INFLUENTIAL FRIENDS?
IMPACT OF SOCIAL CONTEXT ON YOUNG WOMEN’S PAIN EXPRESSIONS

by

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A THESIS SUBMITTED IN PARTIAL FULFILMENT OF
THE REQUIREMENTS FOR THE DEGREE OF
DOCTOR OF PHILOSOPHY
in
THE FACULTY OF GRADUATE STUDIES
(Psychology, Clinical Psychology)
THE UNIVERSITY OF BRITISH COLUMBIA
April 2005

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Abstract

Research examining social influences on pain has largely neglected the impact of friends, while studies on the social context of emotional display have demonstrated differences in expressivity in the presence of friends versus strangers. Given that pain is a universal phenomenon with both affective and sensory components, it appeared important to merge and extend research in both pain and emotions domains by examining the role of friends as determinants of pain experience and expression. An experimental investigation was undertaken to examine the impact of friendship, as a feature of audience effects and social modeling, on pain expression, as well as to examine the impact of menstrual factors that have been hypothesized to contribute to young women’s current pain experience.

Participants were female undergraduate students from the University of British Columbia. They were randomly assigned to undergo the cold pressor task with either a friend or a stranger, resulting in 52 pairs of friends and 52 pairs of strangers. Half of the participants had been exposed to the friend or stranger undertaking the task in advance of their own exposure to the cold pressor, so as to examine social modeling phenomenon. Measures of pain expression included self-rated pain intensity and unpleasantness, behavioural tolerance time, and facial pain activity.

Robust social modeling effects were observed in all measures of pain, with the bulk of the modeling effect being expression modality-specific. A differential social modeling effect of friends vs. strangers was observed only in pain facial activity. Women’s dysmenorrhea status and its severity, when evident, were unrelated to current pain expression. The presence of friends significantly facilitated expression of disgust.
but no significant group differences were observed for other emotions. Results are discussed from social communication model of pain and evolutionary perspectives and highlight individuals' apparent innate propensity to evaluate the costs and benefits associated with social communication. Future research is needed to elucidate factors that influence the transmission and reception of social information.
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Acknowledgements

This work is dedicated to Stephen... we did it together.

I recently traveled the road to Hana, and am glad that I approached my doctoral studies differently. For those of you who plan to go to Hana, I hope you will enjoy the process. I was told there are some breathtaking views along the way.

In the process of getting my Ph.D., I had the fortune and pleasure of meeting and working with many wonderful people; I will only mention a few here. I am indebted to my research supervisor, Dr. Kenneth Craig, for his wisdom and mentorship. His guidance and generous support inspired me to challenge myself and to aim higher. I am grateful to my research committee members, Drs. Delongis and MacBeth, for their valuable feedback that made my proposed study better. To my colleagues in the Pain Lab, thank you for cheering me on. I would also like to thank all members of my examining committee for their time and interest in my work. I am grateful to the Canadian Institutes of Health, Michael Smith Foundation for Health Research, and Pain in Child Health consortium for the luxury of focusing on my research and taking advantage of research-related opportunities.

I would not be here today, nor would any of this matter without the unconditional love and support from my family and friends. Thank you for reminding me to enjoy the process, and for making the process worthwhile.
Introduction

Pain is a universal, multidimensional phenomenon whose biological and psychological features have largely been addressed from an intrapersonal perspective. The International Association for the Study of Pain (IASP) defines pain as: "An unpleasant sensory and emotional experience associated with actual or potential tissue damage, or described in terms of such damage" (Merskey & Bogduk, 1994). This definition recognizes the importance of sensory and affective-emotional components of pain and addresses crucial biological processes. It fails, however, to capture the social complexity of the pain experience. In contrast, the socio-communication model of pain experience and expression provides a conceptual model allowing consideration of both intrapersonal and interpersonal factors in understanding pain (Craig, 2002; Hadjistavropoulos & Craig, 2004).

An individual's pain experience usually is associated with overt features that appear relatively automatic and reflexive (e.g., facial displays) or non-automatic and voluntary (e.g., self-report), with both able to serve social communication functions and potentially having profound effects on others (Hadjistavropoulos & Craig, 2002; Hill & Craig, 2002). From an evolutionary perspective, pain is usually conceptualized as serving an important intrapersonal, adaptive function, warning the individual suffering from or at risk of tissue damage or danger. In signaling physical threat or injury, it motivates self-care, including avoidance or escape from harm and convalescent behaviour. But pain research also has often ignored important interpersonal functions
that are evident in nonhuman species and particularly in humans. For example, in nonhuman species and humans, pain expression often signals danger. In humans, it is more likely that survival of the injured person may depend upon how well the nature and severity of distress is communicated to others who would be in a position to intervene or provide care. Communications are most likely to be effective to the extent that they reflect specific features of both the individual and the social context, with consequences varying depending on whether pain expression is appropriate for the person in that place. As with most human behaviour, pain expression must be sensitive to the often very subtle intricacies of human social contexts.

Previous research has found significant effects of social context, vicarious learning, and social influences on pain experiences (e.g., Craig & Patrick, 1985; Craig & Prkachin, 1978; McCracken, 2004; Skevington & Mason, 2004). These investigations have benefited from and encouraged researchers to consider familial influence in children’s pain (e.g., Blount, Bunke, & Cohen, 2001; Chambers, Craig, & Bennett, 2002; Goodman & McGrath, 2003). Our theoretical perspective and this study recognize the importance of family members as socializing agents but the friendship context, given its developmental significance, appears to have been neglected as a source of influence on pain and also warrants careful attention. Friendship is a highly salient feature of people’s lives (e.g., Goldman, Cooper, Corsini, & Ahern, 1981). Women’s friendships, in particular, have been associated with promoting physical and psychosocial well-being (e.g., Logsdon, Usui, & Cronin, 1998; Walen & Lachman, 2000).

No consensus on the meaning and definition of friendship has been reached among theorists, researchers, and society as a whole. Friendship is defined by the New
Webster's Dictionary as "someone on terms of affection and regard for another who is neither relative nor lover; and someone who freely supports and helps out of good will (Cayne et al., 1992, p.380)." The evolutionary perspective also espouses the notion of reciprocal altruism in friendships, which are established through acts of altruism with the goal of mutual protection and enhancing gene pools (Trivers, 1971). Friends and strangers differ in their relative contributions to and interests in a person's survival and reproductive fitness.

There is a dearth of research directly exploring the influence of the friendship context on pain experience and expression. For example, does being observed by a friend versus a stranger alter a person's pain expression? Or, is the vicarious learning experience more potent when the model is a friend than a stranger? Studies on expressivity of emotions independent of pain have focused on women and found that they are generally more expressive with friends than with strangers (e.g., Buck, Losow, & Murphy, 1992; Wagner & Smith, 1991). Since pain is an experience with powerful emotional features, one would expect the nature of relationships with others who are present or have an interest in the person in pain to have an impact on pain expression. Thus, attempting to elucidate the contribution of the relationship context when people are suffering from pain in the presence of others has implications for etiological theories and treatment approaches.

The purpose of this study was to build on previous research by examining whether the friendship relationship context plays a role in women's pain expressions in an interactive setting. The focus was on women for the following reasons: 1) research has indicated that women's friendships are richer and more intimate than men's (Bell,
1981; Tognolli, 1980) and therefore would be more likely to have an impact on pain experience; 2) women suffer disproportionately more than men from a large number of acute, recurrent, and chronic pain syndromes (e.g., Dao & LeResche, 2000; Rollman & Lautenbacher, 2001). Moreover, this focus on women led to consideration of factors related to reproduction, with menstrual pain being of special interest, as women are vulnerable to dysmenorrhea (i.e., recurrent menstrual-related pain).

