

RESEARCH ARTICLE

How do Orthopedic Surgeons Address Psychological Aspects of Illness?

Ana Maria Vranceanu, PhD; Reinier B. Beks, BSc; Thierry G. Guitton, MD, PhD; Stein J. Janssen, MD; David Ring, MD, PhD

Research performed at Massachusetts General Hospital, Ma, USA

Received: 24 Jan 2016

Accepted: 24 May 2016

Abstract

Background: Orthopaedic surgeons have a pivotal role in transitioning the care of orthopedic patients from a biomedical to a biopsychosocial model. In an effort to foster this transition, we designed a study aimed to determine surgeons' attitudes and practice of noticing, screening, discussing psychological illness with patients, as well as making referrals to address psychosocial issues in patients in need. Additionally, we asked surgeons to rank order potential barriers to and reasons for referrals to psychosocial treatment.

Methods: Orthopaedic surgeons members of the Science and Variation Group and Ankle Platform (N =350) completed demographics, and a 4-part survey assessing the degree to which surgeons notice, assess, screen and refer for psychological treatments, as well ranked ordered barriers to engaging in these processes.

Results: As a group surgeons were neutral to referral for psychological treatment and formal screening of psychological factors, and somewhat likely to notice and discuss psychological factors. Surgeons were more likely to refer for psychological treatment if they engaged in research, or if they reside in South America as opposed to North America. The highest ranked barriers to screening, noticing, discussing and referring for psychological treatment were lack of time, stigma and feeling uncomfortable.

Conclusion: Overall surgeons are likely to notice and discuss psychological factors, but less likely to formally screen or refer for psychological treatment. Transition to biopsychosocial models should focus on problem solving these barriers by teaching surgeons communication skills to increase comfort with discussing psychoemotional factors associated with orthopedic problems. The use of empathic communication can be very helpful in normalizing the difficulty of coping with an orthopedic condition, and may facilitate referral.

Keywords: Biopsychosocial model, Psychological treatment, Referral, Surgeons

Introduction

Orthopaedic surgeons successfully treat millions of patients yearly using operative or nonoperative techniques. However, self-reported disability and pain intensity vary widely across patients undergoing similar treatments or surgical procedures, with limited correlations between objective data from radiographs or physical exam and patient self-report (1-6). Psychological factors, such as symptoms of depression, health anxiety, or catastrophic thinking are consistently associated with disability and pain intensity in patients with a variety of musculoskeletal illness concerns (7-10).

Despite the abundant research on the importance of psychosocial factors in the care of both surgical and nonsurgical orthopaedic patients, including emerging

evidence on the efficacy of psychosocial intervention in improving pain and disability in orthopedic patients (11), biopsychosocial models –where both the medical and psychosocial factors are assessed and addressed– have not yet been incorporated in most orthopaedic surgical practices. Orthopaedic surgeons have a pivotal role in this transition process, by noticing when these factors are present, discussing them with patients, and providing referrals to psychosocial treatment, when necessary. Such referrals can occur prior to orthopedic surgery, when emotional health challenges predictive of less postoperative recovery (12, 13) are identified, or post orthopedic surgery, when difficulties coping may develop. In an effort to understand potential barriers toward

Corresponding Author: Ana Maria Vranceanu, Department of Psychiatry, Behavioral Medicine Service, Massachusetts General Hospital, Harvard Medical School, Boston, USA
Email: avranceanu@mgh.harvard.edu



THE ONLINE VERSION OF THIS ARTICLE
ABJS.MUMS.AC.IR

addressing psychosocial factors within orthopaedic practices, we designed a study aimed to survey surgeons' attitudes and practice of: noticing, screening, discussing psychological illnesses with patients, as well as making referrals to address psychosocial issues in patients in need. Our primary null-hypothesis is that there are no associations between the degree to which surgeons refer for psychological treatment and surgeon specific factors. Our secondary null-hypotheses were that there are no associations between the degree to which surgeons notice, screen, and discuss psychological illnesses and surgeon specific factors. Additionally, we asked surgeons to rank order potential barriers to and reasons for referrals to psychosocial treatment.

