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Résumé

La sous-estimation de la douleur par les prestateurs de soins : vers la conception d'un modèle d'inférence pour évaluer la douleur chez autrui

Kenneth M. Prkachin, Patricia E. Solomon et Joan Ross

Les professionnels de la santé sont régulièrement exposés aux manifestations de la douleur chez autrui. Il est donc important de comprendre les processus par lesquels ils évaluent celle-ci. Les auteurs présentent une synthèse des travaux de recherche récents sur les moyens d'évaluer la douleur et proposent un modèle conceptuel de ce processus. Ils analysent les questions méthodologiques et conceptuelles découlant de la conduite des recherches sur l'évaluation de la douleur. Les travaux menés dans ce domaine depuis 40 ans révèlent chez les soignants une tendance à sous-estimer l'intensité de la douleur, si on compare leurs évaluations à celles des patients eux-mêmes. Les auteurs analysent le rapport entre cette tendance et des variables comme la nature de la douleur ressentie par le patient et l'expérience clinique du sujet qui pose le jugement. Ils examinent également les variables expérientielles et cognitivo-perceptives censées influer sur le degré de sous-estimation, tels que la fréquence d'exposition aux manifestations de la douleur et les doutes à l'égard des motifs du patient. Enfin, ils présentent un modèle décrivant le processus de décodage de la douleur. Ils réfléchissent aux conséquences de la sous-estimation sur les résultats thérapeutiques et cernent des priorités pour les recherches futures.

Mots clés : douleur, évaluation, sous-estimation

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Underestimation of Pain by Health-Care Providers: Towards a Model of the Process of Inferring Pain in Others

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Health professionals are routinely exposed to evidence of pain in others. It is important that the processes by which they evaluate pain be understood. The purposes of this article are to review and synthesize recent research on how health professionals judge the pain of others and to present a conceptual model of this process. Methodological and conceptual issues in the conduct of pain judgement studies are addressed. Research in this field over the last 40 years has indicated that, when compared with the pain judgements of patients themselves, health professionals tend to underestimate pain. The authors review the relation of this underestimation bias to such variables as the nature of the patient's pain and the clinical experience of the judge. They also review experiential and cognitive-perceptual variables found to influence the degree of underestimation bias, such as the amount of exposure to evidence of pain and suspicion about the motivations of the patient. A model of the pain decoding process is presented. The issue of whether underestimation has implications for treatment outcome is addressed and priorities for future research are identified.

Keywords: Pain, judgement studies, expression, assessment, bias

Like effective human relations, effective health care depends on the ability to understand the physical, sensory, and affective experiences of other people. Health-care providers — nurses, physicians, therapists from various disciplines — help to improve health or minimize suffering by deploying technical and personal skills. Often, it is possible to evaluate whether health goals are being advanced by measuring objective indicators — a test reveals that lipid levels have improved, or a patient demonstrates increased functional capacity. Sometimes, however, health-care providers must infer how things are on the strength of complex and subtle evidence concerning the behaviour of the patient. Prototypic examples include the patient presenting in emergency complaining of chest pain, the patient with back pain participating in a rehabilitation program, and the nursing home resident with dementia who protests loudly during transfers. The question of whether these individuals are in pain or whether the nature and degree of their painful distress warrants

intervention is so basic that we are often unaware that it exists and guides our actions.

Evaluating others' pain is a classic case of decision-making in uncertainty. The difficulty of the task is complicated by the fact that the clinician must try to "look inside" another person. In an ideal world, the clinician would be able to use some kind of "mental dipstick" to slide inside the patient's consciousness, capture her or his current state, and, on the basis of this reading, recommend further action. Although no mental dipstick exists, people are able to infer, sometimes with what appears to be surprising accuracy, the feelings, thoughts, and experiences of others (Ambady & Rosenthal, 1992; Ickes, 2003). What are the properties of inferences about others' suffering, and on what basis are they drawn?

Of the dimensions that influence inferences about pain, several are obvious and some have been subject to considerable study. Certainly, direct evidence of injury, such as the presence of a burn, plays a part in determining our judgements. Findings of medical testing procedures also contribute. A key role, however, is played by the behaviour of the sufferer — verbal descriptions, complaints, protective behaviour, and other phenomena such as facial expressions whose evolutionary function appears to be largely communicative (Williams, 2002).