Female participants undergoing a lab-induced cold pressor pain task were randomly assigned to being observed either by a friend or by a stranger, permitting an examination of audience effects. These participants, in turn, served as friend or stranger social models for the observing person, who subsequently underwent the same task, thereby allowing study of the differential impact of friends and strangers as social models. Pain responses were measured by self-reports of pain intensity and unpleasantness, pain tolerance, and facial display. The women undergoing the task knew that they were being videotaped by a camera behind a one-way mirror.

In sum, the design permitted exploration of the predictive value of social modeling, the relationship context, and dysmenorrhea status and menstrual pain severity on women’s cold pressor pain expression. Knowledge of the potency of the friendship context on woman’s responses to pain has implications for understanding pain expression as a form of social communication. The information obtained could be used as a springboard for further research examining women’s pain experience.
Literature Review

Friendship Context

Humans are fundamentally motivated to create and maintain meaningful social relationships with others. Friendship has unequivocal developmental significance across the lifespan and serves as an important buffer against stress throughout the life cycle (Cobb, 1976). Actual and perceived similarity contributes to friendship development and reciprocal self-disclosure maintains this bond. In humans, friends usually serve as age-specific peers who provide resources and direction in socially demanding situations.

Features of Friendship

Definition. From an evolutionary perspective, friendships are established through acts of reciprocal altruism with the goal of mutual protection and serving the interest of enhancing survival and reproductive fitness. It is argued that friends are more likely to help one another in order to maximize their (not necessarily only their “own”) genetic reproductive fitness (Trivers, 1971). Cialdini, Brown, and Lewis (1997) found that as relationship bonds increased, so did empathic concern for a needy other. That is, helping a family member was more likely than helping a close friend, which was more likely than helping an acquaintance, which, in turn, was more likely than helping a near stranger. Kinship and friendship also increase the probability that altruistic behaviour will be reciprocated in the future (Cialdini et al., 1997).

The meaning and definition of friendship are often assumed to be understood; however, no consensus has been reached among theorists, researchers, and society as a whole. Some researchers have studied variation in the definition of friendship and have done so indirectly by asking about the importance of its elements. For example, Parker
and de Vries (1993) compared ratings by female and male undergraduate students of the importance of interactional and emotional dimensions of friendship. A few researchers, most of whom studied older adults exclusively, examined definitions of friendship directly by asking their respondents what the relationship means to them and found variable characterizations (e.g., Roberto & Kimboko, 1989). The difficulty of reaching consensus may lie in the very nature of friendship, which O'Connor (1992) described as “a human attachment and culturally constructed relationship which varies both historically and cross-culturally (p.3).” Indeed, Adams, Blieszner, and De Vries (2000) found that definitions of friendship differed across age and gender groups within each culture and observed striking cross-cultural variation.

In the absence of a coherent theoretical framework for understanding friendship, researchers have often characterized friendship as “one type of social support characterized by intimacy, self-disclosure, mutual concern, a sharing of resources, equality in power, and ultimately empowering” (e.g., Knickmeyer, Sexton, & Nishimura, 2002) or some variation on this theme. The present study also adopted this definition of friendship.

Women's friendship. A tendency to have more same-sex than cross-sex friends has been documented across the life span (Weiss & Lowenthal, 1975). Although no global sex differences in the importance of peers have been reported, females' and males' same-sex friendships are believed to differ dramatically in the content of their interactions. Male-female friendships have been described in the literature as less intimate and less stable (Davis & Todd, 1985) than female-female friendships. Opposite-sex friends are also less likely to interact with one another (Rands & Levinger, 1979) and
to share similar interests. Women’s friendships also have been found to be richer and more intimate than men’s (Bell, 1981; Tognolli, 1980), with more emphasis placed on reciprocity, mutual trust, and self-revelation in their friendships (Weiss & Lowenthal, 1975).

For women, friendship in early adulthood has been shown to be related to issues of personal values, relationship with friends, and relationships with the opposite sex. During this developmental stage, women begin to use their own resources, take responsibility for their actions, and develop a sense of identity apart from their families (Rayfield, Llabre, & Stokes, 1987). Young women’s relationships with close friends may be particularly important, salient, and influential as they rely on their friends for validation, support, and approval. Social roles are learned and patterns of interaction form the basis of subsequent relationships, including romantic relationships (Rayfield et al., 1987).

Significance of Friendship

Existing research on friendship demonstrates a positive association between friendship and well-being (Ponzetti & Cate, 1988; Rayfield, Llabre, & Stokes, 1987; Veniegas & Peplau, 1997). Absence of friendship networks has been associated with loneliness, depression, and psychosomatic illness among other psychopathological disorders (Rayfield, et al., 1987). Various studies indicate that friendship has a buffering effect against stress for transitions at adolescence (Weinberg, 1970), onset of parenthood (McGuire & Gottlieb, 1979), early adulthood, (Tokuno, 1983), and old age (Lowenthal & Haven, 1968). The buffer effect may also prevent, reduce, or eliminate diseases or syndromes such as coronary heart disease (D’Elio & Ness, 1997) and premenstrual
syndrome (Morse, 1997). For instance, Logsdon et al. (1998) found that having supportive friends appears to influence self-esteem and is associated with quicker recovery from coronary artery bypass surgery.

**Social support.** Women may be more sensitive to the supportive actions of other women than other men (Barbee, Gulley, & Cunningham, 1990; Flaherty & Richman, 1989). Studies in the stress and coping literature suggest that women are more likely to seek support from a same-sex friend than an opposite-sex friend (Barbee et al., 1990; Burke & Weir, 1978; Flaherty & Richman, 1989). In a laboratory study using confederates to deliver supportive or neutral comments, support from women attenuated cardiovascular reactivity but support from men did not (Glynn, Christenfeld, & Gerin, 1999). For women, the quality of the relationship appears to moderate the effect of social support given by close friends. Uno, Uchino, and Smith (2002) found that women interacting with ambivalent female friends had significantly higher levels of cardiovascular reactivity compared to women interacting with supportive female friends. They suggested that women interacting with ambivalent, female friends may feel threatened and evaluated because the feedback offered could be interpreted in a more negative light. Consistent with this explanation, the women in their study who were accompanied by a female, ambivalent friend rated the task to be harder and viewed them as more dominant than participants in the other conditions.
What about pain?

Friendship clearly has an impact on a person’s well-being, yet it has received little attention as a subject in pain research. It is plausible that the robust findings of strangers’ influences on individuals’ pain responses (reviewed in subsequent sections) have vitiated researchers’ interest in exploring the differential effects of friends versus strangers. After all, the friendship relationship may simply yield a more potent version of whatever interpersonal influence strangers have been shown to exert. It would be naïve, however, to make this assumption. Pain is not only a multidimensional construct; it is also a socio-communicative act. Most individuals, if not all, would attest that they not only disclose more information to a friend than a stranger, but that they also communicate differently with a friend versus a stranger. These anecdotal observations of the differential effects of friends versus strangers are well-supported by research on emotional expression and cardiovascular reactivity (to be reviewed in the following sections). Thus, understanding whether and how the transmission of pain information differs between friends and strangers may provide clues on how to assess and assist others in pain effectively. This study focused on female same-sex friendships as most empirical research examining the differential effects of friends versus strangers in emotion expression and cardiovascular reactivity has examined female same-sex friendships. Moreover, by excluding male same-sex and opposite sex friendship, potential confounds across relationship types were reduced.
Socio-Communication Model of Pain

Widespread and dominant biomedical models of pain feature internal processes by addressing genetic, anatomical, physiological, and neurochemical features of pain, devoting only minimal attention to psychological concomitants. Even the biopsychosocial model of pain (Gatchel, 2004) focuses upon the interactions among biological, psychological, and social factors as determinants of the perception of pain, omitting explicit attention to the interpersonal factors considered in the socio-communication model of pain (Craig, 2002; Hadjistavropoulos & Craig, 2004). According to the socio-communication model, the perception of tissue stress or damage generates pain experience, which is modulated by personal history and immediate contextual factors. The ensuing pain expression, the assessment of observers concerning the nature and severity of pain the person is experiencing, and decisions made concerning whether to intervene in the individual’s painful situation are also recognized as influenced by intrapersonal and contextual factors and made explicit in the model (see Figure 1).

