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MATCHING INTRA-PROCEDURAL INFORMATION WITH COPING STYLE REDUCES PSYCHOPHYSIOLOGICAL AROUSAL IN WOMEN UNDERGOING COLPOSCOPY

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Abstract

This study assessed the combined effects of coping style and intra-procedural information on indices of distress (physiological measures, observed distress, self-report measures of anxiety and affect) among a group of patients undergoing colposcopy. High and low monitors were exposed to one of three interventions: high information (live video feed of colposcopy); low information (complete audiovisual distraction); and control. Results revealed a 2 (monitoring style) × 3 (information level) × 2 (time) interaction for systolic blood pressure (SBP), $F(2, 111) = 3.55$, $p = .032$. Among low monitors, patients in the low-information group exhibited significant SBP reductions during colposcopy, while those in the high-information group exhibited SBP increases. Among high monitors, patients in the high-information and control groups exhibited SBP reductions. Further, high monitors in the low-information group displayed significantly fewer behavioral signs of distress than those in the high-information or control groups, $F(2, 111) = 4.41$, $p = .014$. These findings indicate that tailoring information to suit individual coping style may maximize the apparent efficacy of interventions aimed at reducing stress during medical examinations.

Key words: coping style, intervention, treatment matching, invasive medical procedure

Cervical cancer is the second most common cancer in women worldwide, with estimates of 550 000 new cases and 310 000 deaths in 2007 (Boyle & Levin, 2008). The incidence rate of cervical cancer in the USA is 8.1 per 100 000 women and the mortality rate is 2.4 per 100 000 women (Altekruse et al., 2010). The natural progression of cervical cancer, from pre-cancerous cell changes (cervical intraepithelial neoplasia; CIN) to invasive disease, takes 10 to 15 years on average. This makes it one of the uniquely preventable cancers that can be detected by screening and treated before progression into invasive disease (Holowaty et al., 1999; Tiltman, 2005). The success of screening for cervical cancer is dependent on adherence to follow-up treatment in cases where CIN is found. Positive smear tests require further investigation by a visualization technique known as colposcopy. Cervical cancer screening and colposcopy are associated with significant emotional impact for patients, including high levels of anxiety and psychosexual concerns (e.g. Kola & Walsh, 2009; Rogstad, 2002). As these have been linked to non-adherence to colposcopy (Khanna & Phillips, 2001; Lester & Wilson, 1999), development of effective interventions to reduce anxiety in this patient group may produce health-promoting benefits to the patient.

Previous research studies aimed at reducing anxiety in this patient group have produced mixed results. These include provision of preparatory sensory and procedural information (Freeman-Wang et al., 2001; Howells et al., 1999; Marteau et al., 1996; Tomaino-Brunner et al., 1998), educational and counselling sessions (Byrom et al., 2002; Chan et al., 2004), and other interventions during colposocopy examinations. For example, Chan et al. (2003) found that listening to music during colposcopy resulted in lower patient self-reported anxiety and pain compared to a no-distraction control condition. In contrast, Danhauer et al. (2007) found no differences in anxiety or pain reports in patients who listened to music compared with those who engaged in guided imagery or underwent colposcopy according to standard care. Other studies have found that viewing the colposcopy monitor in real-time may reduce anxiety (Walsh et al., 2004) although, again, contrary results have been reported (Rickert et al., 1994). The inconsistency of these findings may be the result of methodological factors, including unaccounted for variations in patient preferences for information as opposed to distraction. As such, studies that seek to control for individual information preferences may be helpful in clarifying the impact of interventions on patient anxiety or distress (Forys & Dahlquist, 2007).

Attentional style, the extent to which individuals under stress are vigilant to threat and search for information or are insensitive to threat, and avoid further information, represents an important dimension of individual coping differences in response to psychological stress (Miller et al., 1993). Within the literature concerning threatening medical situations, two information-processing styles have been identified (Miller, 1987). High monitoring coping style is characterized by scanning for threatening cues and information-seeking. Low monitoring coping style, on the other hand, is characterized by distraction from, and avoidance of, threatening information (Miller & Diefenbach, 1998). Typically, high monitors have better psychological outcomes when presented with detailed sensory and procedural information, while low monitors have better outcomes when presented with minimal information (Miller et al., 2001; Miller & Mangan, 1983). Given the different information-processing styles of high and low monitors, tailoring interventions to suit individual needs and requirements may maximize patient adjustment, adherence, and psychological outcomes. A number of studies have reported that patients are less aroused and display better adjustment when the amount of information received is consistent with the patients' individual coping styles (Miller & Mangan, 1983; Williams-Piehota et al., 2005).

