

Symptom Perception and Interpretation

Chiara Gasteiger and Keith J Petrie, Department of Psychological Medicine, Faculty of Medical and Health Sciences, University of Auckland, Auckland, New Zealand

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Introduction

Symptom perception and interpretation play a significant role in almost all somatic diseases and guide life-saving health behaviors, such as seeking timely medical care, treatment adherence, and self-management for patients with chronic conditions. Symptom reporting also plays an integral part in healthcare encounters, as most diagnoses begin by eliciting symptom reports, and treatment monitoring also generally relies on patients' tracking relevant symptoms. Symptom management is the major cause of health care costs and symptoms are strongly related to disability.

This article begins by examining how common symptoms are in the community. We review key theories to understanding how symptoms are noticed and factors that play a role in this process. Following this, the interpretation and misinterpretation of symptoms are considered with a focus on the delay in seeking medical care. We also examine how patients use technology to make sense of symptoms, and how reassurance can be used to address issues related to symptom perception and interpretation.

How Common are Physical Symptoms?

Physical symptoms are a normal part of the human experience and fortunately, most of the symptoms we experience are not associated with serious illness. Finding out how many symptoms people in the general population experience has not been straight-forward. Many of the larger population studies use only a limited number of symptoms in their surveys and often with a lack of consistency in the types of symptoms assessed. A review of the instruments used in symptom surveys showed these ranged from 5 to 78 symptoms with most using under 20 items. The time-periods also varied from a 7-day period to assess whether they have experienced the symptom over their lifetime (Zijlema et al., 2013). A study using a representative sample of the general population and a large 46 item symptom scale found people experience a median of 5 symptoms over the previous 7 days (see Fig. 1) (Petrie et al., 2014).

This survey also highlighted the variability and nature of common symptoms. While 11% of the population reported no symptoms in the past week, a significant portion of the population (23%) experienced more than 10 symptoms a week, and 4% more than 20 (Petrie et al., 2014). The most common symptoms people experience are shown in Fig. 2. As found in other surveys, back, muscle, and joint pain are commonly reported (Eliassen et al., 2017), along with headaches, cough, fatigue, and sleeping problems (Bardel et al., 2019; Elnegaard et al., 2015). Interestingly, the most common symptoms found in this general population survey also frequently appear as adverse drug reactions, suggesting there may be considerable misattribution of common symptoms as drug side effects (Tan et al., 2014).

An important demographic difference highlighted in the graph of the most common symptoms is the sex difference in reporting, with females reporting higher rates of symptoms than males. This is apparent in general population surveys and also in studies of patient groups (Cepeda and Carr, 2003; Cheung et al., 2011). This difference has been explained by a reporting difference with less stoicism and higher levels of expressiveness in females (Barsky et al., 2001). Other differences in symptom reporting are a tendency

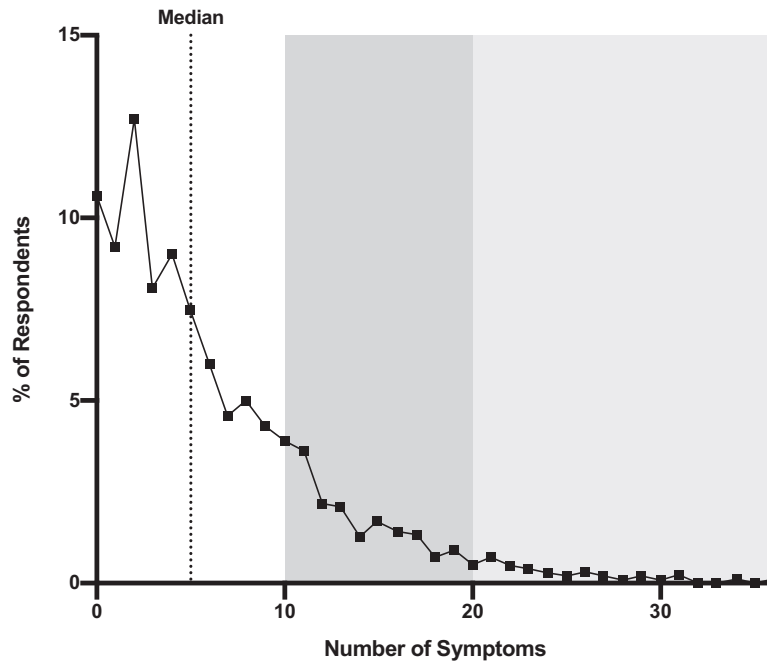


Fig. 1 Graph showing the number of symptoms reported for the previous 7 days. Petrie, K.J., Faasse, K., Crichton, F., Grey, A., 2014. How common are symptoms? Evidence from a New Zealand national telephone survey. *BMJ Open* 4, e005374.