Materials and Methods

Study design

After approval by our institutional review board, we invited all members of the Science of Variation Group (SOVG; 708 upper extremity surgeons) and the Ankle Platform (428 lower extremity surgeons) to participate in this cross-sectional study. Of these, three hundred-ninety (34%) surgeons responded, and 350 (31%) completed the questionnaire. This response rate is similar to that obtained in other studies using the SOVG (10,14, 15). Invitations were sent via email in March 2015, followed by a reminder after 2 weeks. The SOVG and the Ankle Platform are international collaborations of orthopaedic surgeons with upper extremity and ankle specializations, respectively. The groups are aimed at studying variations in the definition, interpretation, classification and treatment of illness. Participation is voluntary and not compensated.

We developed an online survey using Survey Monkey (Palo Alto, CA, USA)(10). The survey contained 132 questions aimed to assess how orthopaedic surgeons notice, screen, and discuss psychological illness and refer for psychological treatment. We used a similar methodology in several prior studies (16, 17).

Study surveys

The survey consisted of 4 parts measuring the degree to which surgeons: notice (32 questions), screen (35 questions), and discuss (32 questions) psychosocial issues with their patients, and the degree to which they refer patients for psychological treatment (31 questions). All questions were answered on a 5-point Likert-scale: (1) "very unlikely", (2) "somewhat unlikely", (3) "neutral", (4) "somewhat likely" and (5) "very likely". Additionally, we asked for what reason, when, and how patients were referred for psychological treatment. Subsequently, we explored eleven barriers to referring patients for psychological treatment, including a possibility for own suggestions. Participants rated the barriers from most important to least important. We rank ordered these by assigning a score of 0 for the least important barrier and a score of 10 for the most important barrier.

Statistical analysis

Data was described using frequencies and percentages for dichotomous and nominal variables, and means with standard deviations for ordinal and continuous variables.

In bivariate analysis, the association of surgeon characteristics with the Likert-scale score of noticing,

screening, discussing, and referring psychological illnesses, was assessed using an unpaired T-test for dichotomous explanatory variables (sex, engagement in research, and engagement in teaching), oneway analysis of variance (ANOVA) with the Bonferroni correction for categorical explanatory variables (country of practice and specialization), and a Pearson's correlation coefficient for continuous explanatory variables (age, years in practice, and number of patients treated per week). All analyses were performed with Stata 13 (StataCorp LP) and a two-tailed *p* value of less than 0.05 was considered significant.

Surgeon characteristics

The mean age of the participants was 44 years; the majority were men (325, 93%), [Table 1]. On average

Table 1. Baseline characteristics of wsurvey respondents *

	Mean (± SD)
Age (in years)	44 (8.8)
Work experience (in years)	14 (8.7)
Number of patients treated per week	72 (50)
Sex	n (%)
Men	325 (93)
Women	25 (7)
Location of practice	
Europe	171 (49)
North America	120 (34)
South America	27 (7.7)
Asia	17 (4.9)
Australia	8 (2.3)
Middle East	4 (1.1)
Africa	3 (0.9)
Specialization	
Orthopaedic traumatology	112 (32)
Hand and wrist	87 (25)
General orthopaedics	81 (23)
Shoulder and elbow	46 (13)
Resident	21 (6)
Other**	3 (0.9)
Engage in research	
Yes	300 (86)
No	50 (14)
Engage in teaching	
Yes	298 (85)
No	52 (15)

* n=350

**Other = Retired (n = 2). Radiologist (n = 1)

SD: Standard deviation

the participants treated 72 (standard deviation [SD] 50) patients per week and had a mean work experience of 14 years (SD 8.7). Most participants were from Europe (n = 171, 49%) and North America (n = 120, 34%). Three hundred (86%) participants engaged in research and 298 (85%) engaged in teaching, in addition to clinical practice.