It can be noted that distinctions between high and low monitors reflect some of the variations in interventions used in previous research. In general, while the interventions used in these studies have had face validity without explicitly identifying the independent variables under manipulation, most interventions appear to have sought to control the amount of procedure-related information made available to patients during colposcopy. For example, interventions where patients are presented with live video feeds of their colposcopies appear to be aiming to maximize the amount of colposcopy-related information provided during the procedure, whereas distraction-based interventions appear to be aiming to minimize the amount of information. Furthermore, previous studies have typically assessed only one type of intervention in relation to a control group, and therefore fail to take into account the full range of information preferences. If high and low monitors do differ in their preference for information access, then it stands to reason that the use of different interventions will yield varying results across patients, and perhaps therefore across studies. As such, by comparing high- and low-information interventions among high- and low-monitor patients undergoing colposcopy examinations, the present study aimed to test directly whether monitoring style and information-level, in combination, determined the success of these interventions in reducing patient stress.

In the present study the high-information intervention (live video colposcopy) allowed patient to become fully engaged in all visual, auditory and sensory cues relating to their colposcopy, whereas the low-information intervention (complete audiovisual distraction) sought to minimize, if not eliminate, patients' perceptions of these cues. Both interventions were compared to a control procedure, in which patients underwent colposcopy according to standard care. These patients did not watch the video colposcopy screen and were not offered any additional information or any explicit coping interventions.

In summary, the present study is one of the first to compare information provision (high and low) during colposcopy, as well as assessing the effects of coping style on a range of stress-related outcomes. It was hypothesized that greatest stress reduction would be observed where patients' monitoring style was consistent with the information-level of the interventions they were presented with, such that low monitors would display better outcomes in the low-information condition, and high monitors would display better outcomes in the high-information condition. As most previous studies had relied on only self-reported stress outcomes, the present study sought to corroborate self-report findings with observed behavioral and physiological indices of stress.

Method

Design

The present study was of a 2 × 3 × 2 mixed factorial design for physiological and self-report stress indices, and of a 2 × 3 mixed design for observed behavioral indices. The two between-groups factors were monitoring style (two levels: high and low monitors) and intervention group (three levels: high information, low information, and control). For physiological and self-report indices there was an additional within-groups factor, time (two levels: before and during colposcopy for physiological indices, and before and after colposcopy for self-report indices).

Patients were randomly assigned to one of the three intervention groups, low-information condition (audiovisual distraction), high-information (video colposcopy), or control (standard care). Patients were classified as either low or high monitors on the basis of median-splits of raw scores from the Miller Behavioral Style Scale (MBSS; Miller, 1987). Low monitors were identified as those who scored 8 or below on the MBSS while high monitors were identified as those who scored 9 or above. Similar scores have been obtained in other studies (Miller, 1987; Miro, 1997; Miró & Raich, 1999).

The dependent variables consisted of physiological measures (systolic blood pressure [SBP], diastolic blood pressure [DBP], and heart rate [HR]), behavioral distress, and self-report measures of anxiety, negative and positive affect.

Participants

Participants were 117 first-time colposcopy patients recruited at a university-affiliated teaching hospital. Participation was restricted to patients who had never previously undergone a colposcopy examination, as prior knowledge of the procedure may influence anxiety levels (Walsh et al., 2004). Further exclusion criteria included presence of severe cardiac, pulmonary, or liver disease, epilepsy, or current chronic pain; however no information relating to medication use was gathered. The age range of participants was 18 to 58 years, with a mean age of 30.68 years (*SD* =

8.97 years), which is consistent with the age of peak incidence of cervical pre-cancerous lesions (Parkin et al., 2001). The majority were single (60%), with the remainder either married/living as married (38%) or separated/divorced (2%). Fifty-six percent reported having completed college-level education. Overall, the demographics of the sample were similar to those described in other studies (e.g. Le et al., 2006). Thirty-three women were smokers (38%); the distribution of smokers and non-smokers across interventions groups was balanced, $\chi^2(2) = 3.03$, $p = .22$. While it was not possible to restrict smoking behavior in women prior to their appointments, it was estimated that the timeline between the last smoked cigarette and baseline measures of physiological data was approximately 50 minutes. Abstaining from smoking for one hour allows acute cardiovascular effects of smoking to recede (Domino et al., 2004), while avoiding the impact of withdrawal effects on cardiovascular function (Tsuda et al., 1996). All procedures were reviewed and approved by the pertinent institutional ethics committee.

Experimental Groups

Low-Information Intervention Group. Patients in the low-information group viewed and listened to a DVD during the colposcopy examination. Patients wore an adjustable head-mounted display (HMD) with built-in headphones (Virtual i-glasses Model PC/SVGSA, i-O Display Systems, Sacramento, CA, USA). The HMD resembles a pair of spectacles with a headband, is very lightweight, and incorporates both a liquid crystal display (LCD) screen and high fidelity headphones. The HMD was connected to a laptop showing a DVD of nature scenes with soothing instrumental music (*At Water's Edge* by SereneVision Productions, Inc., Shippensburg, PA, USA), which served to block the visual and auditory sensory input from the clinic environment and direct attention away from noxious stimuli (Dahlquist et al., 2007). The patients received the following instructions: "During the examination you will be given a pair of virtual reality glasses to wear, and a DVD will be played to you for the duration of the examination".

