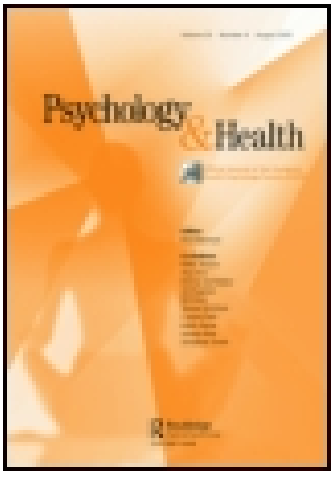

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Do individual differences in intolerance of uncertainty affect health monitoring?

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Do individual differences in intolerance of uncertainty affect health monitoring?

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Abstract
Researchers have postulated that individual differences in intolerance of uncertainty (IU) may affect people's health behaviours. Study 1 ($N = 147$ university students) supports this proposition showing that higher IU is associated with higher monitoring (seeking threat-relevant information). Study 2 ($N = 117$ university students) experimentally manipulated IU to ensure that the association is not due to other related constructs such as anxiety or worry. Results show that inducing high IU led to increased monitoring as reflected by higher scores on an index of monitoring measures. Wanting information about the health threat in order to reduce their uncertainty was an independent predictor of monitoring and did not mediate the relationship between IU and monitoring. Findings suggest that high IU induces people to increase their monitoring; an adaptive strategy when the health threat can be reduced through this behaviour.

Keywords: *Intolerance of uncertainty, monitoring, HPV, health threat*

Introduction

When people are faced with a potential health threat, a key element affecting their subsequent behaviour is how certain or uncertain they feel that the threat will actually ensue. For example, a woman faced with the certain health threat of a positive breast cancer diagnosis is likely to comply with the physician recommended treatments. In contrast, it is more difficult to predict whether a woman who is faced with the uncertain health threat of a family history of breast cancer will go for regular mammograms or not. Uncertainty refers to the circumstance whereby a particular event or situation cannot be structured or categorized because of insufficient information (Budner, 1962). Thus, uncertainty may result from a lack of information or may arise when there is no possible

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information to adequately resolve the uncertainty. In the above example, there is no test that could provide certain information about whether or not a woman with a family history of breast cancer will develop breast cancer. Uncertainty about a health threat may refer to any or all aspects of the health condition. For example, there may be uncertainty with respect to the seriousness of the condition, one's vulnerability or risk, treatment efficacy and prognosis (Mishel, 1981). The focus of the present research is on uncertainty whereby there is no possible information that could provide permanent certainty. For example testing positive for the Human Papillomavirus (HPV) does not mean that one will develop cervical cancer for certain; however the potential health consequences may be prevented by following screening recommendations.

Study 1

Past research exploring the role of uncertainty in health can be divided into two domains. First, research has examined the role of uncertainty caused by particular situations, for example, the uncertainty produced when people find out that they possess a certain gene that might, or might not result in a disease (e.g., Gwyn, Vernon, & Conoley, 2003). Situational uncertainty of this kind can lead to psychological distress, such as increased anxiety, particularly when that uncertainty remains unresolved (Maissi et al., 2004). In fact, one study found that women at increased risk for ovarian cancer experienced high levels of psychological distress equivalent to that experienced by breast cancer patients (Schwartz, Lerman, Miller, Daly, & Masny, 1995). Although these women were only *at risk* for cancer, that is, whether or not they would develop cancer was uncertain, they experienced distress analogous to women with cancer.

A second domain of research examining uncertainty has looked at individual differences in intolerance of uncertainty (IU) (e.g., Freeston, Rhéaume, Letarte, Dugas, & Ladouceur, 1994). In addition to the effect of situational uncertainty, people may be more or less affected by the unknown outcome of a health threat and these differences could explain additional variance in behaviours such as information seeking and adherence to screening appointments. Intolerance of uncertainty refers to cognitive, emotional, and behavioural reactions to uncertainty (Freeston et al., 1994). It differs from situational uncertainty in that it refers to a trait of the individual rather than a characteristic of the situation. More specifically, high intolerance of uncertainty refers to "a predisposition to react negatively to an uncertain event or situation, independent of its probability of occurrence and its associated consequences" (Ladouceur, Gosselin, & Dugas, 2000, p. 934). Thus, a person with a high intolerance of uncertainty would view uncertain situations as unacceptable and highly aversive in contrast to a person with low intolerance of uncertainty who would not feel disturbed by these same situations (Freeston et al., 1994).