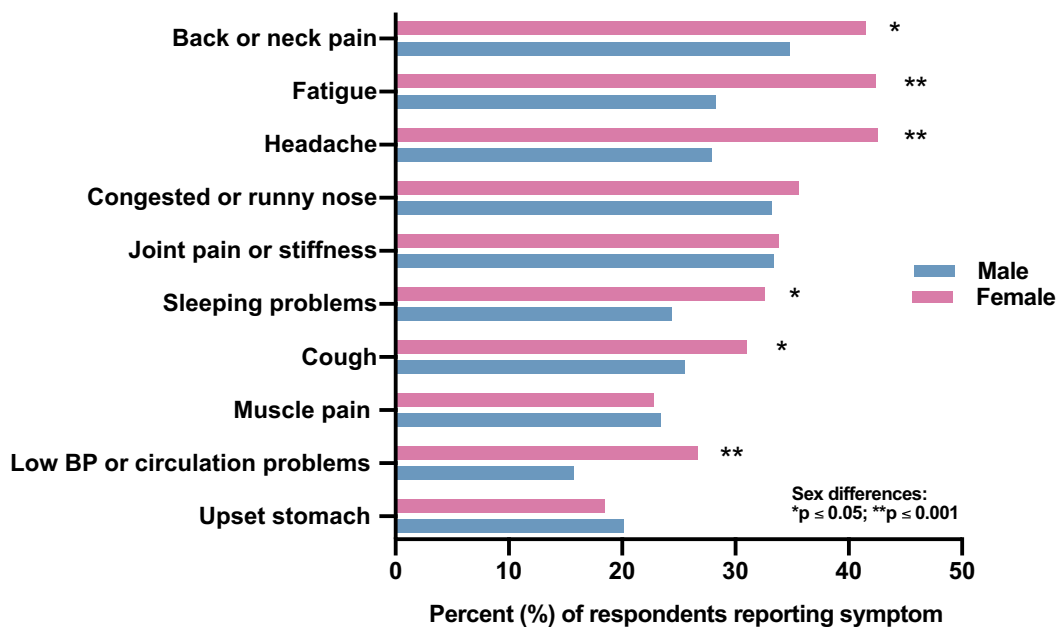


Fig. 2 Bar graph of the most common symptoms reported by gender. Petrie, K.J., Faasse, K., Crichton, F., Grey, A., 2014. How common are symptoms? Evidence from a New Zealand national telephone survey. *BMJ Open* 4, e005374.

for those that live alone and those who are unemployed to report more symptoms than those that live with others or work full-time (Pennebaker and Epstein, 1983; Petrie et al., 2014). These findings point to the role of the environment in influencing the attending to symptoms; an issue that is discussed in the next section.

Role of Anxiety and Negative Affect

Individuals with anxiety, and in particular health-related anxiety, are more prone to noticing symptoms. Anxiety augments harmful behaviors such as scanning the body for symptoms and the development of causal attributions to severe health conditions

(Rief et al., 2004). Increased interoceptive sensitivity (the accuracy of detecting internal bodily sensations) is also associated with anxiety disorders (Domschke et al., 2010). People with heightened cardiac interoceptive sensitivity, for example, may become preoccupied with concerns about suffering a heart attack, which consequently induces anxiety. People with anxiety are often dubbed to be “worried well,” denoting the unnecessary seeking of health care and an inability to be reassured by health professionals.

The activation of illness schemas may also be influenced by dispositional factors, such as emotions. Inducing sadness in a laboratory setting increases other symptom reporting of aches and pains, and decreases confidence in carrying out future illness-alleviating behaviors (Salovey and Bimbaum, 1989). Similarly, in a study examining negative affect in people receiving a vaccine for travel, those with negative affect attributed significantly more symptoms to the vaccine than those without high levels of negative affect (Petrie et al., 2004). It has been suggested that neuroticism is linked to hypervigilance, rumination, and introspective cognitive styles, causing people with high levels to increasingly notice symptoms (Affleck et al., 1992). Similarly, people with high levels of negative affect develop more negative interpretations of normal symptoms.

Noticing Symptoms

Many people have had the experience of being so immersed in a sporting event or activity that they did not notice that they had injured themselves until much later. Other people may have also noticed when they are running while listening to music, they tend to be less aware of their fatigue and aching muscles. Both of these examples illustrate how external factors can draw our attention away from noticing symptoms.

Pennebaker developed the competition for cues theory to explain the process of how the environmental context influences symptom perception (Pennebaker and Lightner, 1980). The theory proposes that attending to symptoms is influenced by the competition between internal sensory experiences and the external environment. Boring and non-stimulating environments focus our attention internally, whereas stimulating environments direct our attention away from our internal state. A number of studies support this theory, including that where participants who ran on a treadmill while listening to an amplification of their breathing (internal focus) reported more symptoms than those listening to distracting sounds (external focus) or nothing at all (Pennebaker and Lightner, 1980). A more recent study also demonstrated that running on a treadmill while hearing music or watching television (stimulation) decreases symptom reporting and improves satisfaction for exercising (Rider et al., 2016). There is also fascinating research demonstrating more boring lectures led to higher rates of coughing in attendees, compared to interesting lectures (Pennebaker, 1980).