The purpose of this article is to present the empirical basis and framework for a model of the processes that unfold when people draw inferences about the pain of others. The particular focus is the correspondence between pain from the perspective of the patient and pain from the perspective of health professionals and other judges with a stake in interpreting pain. This article expands on a previous review of research on agreement between the ratings of pain by health professionals and by patients up to the turn of the 21st century (Solomon, 2001). This review covers more recent research and observations that address inferences by health-care providers about pain in others. Attention is restricted to studies that evaluate responses to complex but natural evidence of pain, such as reports of patients in clinical situations or judgements of actual pain-related behaviour (as opposed to vignette studies, which ask judges to respond to hypothetical scenarios presented in verbal form).

Because the goal of the article is to articulate a model, our review of the literature is selective, though not unrepresentative. In preparing the article we undertook searches in the PsycLit and Medline databases covering the years 2000 to 2006 using the keywords *pain, judgement, judgement study,* and *bias.* Reference sections from articles identified in this manner were also reviewed for relevant articles.

The Phenomenon of Pain Underestimation

A considerable amount of research has investigated health-care providers' ratings of others' pain and has documented a particular phenomenon: pain underestimation. One of the most widely cited early studies was conducted by Teske, Daut, and Cleeland (1983). The participants were nurses who rated the pain of acute and chronic pain patients using a visual analogue scale (VAS). The patients had independently provided their own ratings on the same scale. The nurses' ratings were significantly correlated with those of the patients. The magnitude of the correlation (Pearson's $r = .38$) was quite low, however, suggesting that, although there was some sensitivity among the nurses to variation in patients' pain states, it was far from optimal. More important is the fact that the nurses' overall ratings were lower than those of the patients, significantly so for patients with chronic pain. In this example, nurses based their evaluations on a complex array of evidence, including knowledge about the patients' conditions and prior ratings that had been made of their pain-related behaviours.

These findings, taken at face value, imply that nurses underestimate patients' pain. In the years since the publication of that report, several studies have compared the pain ratings of patients suffering from various conditions and those of various groups of judges. Observer groups that have been studied include nurses, physicians, other health-care providers, and relatives of the sufferers. In the following sections we will review and synthesize the general findings of such studies.