Results

Refer for psychological treatment

The mean Likert-scale score for referring for psychological treatment was 3.5 (SD 1.3), suggesting that as a group, surgeons were neutral to referring for psychological treatment. However, surgeons who were somewhat (33%) and very (27%) likely to refer for psychological treatment retained a close majority [Table 2]. Bivariate analysis showed that the likelihood of referring for psychological treatment differed by continent of practice (F= 2.87, P= 0.0096). Among different continents surgeons in South America were more likely to refer for treatment compared to those in North America (Mean= 4.4. versus Mean = 3.3; P= 0.001), and Europe (Mean= 4.4. versus Mean = 3.5; P= 0.011) [Table 3].

Surgeons who engaged in research were more likely to refer patients for psychological treatment compared to those who did not engage in research (P= 0.05). Surgeons engaged in teaching seem more likely to refer for psychological treatment, though the effect did not reach statistical significance (P= 0.13). Neither gender (P= 0.56) nor specialization (P= 0.20) showed any difference in degree of referring for psychological treatment.

The majority of surgeons refer their patients through the primary care physician (n= 201, 57%) or provide the patients with a list of names (n= 93, 27%) [Table 4].

Notice, screen, and discuss psychological illnesses

The mean Likert-scale scores for noticing and discussing psychological illness were 4.3 (SD 0.75)

and 3.9 (SD 1.1), respectively, suggesting that as a group surgeons were somewhat likely to notice and discuss psychological illnesses. The majority of surgeons were somewhat likely (46%), and very likely (44%) to notice psychological illness. Similarly, the majority of surgeons were also somewhat likely (41%) and very likely (33%) to discuss psychological illness with their patients. Women were more likely than men to discuss psychological factors (P= 0.03). Screening for psychological illness scored a 3.2 (SD 1.3), meaning that as a group surgeons were neutral with regards to formal screening for psychological illnesses. The majority of surgeons were somewhat likely (33%) and somewhat unlikely (21%) to formally screen for psychological illness. Bivariate analysis showed a difference in country of practice and likelihood of screening for psychological illnesses (ap= 0.013), and was highest for surgeons from South America (Mean= 3.9, SD 1.2) and lowest for surgeons from the Middle East (Mean = 2.8, SD 0.96) [Table 3]. Among different continents surgeons in South America were more likely to screen for treatment compared to those in North America (Mean= 3.9. versus Mean= 3.0; P= 0.017) [Table 3].

Other surgeon characteristics showed no difference in degree of noticing, screening and discussing of psychological illness [Table 3]. The majority of participants reported that they use the interview (n = 282, 81%) and the medical record (n = 201, 57%) rather than questionnaires (n = 85, 24%) to screen for psychological illnesses [Table 5].

Barriers to referral for psychological treatment

Of all the explored barriers lack of time (8.9, SD 2.0) is the most important barrier to referring for psychological treatment [Table 6]. The stigma associated with psychological factors (7.8, SD 1.6) and to be unsure how to refer (7.7, SD 2.3) are other important barriers. Not wanting to hurt reputation (2.4, SD 1.4) and not want to get in trouble with

Table 2. Percentage of participants per category noticing, screening, discussing and referring for psychological illness *

	Notice	Screen	Discuss	Refer
	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)
	4.3 (0.75)	3.2 (1.3)	3.9 (1.1)	3.5 (1.3)
	n (%)	n (%)	n (%)	n (%)
Very unlikely	1 (0.3)	41 (12)	10 (2.9)	25 (7.1)
Somewhat unlikely	8 (2.3)	73 (21)	35 (10)	62 (18)
Neutral	27 (7.7)	67 (19)	49 (14)	56 (16)
Somewhat likely	160 (46)	116 (33)	142 (41)	114 (33)
Very likely	154 (44)	53 (15)	114 (33)	93 (27)