To illustrate this model, cold pressor pain would be conceptualized as modulated in experience by both interoceptive or intrapersonal processes, such as somatic events, fear of pain, and catastrophizing tendencies (e.g., Sullivan, Thorn, Rodgers, & Ward, 2004), as well as interpersonal or contextual factors, such as who is observing and social role expectations (e.g., Chambers et al., 2002).
Figure 1

*Social Communication Model of Pain*

Actor

<table>
<thead>
<tr>
<th>Intrapersonal factors</th>
<th>Pain Experience</th>
<th>Pain Expression</th>
<th>Social and Physical Context (Interpersonal Factors)</th>
</tr>
</thead>
</table>

Observer

<table>
<thead>
<tr>
<th>Intrapersonal factors</th>
<th>Assessment of Pain</th>
<th>Action</th>
</tr>
</thead>
</table>
The model predicts that these internal and external influences modulating pain experience would be manifest in verbal and nonverbal expressions as a product of various automatic (e.g., reflexive) and higher cognitive processing programs (e.g., vicarious learning, previous experience, and problem solving). Observers subsequently decode these cues with varying success and act upon their understanding, reflecting another set of intrapersonal and interpersonal factors influencing observers. Thus, an individual’s pain experience usually has a range of overt features, which serve social communication functions and are capable of having a profound effect on others (Hadjistavropoulos & Craig, 2002; Hill & Craig, 2002).

The importance of social contextual factors is evident from an evolutionary perspective. Pain is usually construed as serving survival by warning the afflicted individual of danger and motivating escape and avoidance. But pain also fulfills other adaptive functions by signaling to others that the person has suffered physical injury. Cry, facial activity, and verbal output are examples of human signals of pain. These can provoke delivery of care to the suffering person, as well as prompting self-care in observers. In this manner, sensitivity to another person's pain can yield adaptive benefits to both the suffering person and the observer (Craig, 2004). The ability to detect pain in others is already significantly developed by age five to six and the capacity to differentiate subtleties in the severity of pain expressed by others increases with age and is well-developed by late childhood (Deyo, Prkachin, & Mercer, 2004).
While pain undoubtedly has personal survival value, its expression, perception by others, and its social consequences have associated costs and benefits (whether implicit or explicit and conscious or unconscious) that can be appreciated as contributing to the complexities of the social communication of pain. For example, exhibiting pain to a friend may stem from a desire to receive attention and care and subsequently instigate concern and medical attention. Pain expressed to an opponent, however, may invite further provocation or harm. Thus, social context and perceived consequences are important to both expressive and receptive features of the communication process.

There appear to be several major forms of interpersonal, contextual influence. The impact of the mere presence of others observing the person on individuals' expressiveness, known as audience effects, may serve as a sensitive indicator of important social communicative processes. Vicarious processes (e.g., observing) and certain contextual cues (e.g., model level of tolerance) can also influence pain behaviour through observational learning. Although this study focused on the effects of audience and social modeling, research has also implicated other factors such as setting, perceived consequences, and social reinforcement in the influence of pain expression. For instance, a dental procedure administered in a dental clinic is associated with greater reports of pain than the same procedure administered in a research laboratory (Dworkin & Chen, 1992). Anthropological evidence also describes a number of rituals that involve considerable tissue damage to the celebrants that they do not experience as painful (e.g., Kosambi, 1967). Finally, greater parental reinforcement of children's pain is also associated with greater functional disability, independent of stress (Whitehead, Crowell, & Heller, 1994) and pain severity (Gidron, McGrath, & Goodday, 1995).
Audience Effects

“Audience effects demonstrate the sensitivity of displays to the social context of their emission and have been widely noted in both nonhumans and humans” (Fridlund, 1994, p. 146). Audience effects require the presence of an actor (e.g., the participant undergoing a pain stimulus, story-teller), the object of reference (e.g., the pain stimulus, a story), and an audience (e.g., the observer, listener). They are quite evident in children’s emotional displays. From an early age, children learn to manage their emotional expression by learning a set of cultural display rules (Cole, 1986; Gnepp & Hess, 1986). What and how much emotion one displays depend on one’s characteristics and who is watching. Zeman and Garber (1996) found that elementary-age girls were more likely to express pain than boys, and observed that, in general, children were less likely to express pain in front of a “medium-type” friend (i.e., someone they liked and played with but whom they did not consider to be their “best friend”) than in the presence of either their mother, father, or when alone. Children also learn from an early age that expression of negative affect receives less favourable responses than positive affect (Malatesta & Haviland, 1982). Observational learning (Bandura, 1971) would contribute to acquisition of this understanding.

Pain expressions. Audience effects on adults’ pain expressions have been reported in numerous empirical studies. Kleck et al. (1976) studied the effects of observation on expression during painful stimulation. Their participants were college-aged men observed by a same-sex or opposite-sex stranger. They found that judges rated these men as less expressive when they were observed than when they were alone and found no evidence for a differential impact of the sex of the observer. In a recent study,
Badali and Craig (2002) compared cold pressor induced pain responses of participants alone and in the presence of a stranger. They also found an audience to diminish judgment-rated nonverbal expressivity, self-reported painful affective discomfort, and physiological reactivity (as reflected in heart rate). It did not affect reports of the sensory intensity of the cold pressor experience. The mere presence of an observer may be necessary and sufficient to invoke an audience effect. Craig (1978) found that when an observer was concurrently undergoing the noxious stimuli (i.e., co-active), this co-active companion did not contribute reduction in distress beyond the presence of an inactive observer.

In contrast, some researchers have found effects of certain experimenters’ characteristics on pain reports. For instance, Levine and De Simone (1991) examined the effect of the experimenters’ sex on pain reports in a sample of undergraduate students. The participants rated their cold pressor pain in front of either a male or a female experimenter who was selected for his or her attractiveness. Males reported significantly less pain in front of a female experimenter than a male experimenter. No effect of experimenter sex was found for females. Kallai, Barke, and Voss (2004) also investigated experimenters’ sex as well as professional status (i.e., faculty member or student) on participants’ pain reports and tolerance. They found that the participants tolerated pain longer when they were tested by an experimenter of the opposite sex or when they were tested by a faculty member. Moreover, the participants tested by female experimenters reported higher pain intensities. Clearly, features of the audience as well as the relationship between the actor and the audience warrant further exploration.

In the aforementioned studies, the audience, co-active or not, was a stranger to the participant. Since friends are likely to witness and assist with each other’s pain, the
friendship relationship merits examination. Friendship is an obvious choice given its significance in most people’s lives. To date, Brown, Sheffield, Leary, and Robinson (2003) conducted the only empirical study that examined the influence of the friendship relationship on pain response.