The competition for cues theory has implications for dealing with chronic conditions. While patients with chronic pain are often recommended to stay in what is usually a less stimulating environment at home, this may cause increased focus and attention to their condition. Likewise, symptom diaries are a common intervention used to help patients recall symptoms and to identify patterns. However, by heightening the attentional focus on bodily sensations these can unintentionally amplify symptom perceptions. In a randomized controlled trial of 35 healthy participants, half of the participants recorded symptoms using a diary (Ferrari and Russell, 2010). After 2 weeks, participants reported double the symptoms, and more with an increased intensity compared to the control group. Drawing attention to our internal state may therefore exacerbate symptom reporting.

Similar effects have been demonstrated in the use of smartphone applications with features to track symptoms. In an experimental study, female participants were randomized to use either a menstrual-monitoring application with a symptom tracker or a simple calendar application, or no application at all (MacKrell et al., 2020b). Women who used the application with the symptom tracker function reported significantly more period-related symptoms at 4 months and a greater portion of these participants were classified as high period symptom reporters. As smartphone applications with symptom trackers are readily available, this causes concern for exacerbated symptom reporting.

Expectations

There is also evidence to suggest that having a strong belief that symptoms will occur influences the reporting of physical sensations. The significant impact of expectations has been demonstrated in a laboratory-based experiment that used framing of audio-visual stimuli to induce expectations of infrasound exposure-related symptoms (Crichton et al., 2014). Participants were exposed to the same stimulus, but those who received negative expectations reported more frequent and intense health complaints, whereas those given a positive message reported a decrease in symptoms and an improvement in mood, as consistent with the expectancy hypothesis. Further, telling women that they are in the pre-menstrual phase also creates more expectations about negative symptoms and increases symptom reporting (Klebanov and Jemmott III, 1992). The expectation of experiencing certain symptoms may alter how sensations are attended to and lowers the threshold for labeling normal sensations as symptoms.

Negative expectations are easily induced through the provision of information about new treatments. Doctors might warn their patients that the new vaccine might sting, or to keep an eye out for certain side effects when prescribing a new drug. Yet this information can induce negative expectations of a new therapy and ultimately lead to the development of adverse effects. As evident in a multicenter trial, including a statement in the consent form that outlines possible gastrointestinal side effects related to aspirin or sulfinpyrazone led to a six-fold increase in the number of participants withdrawing from the study due to subjective, minor gastrointestinal symptoms (Myers et al., 1987).

In a study by [Cocco \(2009\)](#) male participants were randomized to receive different levels of information about metoprolol and its ability to induce erectile dysfunction (ED). Participants were either fully informed about the drug and that it might induce ED, partly informed of the drug but not that it can induce ED, or not informed at all ([Cocco, 2009](#)). After 60 days, men who were fully informed reported significantly more problems with erectile dysfunction (32%) than those partly informed (13%) or not informed at all (8%). These findings highlight the need for healthcare providers to carefully consider the negative impacts of the information they provide to patients. Optimizing written and verbal treatment information to increase positive expectations is an easy-to-use strategy in the clinical context ([Bingel, 2020](#)).

The belief that one is sensitive to the effects of medicines also influences the number of side effects reported following treatment initiation ([Horne et al., 2013](#)). Increased symptom reporting may occur as a result of expecting more side effects and attributing general symptoms to the new medicine. It is concerning that roughly 20% of the population hold this belief, as high levels of perceived sensitivity to medicines are not only associated with symptom reporting but also more medical care utilization, intentional non-adherence, the modification of treatment doses, and increased information seeking about medicines ([Faasse et al., 2015a](#)). A perceived sensitivity to medicines is further heightened in females, those who were unemployed, and of older age.

Social Modeling

One cannot consider the impact of expectations on symptom perception without acknowledging the influence of social modeling in creating placebo and nocebo responses. Most human behavior is learned from observing others. For example, young children learn pain-related beliefs and behaviors by looking at their parents' reactions after falling over. In a similar way, social modeling can improve treatment outcomes or increase side effects depending on the behavior being viewed, thus leading to either placebo or nocebo responses ([Faasse and Petrie, 2016](#)). The placebo effect occurs after building positive expectations about the safety and efficacy of an inert treatment to provide favorable clinical responses. In stark contrast, nocebo responses occur when negative expectations about a treatment cause an adverse effect. To illustrate, merely witnessing a research confederate report side effects attributed to an inert drug increased symptom reporting in female participants and the number of symptoms attributed to the medicine ([Faasse et al., 2015b](#)). See [Fig. 3](#).