It may be helpful in understanding the construct of IU to differentiate it from other related but distinct constructs. First, neuroticism refers to a broad and stable personality trait characterized by chronic negative emotions

(e.g., sadness, anxiety, guilt) and characteristics such as low self-esteem and preoccupation (Smith, Pope, Rhodewald, & Poulton, 1989). One study found that neuroticism had a causal effect on the development of intolerance of uncertainty, which in turn had a causal effect on worry (Sexton, Norton, Walker, & Norton, 2003). The authors suggested that neuroticism represents a higher-order factor common to many people and disorders whereas intolerance of uncertainty is a more specific factor with its own effects such as the development of worries. Indeed, research by Dugas and colleagues (e.g., Dugas & Ladouceur, 2000; Ladouceur et al., 2000) supports the causal role of IU in the development and maintenance of worry.

Thus, the second important distinction is between worry and IU. Buhr and Dugas (2002) distinguish between IU and worry by defining worry to be a *mental act* whereby a person thinks repeatedly about a situation and the possible negative outcomes. In contrast, IU is considered to be a *filter* through which the environment is viewed and uncertainty is regarded as unacceptable. In fact, Dugas, Freeston and Ladouceur (1997) demonstrated differential patterns of correlations for worry and IU on performance in specific behavioural tasks varying in ambiguity. Their findings showed that IU was negatively correlated with performance on moderately ambiguous tasks whereas worry showed no correlation. Additionally, research demonstrates that worry is closely related to other mood states so it is not surprising to find high correlations between intolerance of uncertainty and worry ($r = 0.63$), anxiety ($r = 0.57$), and depression ($r = 0.52$) (Freeston et al., 1994). Although the correlations are moderate to high, there is still unique variance attributed to IU that cannot be captured by these other variables.

IU and monitoring

Although prior research has focused on the impact of uncertainty on psychological functioning, uncertainty may also affect health behaviours. Previously, two researchers have postulated a role for individual differences in intolerance of uncertainty either explicitly (Krohne, 1993) or by implication (Miller, Summerton, & Brody, 1988) in explaining peoples' health seeking behaviours when faced with a threatening situation. First, Miller (1980) identified "monitors" as a group of individuals who scan for threat-relevant information when faced with a health threat. For example, high monitors may request additional information about a test result compared to low monitors who do not actively seek out threat-relevant information and may distract themselves rather than think further about a test result.

Several studies demonstrate an association between high monitoring and increased psychological distress when faced with a health threat (e.g., Miller et al., 1988; Miller, Roussi, Caputo, & Kruus, 1995). Research suggests that high monitors tend to overestimate the potential severity, likelihood, and unpredictability of threatening events compared to low monitors (e.g., Miller et al., 1988; Schwartz et al., 1995). Similarly, high monitors are more likely to process

ambiguous information as highly threatening and to ruminate on this information leading to exaggerated risk perceptions compared to low monitors (Miller et al., 1995). Taken together, this research suggests that the trait tendency to monitor may lead to an exaggeration of the seriousness of a situation resulting in more psychological distress.

If high monitoring is associated with distress, why then are people motivated to do it? Miller et al. (1988) proposed that high monitors may not be interested in information purely for its instrumental value. In fact, their study of primary care patients found that high monitors wanted more tests, information, and counselling than their lower scoring counterparts, yet they desired a more passive role in their health care, that is, they preferred their physician to make the decisions regarding their medical treatment. In addition, high monitors scanned for information even when the health threat was uncontrollable. The authors interpreted these findings to mean that monitors may be motivated to seek information because of a desire to reduce uncertainty rather than out of a desire for control (Miller et al., 1988). However, they could not support this assertion with empirical evidence because they did not directly ask patients why they monitored.

Secondly, Krohne (1993) proposed a similar construct to monitoring that he called ''vigilance.'' Individuals characterized by ''vigilance'' cope by constantly seeking out and processing threat-related information in order to reduce the uncertainty that is inherent in most threatening situations. In contrast to Miller, Krohne makes explicit the point that vigilance is carried out *in order to reduce uncertainty*. A study by Hock, Krohne and Kaiser (1996) found that highly vigilant individuals show biases in both their attention (showing shorter response latencies to ambiguous compared to unambiguous stimuli) and interpretation (by rating ambiguous situations as more unpleasant than unambiguous situations) of ambiguous information as threatening compared to low vigilant individuals. However, the authors did not provide empirical evidence to support Krohne's assertion that vigilants processed or searched for information in order to reduce their uncertainty.

Thus, both researchers have in effect suggested that searching for threat-related information may be driven by the desire to reduce uncertainty. Despite the fact that this theoretical explanation makes intuitive sense, it has not been empirically tested. Furthermore, although the two domains of situational and individual differences in intolerance of uncertainty may be examined separately; it is also necessary to examine their effects simultaneously to provide a richer understanding of how differences in uncertainty predict health behaviours.