Judging Pain in Others

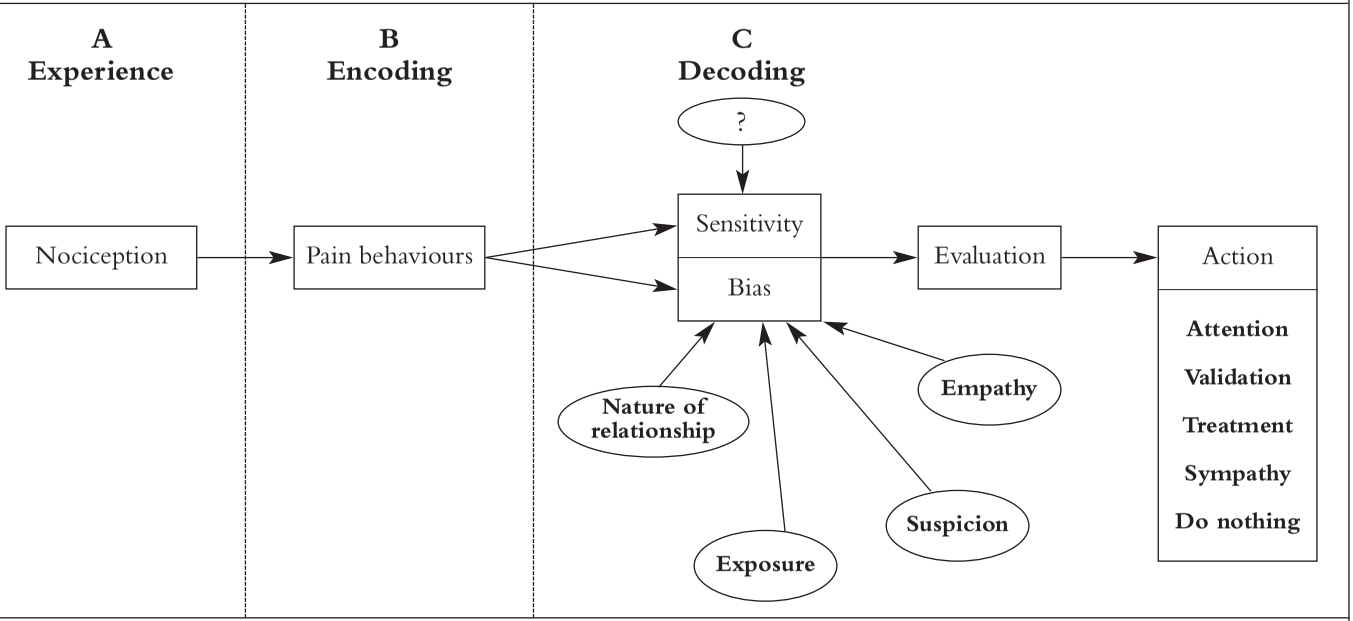
Methodological Issues

A patient presents in emergency following a rear-end motor vehicle collision. There are no abrasions or contusions. He is sent for X rays, which reveal no fractures. Functional tests and records indicate that he has not lost consciousness and he has limited range of motion in the cervical spine. He complains of stiffness and aching in the neck and the back of the head and says he has a headache coming on. How much pain is the patient experiencing?

The question cannot be answered directly, of course, because of the dipstick problem described above. Yet people readily draw an inference. Two issues are then raised: How valid is that inference, and what are its other properties? Empirical studies have attempted to shed light on this by comparing the inferences of observers with other evidence from the patient.

Several techniques can be employed in conducting such studies. Minimally, investigators must have a way of measuring pain in the

Figure 1 *A Model of the Pain-Communication Process*



Source: Adapted from Prkachin and Craig (1994).

An episode of pain begins with activation of nociceptive processes that may be encoded into a socially recognizable signal through changes in the sufferer's behaviour. The actions of an observer are likely governed by her or his perception of the pain-related signal, of which there are two components: sensitivity and bias. The available empirical evidence has more to say about the factors that influence bias than those that influence sensitivity. Several empirically supported determinants or correlates of bias are identified in the model.

sufferer, a way of measuring an observer's judgement of the sufferer's pain, and a way of comparing the two. Rosenthal (1984, 2005) has provided a useful description of the components of any process involving the communication of internal states. He distinguishes three: A – the internal state of the subject, B – the behaviours that provide evidence about the internal state, and C – the inferences made by the observer about the internal state based on the evidence. In the present context, we can conceive of A as the subject's pain, B as the subject's pain-related behaviour, and C as the observer's inference about the subject's pain. Figure 1 presents a conceptual model illustrating some of the key processes and variables involved in the pain-communication process. We have modified it from an earlier model (Prkachin & Craig, 1994) to emphasize aspects of the pain-communication process that are the focus of this article.

The process by which the sufferer's pain is translated into behaviours that communicate pain is called *encoding* and the process by which the sufferer's communicated behaviours are translated into an observer's inference is called *decoding.* Providing that one has measures of each of the three components, it is possible, by making these distinctions, to independently evaluate A→B relations (encoding studies), B→C relations (decoding studies), and A→C relations (inference studies).

The literature on the judgement of pain in others typically makes use of some kind of numerical, verbal descriptor or visual analogue scale when information about the subjective experience of the sufferer (A in Rosenthal's [1984] model) is being collected. Judges, in turn, typically make use of the same scales to record their inferences about patients' pain (C in Rosenthal's model). There is considerable variation in the behaviour that is sampled to provide a basis for judges' evaluations (B in Rosenthal's model). Occasionally, the evidence base is holistic. In such cases, patients undergoing a health-care procedure, for instance, are asked at some point to rate their pain. Providers involved in their care are asked to give their own judgements based on their experiences with the patients. These judgements can, in principle, be based on what the providers have heard, seen, or inferred from independent evidence such as the patients' medical records. Occasionally, a particular type of behaviour is used. In our studies, for example, video records of facial expression are provided to judges as a basis for their inferences.

Measuring the correspondence between the sufferer and the judge requires the setting of some kind of evaluation criterion. One way of doing so is to establish a benchmark for "accuracy." In an influential study by Iafrati (1986), accuracy was defined as existing when a judge's rating on a numerical scale falls within plus or minus one point of the patient's.