Interestingly, patient characteristics influence the extent to which participants are affected by social modeling. Using an experimental design, [Vogtle et al. \(2013\)](#) demonstrated that the nocebo response is correlated with pain catastrophizing. In this study, 85 students received a pressure pain stimulus, followed by an ointment to induce the nocebo response. Depending on their group allocation, participants either heard (verbal suggestion) or watched (social learning) a confederate report pain sensitivity or were told the ointment did not affect pain perception (control). While the nocebo response to pressure pain was induced by observational, not verbal cues, pain catastrophizers who felt less equipped to deal with the pain were more susceptible to the nocebo effect. [Lorber et al. \(2007\)](#) also show that female participants are more receptive to the nocebo effect. In this study, half of the sample viewed a female confederate report various symptoms after inhaling a placebo substance that was described to be a suspected environmental toxin linked to a recent instance of mass psychogenic illness (see explanation below on MPI). As negative expectations about medicines easily develop (i.e., through social modeling side effects in the media, information about side effects and unintentionally by the treating physician) nocebo responses provide a clinical challenge relating to symptom perception ([Faasse and Petrie, 2013](#)).

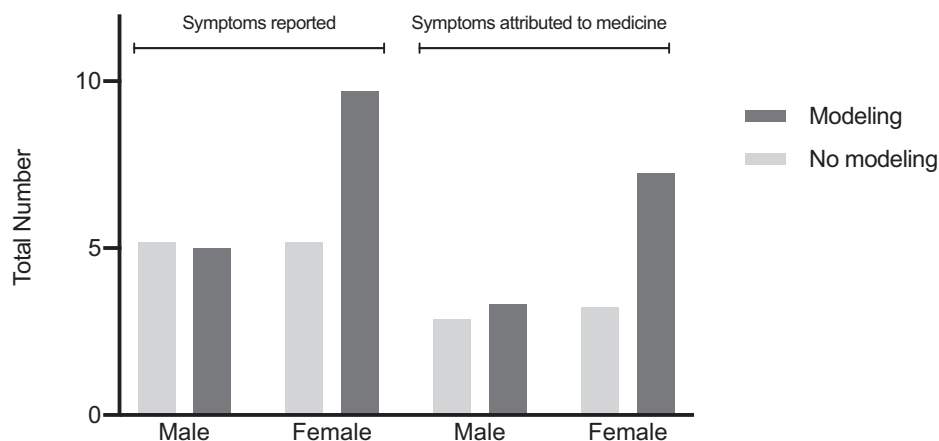


Fig. 3 Bar graph demonstrating the effects of social modeling on symptom reporting and symptoms attributed to the placebo medication. Faasse K., Grey A., Jordan R., Garland S. and Petrie K.J., Seeing is believing: impact of social modeling on placebo and nocebo responding, *Health Psychol.* 34, 2015b, 880–885.

Influence of Media

With the rise of social media and access to information technology, recent literature has demonstrated how new technology can impact symptom perception and interpretation. As the Internet provides the combined benefit of anonymity and increased ease and accessibility to health information, it is unsurprising that searches for symptoms account for roughly 1% of three billion searches daily (Pinchin, 2016). The Internet can also help patients understand and find causal explanations for their symptoms. Mild symptoms can be appraised prior to attending a consultation, thus maximizing efficiency and reducing pressure on health systems (Mueller et al., 2017). In a recent cross-sectional study with 287 adults, 64% reported searching the Internet to understand their acute symptoms (Aoun et al., 2020). Equally, the Web is used as a guide to self-management, by indicating to patients the severity of their symptoms and guiding help-seeking behaviors. Cocco et al. (2018) found that in patients seeking care from an emergency department, 35% had searched for their symptoms online before presenting, and 49% regularly use the Internet to seek medical information.

Of course, access to unlimited knowledge also comes with downsides. Reading unregulated information can enhance the risk for healthy adults to misattribute symptoms, self-diagnose, and ultimately waste healthcare resources. Importantly, this information increases checking behaviors (e.g., for symptoms mentioned in the material) and worry – often known as “cyberchondria” (Singh and Brown, 2016). While searching the Internet for symptoms may be reassuring for some people, it can exacerbate feelings of distress in those already concerned about their health. In a 15-minute Internet search task, looking for health-related information online increased anxiety in participants already concerned about their health (Singh and Brown, 2016). This group was also more likely to search for information about unlikely and serious diseases.

It is important to note that searching for health information online is more common in adults with higher health anxiety, and those with higher educational attainment and trust in Internet-based medical information (Aoun et al., 2020; Petrie et al., 2019). Likewise, searches are also more likely to occur at night-time during the working week (specifically between 3 and 6 a.m.) (Petrie et al., 2019). See Table 1 for the peak times for the 50 most common searches. This is in line with the competition for cues theory, as evenings often provide fewer distractions than during the day. Clinicians should therefore advise people with health anxiety to restrict Google use at night (Petrie et al., 2019). Directing worried patients to credible sources, providing clear information on the duration of the symptoms and indications of what type of care to seek can also be beneficial (Mueller et al., 2017).