Brown and her colleagues (2003) examined undergraduate students’ performance on the cold pressor task either alone or accompanied by a friend or stranger who provided active support, passive support, or naturalistic interaction. The active support condition involved the presence of a supportive other (stranger or friend) who made explicitly supportive gestures and comments. In contrast, the passive support condition involved the presence of a supportive other, either stranger or friend, who was prohibited from communicating support through verbal and nonverbal channels. In the interactive condition, supportive others were free to interact with the participant as much or as little as they wanted. The interactive group seemed to be intermediate in the level of engagement to the active and passive support groups. Participants rated the intensity of their cold pressor experience every 20 seconds while their hand was immersed in the water.

Brown et al. (2003) found no significant friend versus stranger group differences. Regardless of the relationship context, participants in the active support and passive support conditions reported less pain than participants in the alone and in the interaction condition, although these group differences did not emerge until the participants’ hands had been immersed for 60 seconds. It is possible that social support takes time to exert its effect. These findings largely confirm audience effects, although the limited impact of the interactive condition is largely unexplained and the possible role of distraction could
not be ruled out. It is conceivable that by manipulating the supportive behaviour of friends, their actions were perceived as uncharacteristic and therefore distracted the participants. Moreover, the partition between the participant and the supportive other may have disrupted the typical interaction pattern between friends and therefore limited the detection of differential friends versus stranger effects. Even if distraction could be ruled out, the process by which social support exerts its effects remains elusive. That is, the presence of a supportive other may attenuate pain through cognitive, emotional, and physiological mechanisms, which, directly or indirectly, influence pain expression. For example, the presence of a supportive other could alter appraisals of the situation, decrease negative affect, or alter pain expectations (e.g., Cohen, 1988).

This study extended Brown et al.'s findings by examining the friendship relationship on multiple pain measures (i.e., pain tolerance, intensity, affective discomfort, and facial activity) to reflect the multidimensional nature of the pain experience. To enhance ecological validity, this study allowed participants to interact as naturally as possible with minimal verbal exchange. Since a friend may be more likely than a stranger to know what the participant needs in the way of support and to select supportive behaviours accordingly, the presence of a friend was hypothesized to reduce pain and distress relative to the presence of a stranger.

Expression of emotions independent of pain. Badali and Craig's (2002) finding that social context differentially influenced pain affect and sensation contributes to the growing appreciation for the importance of understanding affective/motivational components of pain. To this end, pain research could benefit from the growing body of emotion expression research on audience effect.
Interestingly, certain emotional facial expressions (e.g., smiling and laughing in the presence of an amusing stimulus) have been found to be facilitated by the presence of an audience (Chovil, 1991; Fridlund, Kenworthy, & Jaffey, 1992). Chapman (1973) reported that children smiled and laughed more when another child was present as an observer, and smiled and laughed even more when another child was present as an interactive fellow listener. Brightman, Segal, Werther, and Steiner (1975, 1977) also found their participants to be more expressive when evaluating flavoured sandwiches in the presence of another child performing the same task than when they were alone. In adults, Wagner and Smith (1991) investigated the effect of the physical presence of a friend or of a stranger on facial expressiveness. Pairs of female friends and female strangers were seated side-by-side, about 15 cm apart, and were discretely videotaped while they viewed a number of emotional stimulus slides. Eight emotion contents were used: happy, tender, amused, peaceful, puzzled, angry, sad, and disgusted. Judges subsequently rated the emotional valence of the slides based on each woman's facial activity. Amused, tender, and sad expressions were rated as more readily identifiable in women with friends than with strangers. Disgusted expressions were recognized above chance in both groups. In sum, women were generally more expressive and their expressions were more content-sensitive in the presence of friends than with strangers.

Other studies further demonstrated that the social context as well as stimulus intensity affects facial activity; participants smiled more in response to a "strong" than a "moderate" film clip, and they smiled more if their friend was in the same room (Jakobs, Manstead, & Fischer, 1999). Social motives (e.g., inclination to compete, support seeking), which are partly determined by that relationship, have been implicated as the
underlying mechanism that influences what and how much emotion one displays (e.g., Hess, Banse, & Kapps, 1995; Jakobs et al., 1999). Presumably, different social motives are engaged when interacting with a friend or a complete stranger. Early investigators speculated that friends may be motivated to support each other, whereas strangers are probably motivated to maintain social distance. This explanation may oversimplify a probably very complex set of relationship factors. For example, the strangers could be construed as antagonists, instigating competitive feelings or fear, or, alternatively, construed as potential allies with expression potentially building an alliance. The expressivity of emotional display, then, seems to be a function of the relationship between the actor and audience and underlying motives, which may suggest to the actor an appropriate role to adopt in the social interaction.

Sociality, defined as the extent to which individuals can interact with each other through the auditory and visual channels of language, is yet another factor that has been explored in understanding emotional expressivity. Chovil (1991) examined women’s frequency of displays across different levels of increasing sociality. These levels included listening to a tape-recording of another person, interacting with another person in the same room but separated by a partition, interacting over the telephone, and interacting face-to-face with another person. Participants in the dyad conditions were paired with strangers and were instructed to tell each other about a “close call” experience in which something bad almost happened or the experience was not as bad as it could have been. She found that the degree to which women can interact with each other was related to the extent to which individuals mimicked facial displays. That is, facial displays occurred more frequently in the interactive conditions than in the non-
interactive condition. Listeners who could see the story-teller also exhibited more facial displays than listeners who did not have visual access to the story-teller. The importance of visual availability was consistent with other findings in which the visual presence of another person increased the likelihood of display (e.g., Brightman et al., 1975; Kraut & Johnson, 1979). This would be consistent with the proposition that facial displays are major modalities of social communication (Ekman & Rosenberg, 1997).

Although Chovil’s (1991) findings of increased facial activity as a function of both physical presence and communication potential among strangers were inconsistent with those of Hess et al. (1995) and Jakobs et al. (1999), who only observed social context effects among friends, these differences in findings may be attributable to the difference in the affective valence of the stimuli (i.e., negative in Chovil’s study and positive in the other two studies) and the stimuli probably differed in degrees to which they evoked “empathic understanding” (Chovil, 1991, p. 144). This suggests that establishing empathic understanding may lead to both physical presence and communication potential having an effect on facial displays, regardless of whether the participants are strangers or friends. In contrast, an affective stimulus that fails to establish empathic understanding only results in physical presence effects on facial displays and then only among friends.

Extrapolating the reviewed literature on emotion expression to pain research, it seems that friends could play an important role in an individual’s pain responses. Given the negative valence of pain and its potential for generating empathic understanding, it was hypothesized that participants would exhibit more facial pain expression in the presence of friends than strangers. In contrast, the evidence from the social support
literature suggests that the presence of supportive others reduces distress, which implies a decrease in friends' facial activity. Thus, in addition to the primary goal of examining differential friends' versus strangers' audience effects, this study also explored differences between friends and strangers in their effects on emotion expressivity. The findings from this study could, in turn, contribute to the understanding of the interplay among stimuli valence, empathy, and emotion expression.

Social Modeling Effects

Audience effects, by definition, exclusively examine the influence of the presence of an observer on an actor. However, social contacts among people probably would involve reciprocal influences and bi-directional feedback. The complexity of this interaction process can be reduced through isolation of some of the components of interaction. One feature worthy of examination concerns whether the audience has provided a model for how one could behave when exposed to a painful event the model is known to have encountered. An investigation of the influence of the friendship context on pain expression would be incomplete without studying its effect on the social modeling of pain.