One study has examined a similar construct to IU, called uncertainty-orientation (Sorrentino & Short, 1986), and its effect on health compliance, which is one feature of monitoring (Brouwers & Sorrentino, 1993). The researchers classified individuals as either ''uncertainty-oriented'' (those who deal directly with uncertainty, are motivated to reduce it, and are capable of resolving it) or ''certainty-oriented'' (those who feel threatened by information that contains uncertainty or is inconsistent and therefore avoid it). They found

that uncertainty-oriented individuals were more likely to seek out health information compared to certainty-oriented individuals (Brouwers & Sorrentino, 1993). Their findings suggest that individual differences in information seeking may be motivated by individual differences in whether people will approach or avoid uncertainty. This conceptualization is different from an evaluation of one's *intolerance* of uncertainty (IU) because IU focuses on the psychological effects of given uncertainties (like health threats) on the individual (e.g., the activation of coping efforts such as information seeking) whereas uncertainty-orientation focuses on individual differences in the desire to resolve or avoid uncertainty.

Case study for uncertainty: HPV

The sexually transmitted infection (STI), Human Papillomavirus (HPV) is ideal for studying the effects of uncertainty on monitoring because it is affected by many sources of uncertainty and the potential health risks can be reduced through cervical cancer screening (monitoring). HPV-DNA has been found in up to 99.7% of cervical cancer cases worldwide leading researchers to conclude that certain strains of HPV *cause* cervical cancer (Walboomers, et al., 1999).

The first source of uncertainty concerning HPV is that women may not know that they carry the virus because it can stay hidden for years after it was first acquired and the immune system is equipped to clear the infection on its own (Ho, Bierman, Beardsley, Chang, & Burk, 1998). Secondly, it remains unknown as to what extent HPV can be prevented by using condoms and what the probabilities are that HPV can be transmitted through skin-to-skin contact with infected areas and through other forms of contact such as touching infected towels (Manhart & Koutsky, 2002). Thirdly, given that there is no clear means of full protection, there is a high level of uncertainty as to how to proceed in one's sexual activities to prevent transmission.

Some research suggests that the heightened negative affect experienced by women after receiving a positive HPV result may be related to uncertainty. Indeed, not knowing whether a positive HPV result will or will not lead to negative health consequences (i.e., cervical lesions) has been associated with higher levels of anxiety in women (Maissi et al., 2004). In addition to causing distress, the uncertainty inherent in HPV may affect monitoring behaviours. Although this hypothesis has yet to be tested, Funke and Nicholson (1993) found that women receiving an abnormal Pap test who agreed with the statement ''the uncertainty about my Pap test makes me nervous'' were four times more likely to comply with health providers' recommendations than women who disagreed with the statement. These results suggest nervousness associated with uncertainty over the potential health consequences of a positive test result may in fact lead to adaptive rather than maladaptive behaviour.

Individual differences such as IU may elucidate why some people are more likely to monitor than others. Identifying individual differences that may increase

people's vulnerability to psychological distress and affect adherence to screening recommendations is important information for health care providers who communicate test results. The goal of the current two studies is to clarify the relationship between IU and monitoring so as to better understand what motivates these behaviours.

Study 1 examined in a descriptive design whether individual differences in IU are associated with differences in monitoring. Research on IU has focused largely on its relationship with anxiety disorders (e.g., Dugas & Ladouceur, 2000). Thus, there is a paucity of research examining the effect of IU on health behaviour. In the current study, we expect that higher IU will be associated with higher monitoring. This hypothesis was examined as part of a larger study examining HPV knowledge in university women.

Method

Participants and procedure

Participants were recruited through the McGill University Psychology subject pool and received course credit for their participation, or they were recruited as volunteers from McGill undergraduate classes. Our research questions were added to a larger study examining cervical cancer and HPV knowledge, thus our sample consisted of 147 (mean age = 20.74, $SD = 1.72$) women. Participants were asked to complete a seven-page questionnaire including the Intolerance of Uncertainty Scale (short form) and behavioural monitoring questions. Participants reported demographic information such as frequency of condom use to establish STI risk that may affect monitoring. Finally, participants were debriefed and provided an information sheet answering frequently asked questions about HPV.