On the other hand, media reporting has the ability to increase the reporting of adverse reactions. In an experimental study, researchers randomly assigned participants to view either a television reporting about adverse health effects from Wifi or a control video (Witthoft and Rubin, 2013). Following the video, all participants received a sham exposure to a Wifi signal. More than half (54%) reported symptoms that were attributed to the Wifi signal, however, those who also viewed the experimental film reported being more worried and believed they were more sensitive to electromagnetic fields.

Similar effects are also evident in uncontrolled real-life scenarios. In 2017, patients in New Zealand were transitioned from their branded antidepressant venlafaxine to a generic drug. Following each media coverage about the generic being less effective and causing side-effects, patients reported more complaints, and in particular, those specifically mentioned in the media (MacKrell et al., 2019). The spike in symptom reporting following television media coverage can be seen in Fig. 4. The authors also identified that the medium of the news story influences reporting, whereby the effect of television stories on the reported adverse reactions was 211% greater than print stories (MacKrell et al., 2020a). These findings when taken together show that media reporting plays an important role in symptom reporting by unintentionally promoting catastrophizing thoughts and increased symptom-focused attention (Brascher et al., 2017; MacKrell et al., 2020a; Witthoft and Rubin, 2013).

Cognitive Schemata

The beliefs and ideas individuals hold about an illness also impact symptom reporting by further influencing how the body is attended to. To help organize and process ambiguous somatic information, individuals develop schemas. Schemas influence how individuals respond behaviorally to their perceived symptoms. For example, individuals tend to disregard information that is inconsistent with the activated schema and instead focus on information that fits. Changing a cognitive schema therefore also manipulates how sensations are attended, as individuals encode information that is consistent with their beliefs.

Contextual and situational cues can effectively modify the cognitive schema by drawing selective attention to symptoms (Petrie and Weinman, 2003). This is evident in experimental studies, whereby randomizing participants to view a video relating to pain, cold or itchiness, generates symptoms relating to the schema (Ogden and Zoukas, 2009). Popular examples also include that of medical students' disease and research showing that yawning is contagious. Medical students' disease is when students perceive symptoms that were previously considered normal as signs of having the illness they are studying. For example, students may begin reporting symptoms related to pulmonary disease or coronary and vascular disease after studying these conditions (Deo and Lymburner, 2011). Interestingly, researchers have also examined whether medical students' disease occurs in psychology students (i.e., psychology student syndrome). Although there has been no rigorous evidence to suggest that psychology students experience mental illnesses after studying them, the authors did find that students high in neuroticism may be at a higher risk for self-diagnosing themselves with psychological problems (Candel and Merckelbach, 2003).

Table 1 The most common symptoms searched on Google (Petrie et al., 2019).

<i>Time</i>	<i>Common Symptoms Searched</i>
10pm	
11pm	Cancer Increased appetite Sexual problems
12pm	
1am	Back or neck pain Drowsiness, breathing problems Death Fatigue or loss of energy
2am	Low blood pressure or circulation problems Numbness or tingling sensations Nightmares or abnormal dreams Headache Joint pain or stiffness, thoughts about suicide
3am	Skin rash or itching Diarrhoea Congested or runny nose, painful or irregular menstruation Irritability or nervousness, difficulty urinating Abdominal pain Anxiety or fearfulness Hot flushes Vomiting, chest pain, big toe pain, tendency to develop bruises
4am	Dry mouth Palpitations or irregular heartbeat Hair loss, agitation, abnormal sweating Depressed mood Convulsions or seizures, upset stomach or indigestion Cough, constipation, muscle weakness, fever or increased temperature, insomnia or sleeping problems Dizziness Hangover, memory problems, reduced appetite
5am	Nausea Eye or vision problems Ear or hearing problems Tremor or muscle spasms
6am	Muscle pain
7am	Difficulty concentrating
8am	

Petrie, K.J., Mackrill, K., Silvester, C., Gamble, G.D., Dalbeth, N., Pennebaker, J.W., 2019. OK computer? A time analysis of Google searches about symptoms. *Clin. Psychol. Eur.* 1, 1–10.