High-Information Intervention Group. Patients in the high-information group were instructed to focus on the sensory experience of the colposcopy examination in a non-emotional manner, and presented with a real-time video feed of their examinations on a nearby monitor. During colposcopy, the colposcope probe magnified and transmitted the real-time images of patients' cervixes to a computer screen (Entuitive Touchmonitor, Elo Touchsystems, Menlo Park, CA, USA). The computer monitor was on a swivel arm, which was position in order to enable viewing by both patients and clinical personnel. Such 'video colposcopy' approaches allow patients to become active participants in their examination, given that viewing the monitor gives patients the opportunity to observe their own anatomy and to watch what the colposcopist is doing. The patients received the following instructions: "During the examination you will be given the opportunity to observe your own cervix on a monitor. During your examination you will experience many sensations in your body. While you are watching the monitor of what is happening, we would like you to pay attention to the physical sensations that you are feeling, and to think about them in objective, non-emotional terms, for example, a "pulling" sensation. The important thing is that you pay close attention to the different sensations you are experiencing during the examination, as you will be asked about them afterwards."

Control Group. Patients in the control group underwent the examination according to usual care. The colposcopy monitor was turned away from the patients, and only minimal information was given throughout the examination. The women received the following instructions: "You will respond to questionnaires before the examination, and we will observe you as you undergo the procedure and measure your heart rate and blood pressure. After the colposcopy you will fill out a few more questionnaires about how you felt during the procedure".

Measures

Physiological measures. Physiological data were collected as objective measures of perceived psychological stress to the colposcopy. The Dinamap Pro100 Vital Signs Monitor (Critikon

Corporation, Tampa, FL, USA) was used to measure SBP, DBP, and HR before and during the colposcopy examination. Although measurement variability will be reduced when two or more measures are averaged, due to clinic time constraints only one measure was obtained at each time-point.

Colposcopy knowledge questionnaire. This questionnaire assessed understanding of cervical cancer screening and colposcopy, and included questions about the purpose of smear tests, symptoms of cervical abnormality, meaning of normal and abnormal smear test results, meaning of the term 'pre-cancer', what a colposcopy examination entails, and what it may reveal. For each of the questions a number of statements were provided, and the patients had to respond to each statement with "True", "False", or "Don't know". The possible range of scores was between 0 and 25, with a higher score indicating more knowledge of smear testing and colposcopy. Cronbach's alpha was .86 for the questionnaire.

Miller Behavioral Style Scale (MBSS). The MBSS (Miller, 1987) was used to assess monitoring coping status. Items consist of four threatening, uncontrollable, hypothetical situations (e.g., "Imagine you are afraid of the dentist and have to get some dental work done"), each followed by eight coping statements. Four of the coping statements relate to monitoring strategies (e.g., "I would want the dentist to tell me when I would feel pain"), and four of the coping statements relate to avoidant strategies (e.g., "I would do mental puzzles in my mind"). The respondent is requested to check all the statements that apply.

The MBSS is scored to obtain a total monitoring score and has a possible range of scores between 0 and 16, with higher scores indicating a higher monitoring tendency. Satisfactory reliability and validity have been established (Miller, 1987). The monitoring scale has been shown to have good predictive utility in health-related contexts and has excellent internal consistency (e.g., Miller et al., 1999; Miller et al., 1996; Rees & Bath, 2000; Schwartz et al., 1995). In the present sample, Cronbach's alpha for the monitoring scale was .68.

State-Trait Anxiety Inventory (STAI). Patients' levels of state and trait anxiety were measured using the STAI (Spielberger et al., 1983). Both the state and trait measure consists of 20 statements, which assess the frequency of the respondents' feelings on four-point scales. The State Anxiety Inventory examines feelings 'at the present moment', while the Trait Anxiety Inventory assesses feelings 'in general'. The possible range of scores for each scale is between 20 and 80, with a higher score indicating greater anxiety levels. Again, satisfactory reliability and validity have been established (Spielberger et al., 1983). In the present sample, Cronbach's alpha was .93 for the state form, and .88 for the trait form.

The Positive and Negative Affect Schedule (PANAS). The PANAS (Watson et al., 1988) was administered to assess patients' mood before and after the colposcopy examination. It consists of 20 adjectives that describe different feelings and emotions, and measures state dimensions of positive and negative affectivity, by asking patients to rate "the extent to which they feel this way right now, that is, at the present moment". Ten adjectives describe positive moods (e.g., interested, excited) and ten adjectives describe negative moods (e.g., distressed, upset). Responses are made on a five-point scale, from 'very slightly, or not at all' to 'extremely'. The positive affect (PA) score equals the total of the positive mood adjectives, and the negative affect (NA) score equals the total of the negative mood adjectives. Scores range from 10 to 50 on both scales, with a higher score indicating greater positive or negative affectivity. Reliability and validity have been established (Watson et al., 1988). In the present sample, Cronbach's alpha was .85 for the PA scale, and .85 for the NA scale.