Measures

Intolerance of Uncertainty Scale – short form. (IUS-S; Buhr, Dugas, Dorval, & Simard, unpublished data, 2004).The Intolerance of Uncertainty Scale (IUS; Buhr & Dugas, 2002) includes 27 items that assess emotional, cognitive and behavioural reactions to ambiguous situations, implications of being uncertain and attempts to control the future. High scores reflect high IU. A principle components analysis revealed a four-factor structure: (1) uncertainty leads to the inability to act (e.g., "uncertainty stops me from having a strong opinion"); (2) uncertainty is stressful and upsetting (e.g., "uncertainty makes life intolerable"); (3) unexpected events are negative and should be avoided (e.g.,"I can't stand being taken by surprise") and (4) being uncertain is unfair (e.g., "I can't stand being undecided about my future"). All factors were highly correlated with the overall IUS score with correlations ranging from 0.82 to 0.94 (all $p < 0.001$). Participants rate the items on a five-point scale from 1 (*not at all characteristic of me*) to 5 (*entirely characteristic of me*). The IUS has excellent internal consistency ($\alpha = 0.94$), good test-retest reliability over a five-week

period ($r = 0.74$; $p < 0.001$) and convergent validity with measures of worry and divergent validity with measures of anxiety and depression (Buhr & Dugas, 2002; Freeston et al., 1994).

The IUS-S includes 13 of the original items and was developed as a brief instrument to be used in health research. The IUS-S has excellent internal consistency ($\alpha = 0.96$, $p < 0.001$) and item-total correlations ranged from 0.65 to 0.88. Factor analysis revealed a one-factor solution. Test-retest reliability at 12 months was low in this validation study ($r = 0.48$, $p < 0.001$) (Buhr et al., unpublished data, 2004). However, less than 50% of the original respondents who participated in the study were re-tested (M. Dugas, personal communication, March 6, 2006). Given that the test-retest reliability was acceptable for the original IUS, that the short-version has excellent psychometric qualities aside from test-retest reliability (which may not have been adequately assessed because only a small portion of the original sample was retested) and given that our measures were added to an already lengthy battery of questionnaires, we elected to use the short version of the IUS.

Behavioural measures of monitoring. Monitoring behaviours were assessed in terms of information seeking and behavioural intentions measured on a scale ranging from 1 (*extremely unlikely* or *strongly disagree*) to 7 (*extremely likely* or *strongly agree*). Examples include: ''How likely is it that you will talk with others about HPV?'' and ''How likely is it that you will ask your partner to get tested for HPV?'' Participants were asked an open-ended question separately for a positive HPV result and for a negative HPV result: ''How much time should a physician/nurse devote to discussing the results of your HPV test with you?'' Wanting their health provider to spend more time discussing their result was assumed to reflect higher monitoring.

Results

Reliability

The internal consistency measured by Cronbach's alpha for the IUS-S was $\alpha = 0.93$. A monitoring score was calculated for the six behavioural monitoring questions. One item was subsequently excluded based on low inter-item correlations with the other items and because the reliability of the scale increased when the item was deleted. The internal consistency measured by Cronbach's alpha of the final behavioural monitoring measure was $\alpha = 0.65$.

Relationship between IU and monitoring

The hypothesis that higher IU is associated with higher monitoring was assessed by correlations (Table I). For behavioural monitoring, the higher people scored on the IUS-S the higher their total monitoring score. Similarly, correlations between IUS scores and the amount of time participants thought physicians/nurses should spend discussing their HPV result were significant for both a

Table I. Correlations between intolerance of uncertainty (IU) and monitoring ($N = 147$).

	IU score	Behavioural monitoring	Time spent discussing positive HPV result
Behavioural monitoring	0.19*		
Time spent discussing positive HPV result	0.23**	0.20*	
Time spent discussing negative HPV result	0.23**	0.26**	0.62**

**$p < 0.01$, *$p < 0.05$.

positive and a negative result. The higher the people's IU, the more time they thought physicians/nurses should spend discussing their positive or negative HPV result.

Discussion

The goal of Study 1 was to demonstrate an association between individual differences in IU and monitoring. Previous research has shown that situational uncertainty can lead to psychological distress such as nervousness, which may in turn lead to increased compliance with medical recommendations (e.g., Funke & Nicholson, 1993). However, this study is the first to examine the association between IU and monitoring. Consistent with the initial hypothesis, women with a higher IU were more likely to monitor.

Study 2

The purpose of Study 2 is threefold: (1) to assess perceived situational uncertainty, (2) to test Krohne's hypothesis that people with high IU monitor in order to reduce their uncertainty, and (3) to test whether high IU causes monitoring. Manipulating low/high intolerance of uncertainty is the most direct way to clarify the causal relationship between IU and monitoring and attempt causal inferences.