n=350*

Table 3. Bivariate analysis of baseline characteristics and likelihood of noticing, screening, discussing and referring psychological illnesses *								
	Notice		Screen		Discuss		Refer	
	Coefficient	P value						
Age (in years)	0.068	0.20	0.016	0.76	0.054	0.31	0.031	0.56
Work experience (in years)	0.055	0.31	0.062	0.25	0.040	0.46	0.076	0.15
Number of patients treated per week	-0.083	0.12	0.051	0.34	-0.011	0.83	-0.028	0.61
	Mean (\pm SD)	P value						
Sex		0.35		0.39		0.039		0.45
Men	4.3 (0.75)		3.2 (1.3)		3.9 (1.1)		3.5 (1.3)	
Women	4.4 (0.51)		3.4 (1.1)		4.3 (0.56)		3.7 (1.1)	
Location of practice		0.90		0.013		0.39		0.0096
Europe	4.3 (0.72)		3.2 (1.2)		3.9 (0.97)		3.5 (1.2)*	
North America	4.3 (0.75)		3.0 (1.3)*		3.8 (1.2)		3.3 (1.3)*	
South America	4.4 (0.64)		3.9 (1.2)*		4.3 (0.92)		4.4 (1.1)*	
Asia	4.2 (1.0)		3.7 (0.99)		3.9 (1.2)		3.6 (1.5)	
Australia	4.3 (0.71)		2.8 (1.5)		3.8 (0.89)		3.5 (1.1)	
Middle East	4.5 (0.58)		2.8 (0.96)		3.8 (0.96)		3.8 (0.96)	
Africa	4.3 (0.58)		3.7 (0.58)		4.0 (1.0)		4.0 (1.0)	
Specialization		0.078		0.084		0.59		0.20
Orthopaedic traumatology	4.2 (0.76)		3.2 (1.2)		3.9 (1.0)		3.7 (1.2)	
Hand and wrist	4.5 (0.61)		3.2 (1.4)		3.8 (1.2)		3.4 (1.3)	
General orthopaedics	4.3 (0.69)		3.0 (1.3)		4.1 (1.0)		3.7 (1.2)	
Shoulder and elbow	4.4 (0.80)		3.6 (1.2)		4.1 (1.1)		3.5 (1.4)	
Resident	4.1 (0.96)		3.0 (1.2)		3.8 (0.94)		3.2 (1.1)	
Other*	4.0 (1.0)		4.3 (1.2)		3.3 (2.1)		4.7 (0.58)	
Engage in research		0.18		0.20		0.25		0.05
Yes	4.3 (0.69)		3.2 (1.2)		3.9 (1.0)		3.6 (1.2)	
No	4.2 (0.96)		3.0 (1.3)		3.7 (1.2)		3.2 (1.3)	
Engage in teaching		0.42		0.48		0.98		0.12
Yes	4.3 (0.75)		3.2 (1.3)		3.9 (1.1)		3.6 (1.2)	
No	4.4 (0.66)		3.1 (1.2)		3.9 (0.93)		3.3 (1.3)	

* n=350

**Significant groups after ANOVA bonferroni statistical test
SD = Standard Deviation

Table 4. How do you refer for psychological illnesses *	
	Refer n (%)
Through the primary care physician	201 (57)
Provide the patient with a list of names	93 (27)
Give main number for psychiatry department	63 (18)
I do not refer	31 (9)
Other	68 (19)

* n=350

Table 5. How do you notice & screen for psychological illnesses *		
	Notice (%) n	Screen (%) n
Medical record	(61) 212	(57) 201
Questionnaire	(17) 58	(24) 85
Interview	(89) 313	(81) 282
I do not notice/screen	(3,4) 12	(7,4) 26
Other	(3,7) 14	(3,4) 12

* n=350

Table 6. Ranked barriers for noticing, screening, discussing and referring patients with psychological illness in the orthopaedic practice *