Observational measure of distress. A three-item measure of outward expression of distress during the examination was completed by the researcher trained in the use of this measure. It was based on similar scales reported in the literature (Maguire et al., 2004), and included vocalizations (moaning and groaning noises), body movements (arms and legs), and verbalizations (words indicating distress, e.g., 'stop', 'that hurts'). Each behavioral indicator of distress was measured on a seven-point scale, based on intensity, frequency, and duration of the behavior. Cronbach's alpha for the combined observation scale was .82.

Procedure

All colposcopy examinations were scheduled between 9:00 and 16:00. First-time patients were individually invited into an adjacent colposcopy room, containing the same equipment as the colposcopy examination room. The patient was invited to take part in a study on women's experiences of their first visit to the colposcopy clinic. Patients were assessed in a room exactly like the one they received their colposcopy examination, reducing the impact of environmental cues on cardiovascular reactivity (Christenfeld et al., 1998). Information about the nature of the study and the specific condition to which the patient had been randomly assigned was provided, and informed consent was obtained.

Patients in the low-information group were instructed they would be wearing the HMD unit that would allow them to watch a generic film and listen to music during the examination. Patients in the high-information group were told they would get the opportunity to watch their colposcopy examinations on a computer monitor, and were also instructed to pay close attention to the different sensations elicited during the examination. Finally, patients in the control group were told that they would answer questions before and after their colposcopy examinations.

The pre-procedure questionnaires included background information, colposcopy knowledge questionnaire, the STAI, and the PANAS. The pre-colposcopy measures of SBP, DBP, and HR were also recorded. On completion of the questionnaires, the patient was asked to sit in the waiting room until called by the nurse colposcopist. Patients underwent colposcopy according to their assigned strategies, with the (female) researcher present throughout the examination to gather physiological data, which were obtained three minutes into the examination. All examinations were carried out by one nurse colposcopist who treated patients in a standardized manner, without varying her routine between patients. Immediately following the examination, the patient was escorted back to the room adjacent to the examining room where the final questionnaires were completed. These included the STAI, the PANAS, and the MBSS.

Statistical analyses

The physiological measures were analyzed using a series of 2 × 3 × 2 mixed analyses of variance (ANOVA), with two between-groups factors: monitoring status (low and high) and group (low-information intervention, high-information intervention, and control); and with time (pre- and intra-colposcopy) as a repeated-measures within-groups factor.

The three subscales of the observation of distress measure were averaged and yielded a composite mean distress score. It was subject to a 2 × 3 ANOVA, with monitoring status (low and high) and information condition (low-information, high-information, and control) as between-subjects factors.

The self-report measures of state anxiety, PA, and NA were analyzed using a series of mixed 2 × 3 × 2 ANOVAs, with two between-groups factors: monitoring status (low and high) and group (low-information, high-information, and control), and with 'time' (pre- and post-colposcopy) as a repeated-measures within-groups factor for each of the dependent variables.

To confirm findings based on categorical data, Spearman's rho analyses were conducted using continuous monitoring status scores. Physiological reactivity scores were calculated by subtracting Time 2 (during colposcopy) from Time 1 (pre-colposcopy) measures.

Results

Preliminary analyses

The sample comprised 117 patients, 66 low monitors (mean age = 29.89 years, *SD* = 8.64) and 51 high monitors (mean age = 31.71 years, *SD* = 9.36). Based on the cross-tabulation of between-groups factors, this resulted in six cells (low information/low monitors $n = 23$; low information/high monitors $n = 16$; high information/low monitors $n = 24$; high information/high monitors $n = 16$; control/low monitors $n = 19$; control/high monitors $n = 19$).

Monitoring status was assessed following the colposcopy examination. There is no evidence to suggest that the interventions influenced patients' responses to the MBSS, within the present study or previously (Muris et al., 1995). The test-retest reliability of the MBSS over a six-month period has been shown to be excellent (r = .84; Miller et al., 1999). Monitoring scores were not correlated with any of the physiological or self-report measures, and monitoring style was balanced across biopsy status (all *p*s >.05).