A rating falling outside that range thus becomes identified as an under- or overestimate.

This type of definition has several problems, apart from arbitrariness. The first is that it is dependent on the use of a particular numeric rating scale. Several techniques for quantifying patients' pain reports are commonly employed. They include the 0–10 numerical rating format used by Iafrati (1986), 0–100 scales, and categorical and scaled verbal descriptor scales. The equivalent range for categorizing a response as in agreement on a 0–100 scale or a verbal descriptor scale is not self-evident. For example, Cremeans-Smith et al. (2003) studied patient, spouse, and physician agreement on a patient's pain using a five-category Likert scale. To be considered in agreement, patients' and observers' ratings had to be the same.

The second problem is that, by reducing the comparison to qualitative categories, information available on the magnitude of the discrepancy between patients' and observers' judgements is lost.

The third problem is that the method does not allow for the evaluation of the observer's judgement processes to be as discriminating as possible. When examining the performance of the observer, it is possible to distinguish two processes that are involved in the inference about another's pain: sensitivity and response bias.

Sensitivity refers to the ability to tell the difference between levels of pain, independent of the overall level of pain present. This is indicated by covariations between the magnitude of the observer's judgement and either the behavioural referent or the patient's report. Sensitivity can be evaluated in two ways: by measuring the correlation between an observer's rating and the subject's rating or behaviour, such as reported by Teske et al. (1983), or through the use of signal detection procedures that allow calculation of direct measures of the ability to discriminate states of the patient (Deyo, Prkachin, & Mercer, 2004). Response bias refers to the likelihood of imputing or being prepared to impute pain to others (Swets, 1996). It can also be measured in two ways: by finding a measure of the central tendency of observers' ratings, such as the mean, or by calculating specific signal detection parameters (cf. Prkachin, Mass, & Mercer, 2004). Underestimation and overestimation of another's pain, the type of judgement we are focusing on in this article, are types of response bias.

Sensitivity and bias are independent parameters that contribute to an overall evaluation of the intensity of the sufferer's pain. In the model, such evaluations serve as the basis for several possible courses of action (including taking no action). Undoubtedly, further social-cognitive processes mediate the relation between evaluation and action.

Findings and Concepts

Solomon's (2001) review of research on the pain judgements of health professionals (mostly nurses) indicates that, although it is possible to overestimate, underestimate, or accurately judge another's suffering, professionals' ratings tend to be lower than those of the patients themselves. This is consistent with the conclusion that there is an overall bias towards underestimation of pain (Ferguson, Gilroy, & Puntillo, 1997; Grossman, Sheidler, Swedeen, Mucenski, & Piantadosi, 1991; Guru & Dubinsky, 2000; Hall-Lord, Larsson, & Steen, 1998; Rundshagen, Schnabel, Standl, & Schulte am Esch, 1999; Stephenson, 1994; Teske et al., 1983; Thomas, Robinson, Champion, McKell, & Pell, 1998; Zalon, 1993). Several studies using correlation techniques found that sensitivity to variations in patients' pain was low to non-existent (McKinley & Botti, 1991; Singer, Richman, Kowalska, & Thode, 1999; Thomas et al.; Van der Does, 1989).

There have been some exceptions to the finding that judges, whether health professionals or not, underestimate pain relative to the ratings made by sufferers. When patients' ratings are comparatively low, the ratings of health professionals are occasionally higher than those of the patients (Olden, Jordan, Sakima, & Grass, 1995; Zalon, 1993). Heikkinen, Salanterrä, Kettu, and Taittonen (2005) studied prostatectomy patients during postoperative recovery. Patients and nurses independently completed numerical pain ratings. In addition, the patients completed VAS ratings and their direct verbal expressions of pain were categorized on an intensity scale. On the numerical scale, nurses' ratings were significantly lower than those of the patients. However, when numerical rating-scale points were re-categorized into ranges of approximately three points, nurses appeared to overestimate approximately as often as they underestimated. Overestimation was most likely to occur when patients were reporting no pain, underestimation when patients were reporting pain ranging from mild to intense.