Mass Psychogenic Illness

Changes to the cognitive schema can also result in more extensive problems with symptom reporting. Mass psychogenic illness (MPI) or mass hysteria is the rapid spread of symptoms that stem from an environmental trigger and impact members within a social group, although the symptoms do not have an organic cause (Bartholomew and Wessely, 2002). MPI is a prevailing public health problem, with symptoms often fitting into two categories - anxiety hysteria or motor hysteria (Wessely, 1987). Anxiety hysteria is triggered by sudden stress within small groups and includes short-lived symptoms of dizziness, fainting, and headaches. Motor hysteria, which includes the development of twitching, weeping, communication difficulties, and shaking typically takes weeks or months to diminish if it does at all (Wessely, 1987). There are various examples of MPI reported throughout history

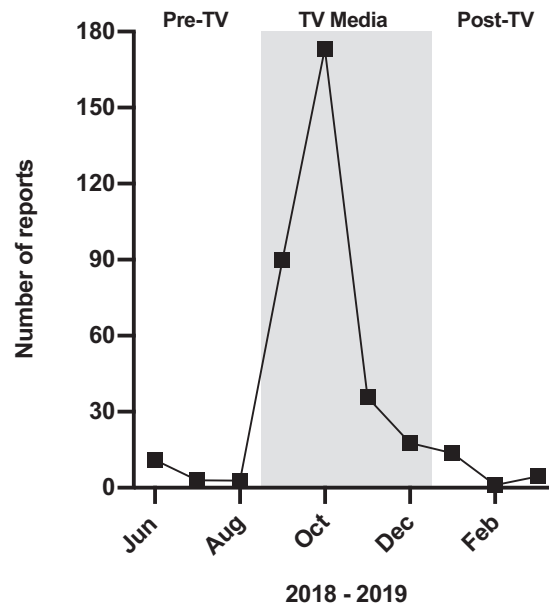


Fig. 4 Graph showing the increase of symptom reporting following television (TV) media coverage. Mackrill K., Gamble G.D. and Petrie K.J., The effect of television and print news stories on the nocebo responding following a generic medication switch, *Clin. Psychol. Eur.* 2, 2020a, e2623.

with symptoms being believed to arise from an array of environmental triggers including tiffin cake, a Pokémon episode, and the tetanus-diphtheria toxoid vaccination.

Although MPI does not directly occur from media reporting, media coverage has been noted as a significant driving force in propelling the development and spread of mass psychogenic illness symptoms. Media reporting can increase an awareness of symptoms and concerns about the given stimulus, which in turn direct attention internally. By rapidly disseminating information, media coverage can therefore intensify and escalate incidents, causing anxiety for those engaging with the media (Vasterman et al., 2005). Commonly, coverage of MPI events includes print media, television reporting, and other mass media campaigns (Kharabsheh et al., 2001). The rise of technology and social media platforms such as Facebook and Twitter provide novel challenges in understanding mass psychogenic illness (Bartholomew et al., 2012).

Interpreting Symptoms

Although symptoms are common, most are transient and benign. Individuals must evaluate each symptom in terms of its potential threat and make behavioral decisions based on the evaluation (Petrie and Weinman, 2003). Misinterpretations of common symptoms can bring an array of consequences. For one, this can become costly for the health system, particularly as people who report more symptoms also engage in more health-seeking behaviors (Petrie et al., 2014). A poor understanding of symptoms can also adversely impact life-threatening preventative health behaviors. For example, asthmatics are frequently prescribed an inhaler to prevent future asthma attacks. Asthmatics who perceive an absence of symptoms to indicate an absence of disease are less likely to adhere to their treatment and participate in fewer self-management tasks such as attending medical appointments (Halm et al., 2006; Schröder et al., 2012). An absence of symptoms can therefore misguide patients to believe their chronic conditions are merely acute episodes.

The (In)accuracy of Symptoms

It is commonly assumed that symptoms accurately indicate physiological changes in the body. However, this is not always the case. Pennebaker (1982) explains that although our heart rate may be stable across different contexts, our perceptions of how fast our heart is beating may be different. Similarly, it is difficult to interpret symptoms accurately. Ambiguous bodily changes such as blood pressure or lung functioning remain more difficult to detect than common symptoms felt in relation to hunger or needing rest. In fact, 60% of adult patients with asthma are unable to discriminate changes in their lung function correctly (Kendrick et al., 1993). In another study, children (6 to 19 years) with asthma were just as accurate as their parents (Yoos et al., 2003). Researchers in a study conducted by Gonder-Frederick et al. (1986) compared symptom checklists and blood glucose levels in a group of patients with diabetes. Findings indicate that most patients missed blood glucose-related symptoms or were monitoring irrelevant symptoms. The disparity between actual and perceived symptoms may be a result of our evolved inability to notice subtle changes or a result of the psychological process related to how we notice symptoms (Broadbent and Petrie, 2007).

Patients with diabetes rely on the close monitoring of their condition, but also use their perceptions of the symptoms to inform treatment. Both insulin-dependent and non-insulin-dependent patients report engaging in some behaviors to reduce or raise blood glucose levels when they feel too high or low (Gonder-Frederick et al., 1986). To complicate self-management, symptoms relating to blood glucose levels are often idiosyncratic, whereby trembling may be an indication of hypoglycemia for one patient but high blood glucose levels for another (Gonder-Frederick et al., 1986).

Delay in Seeking Care

Although symptoms are often considered a nuisance, they are crucial to encouraging help-seeking behaviors and the self-management of chronic conditions. Health seeking behaviors have been extensively studied in a variety of populations, including individuals who have had a myocardial infarction and those with symptoms related to breast cancer. Delays in care-seeking remain a significant health problem, particularly for life-threatening conditions requiring urgent action.