A randomization check by multivariate analysis of variance revealed that all six groups were comparable in age, marital status, education level, referral smear grade, waiting time for appointment, trait anxiety, and there were no baseline differences in physiological measures, state anxiety or mood, $F(22, 186) = .90$, p =.68. Unsurprisingly, high monitors had higher knowledge scores (mean = 15.20, *SD* = 5.53) than low monitors (mean = 12.94, *SD* = 5.17), $F(1, 111) = 5.27$, p = .02. Knowledge scores were not controlled for in subsequent analyses, as knowledge was unrelated to any of the pre- or post-colposcopy stress indices. Sample characteristics are presented in Table 1. Fifty-five women underwent biopsy during colposcopy (47%); the distribution of women who underwent biopsy and those who did not was balanced across intervention groups, $\chi^2(2) = .02$, $p = .99$.

Insert Table 1 about here

Physiological measures

SBP. There was a significant main effect for time on SBP, $F(1, 111) = 6.98$, $p = .009$, partial η^2= .059, with higher SBP pre-colposcopy (*M* = 125.91, *SD* = 17.27) compared to intra-colposcopy (*M* = 123.21, *SD* = 17.08). There were no time × group, time × monitoring status, or group × monitoring status interaction effects, all *p*s >.05.

A significant time × group × monitoring status interaction for SBP was observed, $F(2, 111) = 3.55$, $p = .032$, partial η^2= .060. Examination of Figure 1 shows that low monitors exhibited an increase in SBP during colposcopy from pre-colposcopy levels when in the high-information group;

however, low monitors in the low-information and control groups showed a decrease in SBP from pre-colposcopy levels.

High monitors, on the other hand, experienced a significant reduction in SBP from pre-colposcopy levels in the high-information and low-information groups, but showed no change from pre-colposcopy levels in the control group. Spearman's rho confirmed that there was a significant negative correlation between monitoring score and SBP reactivity in the high-information group ($\rho = -.31$, $p = .05$), and a significant positive correlation between monitoring score and SBP reactivity in the control group ($\rho = .31$, $p = .05$). This significant time × group × monitoring status interaction indicated that matching information provided to patients with their monitoring style influenced SBP levels during colposcopy.

DBP. There was a significant main effect for time on DBP, $F(1, 111) = 6.34$, $p = .013$, partial $\eta^2 = .054$, such that DBP was significantly higher before colposcopy ($M = 74.19$, $SD = 11.29$) than during colposcopy ($M = 72.39$, $SD = 10.41$). There was a significant main effect for group, $F(2,111) = 4.52$, $p = .013$, partial $\eta^2 = .075$. Post hoc Tukey HSD test revealed that DBP was significantly lower for patients in the low-information group ($M = 70.24$, $SD = 7.70$) compared to patients in the control group ($M = 75.88$, $SD = 11.32$). No other significant differences were observed. The group × monitoring status interaction approached significance, $F(2, 111) = 2.79$, $p = .066$, partial $\eta^2 = .048$. The trend of this interaction showed that the highest DBP levels were exhibited by high monitors in the control group, with the lowest DBP levels exhibited by low monitors in the low-information group. This trend was also confirmed by Spearman's rho (using the continuous monitoring score) which indicated a significant positive correlation between monitoring score and mean DBP in the control group ($\rho = .636$, $p = .001$). The time × group interaction and the time × monitoring status interaction were non-significant, as was the time × group × monitoring status interaction, all *p*s > .05.

HR. There was a significant main effect for time on HR, $F(1, 111) = 18.05$, $p = .001$, partial $\eta^2 = .140$. HR was significantly higher before colposcopy ($M = 77.58$, $SD = 11.89$) than during colposcopy (*M* = 74.28, *SD* = 11.92). The remaining main and interaction effects were all non-significant, all *p*s > .05.

Insert Table 2 about here

Observation of distress

There was a significant main effect for group on observations of overt signs of distress displayed during the colposcopy examination, $F(2, 111) = 4.41$, $p = .014$, partial $\eta^2 = .074$. Post hoc Tukey HSD test revealed that patients in the low-information group displayed fewer observable signs of distress (*M* = 5.85, *SD* = 4.10) than those in the high-information group (*M* = 8.43, *SD* = 4.84) or control group (*M* = 8.76, *SD* = 5.17). There were no other significant differences. There was no main effect for monitoring status, $F(1, 111) = .181$, $p = .67$, nor group × monitoring status interaction, $F(2, 111) = .185$, $p = .83$.

Insert Table 3 about here

Anxiety and Affectivity

For state anxiety, there was a main effect for time, $F(1, 111) = 85.70$, $p = .001$, partial $\eta^2 = .44$. Mean scores are displayed in Table 3. State anxiety was significantly lower after colposcopy (*M* = 33.62, *SD* = 10.45) than before colposcopy (*M* = 44.51, *SD* = 12.18). There were no interaction effects for state anxiety, all *p*s >.05.

For NA, there was a main effect for time, F(1, 111) = 57.08, $p = .001$, partial $\eta^2 = .34$,. NA was significantly lower post-colposcopy (*M* = 13.44, *SD* = 4.37) than pre-colposcopy (*M* = 17.73, *SD* = 6.15). As with state anxiety, all interaction terms were non-significant, all *p*s >.05. There were no significant effects for PA, all *p*s >.05.