	Notice	Screen	Discuss	Refer
Barriers	Score (\pm SD)			
Lack of time	8.9 (1.8)	9.1 (1.7)	9.2 (1.7)	8.9 (2.0)
Unsure how to notice, screen, discuss or refer	7.5 (2.0)	8.0 (1.8)	7.9 (1.8)	7.7 (2.3)
The stigma associated with psychological factors	7.6 (1.7)	7.7 (1.4)	7.8 (1.4)	7.8 (1.6)
I am uncomfortable discussing psychological illnesses	6.8 (1.5)	6.9 (1.2)	6.9 (1.3)	6.9 (1.5)
Do not want to upset patients	7.0 (1.6)	6.8 (1.5)	6.8 (1.4)	6.8 (1.6)
I do not think psychological factors are important	4.5 (1.6)	4.6 (1.2)	4.7 (1.2)	4.4 (1.8)
No need: my injections and/or surgeries help everyone	3.9 (1.4)	3.9 (1.2)	4.0 (1.1)	3.8 (1.4)
It is not my job to worry about psychological factors	4.4 (1.9)	3.9 (1.8)	3.7 (1.7)	3.1 (1.4)
I do not want to hurt my reputation	NA	NA	NA	2.4 (1.4)
I do not want to get in trouble with my colleagues / superiors	NA	NA	NA	2.2 (2.3)
Other**	3.4 (2.3)	3.1 (2.3)	2.9 (2.1)	1.1 (2.7)

* n=350

** See manuscript. SD = Standard Deviation; NA = not applicable. these question were not included in the notice, screen and discuss questionnaires.

Table 7. Proportion of participants noticing, screening, discussing, and referring for psychological illnesses *

	Notice	Screen	Discuss	Refer
	n (%)	n (%)	n (%)	n (%)
Psychological illnesses				
Drug use	220 (63)	220 (63)	242 (69)	222 (63)
Depression	285 (81)	255 (73)	273 (78)	295 (84)
Anxiety	299 (85)	239 (68)	276 (79)	254 (73)
Stress	239 (68)	213 (61)	259 (74)	210 (60)
Ineffective coping strategies	171 (49)	142 (41)	176 (50)	162 (46)
Heightened illness concern	231 (66)	163 (47)	191 (55)	129 (37)
Social support	158 (45)	158 (45)	179 (51)	136 (39)
Other**	18 (5,1)	17 (4,8)	8 (2,3)	19 (5,4)

* n=350

** See manuscript

colleagues/superiors (2.2, SD 2.3) were the least important barriers for referring for psychological treatment. Other common suggested barriers by the participants were lack of psychological education/training, language barrier, non-cooperating patient, and lack of medical record.

Psychological illnesses

Surgeons are more likely to refer patients for psychological treatment for depression (295, 84%) and anxiety (254, 73%), and least likely for problems with lack of social support (136, 39%) and drug use (222, 63%) [Table 7]. The majority of surgeons refer through the primary care physician (201, 57%). Of all respondents 31 people (9%) say not to refer at all. Other suggested psychological illnesses addressed by the

participants were secondary gain and pain catastrophizing.

Discussion

There is substantial variation in reports of pain intensity and disability in orthopaedic patients with similar objective pathology or who undergo similar medical procedures including surgeries. Psychosocial factors, in particular depression, catastrophic thinking, and health anxiety have been found to explain a larger part of this variation (7, 8, 18-21). Biopsychosocial models, where psychosocial factors are assessed and treated along with medical care have become standard of care in the treatment of many medical conditions including cancer, diabetes, cardiovascular conditions, and chronic pain (22-25), but have not yet been

incorporated in most orthopaedic practices.