Process. Human behaviour is transmitted intergenerationally, whether deliberately or inadvertently, largely through exposure to social models. Bandura (1971) has observed that most complex human behaviours are learned through a combination of verbal transmission of information and observation of a skilled model. The modeling influence is adaptive because, under circumstances in which mistakes can be costly or dangerous, learning from a competent model can minimize errors. The modeling phenomenon is a function of four interrelated processes (i.e., attention, retention, motor
reproduction, and motivational processes), which suggest a prominent cognitive role in
the acquisition and regulation production of human behaviour. For example, attention-
controlling factors can be influential in determining which models are closely observed
and which are ignored. The observer's motivation and psychological characteristics, and
the perceived characteristics of the social model are some of the factors that exert
influence over the attention people pay to the variety of modeled activities they encounter
(Bandura, 1971). The importance of learning factors in understanding pain has long been
appreciated (Fordyce, 1982), and social learning theory provides a useful framework for
investigating whether friends and strangers differ in their contribution to the socialization
of pain responses.

Pain expressions. The robustness of the social modeling effect has been
demonstrated in a series of controlled experimental studies by Craig and his colleagues.
In one of their earlier studies, Craig et al. (1975) examined participants' judgments of the
intensity of electric shocks while confederates posing as naïve peers presented as either
tolerant or intolerant in response to the same shock. They found that participants
observing a tolerant model accepted substantially greater shocks and, on several
psychophysical measures, reported no greater discomfort than those exposed to an
intolerant model. In a subsequent study, Craig and Prkachin (1978) administered electric
shocks of increasing intensity to both a female participant and, allegedly, to a confederate
who modeled tolerant behaviour. Participants then underwent a series of pre-selected
random shocks. Consistent with earlier results, tolerant modeling was found to be
associated with lower discriminability of the shocks using sensory decision theory
measures, and lower distress using both self-report and psychophysiological measures.
Tolerant modeling also reduces evidence of pain nonverbal expressions (Prkachin & Craig, 1985).

The social modeling effect on pain behaviour appears to be unaffected by the manipulation of sociality. Craig (1978) administered electric shocks in progressively increasing intensities to either the participant alone or to both the participant and a peer companion, with the latter serving as either a tolerant or intolerant model. The sociality regarding pain ratings and current intensities were manipulated and ranged from both-verbally-active (interactive), participant-verbally-active-only, model-verbally-active-only, both-silent, and participant-written-only (peer observed). The results revealed that those exposed to the tolerant models provided significantly lower pain reports and those exposed to the interactive tolerant model persisted to higher levels of stimulation before withdrawing. There were no differences between having a peer subjected to the same noxious stimuli without information as to its affective consequences for the peer and having the peer present but not receiving shocks.

To increase the ecological validity of their findings, Prkachin and Craig (1986) examined whether naturally occurring variations in pain behaviour might have a different interpersonal impact than confederates in a scripted role. They selected high- and low-tolerance female participants and then asked them to rate voluntarily administered electric shocks alone or with another woman who had either a similar or dissimilar pain threshold. In general, the results further affirmed the effects of social modeling. Contrary to the hypotheses, however, social influence was found to be unidirectional; participants became relatively intolerant by exposure to intolerant individuals, but the reverse did not occur. Participants appeared much more easily influenced to display pain
behaviour than to inhibit its expression. A more complex picture of social modeling effects emerged.

When the information about pain is available to the observer through multiple communication channels (e.g., auditory, visual), the outcome of the social influence appears to remain modality specific. For example, Goodman and McGrath (2003) found that children exposed to “exaggerated”, “control”, or “minimize” maternal modeling of pain behaviour on a cold pressor task learned to moderate their pain threshold and facial behaviour from a very brief exposure to maternal modeling. Specifically, children in the “exaggerated” group had lower pain thresholds while children assigned to the “minimize” group showed significantly less pain behaviour. The maternal modeling effect appeared specific to pain behaviour and had little impact on the children’s pain tolerance or intensity rating. Similarly, Chambers et al. (2002) found that the type of maternal verbalization (i.e., pain-promoting, pain-reducing, or pain-neutral-control) influenced girls’ verbal report of pain intensity in the expected direction, but failed to influence their pain affect, facial activity, tolerance, or heart rate. Whether social modeling influences operate in a modality-specific or cross-modality manner has yet to be empirically tested. Thus, this study addressed this gap in research by examining the relative predictive value of the social model’s pain tolerance, affect, and facial expressions on each of these measures in the observer.
**Mimicry.** The robust social modeling findings in pain expression may be partially accounted for by human’s fundamental motivation to create and maintain meaningful social relationship with others. We appear to operate as if there were a belief that if we engage in behaviours of which others approve, others will approve of us, but it is unlikely that propensities to match others’ behaviours is consciously motivated. Thus, we use approval and liking cues to help build, maintain, and assess the intimacy of our relationship with others.

There is substantial evidence that individuals automatically mimic a wide range of behaviours of their interaction partners, including speech patterns (e.g., Cappella & Panalp, 1981), facial expressions (Termine & Izard, 1988), moods (Neumann, & Strack, 2000), emotion (Hatfield, Cacioppo, & Rapson, 1994), and postures and mannerisms (Chartrand & Bargh, 1999). The tendency to mimic others is potent and there is experimental evidence that people even mimic the mannerisms of complete strangers (Chartrand & Bargh, 1999).

It is conceivable that, by matching one’s behaviour to that of the social model, one signals affiliative interest and willingness to cooperate. In particular, nonconscious mimicry, or the tendency to adopt the behaviours, postures, or mannerisms of the interaction partners without awareness of intent, has been associated with increased empathy, liking, and rapport (Lakin, Jefferis, Cheng, & Chartrand, 2003). Recent research has shown that the desire to affiliate is associated with increased mimicry. Lakin and Chartrand (2003) showed that people who were given an explicit or implicit affiliation goal were more likely to mimic the behaviours of an interaction partner than people who did not have a goal to affiliate. Moreover, they found that people who
experienced a recent failed attempt to affiliate with another person engaged in more mimicking behaviour than those who were successful in a recent attempt to affiliate. Interestingly, the relationship between mimicry and rapport appears to be bidirectional, as increased rapport is associated with increased mimicking behaviour (Lakin et al., 2003). Lakin et al. (2003) found that, as people shared personal information and learned information about their interacting partner, they began to engage in more similar nonconscious behaviours. Thus, sharing information may lead to greater rapport, which is expressed through increased mimicry.

The mimicking of others may have evolutionary roots. If the behaviour of others communicates necessary survival information, the individuals' ability to perceive others' behaviour and use it to guide their own would be critical to their fitness and survival. Moreover, mimicking may have initially enabled individuals to be included in group membership and benefit from joint survival-related activities (de Waal, 1989), and later evolved to serve as a social role. For example, van Baaren, Holland, Kawakami, and van Knippenberg (2004) found that mimicry enhanced prosocial behaviour and strengthened social bonds. This body of literature would further predict that the social modeling influence would be modality-specific. Given the significance of nonverbal behaviours in communicating important information to others (DePaulo & Friedman, 1998), these behaviours may have been particularly influenced by evolutionary selective pressures.

Taken together, the literature on mimicry suggests that the strength of the social modeling influence appears to depend more on the observer's affiliative desire and the level of rapport with the social model than on the relationship between the social model and the observer. Accordingly, it was hypothesized that friends, by virtue of their
relationship, have an established level of rapport and an interest to enhance their social bond, would mimic each other's pain behaviour more than strangers would. However, since normative expectations, especially for women, seem to dictate that one should overlook the negative affect expressed in others to smooth interpersonal relations (Hall, Carter, & Hogan, 2000), friends may be more likely than strangers to overlook nonverbal cues, such as facial expressivity of pain.