Discussion

The results of the present study suggest that individual differences in monitoring style may help to determine the success of stress-reducing interventions in women undergoing colposcopy. Specifically, when the amount of information presented to patients is consistent with their coping style, then stress-reduction is enhanced. Moreover, this was demonstrated using objectively obtained physiological measures, rather than self-reported stress. The fact that monitoring status was found to influence physiological arousal is consistent with long-standing empirical evidence gathered in other contexts (Miller & Mangan, 1983; Sparks & Spirek, 1988). In addition, degree of information appeared to predict levels of behavioral distress, with less information leading to more effective stress reduction. Information typically focuses individuals on the negative aspects of an aversive situation (Miller, 1992), and monitoring status reflects the extent to which individuals seek or avoid information under stressful situations. Some individuals demonstrate less arousal with the provision of extensive information, while others demonstrate less arousal with the provision of less information (e.g., Miller & Mangan, 1983).

Largely consistent with study hypotheses, monitoring status interacted with information-level of intervention to determine physiological response to colposcopy. Low monitors exhibited a decrease in SBP during the colposcopy from pre-colposcopy levels when in the low-information or control groups. In contrast, SBP increased during colposcopy from pre-colposcopy levels when low monitors were in the high-information group. These data are in line with previous research, demonstrating that low monitors show less arousal and have better outcomes when they receive minimal sensory and procedural information.

High monitors, on the other hand, displayed significantly reduced SBP in the high-information and low-information groups, whereas high monitors in the control group showed no change in SBP from pre-colposcopy to intra-colposcopy levels. This is in line with previous work indicating that high monitors show less arousal and have better outcomes when greater information is available (e.g. Miller & Mangan, 1983; Morgan et al., 1998). In the present study, the video colposcopy intervention allowed for detailed explanations of the colposcopy examination to be provided to patients. However, the fact that high monitors exhibited a decrease in SBP when receiving the low-information intervention warrants consideration.

It is possible that the use of the HMD in the low-information group, which blocked the sights and sounds of the clinic environment, may have enhanced coping for both high and low monitors. Specifically, the physical as well as psychological blocking of threatening stimuli may have enabled high monitors to simultaneously inhibit scanning for threatening information while giving a specific focus. High monitors find it difficult to disengage from threat cues (Miller, 1987) and due to their inability to self-distract from threatening information may benefit from some types of distraction interventions. This is supported by the fact that high monitors in the control group showed elevated SBP and DBP, with no changes in SBP or DBP from pre-colposcopy to intra-colposcopy. In contrast, high monitors showed significant decreases in SBP from pre- to intra-colposcopy, in both the high- and low- information groups. These data are supported by other research suggesting that under short-term, uncontrollable stress, cognitive avoidance and distraction are more adaptive coping strategies (Miller et al., 1989; Suls & Fletcher, 1985). This suggestion is further supported by research demonstrating that high and low monitors benefit equally from relaxation training prior to undergoing a surgical procedure (Miró & Raich, 1999), and high monitors benefit from both distraction and sensory focusing when undergoing an analogue pain task (Forys & Dahlquist, 2007). Thus, it may be the case that directing the attention of high monitors, is itself, sufficient to promote good psychological adjustment to stressful medical procedures. However, further research is required to confirm and extend these findings.

The self-reported measures of anxiety and affect obtained following colposcopy failed to show any group differences. Pre-colposcopy state anxiety levels were very high, the mean score of 44.51 (*SD* = 12.18) represents the 81st percentile in normal female adults aged 19-49 years (Spielberger et al., 1983). Thus, women in the present sample found colposcopy very stressful, and would therefore have reason to utilize coping strategies. In other words, as women perceived the situation as anxiety-provoking, we would expect to see an effect of monitoring style on coping strategies. However, women reported significantly lower state anxiety levels post-colposcopy (*M* = 33.62, *SD* = 10.45), which is similar to the normative mean score for female adults of 35.20 (*SD* = 10.61) reported by Spielberger et al. (1983). It is possible that if anxiety had been measured during the colposcopy examination, a moderating effect of coping style may have emerged.