The type of pain in question appears to have some influence on the tendency towards underestimation or overestimation or on the degree of underestimation. Studies with burn patients, for example, have tended to find comparable degrees of underestimation and overestimation among professionals (Choinière, Melzack, Girard, Rondeau, & Paquin, 1990; Iafrati, 1986). Indeed, Everett et al. (1994) report approximate agreement between patients and nurses in approximately half of 49 cases. Even in these studies, however, the phenomenon of underestimation has occurred among significant numbers of participants. In the study by Choinière et al., for example, nurses with a greater amount of clinical experience were more likely to underestimate the pain of burn victims, while nurses with less experience were more likely to overestimate it. Puntillo,

Neighbor, O'Neill, and Nixon (2003) compared the pain ratings of patients and nurses in an emergency department setting. Nurses rated pain on the standard 0–10 intensity scale used by patients. The nurses underestimated patients' pain, with ratings between 54 and 68% as high as those of the patients. Although, on average, the intensity of all types of pain was underestimated, the degree of underestimation varied according to the type of pain being presented. Underestimation was greatest for pain associated with musculoskeletal injuries, abdominal problems, and cellulitis/abcesses but minimal (by Iafrati's criterion) for headaches, fractures, and radiculopathies.

In most studies, judges have evaluated patients' pain on the basis of holistic evidence, such as their observations in clinical settings. Consequently, the bases on which judgements have been made are not entirely clear. In other studies, it has been possible to be more precise about the bases on which judgements were made. For example, Prkachin, Berzins, and Mercer (1994) showed observers videotapes of the facial expressions of patients with shoulder pain going through exercises that produced pain in the affected shoulder. The patients had rated the intensity of their pain on each test using validated verbal descriptor scales (Heft, Gracely, Dubner, & McGrath, 1980). Observers used the same scales as the patients to rate the amount of pain they thought each was experiencing, basing their judgements on the patients' facial expressions. The results show that observers' judgements of patients' pain were substantially lower — by 50 to 80% — than those of the patients themselves. To the extent that we can consider patients' characterization of their pain as "ground truth,"[1] this finding also suggests that, in general, observers display what we have called an "underestimation bias."

Determinants of Underestimation

Although underestimation appears to be a common finding, there are variations in its degree, apparently resulting from differential experience, social-cognitive factors, and personality characteristics. What are the potential sources of underestimation?

[1]The question of whether patients' verbal characterization of their pain should enjoy such privileged status as the "gold standard" (Wheeler, 2006) does not, however, have a consensual answer (Hadjistavropoulos & Craig, 2004). Therefore, is not clear from any study of this nature whether it is appropriate to characterize observers as underestimating. Other techniques, however, provide some basis for evaluating the question of whether judgements of suffering in others can be characterized as "biased" and provide further insight into the processes involved when one person draws inferences about the suffering of another. We will continue to use the terms "underestimation" or "underestimation bias" to refer to situations in which judges' ratings of patients' pain turn out to be numerically lower than those of patients, recognizing the conceptual difficulties associated with this way of characterizing the phenomena.

A first answer to this question harkens back to the dipstick problem. Because observers do not have direct access to sufferers' internal experiences, their judgements are reliant on sources of evidence in the sufferer's behaviour or context. In the setting of most empirical studies, access to that evidence is limited. For example, in a clinical study the judge must evaluate the patient's pain-related behaviour holistically but without access to the complete medical history, and in an experimental study the judge must evaluate a record of the patient's behaviour and attention is deliberately restricted to some discrete indicator of pain. Not only are these sources of information incomplete, but some, such as facial expressions, are subtle and difficult to detect without training. For these reasons, limited information is a source of suboptimal judgements.

There are other potential sources of variations in pain judgements, however. One that is of traditional interest is experience; in this case, a history of exposure to evidence of pain in others. In her review of the accuracy of pain judgements, Solomon (2001) noted a trend in studies of the judgements of health professionals towards a paradoxical increase in underestimation with experience. As noted above, Choinière et al. (1990) found that greater clinical experience was associated with underestimation, rather than overestimation, of burn patients' pain. Von Baeyer, Johnson, and McMillan (1984) observed a similar effect with nursing students. In that study, observers' judgements were not compared with those of patients. Instead, observers rated videotaped simulations of interviews with patients. Participants with more experience showed less sympathy and concern than those with less experience. Although these findings do not reflect directly on judgements of pain, they do suggest differences in the emotional impact of pain behaviour as nursing students acquire more experience. Other investigators have provided evidence of an effect of increasing clinical experience on pain underestimation (Lenberg, Glass, & Davitz, 1970; Perry & Heidrich, 1982), although there have also been failures to observe such an effect (Dudley & Holm, 1984; Everett et al., 1994; Hamers, van den Hour, Halfens, Huijer Abu-Saad, & Heijltjes, 1997; Oberst, 1978).