Previously, two studies have manipulated IU to examine the relationship between IU and worry (Ladouceur et al., 2000; Grenier & Ladouceur, 2004). For example, in one study, the researchers designed a computerized roulette game where IU was increased or decreased by manipulating whether the uncertainty of winning the game was acceptable or unacceptable to the individual. The results showed that participants in the high IU condition worried more than those in the low IU condition (Ladouceur et al., 2000). Thus, these studies demonstrate successful attempts at experimentally manipulating IU.

The current study employs a different methodology for manipulating IU: a linguistic manipulation developed by Salancik and Conway (1975) coupled with written false feedback based on responses to the questionnaire. The linguistic manipulation has previously been shown to manipulate cognitive constructs such as religious attitudes (Salancik & Conway, 1975). In addition, the procedure has

been shown to successfully manipulate self-perceptions such as the perception of self-control in dieting (Polivy & Herman, 1991), perception of oneself as a ''close, intimate partner'' in a relationship (Broemer & Blumle, 2003), and in academic performance (Ehrlinger & Dunning, 2003).

The linguistic manipulation of IU is based on Bem's self-perception theory that states that individuals will infer their attitudes based on information derived from their behaviour (Bem, 1972). Salancik and Conway (1975) further proposed that individuals will infer their attitudes by generating and reviewing relevant information from the past and present, particularly by using information made most salient to them at that time. Accordingly, when a person responds positively or negatively to a statement describing an attitude or behaviour, he or she will generate cognitions consistent with their endorsement. Salancik and Conway (1975) inferred that one can manipulate these cognitions by changing the probability by which a person will endorse a statement.

The manipulation assumes that people are more likely to endorse that something is *occasionally* rather than *frequently* true of themselves. In the original study examining religious attitudes, participants in the ''pro-religious'' condition who were given items paired with the word ''occasionally'' (e.g., ''I occasionally attend a church or synagogue'') responded positively to more items compared to participants in the ''anti-religious'' condition who were given items paired with the word ''frequently'' (e.g., ''I frequently attend a church or synagogue''). Importantly, to further assess the efficacy of their manipulation, the authors correlated participants' self-perceptions about how religious they were (''To what extent are you religious?'') with their endorsement of religious behaviours. The pattern of correlations indicated that endorsing pro-religious statements was positively correlated with self-perceptions of religiosity and endorsing anti-religious statements was negatively correlated. Thus, the results showed that participants could be led to *perceive themselves* as more or less religious based on how they were asked about their previous religious behaviours (Salancik & Conway, 1975).

The second part of our manipulation provided false feedback on how well an individual tolerates uncertainty based on the number of statements endorsed in the manipulated IUS. Numerous studies have shown that providing false feedback can successfully manipulate self-perception, for example in state self-esteem (Rector & Roger, 1997), self-efficacy (Sana, 1992) and perceived intelligence (Fein & Spencer, 1997). For example, Fein and Spencer (1997) randomly gave participants either positive or negative feedback about their performance on an intelligence test. Their manipulation check revealed that participants believed the feedback and that it significantly affected their state self-esteem.

We predict that inducing high IU will cause increased monitoring and inducing low IU will reduce monitoring. We also predict that participants who are induced to be more intolerant of uncertainty will be more likely to endorse the reason why they monitor as a desire to reduce uncertainty compared to participants with lower IU.

Method

Participants

Participants were recruited through the McGill University Psychology subject pool and received course credit for their participation, or through an advertisement on the McGill University website and received financial compensation. Eligible participants had to be sexually active (having contact with another person's genitals) in the past or present to ensure they would feel at risk for the sexually transmitted infection (STI) introduced in the study. Sixty-three men (mean age = 22.30 years, $SD = 4.05$) and 101 women (mean age = 20.94 years, $SD = 3.31$) participated in the study.

Procedure

Participants completed an online consent form and the *Miller Behavioral Styles Scale* (MBSS; Miller, 1980) on a secure website approximately one week prior to the laboratory session. Scores on the MBSS served as a baseline and were later used as a control for MBSS scores after the experimental manipulation. Participants were randomly assigned to either a high or low intolerance of uncertainty (IU) condition. The manipulation consisted of two parts: (1) a linguistic manipulation of the IUS scale and (2) false feedback about one's IUS score.

Firstly, in the high IU condition questionnaire items were combined with the qualifier "occasionally". In the low IU condition, items were paired with the qualifier "almost always". Thus, participants in the high IU condition were expected to endorse a high number of statements compared to those in the low IU condition.