It is important to note the following study limitations. First, the researcher was not blind to the allocation of participants to groups. The data on behavioral ratings of distress should be interpreted with this in mind. However, great care was taken to ensure standardization of procedures, instructions and conditions throughout. In addition, it is unclear whether the observed interaction effects in physiological arousal were due to differences in availability of intra-procedural information. Specifically, for low monitors in the low-information group, the reduction in SBP could be due to induced relaxation from viewing the DVD, rather than the absence of sensory informational cues. Similarly, for high monitors in the high-information group, the reduction in SBP could be due to engaging in sensory focus rather than the presence of visual and auditory informational cues. These results are, however, entirely in line with previous research, demonstrating that individuals fare better when interventions match coping style (Gattuso et al., 1992; Ludwick-Rosenthal & Neufeld, 1993; Miller & Mangan, 1983; Morgan et al., 1998). Nevertheless, to untangle these effects systematically, interventions must be designed that differ only in the level of sensory information provided. Thirdly, while the main objective in modifying procedures across group was to manipulate information content levels, practical constraints meant that the groups differed in multiple dimensions of which information content was one. For example, the high-information group was exposed to high information via video colposcopy, but also had their expectations of colposcopy manipulated by the experimental instructions. As such, while outcomes may be linked statistically with differences in information level, it is possible that other between-group variations contributed to the effect. Should medical practicalities allow, future research should seek to minimize between-group variations when examining information effects.

Further, while exclusion criteria prevented the recruitment of patients with serious illness, there were no exclusions related specifically to the use of medication that may affect blood pressure and heart rate. The physiological data should be interpreted with this limitation in mind. Finally, as this study used a homogenous patient group undergoing the same medical procedure, results may not generalize to other patient groups or medical procedures. Indeed, due to the use of a female-only sample (as necessitated by the nature of the medical procedure), gender differences in the effectiveness of matching information provided with monitoring status could not be addressed in the present study.

Nonetheless, the present findings highlight the effectiveness of tailoring interventions according to patient characteristics, and the potential drawbacks in presenting one-size-fits-all interventions to this important screening population. While the present results revealed effects for objective stress indices, it is notable that self-report indices did not show differences for interventions. The implications of intervention and examination contexts on patients' willingness to report objectively verifiable differences in emotional responses, or indeed their conscious perception of such responses, may warrant further research. Given that concerns surrounding colposcopy examination are known to moderate screening uptake, such findings may help optimize screening protocols in ways that help early detection of this preventable cancer.

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TABLE 1. Mean (*SD*) demographic variables by low and high monitors in each of three information groups (*n* = 117)

Variable	**Low-information Group**		**High-information Group**		**Control Group**	
	LM	**HM**	**LM**	**HM**	**LM**	**HM**
Age	27.74 (5.62)	32.75 (9.98)	32.00 (10.29)	27.75 (7.90)	29.84 (8.64)	31.71 (9.36)
Marital status *n* (%)						
Single	18 (46)	9 (23)	13 (33)	11(28)	11 (29)	10 (26)
Married/ Living as married	5 (13)	7 (18)	11 (27)	5 (12)	8 (21)	9 (24)
Education level *n* (%)						
College education	11 (28)	11 (28)	12 (30)	8 (20)	12 (32)	11 (29)
Less than college education	12 (31)	5 (13)	12 (30)	8 (20)	7 (18)	8 (21)
Referral smear grade *n* (%)						
Unsatisfactory	2 (5)	6 (15)	5 (12.5)	4 (10)	4 (10.5)	1 (3)
ASC-US	3 (8)	0 (0)	3 (7.5)	2 (5)	4 (10.5)	2 (5)

LSIL	9 (23)	7 (18)	10 (25)	4 (10)	7 (18)	7 (18)
HSIL	9 (23)	3 (8)	6 (15)	6 (15)	4 (10.5)	9 (24)
Waiting time	9.62	7.80	8.70	8.62	8.29	6.84
	(6.86)	(4.57)	(7.59)	(6.49)	(7.21)	(4.62)
Trait anxiety	34.13	36.18	34.08	33.44	35.42	35.26
	(5.75)	(6.11)	(9.92)	(7.69)	(9.79)	(6.67)
State anxiety	47.21	42.94	41.33	45.63	45.53	44.63
	(12.00)	(11.09)	(12.92)	(13.37)	(11.35)	(12.63)
Negative affect	17.39	16.75	17.75	18.94	18.79	16.89
	(6.59)	(5.48)	(6.79)	(7.12)	(5.83)	(5.09)
Positive affect	26.67	29.81	28.50	27.94	27.76	26.97
	(9.60)	(8.14)	(7.48)	(5.47)	(8.94)	(5.40)
Knowledge	12.70	15.88	12.83	16.06	13.37	13.90
	(5.56)	(5.55)	(5.55)	(4.94)	(4.37)	(6.00)

TABLE 2. Mean (*SD*) physiological data before and during colposcopy by low and high monitors in each of three information groups (n = 117)

