (1) to do more to reach out to NIH institutes and programs so as to improve their understanding of issues of relevance to behavioral medicine, (2) to identify strategies that can better prepare SBM members to impact health policy, (3) to develop novel programs to more actively engage with community-based groups addressing behavioral medicine issues (e.g., promoting health and wellness) in the cities in which our annual meeting occurs, and (4) to develop and strengthen SBM's ties with the VA system. The highest priority intermediate-term goals identified included: (1) developing a plan to work with changes related to passage of health care reform, (2) enhancing the SBM website so as to improve communication with our members and the public, (3) establishing a post-doctoral behavioral medicine health policy fellowship training program, (4) enhancing technology at the SBM annual meeting (SBM blog, Twitter), and (5) offering annual "state of the science" presentations at the annual meeting.

At a little over 30 years old, behavioral medicine remains a relatively new field. Yet, each of us whether new or established in the field has witnessed rapid advances in behavioral medicine knowledge and research. The future holds the promise of exciting new advances, many having major implications for behavioral medicine. SBM is well positioned to play a leading role in exploring and implementing creative, new ways to address these advances and their implications.

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