Secondly, participants summed the number of statements they endorsed as "true" on the IUS and read their corresponding feedback. The cutoff points for receiving the feedback were manipulated in accordance with each condition to increase the probability of receiving the correct feedback for the condition. Thus, participants in the high IU condition only had to endorse five or more statements in order to receive the following feedback (based on the definition of IU by Freeston et al., 1994): "You do not tolerate uncertainty well. You find uncertainty stressful and upsetting and avoid uncertain events at all costs. You feel that being uncertain is unfair and can lead to the inability to take action." In the low IU condition participants had to endorse 15 or less statements in order to receive the opposite feedback.

Following the manipulation, participants were subsequently introduced to a fictitious STI, Bacillosis Virus (BV) designed to have similar uncertain properties to HPV. Participants were asked as a manipulation check for situational uncertainty, "how certain do you feel right now that you do *not* have BV?" on a scale of 1 (*not at all certain*) to 7 (*extremely certain*). We used a fictitious STI in order to, first, control for the amount of exposure and existing knowledge about the STI, and second, to avoid the ethical problem that information about a real STI could lead to anxiety and worry over carrying or contracting the infection.

Participants completed behavioural measures of monitoring, the MBSS, and provided demographic information. Upon completion, participants were directed to a separate room for debriefing and were given the opportunity to pick up health information sheets including a sheet about BV. The experimenter recorded whether or not participants took a BV sheet as a final measure of monitoring. Participants were then informed that the STI, BV, is fictitious and that the uncertainty feedback was a manipulation. Finally, participants reported to what extent they believed that the STI, BV, was real in order to check the believability of the cover story.

Measures

Intolerance of Uncertainty Scale. (IUS; Buhr & Dugas, 2002). The properties of this scale were described in Study 1. Participants endorsed items by responding "true" or "false." A higher number of true statements reflected higher intolerance of uncertainty.

Miller Behavioral Styles Scale. (MBSS; Miller, 1980). The MBSS is composed of four scenarios that present a threatening situation (e.g., undergoing a dental procedure) followed by statements representing methods of coping, four of which reflect monitoring (e.g., "I would ask the dentist exactly what to do"). Participants check as many statements as they like. A monitoring score was calculated by summing the number of monitoring statements endorsed, ranging from 0 to 16. The MBSS has shown good internal consistency (e.g., $\alpha = 0.80$ in Shiloh, Ben-Sinai, & Keinan, 1999) and good discriminative validity (e.g., Miller, 1987).

Behavioural measures of monitoring. Monitoring behaviours were assessed in terms of intentions and whether or not participants took an information sheet on BV. Intentions were measured with 7 items on a scale ranging from 1 (*extremely unlikely*) to 7 (*extremely likely*). Examples include: "How likely are you to talk with others about BV?" and "If your partner has not been tested for BV, how likely are you to ask him/her to get tested?" Scores on these items were summed to create a behavioural monitoring score ranging from 1 to 49. Participants were also given the opportunity to take information sheets on different STIs, including one on BV, and on general health issues (e.g., stress). Whether or not they took a BV sheet was recorded as a separate measure of behavioural monitoring.

Process variable. To assess Krohne's hypothesis that people monitor in order to reduce their uncertainty, participants were asked "I want to get more information about BV to find out for sure whether or not I have the virus". Participants indicated the extent to which they agreed with the statement on a scale of 0 (*not at all*) to 4 (*very much*).

Results

Participants

Eight participants were excluded because they completed a version of the questionnaire package that was missing the manipulation check. An additional 15 participants were excluded because they endorsed too many or too few items to receive the correct feedback for the condition to which they were assigned (e.g., a participant in the low IU condition endorsed many statements as true and therefore received the high IU feedback). Finally, 24 participants reported that they felt ''extremely certain'' that they did not have BV and were excluded under the assumption that individual differences in IU must be activated by situational uncertainty. There were no significant differences in age, gender, or IUS scores between the excluded and included participants. The final sample included 48 men (mean age = 22.65 years, $SD = 4.42$) and 69 women (mean age = 21.13 years, $SD = 3.68$).

Manipulation and deception checks

An independent samples *t*-test showed that participants in the high IU condition ($M = 15.66, SD = 5.30$) endorsed a significantly higher number of true statements compared to those in the low IU condition ($M = 6.13, SD = 4.15$), $t(140) = 11.86, p < 0.001$. Owing to the feedback component of the manipulation, we were not able to obtain a direct manipulation check (''how well do you tolerate uncertainty?'') because it would not yield valid results as participants would be likely to simply repeat what they were just told in the feedback. In addition, this question might arouse suspicion of our manipulation. In line with previous studies (e.g., Polivy & Herman, 1991; Broemer & Blumle, 2003) we therefore assessed the success of the manipulation by the mean differences in the number of endorsed statements, as reported above.