Orthopaedic surgeons have a pivotal role in fostering the transition from a biomedical to an evidence based biopsychosocial model of care. We found that as a group upper extremity and ankle orthopaedic surgeons are generally neutral to referring patients for psychological treatment, with a little over half of the surgeons surveyed reporting that they would refer patients for such treatment. Surgeons engaged in research were more likely to refer patients for psychological care, perhaps due to more exposure and familiarity with the research on psychosocial factors in orthopaedic conditions, including strategies to facilitate referrals. Surgeons in South America were significantly more likely to refer patients for psychological treatment compared to those in North America and Europe. Depression, anxiety and health anxiety were the most likely referrals, and referrals were made most likely through the primary care physician.

Interestingly, as a group, surgeons were somewhat likely to notice and discuss psychosocial factors with their patients, with 90% and 74% reporting that they were somewhat or very likely to notice and discuss psychosocial factors. These high rates are in contrast with the much lower rates of referring for psychological treatment, suggesting that surgeons are aware of psychosocial factors, notice and discuss them, but often refrain from making referrals for treatment.

With regard to formal screening for psychological factors, surgeons were overall neutral, with about 45% surgeons reporting that they are somewhat or very likely to formally screen patients. The interview and medical record were the preferred methods for screening, while standardized questionnaires were the least preferred. This finding is interesting, as standardized questionnaires are quick, easy to administer while patients wait for their visit, much more time efficient compared to the interview, and more accurate than the medical record, which is often outdated or incomplete.

Among the barriers to screening, noticing, discussing psychosocial factors and referring for psychological treatment, lack of time, stigma and feeling uncomfortable were the top reasons, while lack of belief in the importance of psychosocial factors and beliefs that a biomedical treatment alone is sufficient were ranked very low. This clearly shows that surgeons value the role of psychological factors, suggesting that transition toward a biopsychosocial model should focus on problem solving the aforementioned barriers. Further, it is likely that the higher referral likelihood in South America versus North American and Europe is due to a less likelihood of interference from these barriers. Indeed, the South American culture is communal, with a focus on warm interpersonal interactions, and a more lax sense of time compared to North America and Europe. While lack of time is a significant barrier in the fast paced, insurance driven North American medical system, it is important to mention that more time spent is not necessarily associated with patient satisfaction (26), and a discussion of psychosocial factors does not need to be lengthy.

The use of empathy and communication skills, rather than time spent, is key in discussing psychosocial factors, making referrals, and maintaining patient satisfaction (27). Although

mental health stigma continues to be a problem across patients including those in orthopaedic practices, there is an increased understanding that the physical and emotional aspects of illness cannot be separated, that distress and stress are to be expected and should not be considered shameful, and that psychosocial treatments can significantly improve pain and disability and increase health and wellbeing. Orthopaedic surgeons have the opportunity to help decrease rather than proliferate such stigma through empathic explanations of the role of psychological factors, as well as referrals; patients need to feel cared for, and approached as a person rather than a disease. Unfortunately, until recently surgeons have not been formally taught communications skills and the importance of the patient-doctor relationship, including the use of empathy. Recent research emphasized the need of teaching such skills in medical schools within North America and abroad (28, 29). An innovative drama training technique called "Being-in-role" has been found to increase both reported empathy and competence in consultation in medical students within a randomized controlled trial (30). For those currently in practice, several papers have been published on this topic (31-33), which can be very helpful in increasing confidence in the ability to communicate psychosocial issues with patients. Educational pamphlets written in lay, easy to understand language can also be helpful in starting conversations with patients about the role of psychosocial factors and psychosocial treatment for orthopaedic conditions.

This study has some limitation. The SOVG and the Ankle Platform are a subgroup within the community of orthopaedic surgeons resulting in a selection bias and limiting generalizability of results. In particular, the group of surgeons that are neither American nor European was small, and the observed differences might be spurious.

Orthopaedic surgeons are likely to notice psychological illness, however, because of several identified barriers surgeons are neutral when it comes to referral for psychological treatment. Among the barriers to referral for psychological treatment stigma and feeling uncomfortable are the most highly ranked. To foster the transition of the biomedical model to the biopsychosocial model and bypass barriers to referring, surgeons will have to focus on empathy and communication skills.