In summary, the social modeling process is likely mediated by complex psychological processes such as attention, memory, emotions and motivational factors. The effects on the person observing a model could account for the acquisition of novel behaviour patterns, elimination of fears and inhibitions, or the facilitation of pre-existing modes of response (Bandura, 1969). A number of studies using retrospective, correlational methodology (e.g., Osborne, Hatcher, & Richlemsier, 1989) and experimental investigations (Chambers et al., 2002; Goodman & McGrath, 1999) have demonstrated the powerful impact of family socialization on children's pain experience. Children most commonly identified their parents as "pain models", and perceived the frequency and intensity of their own pain to be similar to their models' pain experiences (Osborne et al., 1989). Moreover, Whitehead, Busch, Heller and Costa (1986) found that parents and family members expect, model, and value certain patterns of behaviour, which are positively reinforced either directly (e.g., sympathy, provision of medication) or indirectly (e.g., allowing avoidance of undesirable activities) or both. However, most studies investigating social modeling effects on adult pain have precluded examining the relationship between the social model and observer.
Friends were hypothesized to exert modeling effects, and possibly more potent effects than strangers. Based on existing social modeling research in pain and the literature on mimicry, it was further hypothesized that the social modeling influences would be modality-specific. That is, when information about pain tolerance, affective discomfort, and facial activity are all available, only the social model’s pain tolerance was expected to predict tolerance, and affect was expected to predict affect, and so forth.

_Intrapersonal Factors_

Everyone experiences pain, but not everyone experiences pain equally. By focusing this study on female friends, the opportunity was ripe for exploring some intrapersonal factors associated with women’s pain.

_Pain in Women_

Although debatable, a sizable literature indicates that women have significantly lower pain thresholds and tolerance levels than men and rate equally intense noxious stimuli as more painful (e.g., Edwards et al., 1999; Fillingim, Edwards, & Powell, 1999; Rollman, Abdel-Shaheed, Gillespie, & Jones, 2004). Women are also more likely than men to report high levels of pain, (for a review, see Verbrugge, Lepkowksi, & Konkol, 1991). Substantial evidence also indicates that women suffer disproportionately from a large number of acute, recurrent, and chronic pain syndromes (e.g., Dao & LeResche, 2000; Rollman & Lautenbacher, 2001). A number of biological, psychological, and social variables have been implicated as contributing to variations in individual pain responses and to some of the differences in pain reactivity between males and females.

Examples are readily available in the domain of biological influences. Karandrea, Kittas, and Kitraki (2002) found sex differences in gene expression and hippocampal-
pituitary-adrenal axis regulation following chronic painful distress. Neuroimaging studies also have found sex differences in the magnitude and direction of brain activation following noxious stimulation (Zubieta et al., 2002). Gonadal hormones such as estrogens and androgens have been found to have potent effects on pain threshold in female and male rats (Liu & Gintzler, 2000) and have been implicated in the menstrual cycle variability associated with migraine pain (MacGregor, 1997) and other chronic pain conditions. In the psychosocial domain, several studies have found that a pattern of thinking known as catastrophizing might account for gender differences in pain.

Catastrophizing can be described as a tendency to magnify or exaggerate the threat value or seriousness of the pain sensation and an inability to divert attention away from pain (Sullivan, Bishop, & Pivik, 1995). Women reported more intense pain and displayed more pain behaviour than did men in a sample of asymptomatic undergraduate students participating in a cold pressor procedure (Sullivan, Tripp, & Santor, 2000). In these studies, gender differences in pain and pain behaviour were no longer significant after controlling for catastrophizing scores (Sullivan et al., 2000). Social factors and goals may play a role in the development and maintenance of catastrophizing as a habitual pattern of reaction to adversity (Keefe, LeFebvre, & Egert, 2000).

Taken together, women are probably particularly vulnerable to pain due to anatomical differences and hormonal fluctuations, with this vulnerability also influenced by psychological and social factors.

**Fluctuations with the Menstrual Cycle**

Berkley (1997) stressed that biological variations arising from female reproductive organs lend women to become more susceptible to pain. The menstrual
Several researchers (e.g., Johannes et al., 1995; Pfleeger, Straneva, Fillingim, Maixner, & Girdler, 1997) have shown fluctuations in physical and psychological functioning during a woman's menstrual cycle, but have yet to delineate factors responsible for these changes. In a meta-analytic review of sixteen published studies examining pain perception across the menstrual cycle, Riley, Robinson, Wise, and Price (1999) found relatively consistent patterns of variation in sensitivity to painful stimuli. That is, with the exception of electrical stimulation, the follicular phase (days 6-11, where day 1 is the first day of menstruation) demonstrated higher thresholds than later phases across all stimulus modalities, including pressure stimulation, cold pressor pain, ischemic muscle pain, and thermal heat stimulation. In contrast, Hellström and Lundberg (2000) reported that women were less sensitive to a cold pressor pain stimulus during days 20 to 24 of the menstrual cycle than on days 2 to 4. The inconsistency has not been reconciled, but the Riley et al. meta-analytic review paper summarizes the dominant research findings.

**Primary Dysmenorrhea**

In addition to cyclic sensitivity to pain, menstrual-related pain is a common phenomenon among young women and contributes to variability in women's pain experience. Menstrual pain is a unique sort of pain; it is neither an isolated incident nor persistent as it only exists for a few days per month. More specifically, primary dysmenorrhea, difficult and/or painful menstruation, is characterized by cramping pain in the lower abdomen at the time of menstruation (i.e., repeated, predictable), often accompanied by headaches, nausea, vomiting, diarrhea, and aching in the lower back and legs (Campbell & McGrath, 1999; Dicke, 1988; Rauh, Lucas, & Shepherd, 1985;
Scambler & Scambler, 1985). In contrast, discomfort associated with premenstrual syndrome is generally related to breast tenderness and abdominal bloating, rather than a lower abdominal cramping pain, and it typically occurs prior to the menstrual cycle and dissipates shortly after the onset of menstruation (Coco, 1999). Primary dysmenorrhea is also distinguished from secondary dysmenorrhea by the absence of organic (uterine and extrauterine) pathology in the former (Coco, 1999). The precise etiology of primary dysmenorrhea is currently unknown, but many physiological factors are implicated and most symptoms can be explained by the action of uterine prostaglandins (Coco, 1999).

**Features and Management.** Prevalence rates of primary dysmenorrhea have been reported as high as 90% (Jamieson & Steege, 1996) and as low as 43% (Svanberg & Ulmsten, 1981). Many women consider pain to be a normal part of the menstrual cycle and therefore fail to report their pain to physicians. Primary dysmenorrhea interferes significantly with normal routine and activities in approximately 10-25% of young women and is one of the major causes, if not the most important single cause, of school/work absenteeism in young women. Rates of absenteeism or loss of activity for dysmenorrheic women range from 34% to 50% (Andersch, & Milsom, 1982; Gruber & Wildman, 1987; Harlow & Park, 1996; Klein & Litt, 1981; Sundell, Milson, & Andersch, 1990).

Although many young women suffer menstrual pain substantial enough to interrupt their daily lives, they typically do not use medication in a way that sufficiently alleviates pain. Neither medication nor non-pharmacological methods provide adequate relief of menstrual pain for most adolescent females, because they are not taking effective medication dosages, are intolerant of them, do not respond to medication, or are using
ineffective non-pharmacologic methods (Campbell & McGrath, 1997). Clearly, there is substantial room for improvement in controlling this source of young women’s painful distress.