The study aimed to place everyone under conditions of uncertainty and to only manipulate individuals' intolerance of uncertainty. Thus, we did not expect or find differences between conditions on the extent to which participants felt uncertain about whether or not they had BV ($M = 4.65$, $SD = 1.90$). There were also no significant differences between conditions on the extent to which participants believed that the STI, BV, was real ($M = 4.45$, $SD = 2.10$).

Reliability

For all analyses, IU was measured using scores from the Intolerance of Uncertainty Scale (IUS; Buhr & Dugas, 2002) where higher scores reflect higher intolerance of uncertainty. The internal consistency measured by Cronbach's alpha for the IUS was $\alpha = 0.90$. To assess individual differences in monitoring, the Miller Behavioral Styles Scale (MBSS) was administered to participants before the experiment (MBSS pre-manipulation) and following the manipulation (MBSS post-manipulation). High scores indicate more monitoring. The internal consistency measured by Cronbach's alpha for the MBSS

Table II. Regression analysis for effect of IU and desire to reduce one's uncertainty on monitoring.

Variable	β	SE_β	F	p
Criterion:				
Monitoring index			45.17	<0.01
Predictors:				
IU Condition	−0.66**	0.26		
Desire to reduce uncertainty	0.77**	0.12		

**$p \leq 0.01$

pre-manipulation was $\alpha = 0.70$ and for the MBSS post-manipulation, $\alpha = 0.69$. These alpha levels are consistent with other research that found alpha levels of $\alpha = 0.70$ and.76 for the monitoring subscale (e.g., Miller, Rodoletz, Schroeder, Mangan, & Sedlacek, 1996). A total monitoring score was calculated based on responses to the behavioural monitoring questions described in the methods section. The internal consistency of the behavioural monitoring measure was $\alpha = 0.86$.

Effect of IU on monitoring

The hypotheses that higher IU leads to higher monitoring and that participants in the high IU condition would be more likely to seek information because they want to reduce their uncertainty were assessed using linear regression analyses (Table II). We elected to use regression analyses in order to simultaneously examine the contribution of a dichotomous (IU condition) and a continuous (seeking information to reduce one's uncertainty) variable to monitoring. As we did not have specific hypotheses on how the individual monitoring variables would differ, the hypothesis was tested by creating a monitoring index score. This index is statistically more reliable than running analyses with the separate monitoring variables. Standardized scores were calculated and summed for the three monitoring dependent variables: (1) MBSS (consisting of scores on the MBSS post-manipulation), (2) total behavioural monitoring scores (consisting of seven questions), and (3) whether or not the participant took an information sheet on BV. Standardized MBSS pre-manipulation scores were entered into the first step of the regression analysis to control for baseline monitoring prior to the manipulation. The hypothesis was supported such that people in the high IU condition monitored more ($\beta = -0.66$, $p < 0.01$) and the more people wanted information to reduce their uncertainty, the more they monitored ($\beta = 0.97$, $p < 0.01$), $F = 45.17$, $p < 0.01$. Thus, the results indeed show that higher IU leads to higher monitoring and that people with a higher IU are more likely to seek information in order to reduce their uncertainty compared with people with lower IU.

The mediational hypothesis proposed by Krohne (1993) and Miller et al. (1988) that people with a high IU seek information in order to reduce their uncertainty was examined using the monitoring index as the dependent variable.

The mediational hypothesis was not supported by the current data. According to Baron and Kenny (1986), for mediation to exist it is necessary that the predictor (IU condition) is correlated with the proposed mediator (desire to seek information to reduce one's uncertainty). No correlation between the predictor and the proposed mediator was found in the data ($p = 0.29$) and thus no further investigation of the mediation model was warranted. It can therefore be concluded that the desire to seek information to reduce one's uncertainty does not mediate the relationship between IU and monitoring. Rather, these two variables appear to be independent predictors of monitoring.

Discussion

The first hypothesis was supported such that participants in the high IU condition scored higher on an index of monitoring compared to participants in the low IU condition. Krohne (1993) and Miller et al.'s (1988) proposition that people monitor in order to reduce their uncertainty was not supported. Rather, individual differences in IU and seeking information in order to reduce one's uncertainty were found to be independent predictors of monitoring.