Ana Maria Vranceanu PhD

Department of Psychiatry, Behavioral Medicine Service,
Massachusetts General Hospital, Harvard Medical School,
Boston, USA

Reinier B. Beks BSc

Stein J. Janssen MD

David Ring MD PhD

Department of Orthopaedic Surgery, Hand and Upper
Extremity Service, Massachusetts General Hospital, Harvard
Medical School, USA

Thierry G. Guitton MD PhD

Department of Orthopaedic Surgery, Academic Medical
Center, University of Amsterdam, Amsterdam, the
Netherlands

References

1. Ayers DC, Franklin PD, Ploutz-Snyder R, Boisvert CB. Total knee replacement outcome and coexisting physical and emotional illness. *Clinical orthopaedics and related research*. 2005;40:157-61.
2. Ayers DC, Franklin PD, Trief PM, Ploutz-Snyder R, Freund D. Psychological attributes of preoperative total joint replacement patients: implications for optimal physical outcome. *The Journal of arthroplasty*. 2004;19(7 Suppl 2):125-30.
3. Melzack R. Pain--an overview. *Acta anaesthesiologica Scandinavica*. 1999;43(9):880-4.
4. Atlas SJ, Tosteson TD, Blood EA, Skinner JS, Pransky GS, Weinstein JN. The impact of workers' compensation on outcomes of surgical and nonoperative therapy for patients with a lumbar disc herniation: SPORT. *Spine*. 2010;35(1):89-97.
5. Jensen MC, Brant-Zawadzki MN, Obuchowski N, Modic MT, Malkasian D, Ross JS. Magnetic resonance imaging of the lumbar spine in people without back pain. *The New England journal of medicine*. 1994;331(2):69-73.
6. Mechanic D. Sociological dimensions of illness behavior. *Social science & medicine*. 1995;41(9):1207-16.
7. Vranceanu AM, Bachoura A, Weening A, Vrahas M, Smith RM, Ring D. Psychological factors predict disability and pain intensity after skeletal trauma. *The Journal of bone and joint surgery American volume*. 2014;96(3):e20.
8. Vranceanu AM, Safren S, Zhao M, Cowan J, Ring D. Disability and psychologic distress in patients with nonspecific and specific arm pain. *Clinical orthopaedics and related research*. 2008;466(11):2820-6.
9. Janssen SJ, Ter Meulen DP, Nota SP, Hageman MG, Ring D. Does Verbal and Nonverbal Communication of Pain Correlate With Disability? *Psychosomatics*. 2015;56(4):338-44.
10. Janssen SJ, Teunis T, Guitton TG, Ring D, Herndon JH. Orthopaedic Surgeons' View on Strategies for Improving Patient Safety. *The Journal of bone and joint surgery American volume*. 2015;97(14):1173-86.
11. Vranceanu AM, Hageman M, Strooker J, ter Meulen D, Vrahas M, Ring D. A preliminary RCT of a mind body skills based intervention addressing mood and coping strategies in patients with acute orthopaedic trauma. *Injury*. 2015;46(4):552-7.
12. Riediger W, Doering S, Krismer M. Depression and somatization influence the outcome of total hip replacement. *Int Orthop*. 2010; 34(1):13-8.
13. Rolfson O, Dahlberg LE, Nilsson JA, Malchau H, Garellick G. Variables determining outcome in total hip replacement surgery. *J Bone Joint Surg Br* 2009; 91(2):157-61.
14. Bruinsma WE, Becker SJ, Guitton TG, Kadzielski J, Ring D. How prevalent are hazardous attitudes among orthopaedic surgeons? *Clinical orthopaedics and related research*. 2015;473(5):1582-9.
15. Tosti R, Ilyas AM, Mellema JJ, Guitton TG, Ring D, Science of Variation G. Interobserver variability in the treatment of little finger metacarpal neck fractures. *The Journal of hand surgery*. 2014;39(9):1722-7.
16. Teunis T, Janssen SJ, Guitton TG, Parisien R, Ring D. Do orthopedic surgeons acknowledge uncertainty? *CORR* 2015; ahead of print.
17. Teunis T, Janssen SJ, Guitton TG, Vranceanu AM, Goos B, Ring D. Surgeon personality is associated with recommendations for operative treatment. *Hand* 2015; 10(4):35-39.
18. Vranceanu AM, Safren SA, Cowan J, Ring DC. Health concerns and somatic symptoms explain perceived disability and idiopathic hand and arm pain in an orthopedics surgical practice: a path-analysis model. *Psychosomatics*. 2010;51(4):330-7.
19. Vranceanu AM, Jupiter JB, Mudgal CS, Ring D. Predictors of pain intensity and disability after minor hand surgery. *The Journal of hand surgery*. 2010;35(6):956-60.
20. Farzad M, Asgari A, Dashab F, Layeghi F, Karimlou M, Hosseini SA, et al. Does Disability Correlate With Impairment After Hand Injury? *Clinical orthopaedics and related research*. 2015; 473(11):3470-6. 29(10):e414-20.
21. Teunis T, Bot AG, Thornton ER, Ring D. Catastrophic Thinking is Associated with Finger Stiffness After Distal Radius Fracture Surgery. *Journal of orthopaedic trauma*. 2015; 29(10):e 414-20.
22. Borrell-Carrio F, Suchman AL, Epstein RM. The biopsychosocial model 25 years later: principles, practice, and scientific inquiry. *Annals of family medicine*. 2004;2(6):576-82.
23. Novy DM, Aigner CJ. The biopsychosocial model in cancer pain. *Current opinion in supportive and palliative care*. 2014;8(2):117-23.
24. Kamper SJ, Apeldoorn AT, Chiarotto A, Smeets RJ, Ostelo RW, Guzman J, et al. Multidisciplinary biopsychosocial rehabilitation for chronic low back pain: Cochrane systematic review and meta-analysis. *Bmj*. 2015;350:h444.