		Before Colposcopy		During Colposcopy	
	Group[a]	**LM**	**HM**	**LM**	**HM**
SBP[a]	Low information	123.35 (15.46)[d]	124.19 (14.22)[e]	117.52 (9.60)	119.25 (11.24)
	High information	124.25 (15.54)[f]	127.44 (18.01)[e]	127.63 (16.82)	119.75 (14.71)
	Control	124.26 (16.54)[g]	132.89 (23.22)[g]	121.28 (13.06)	132.68 (27.57)
DBP[b]	Low informaiton	69.17 (8.62)	72.03 (10.26)	68.87 (8.38)	68.85 (7.38)
	High information	75.46 (11.61)	74.56 (11.94)	74.54 (10.25)	70.75 (9.94)
	Control	73.97 (8.60)	80.37 (14.11)	70.66 (6.24)	80.00 (14.54)
HR[c]	Low information	77.35 (10.53)	76.36 (12.89)	75.39 (10.64)	74.33 (12.03)
	High information	77.67 (10.07)	81.69 (15.93)	76.08 (12.65)	75.75 (15.21)
	Control	78.46 (9.76)	74.72 (13.17)	73.96 (9.49)	69.68 (11.83)

[a] Systolic blood pressure measured in mmHg

[b] Diastolic blood pressure measured in mmHg

[c] Heart rate measured in bpm

[d] n = 23, [e] n = 16, [f] n = 24, [g] n = 19

Abbreviations: LM = low monitor; HM = high monitor

TABLE 3. Mean (*SD*) affect before and following colposcopy by low and high monitors in each of three information groups (n = 117)

		Before Colposcopy		**After Colposcopy**	
	Group	**LM**	**HM**	**LM**	**HM**
SA	Low information	47.21 (12.00)[a]	42.94 (11.09)[b]	33.65 (8.40)	32.00 (11.96)
	High information	41.33 (12.92)[c]	45.63 (13.37)[b]	34.04 (12.21)	30.75 (9.91)
	Control	45.53 (11.35)[d]	44.63 (12.63)[d]	34.63 (10.10)	35.84 (10.40)
PA	Low information	26.67 (9.60)	29.81 (8.14)	27.44 (9.35)	29.38 (10.10)
	High information	28.50 (7.48)	27.94 (5.47)	28.13 (9.70)	30.00 (8.69)
	Control	27.76 (8.94)	26.97 (5.40)	26.45 (9.64)	27.21 (9.07)
NA	Low information	17.39 (6.59)	16.75 (5.48)	13.33 (4.41)	12.81 (4.11)
	High information	17.75 (6.79)	18.94 (7.12)	13.75 (5.27)	12.75 (3.26)
	Control	18.79 (5.83)	16.89 (5.09)	14.30 (5.24)	13.42 (3.43)

[a] n = 23, [b] n = 16, [c] n = 24, [d] n = 19

Abbreviations: SA = state anxiety; PA = positive affect; NA = negative affect; LM = low monitor; HM = high monitor

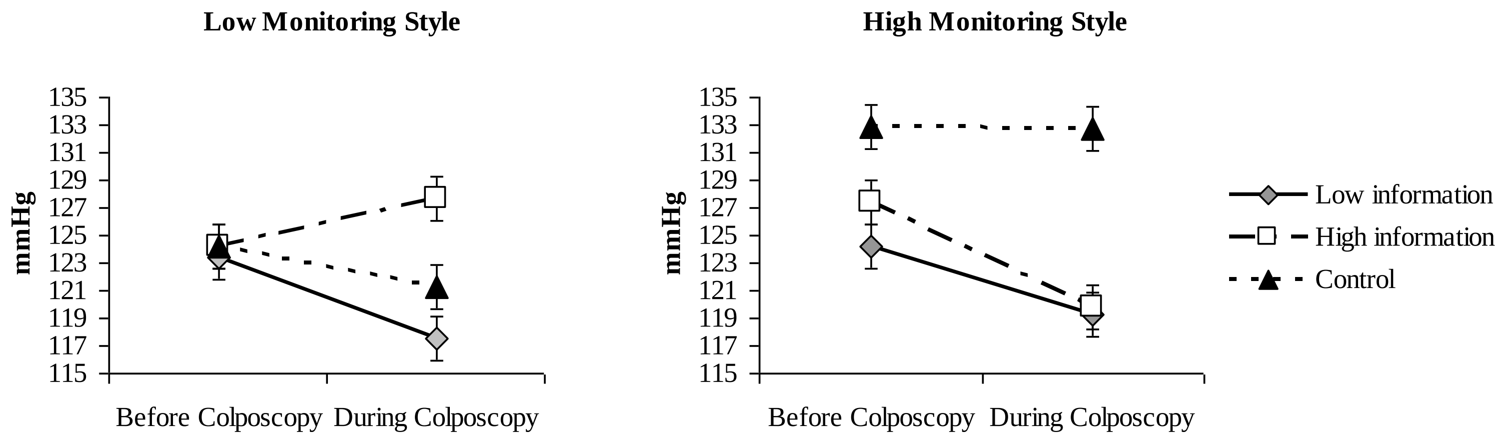

FIGURE 1. Mean systolic blood pressure (mmHg) for low and high monitors before and during colposcopy in each of three groups. Bars denote standard error of the mean