Experience with others' pain is not a unidimensional phenomenon, however, and the nature or quality of experience appears to play some role as a determinant of observers' judgements. Prkachin, Solomon, Hwang, and Mercer (2001), for example, studied the impact of different kinds of experience on pain judgements. Judges observed the videotapes of patients with shoulder pain described in the study by Prkachin et al. (1994) and rated the amount of pain experienced by the patients using the same scale that the patients used. Three observer groups, differing in the nature of their experience with pain sufferers, were studied. One group consisted of clinicians — physical and occupational therapists —

who had experience working with pain patients. A second group consisted of judges with experience of a different kind. These were people who had lived with a chronic pain sufferer. Judges in the third group had had little or no experience with pain sufferers. The ratings of all three observer groups were significantly lower than those of the patients, confirming that all three observer types underestimated pain. Interestingly, however, the three groups did not show the same degree of underestimation. Relative to controls, the clinicians showed greater underestimation. By contrast, those who had lived with a pain sufferer underestimated pain to a lesser degree.

A study by Kappesser, Williams, and Prkachin (2006) identified further potential sources of underestimation. In this study, physicians and nurses from a large city hospital viewed video records of the facial expressions of patients with shoulder pain. Stimuli were selected to display a range of pain expressions. Judges used the same verbal descriptor scales as the participants to rate the amount of pain they appeared to be experiencing. Judges participated in one of three conditions. One group was simply shown the facial expressions and asked to make their judgements. A second viewed the facial expressions but were also given access to the patient's rating of the pain. A third had both facial and verbal report information; in addition, this group was informed that some of the people they viewed were actually faking pain in order to gain access to opioid drugs.

Participants in the face-only condition showed substantial underestimation of patients' pain (approximately 4 points on a 15-point rating scale). Provision of information about the patient's pain rating substantially reduced but did not eliminate underestimation — in this condition judges' ratings were lower than those of the patients by only 2.5 rating-scale points on average. The addition of information about motivated faking largely reversed the reduction of underestimation associated with provision of the patient's verbal rating. In this condition, judges' ratings were approximately 3.5 points lower than those of the patients.

These data implicate two further processes in understanding pain underestimation. The fact that inclusion of the patients' actual verbal description of their pain reduced underestimation suggests that the provision of multiple sources of evidence (in this case, behavioural and verbal) may yield a more accurate approximation of sufferers' internal states. Indeed, the findings may be comforting since it is undoubtedly true that in clinical settings multiple sources of information about patients' suffering are likely to be available and used by care providers. Nevertheless, the findings may not be thoroughly comforting because, even with the evidence of the patients' characterization of their pain available, the judges (who were health professionals) still underestimated.

This is also consistent with the findings of Solomon, Prkachin, and Farewell (1997), who attempted to improve health professionals' ability to judge pain by training them in the recognition of facial expressions of pain. In that study, although training did reduce the discrepancy between patients' and professionals' ratings of the patients' pain, the reduction was not sufficient to eliminate underestimation.

The second issue implicated in the study by Kappesser et al. (2006) is the role of suspicion in influencing perceptions of the suffering of others. Information that *some* participants were faking their pain led to a general discounting of the pain of all. Poole and Craig (1992) made a similar observation. Williams (2002) offers an interpretation of pain expression in which she argues, consistent with concepts from evolutionary psychology (Cosmides & Tooby, 1992), that humans have evolved a "cheating detection" mechanism for circumstances that activate representations of exploitation or deceit. The fact that information evoking suspicion about patients' motives virtually eliminated the "benefit" resulting from additional information pertinent to the pain state is consistent with the idea that such a mechanism can affect perceptions of pain in others.