Three widely accepted stages help us understand delays in seeking care. The appraisal delay stage denotes the time when a patient recognizes their symptoms as a sign of ill health. This is followed by the illness delay stage, which accounts for the time between recognizing one is ill and deciding to seek care. Lastly, the utilization delay stage describes the time from the decision to seek care and accessing services (Safer et al., 1979). Patients who experience painful symptoms have both short appraisal and utilization delays due to interpreting the symptoms to be urgent. Symptoms that are inaccurately perceived not to be serious cause significant delays in seeking medical care, which adversely impacts health outcomes.

Of course, delays in seeking healthcare is not a linear process. Although the authors of the three stages identify additional factors that further influence delayed health-seeking, recent literature has also contributed to its understanding. External factors such as the cost of healthcare may deter patients from accessing care (Safer et al., 1979; Smith et al., 2018). Personal reasons also include an absence of the condition historically, multiple presenting symptoms, unrealistic optimism (judging oneself to have a low risk of a negative event) and, less commonly studied – embarrassment (Goldberg et al., 2008; Treloar and Hopwood, 2008).

Symptom perception and interpretation are fundamental factors for the delay in seeking care for myocardial infarction and breast cancer, and remain a significant problem presented in the literature. Seeking care within the “golden hour” (60 minutes) after a myocardial infarction optimizes the chance for survival. Large-scale studies show only 22%–44% of patients seek care within 2 h of the onset of symptoms and a significant portion (20%) wait more than 12 hours (Gartner et al., 2008, Goldberg et al., 2002). Yet the majority of patients (93%) understand that acute myocardial infarction can be deadly (Kentsch et al., 2002).

A significant factor for this delay is the interpretation of presenting symptoms. The mismatch between the symptoms experienced and those expected causes patients to misattribute symptoms and therefore refrain from pursuing care (Horne et al., 2000). Although patients expect symptoms such as central chest pain, radiating arm or shoulder pain, and collapsing, the most common symptoms of myocardial infarction include feeling feverish, chest pain, and radiating pain. Other common factors for not accessing care include the desire to “wait and see” if symptoms change, symptoms improve, or patients not taking symptoms seriously (Kentsch et al., 2002).

Accessing timely care for breast cancer is also a problem, as long delays are associated with worse health outcomes and poor survival. A significant number of patients wait for more than 3 months to seek care (Facione, 1993). As primary prevention of breast cancer is not possible, early detection is advised, which relies directly on how symptoms are identified and interpreted in relation to the disease. Cognitive models of breast cancer generally include painless lumps, meaning that less known symptoms such as nipple discharge or infection and changes in breast shape are misattributed as non-symptomological (unrelated to a medical condition). Women who therefore experience a lump in their breast have significantly shorter delays in seeking care, compared to those who do not (Meechan et al., 2003).

Emotional responses to symptoms, including the distress of finding a lump further influence healthcare-seeking behaviors (Meechan et al., 2003). The impact of emotions is conflicting in literature and is influenced by the nature of the symptoms, expected risk of cancer, and previous personal and familial experiences. Responses such as fear can delay accessing medical care due to avoiding cancer diagnoses or increases seeking behaviors as patients want treatments as early as possible (Khakbazan et al., 2014). However, symptoms that are perceived to cause serious consequences, such as death, motivate patients to see their doctor.

Clinical Applications and Recommendations

A variety of interventions have been developed to combat issues related to symptom perception and interpretation. Interventions predominantly focus on challenging maladaptive attitudes and beliefs toward symptoms and diseases or aim to inform patients on interpreting and managing symptoms. One of the most common interventions reported in the literature is providing patient reassurance.

Reassurance

Providing reassurance to patients can reduce anxiety about symptoms and misappropriate health care use. Reassurance involves reducing patient concerns through non-verbal or verbal mechanisms and can occur through the provision of information and by explaining symptoms or test results. To be effective, the patient’s specific concerns need to be addressed, and symptoms need

to be adequately explained. Sometimes it is useful for an alternative explanation for symptoms to be given when obtaining a negative diagnostic test result (Petrie and Weinman, 2003). In patients undergoing a cardiology diagnostic exercise stress test, researchers examined reassurance after patients obtained standard information, a pamphlet explaining test function and meaning of normal results, or a pamphlet and a discussion about test results prior to getting a stress ECG treadmill test (Petrie et al., 2007). Patients reported being the most reassured in the discussion group. Participants in the discussion group also had the largest reduction of chest pain and took fewer cardiac medications, which was maintained at the 1-month follow-up. See Fig. 5.