One possible explanation for their independence is that IU is an individual difference assumed to remain relatively stable across situations. In contrast, the motivational factor of wanting to reduce one's uncertainty may be situation-dependent and therefore apply regardless of individual differences in IU, hence the lack of correlation between the two variables. For example, a woman with a low IU may be less likely to request additional information about a test result; however she may report that *if* she were to request additional information, it would be to reduce her uncertainty. Another woman, high in IU, may be more likely to request information, but may be motivated by a desire to reduce her distress. Thus, there are several reasons why high IUs monitor and the desire to reduce uncertainty may not always be one of them. The opposite can also be true; there are various determinants for wanting information to reduce one's uncertainty and IU does not have to be one of them.

The finding that experimentally induced higher IU leads to higher monitoring is a contribution to the literature. Few researchers have attempted to experimentally manipulate this construct in the past and as discussed previously, the literature examining individual differences in IU has focused on their effect on psychological distress (e.g., Dugas & Ladouceur, 2000).

The finding that the motivation to seek information to reduce one's uncertainty predicts higher monitoring is consistent with prior research (e.g., Hurley, Miller, Costalas, Gillespie, & Daly, 2001; Gwyn et al., 2003). For example, one study found that reduction of uncertainty was the factor most strongly associated with interest in prophylactic oophorectomy (the surgical removal of the ovaries) in women with a family history of ovarian cancer (Hurley et al., 2001). This research suggests that the desire to reduce uncertainty increases monitoring.

General discussion

The goal of the present research was to examine the relationship between intolerance of uncertainty and monitoring in both a cross-sectional and experimental design in order to better understand what motivates monitoring behaviour. Study 1 showed that higher IU is associated with higher monitoring. However, this study did not assess perceived situational uncertainty; some people may have felt more uncertain about whether or not they have HPV and this may have influenced their tendency to monitor, in addition to their respective IU. In addition, this initial study did not evaluate Krohne's hypothesis regarding why people with high IU monitor, i.e., that they monitor in order to reduce their uncertainty. Finally, due to the correlational study design, we could not assess the causal effects of IU on monitoring. Study 2 however, used an experimental design to address the aforementioned questions. Its results showed that experimentally induced IU causes higher monitoring and that wanting information about the health threat in order to reduce one's uncertainty was an independent predictor of monitoring and did not mediate the relationship between IU and monitoring.

Certain limitations to the design of Study 2 merit further consideration and caution when interpreting the findings. Firstly, although the results suggest that the manipulation of IU was successful, we cannot be certain that it was only IU that was induced by our manipulation and not additional variables such as worry or anxiety. This limitation is akin to that found in previous studies that manipulated IU (e.g., Ladouceur et al., 2000; Grenier & Ladouceur, 2004) and illustrates the difficulty of manipulating an individual difference factor that is highly related to other cognitive constructs. Future research however, should incorporate measures such as anxiety and worry pre- and post-manipulation to better control for these factors. Secondly, the study used a fictitious STI to control for previous knowledge and possible effects such as anxiety over learning one may have an STI. In addition, we used behavioural intentions to reflect monitoring. Future research should focus on actual infections such as HPV and assess actual behaviours to ensure that the study results are generalizable to real health situations. And third, the results are based on studies with university samples. Although the results are highly applicable to this age group because students are at high risk for STI infection (Aral, 2001), the findings are limited in generalizability to other populations.

Implications

The findings suggest that individual differences in IU may affect people's ability to choose appropriate coping mechanisms when faced with an uncertain health threat. The results indicate that high IU may in fact lead to more adaptive health behaviours, such as getting tested, compared to individuals with a low IU who have a lower tendency to monitor. It would be advantageous for health providers to be aware of these differences to determine when it may be appropriate to foster a higher IU to encourage monitoring of a health threat. However, it should be

noted that the adaptive monitoring behaviours may be accompanied by higher levels of psychological distress such as anxiety. Thus, the future challenge will be to establish a balance in communicating uncertain information in a way that optimizes adaptive health behaviours and minimizes distress. Information that can aid health providers who communicate test results is essential to meeting the psychosocial needs of both patients and caregivers who are confronting a health threat.

Future research

The two studies presented here have revealed some meaningful results however, continued research is necessary to better clarify the relationship between IU, situational uncertainty, and monitoring. Firstly, future studies should manipulate situational uncertainty in addition to IU to examine the interaction between situational and trait differences in uncertainty and its effect on monitoring. Secondly, future research should address how to implement these findings into health care settings. For example, a study could simulate patient–doctor communication where the amount of information provided to the patient is tailored to their IU to examine its effect on monitoring. Similarly, future studies could investigate *how* to foster a high IU to encourage monitoring and whether this will affect patient behaviour and psychological functioning. Although it may be premature to make applied recommendations based on these preliminary findings, our results underscore the importance of addressing individual differences such as IU in health research to aid in increasing adherence to prevention, treatment and effective coping among people facing an uncertain future.

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