How does personal experience with pain influence the judgement of pain in others? Danziger, Prkachin, and Willer (2006) recently collected evidence pertinent to this question in a unique population. The participants were 12 individuals with congenital insensitivity to pain, a rare neurological condition characterized by a profound diminution in pain sensitivity, usually the result of a hereditary sensory and autonomic neuropathy. Patients and healthy controls underwent a variety of tests of perception of pain in others. One test involved facial expressions of shoulder-pain patients such as those described above. Another involved videos of a variety of people experiencing an injury. Notably, the videos of people experiencing injury were selected such that they depicted purely the event of the injury — no pain-related behaviour was displayed. Compared with healthy controls, patients with congenital insensitivity to pain did not differ in their judgements of the pain evident in the facial expressions of shoulder-pain patients. They did, however, tend to underrate the pain associated with injuries. Additional analyses revealed that, among patients with congenital insensitivity, the tendency to impute pain to others was correlated with independent measures of their empathy. This finding suggests that, at least in people with diminished appreciation of pain, personal characteristics involving the tendency to be affected emotionally by others' distress may affect perception of pain in others.

The foregoing studies document differences among various groups of people in terms of perception of pain in others. Most of the findings are

consistent with the suggestion that people in general show an underestimation bias, some identifying differences that appear to be experience-based and some implying that certain kinds of experience can promote underestimation. None of the studies, however, present experimental evidence that might illuminate the sources of underestimation. Studies of the influence of experience on increasing underestimation have been interpreted as implicating a kind of habituation in which repeated experience with suffering is thought to diminish sensitivity to pain in others. Prkachin et al. (2004) provide experimental evidence that is relevant to this issue. Four groups of observers were shown brief video clips of the facial expressions of patients with shoulder pain. The clips occurred in two categories: no pain and moderate pain. Expressions were sampled from these categories based on measurements of pain-related facial movements. The judges' task was to view each clip and indicate whether it displayed pain. The four groups differed according to their exposure to other clips of pain expression. Controls were simply shown the test clips without viewing other pain expressions. Participants in the low-exposure category viewed one example of strong pain expression before judging each test clip, those in the moderate-exposure category viewed five strong pain expressions before judging each clip, and those in the high-exposure category viewed 10 pain expressions before making their judgements. Analyses of observers' judgements by signal-detection techniques indicated that the degree of prior exposure to pain expression left the ability to detect pain expression unaffected. Increasing experience did, however, influence judges' decision criteria. Observers exposed to greater amounts of pain expression became increasingly unwilling to impute pain to others. These findings provide direct experimental support for the hypothesis that simple exposure to high amounts of pain serves to bias judges against reporting pain in others and may go a considerable way towards explaining observations of increased underestimation among health professionals with increased experience.

Is Pain Underestimation a Bad Thing?

Our review suggests that pain underestimation, though not universal, is a common phenomenon among health-care practitioners. The question arises: Is underestimation simply an interesting but benign natural phenomenon, or does it have important implications, beneficial or detrimental, for health care? Theoretical arguments can be made on either side. The idea that pain underestimation may be beneficial can be viewed from the perspective of either the patient or the provider. From the perspective of the patient, it may be that health-care practitioners whose

estimate of the patient's suffering is lower than that of the patient also provide a kind of care that motivates recovery. Like concepts from the operant theory of pain behaviour (Fordyce, 1976), this notion evolves from the idea that a focus on pain, such as one might expect when a health-care provider estimates the sufferer's pain to be of high intensity, may strengthen pain-related behaviour or place a priority on pain suppression as opposed to active rehabilitation. To the extent that such efforts motivate behaviour that is focused on recovery, one would expect pain underestimation to be associated with better health outcomes.

From the perspective of the provider, pain underestimation might be seen as an adaptive coping mechanism, allowing caregivers to deploy their skills despite the empathic distress commonly engendered by exposure to suffering in others. Health-care providers commonly describe a process of becoming "numb" to suffering as they craft their skills. Pain underestimation may be a part of this process, enabling health professionals to administer skilled care under the emotionally provocative conditions under which human suffering takes place.

The argument that pain underestimation may be harmful can also be viewed from patient and provider perspectives. It is an article of faith among many health professions that empathy to the plight of others is a cornerstone of effective practice. Such empathy is largely thought to be helpful because it facilitates an effective therapeutic relationship with patients, out of which flows the kind of shared communication that is necessary for effective diagnosis, monitoring, and cooperation. Pain underestimation may reflect a "disconnection" between the patient and the provider that is associated with a sense of being misunderstood on the part of the patient. Such a sense may well be accompanied by feelings of anger and alienation, which complicate the emotional reaction to suffering and undercut the trust and cooperation that are necessary for therapeutic improvement.