It is important to note that not all patients benefit from reassurance. A failure to reassure patients can be counterproductive, by boosting health anxiety and ultimately increasing symptom reporting. Patients with medically unexplained symptoms and patients with hypochondria are particularly unlikely to benefit. It has been proposed that patients with somatization syndromes overestimate the likelihood of medical causes of symptoms and tend to have more catastrophic interpretations (Rief et al., 2006). Physicians can identify and consequently challenge inaccurate estimations through the use of teach-back methods (asking the patient to explain their understanding using their own words). Similarly, patients are also less likely to be reassured from normal test results if they have strong consequence illness beliefs (Gasteiger et al., 2018). Patients who perceive that their symptoms adversely impact their life are less likely to feel reassured, due to seeking an explanation and ultimately treatment for their symptoms. In these patients, physicians may need to address illness beliefs.

Conclusions and Future Directions

Psychological processes play a significant role in symptom perception and interpretation. Ultimately, misperceptions of symptoms influence health outcomes, through guiding crucial health behaviors. Popular theories such as Pennebaker's competition of cues theory and cognitive schema help us to understand how contexts and cognitions can influence symptom perception. We have also considered the importance of information technology and social media, which provide new challenges for symptom appraisal. Information technology, such as the Internet, can help with understanding symptoms but may also fuel health-related anxiety and misattribution. Media reporting and telecommunication can also drive the spread of mass psychogenic illness and induce nocebo responses. As technology advances, novel obstacles will undoubtedly emerge.

Evidently, more research is needed in this important area. More extensive understanding of how psychological processes, such as negative affect, culture, and context influence symptom perception is needed. There is clearly a significant amount of interindividual and intraindividual variation in symptom perception, but this still needs to be fully understood. Better knowledge is likely to improve the design of health interventions (Petrie and Broadbent, 2019). Petrie and Weinman (2003) have called for more research on symptom appraisal, particularly in laboratory settings to further understand the meaning of symptoms and how combinations of symptoms influence health behaviors. Interventions that focus on adapting unhelpful or inaccurate perceptions of illness also remains an emerging area in the literature (Petrie and Weinman, 2012). Bingel (2020) further argues that researchers should explore how treatment expectations can be addressed in various patient populations, and to examine how much information is actually needed to form expectations.

As information technology rapidly progresses, research is needed to keep up with advancements. This would enable health professionals to understand novel problems and develop strategies. Challenges related to delay in seeking medical care for life-threatening

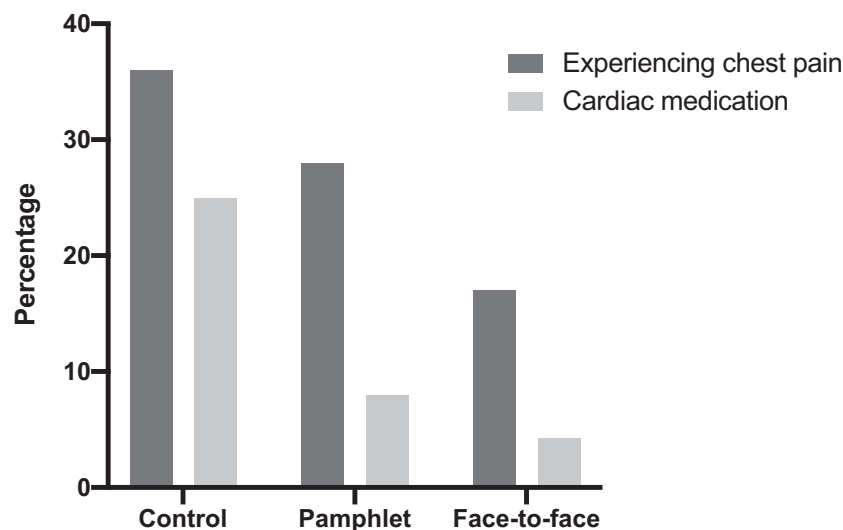


Fig. 5 Graph showing differences in chest pain and cardiac medication at 1-month. Petrie, K.J., Muller, J.T., Schirmbeck, F., Donkin, L., Broadbent, E., Ellis, C.J., Gamble, G., Rief, W., 2007. Effect of providing information about normal test results on patients' reassurance: randomised controlled trial. *BMJ* 334, 352.

illnesses persist. Further investigation is needed to understand the psychological processes that occur at each stage of delay and how individuals progress (Petrie and Weinman, 2003). It is known that information technology influences how individuals appraise symptoms, but more research is needed to elucidate its role in treatment delays.

Healthcare professionals can utilize lessons from research on patient reassurance to improve symptom reporting. This should be employed with careful consideration as many patients will not gain comfort from negative diagnostic test results and will continue to seek healthcare. Contrariwise, patients with a difficulty in interpreting symptoms, and individuals who delay seeking care for life-threatening conditions present other challenges. More work is needed to elucidate the psychological processes involved in symptom perception, to develop successful and cost-efficient interventions that change beliefs and misattributions, decrease delays in seeking care, and improve perceptual accuracy.

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