Dysmenorrhea status and pain. Compared with non-dysmenorrheic women, women with dysmenorrhea have an increased likelihood of additional pain syndromes such as fibromyalgia (Yunus, Masi, & Aldag, 1989) and irritable bowel syndrome (Jamieson, & Steege, 1996). They also are more susceptible to psychological disorders such as depression, anxiety, and somatization (Bancroft, Williamson, Warner, & Rennie, 1993). Several investigators have reported that dysmenorrhea status affects pain sensitivity. For instance, Granot et al. (2001) found that dysmenorrheic women had a higher psychophysical rating of pain and a higher level of anxiety across the menstrual cycle than non-dysmenorrheic controls. Goolkasian (1983) measured reactions to radiant heat stimuli in dysmenorrheic and nondysmenorrheic undergraduate students over a span of four weeks. She found that nondysmenorrheic women varied cyclically in their ability to discriminate painful from nonpainful stimuli, whereas dysmenorrheic women showed consistent pain reactions through the menstrual cycle. In contrast, Giamberardino, Berkley, Iezzi, de Bigontina, and Vecchiet (1997) reported that dysmenorrhea accentuated the impact of menstrual phase and lowered thresholds in the muscle but no the skin. Aberger, Denney, and Hutchings (1983) found no significant differences in pain sensitivity to ischemic pain between dysmenorrheic and non-dysmenorrheic women. Amodei and Nelson-Gray (1989) also could not distinguish pain thresholds and tolerance levels to pressure pain between non-dysmenorrheic and dysmenorrheic women, although the latter group reported the highest degree of pain and distress during the premenstrual
and menstrual phases. In sum, evidence regarding the relationship of dysmenorrhea status to pain is inconclusive. Investigations of the impact of social factors on women’s pain would do well to also attend to the role of biological factors, menstrual discomfort in particular, as determinants of pain expression.

**Personal Pain History and Current Pain**

Previous pain experiences can influence current pain. For example, previous experience with both experimental pain and clinical pain appears to be capable of resetting anchors or comparison points (e.g., Daltroy, Larson, & Eaton, 1999; Dar, Ariely, & Frenck, 1995), so that new pain is judged differently than if the individual had not had the earlier pain experience. There is evidence that an individual’s personal pain history and exposure to familial models can be useful in predicting and managing postsurgical pain (Bachiocco, Morselli, & Carli, 1993). A recent study found that a high frequency of family pain modeling was associated with higher frequency of current pain episodes, more types of pain, greater intensity, and lower subjective pain ratings during the cold pressor task (Zeichner, Wider, Loftin, Panopoulos, & Allen, 1999). Rollman et al. (2004) also reported that expectations and previous pain experience are strongly related; individuals who reported greater lifetime pain were more reactive to induced cold pressor pain. Fillingim et al. (1999) examined thermal pain thresholds and tolerance in a group of young adults and related these levels to the number of pain-related symptoms experienced during the previous month. They found that individuals with greater lifetime pain were also found to be more reactive to induced experimental pain. Moreover, for women, those with a larger number of pain sites and greater health care utilization exhibited greater pain sensitivity to thermal stimuli (Fillingim et al., 1999).
In summary, given the complex interplay of biopsychosocial factors involved in pain experience, it is important to assess family and personal pain history, as well as menstrual phase and dysmenorrhea status in investigations of women’s current pain perception and expression.

**Overview of this Study**

The main purpose of this study was to contribute to current understanding of social influences in pain experience and expression and to explore the relatively uncharted territory concerning the role of friendship. That is, do friends and strangers predict differential pain responses in young women? Considerable research has demonstrated the role of friendship in expressed emotions, with this, consequently, drawing attention to a void in research on the role of friendship in pain expression. For example, studies on facial emotional display have recruited participants’ friends to examine expressiveness in the presence of friends versus strangers while studies on audience effects on pain expression have mostly focused on participants alone or with strangers (e.g., confederates or other participants). Given that pain is not only a sensory and affective experience but incorporates socio-communicative acts, it is important to examine how the relationship context (i.e., friend or stranger) is related to the communication (i.e., expression) of pain. The protective, adaptive function of pain for humans includes not only the ability to warn and motivate escape or avoidance from harm but also the ability to recruit the assistance of caregiving others through instigation of communication of distress.

This study examined differential audience and social modeling effects of friends and strangers. Friendship was the social context chosen for this investigation in light of
its significance from evolutionary and developmental perspectives. Moreover, as the transition to college presents a “vulnerable” period during which important social models other than parents can exert influence on health-related behaviours (Lau, Quadrel, & Hartman, 1990), the university undergraduate age-group was thought to be an appropriate and convenient population in which to examine peer-related influences.

A secondary goal of the study was to explore the role of menstrual factors in current pain experience, within the framework of the socio-communication model of pain. Consideration of women’s menstrual phase, dysmenorrhea status and menstrual pain severity in pain research on women is important as evidence, albeit inconsistent, suggests variability in pain perception as a function of phase of the menstrual cycle. Thus, the potential variability in pain response due to menstrual-related factors needs to be acknowledged in order to facilitate a comprehensive understanding of the relationship between these factors and women’s pain experience. Family pain history and personal pain background were also examined concerning their predictive value in women’s current pain experience.

Participants were paired with either a female friend or a female stranger, whom they had not met prior to the experiment. Participants in each dyad underwent a lab-induced cold-pressor pain task in randomly determined sequence. The first woman who underwent the cold pressor served as the social model for the second woman and the second woman to be exposed to the cold-pressor served as the audience for the first one. Thereafter, the social model also served as the audience when the second woman underwent the task. This scenario, examining embedded audience effects and social modeling effects, has ecological validity, as young women often have opportunities to
observe their friends experiencing common symptoms, especially menstrual pain, and often subsequently experience similar pain and symptoms in the presence of their friends. The impact of friends versus strangers on women's pain experiences during the cold pressor task was measured by participants' self-reports of pain intensity, self-reports of pain affect, observed pain tolerance, and detailed coding of videotaped facial responses. In addition, given that family pain history and personal pain history could affect current pain experiences, analyses also examined group differences in these variables. In light of previous findings that individuals are more expressive in the company of a friend than a stranger, group differences in the display of other emotions were explored.

To fulfill general statistical assumptions of random independent sampling, each dyad was considered as a unit of analysis. Consequently, the current study employed a two group (relationship context: friend versus stranger) between-dyad design.

This study had two main objectives. First, pertaining to audience effects, it was hypothesized that participants would report different levels of pain intensity and unpleasantness, and display different levels of pain tolerance and facial expressivity in the presence of a friend versus a stranger. Second, with respect to social modeling influences, it was hypothesized that social modeling effects would be observed and that the relationship context would differentially predict the second woman's scores on various observable pain measures (i.e., verbally rated self-report of unpleasantness, cold pressor immersion time, and facial pain activity), beyond dysmenorrhea status and menstrual pain severity and the modeled pain response.
Method

Participants

Participants were recruited using posters and advertisements placed in the psychology department at the University of British Columbia and in other buildings on campus where psychology courses were held. Women with a previously diagnosed disorder (e.g., Raynaud's disease) whose symptoms may be exacerbated by exposure to cold and pain-provoking stimuli were excluded from the study. To reduce possible confounds with dysmenorrhea status, women previously diagnosed with endometriosis were also excluded from the study. Participants were randomly assigned to either the Friend condition or the Stranger condition, with the constraint that all participants were able to bring a female friend to the laboratory. Thus, participants in both the Friend and Stranger conditions were sampled on a random basis from the same population. All participants were instructed to bring a "good female friend" to the laboratory. In the Stranger condition, two pairs of friends arrived at the laboratory at the same time and random selection, using a coin toss, determined which person from each pair participated in the study. All participants and their friends received a choice of 1.5 course credit or one $10 gift certificate as compensation for their time. The final sample of participants consisted of 52 pairs of friends and 52 pairs of strangers.