From the perspective of the provider, pain underestimation may contribute to detrimental health outcomes by undermining a sense of therapeutic urgency. Arguably, a health-care provider's decision to intervene to reduce suffering is dependent on her or his estimation of the need for intervention, an estimation that is itself a partial function of the patient's pain. It seems likely that individual clinicians have thresholds of estimated suffering above which intervention may be pursued, and pursued aggressively, but below which it will not be pursued. If one's threshold is substantially reduced, the clinician may be at risk for not taking appropriate action to relieve suffering or to prevent future deterioration. In such a case, then, pain underestimation may lead to substandard care and poorer health outcomes.

It must be recognized that, certainly in principle and likely in practice, issues of pain estimation play out in circumstances that are asymmetrical. Health-care providers are gatekeepers for interventions with the potential to relieve pain. To the extent that, in such circumstances, their evaluations of the amount of suffering in others are critical determinants of the dispensation of pain relief, it is their judgements that hold the ultimate sway, for better or for worse.

The aforementioned mechanisms are but a few ways in which pain underestimation may affect health outcomes. Currently, there is little empirical basis for choosing among them, because few studies have examined the possible link between vicarious pain estimates and health outcomes. Cleeland et al. (1994) found that physician-patient discrepancies in cancer patients' pain were associated with substantially poorer pain management, suggesting that pain underestimation may contribute to poorer health outcomes. Similarly, there is a broader literature on patient-provider concordance that suggests that differences between the evaluations of health-care providers and those of patients with respect to various aspects of patients' experiences are associated with a variety of poorer health outcomes (DiMatteo & Martin, 2002). By contrast, Creamans-Smith et al. (2003) compared the pain ratings of older female osteoarthritis patients (*M* age = 69 years), their spouses, and rheumatologists. On average, the spouses' ratings tended to be higher than those of the patients, while the rheumatologists' ratings were lower. Spouse-patient and rheumatologist-patient dyads were categorized as in agreement, overestimating and underestimating. Patient-spouse underestimation was associated with diminished patient self-efficacy, positive affect, and increased depression, while underestimation in rheumatologist-patient dyads was associated with greater patient self-efficacy and positive affect. Perreault and Dionne (2006) had patients with acute and sub-acute low-back pain and their physiotherapists estimate the patients' pain on the same 11-point numerical rating scale at the beginning of a course of physiotherapy. Four weeks later, after physiotherapy, the patients' pain and functional limitations were measured using the same numerical rating scale and measures of functional limitations. Pain underestimation on the part of the treating physiotherapist was associated with improved pain ratings and function at follow-up. These findings show that underestimation may be associated with improved health outcomes.

The available evidence, therefore, is extremely limited and inconsistent. It provides no clear answer to the question of whether pain underestimation is beneficial, detrimental, or benign. This is a critical question that should be the focus of substantial empirical inquiry.

A Model of Pain Inference

In addition to providing a framework for conceiving the pain-communication process, Figure 1 represents an attempt to summarize and synthesize the literature outlined in this article. It indicates that, of the components of evaluations of pain in others, considerably more is known about variables that affect underestimation bias than about variables that affect sensitivity. Empirical research has identified a number of categories of variables that appear to affect the extent of underestimation bias. These include the nature of the relationship between the patient and the judge (Prkachin et al., 2001), the amount of exposure of the judge to evidence of suffering (e.g., Prkachin et al., 2004), suspicion and other factors that may lead the judge to question the authenticity of pain complaints (Kappesser et al., 2006), and features of the judge's proclivity to empathize with others (Danziger et al., 2006). As also indicated in Figure 1, the influence of these variables on underestimation represents the first step in a process that affects the decisions that individuals make and the behaviours in which they engage when faced with evidence of suffering in others. These decisions and behaviours can range from vigorous and aggressive care to no care at all, and even, in principle, actions that are likely to intensify the suffering. Research into the linkage between the pain judgements and subsequent actions of observers is very limited and needs to be the focus of intensive research.

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