25. Masi AT, Vincent A. A Historical and Clinical Perspective Endorsing Person-centered Management of Fibromyalgia Syndrome. *Current rheumatology reviews*. 2015;11(2):86-95.
26. Dugdale DC, Epstein R, Pantilat SZ. Time and the patient-physician relationship. *Journal of general internal medicine*. 1999;14 Suppl 1:S34-40.
27. Menendez ME, Chen NE, Mudgal CS, Jupiter JB, Ring D. Physician empathy as a driver of hand surgery patient satisfaction. *JHS* 2015; 40(9).
28. Ahrweiler F, Scheffer C, Roling G, Goldblatt H, Hahn EG, Neumann M. Clinical practice and self-awareness as determinants of empathy in undergraduate education: a qualitative short survey at three medical schools in Germany. *GMS Zeitschrift für medizinische Ausbildung*. 2014;31(4):Doc46.
29. Neumann M, Edelhauser F, Tauschel D, Fischer MR, Wirtz M, Woopen C, et al. Empathy decline and its reasons: a systematic review of studies with medical students and residents. *Academic medicine : journal of the Association of American Medical Colleges*. 2011;86(8):996-1009.
30. Lim BT, Moriarty H, Huthwaite M. "Being-in-role": A teaching innovation to enhance empathic communication skills in medical students. *Medical teacher*. 2011;33(12):e663-9.
31. Riess H. Empathy in medicine--a neurobiological perspective. *Jama*. 2010;304(14):1604-5.
32. Vranceanu AM, Cooper C, Ring D. Integrating patient values into evidence-based practice: effective communication for shared decision-making. *Hand clinics*. 2009;25(1):83-96, vii.
33. Riess H. In reply to Ho. *Academic medicine : journal of the Association of American Medical Colleges*. 2015;90(2):128.

Note: No volume number available for references 1, 24.