Procedure

Written ethical approval was obtained from the University of British Columbia's Behavioural Research Ethics Board. Interested young women who telephoned the research laboratory completed a brief telephone screening administered by a research assistant to ensure eligibility for the study (i.e., adequate English proficiency, no
endometriosis, no self-identified, known disorder that may affect cold pressor performance).

Provided that eligibility requirements were met, these young women were given a brief summary of the study (i.e., that we were interested in how women respond to pain and aim to understand menstrual pain better) and an explanation of the cold pressor task (i.e., that they would be asked to immerse their hands in a two degree Celsius water bath from which they could withdraw at any time, with a maximum of 5-minute exposure). If the young woman continued to express interest in participating, she was asked to bring a "good female friend" with her to the laboratory at an appointed time. The quality of the friendship was subsequently checked by the Network of Relationship Inventory (described in Measures section). As noted above, each participant-friend dyad was randomly assigned to either the Friend or Stranger condition at the time the appointment was made. Appointments were confirmed by telephone the day prior to the scheduled appointment.

On the day of testing, after a brief introduction, the general purpose of the study was reviewed with the participant and her friend. The participant and her friend signed informed consent forms (Appendix A) and completed a demographic questionnaire (Appendix B) and a Network of Relationship Inventory (Furman, 1998; Appendix C). Following these questionnaires, participants were invited to the testing room.

In the Friend condition, the experimenter explained the nature of the cold pressor (CP) task and trained members of the dyad to describe their pain using words on the Gracely Unpleasantness Verbal Rating Scale (VRS, Gracely & Dubner, 1987; Appendix D) whenever prompted by a light bulb flashing once on and off. A coin toss determined
which person underwent the cold pressor task first. The “first cold pressor person” was seated on one side of the cold pressor apparatus that allowed her non-writing hand to be immersed in the water (e.g., a right-handed woman would sit on the right side of the cold pressor and immerse her left hand). The observing participant sat on the other side of the cold pressor apparatus. Both participants faced a one-way observation mirror located approximately 1.2 m away from their seats. The VRS (in 72-point font size) was posted on either side of the mirror. Participants were informed that a digital video camera was behind the mirror to record their verbal pain descriptors. The video-recording began approximately one minute before the cold pressor task and stopped approximately one minute after the participant withdrew her hand. Before leaving the cold pressor room, the experimenter reviewed the instructions again. The script was as follows:

Here’s a quick recap: When the light flashes three times, that’s the signal to place your hand up to the wrist in water and thereafter, each time the light goes on, say the word that best describes how you’re feeling. Remember to try to keep your hand in for as long as you can or until the light flashes 3 times in quick succession at the end of 5 minutes. Please keep an eye on the lights and do not talk to each other. You can stop the experiment anytime by withdrawing your hand. Here’s a towel to wipe off afterwards. If you’re done before I come back, just sit and relax. I won’t be long. All you (the observer) have to do is keep her (the CP person) company.

The light flashed three times in quick succession approximately 90 seconds after the experimenter left the room to signal the first person to immerse her hand into the water. If the participant’s hand remained in the water at the end of 5 minutes, the light
flashed three times again to signal the participant to withdraw her hand. After the first testing session, the experimenter re-entered the room and the same process was repeated for the second cold pressor person.

In the Stranger condition, two participant-friend dyads were scheduled to arrive at the same time and were seated in different rooms. After obtaining signed informed consent from each pair as described above, both participants filled out a demographic questionnaire (Appendix B) and the Network of Relationship Inventory (Appendix C). Subsequently, the experimenter informed each pair that only one person, determined by coin toss, was needed to perform the CP task. Only one person per dyad participated in the study to maintain independence of sampling. The designated "cold pressor participant" from each dyad formed a participant-stranger pair. To ensure that these two people were unacquainted with each other prior to the study, the experimenter asked whether they knew each other and in what capacity they may have interacted. No participant-stranger dyads had met prior to the experiment. Thereafter, the participant-stranger dyad undertook the cold pressor task as described in the Friend condition while the participants unselected for testing completed a questionnaire study unrelated to this project.

In both conditions, participants completed the following questionnaires after the cold pressor: Quick Questions, which included self-report rating of pain intensity using the Visual Analogue Scale (Appendix E), Family Health Questionnaire (Koutantji, Pearce, & Oakley, 1998; Appendix F), and the Menstrual Distress Management Questionnaire (Appendix G; Campbell & McGrath, 1997). A sensitive and thorough
debriefing was conducted and participants were invited to speak with the experimenter privately to address individual concerns or questions. All experimenters were female.

*Cold Pressor Apparatus*

The cold pressor device consisted of a commercially manufactured cooler measuring 24 cm wide, 44 cm long, and 28 cm deep with a plastic porous divider separating the ice-cube compartment from the water compartment, where the hand was immersed. Participants lowered their hands through a square opening in the lid measuring 15 cm². The water was maintained at a temperature of 2 degrees Celsius (+/- 1 degree). The water was circulated by a pump to prevent local warming around the hand. A ground fault circuit interrupter protected the pump’s power line. The cold pressor apparatus is a safe and widely used painful stimulus that meets criteria important for experimental noxious stimulation (e.g., stimulus controllability, reliability, discriminability, convenience, and validity) (Hirsch & Liebert, 1998). The cold pressor has been demonstrated to approximate the attributes of a number of common clinical pain, such as cancer pain (Graham, Bond, Gerkovich, & Cook, 1980), tension headache pain (Hunter & Philips, 1981), low back pain and myofascial pain (Keefe & Dolan), and labour pain (Melzack, 1984).

*Measures*

*Demographic information (see Appendix B).* Participants provided basic demographic data (e.g., age, ethnicity, education) as well as general information about their friendship with the female friend they brought to the laboratory (e.g., length of friendship, frequency of contact). Questions about ethnicity are based on the 2001 Canadian census (Statistics Canada, 2001).
Relationship inventory (see Appendix C). Participants completed the Network of Relationship Inventory (NRI; Furman, 1998), which assessed the quality of relationship between the participant and the friend she brought to the laboratory. The NRI consisted of 10, 3-item subscales (i.e., Companionship, Conflict, Instrumental Aid, Antagonism, Intimacy, Nurturance, Affection, Admiration, Relative Power, and Reliable Alliance). The Cronbach alphas of these scales were satisfactory (typical mean $\alpha = .80$; e.g., Furman & Buhrmester, 1992). Two factors, social support and negative interaction, were calculated. The social support measure is the mean of the Companionship, Instrumental Aid, Intimacy, Nurturance, Affection, Admiration, and Reliable Alliance scores. The negative interaction factor is the mean of the Conflict and Antagonism scales. Relative Power was not part of these factors, as it is not a stable factor in the assessment of friendships (Furman, 1998). The support and negative interaction factor scores are reliable ($\alpha > .90$) and stable over a one-month period ($r$s from .66 to .70; Furman, 1998). The NRI has been used with second grade through college-age students (Furman & Buhrmester, 1992). This questionnaire served as a manipulation check on the friendship pair (i.e., to ensure that the individuals in the Friends condition were good friends) and allowed examination of systematic differences in friendship between participants assigned to the Friend and Stranger conditions.

Verbal Measures of Pain

Pain unpleasantness ratings (see Appendix D). The Verbal Ratings Scale (VRS; Gracely & Dubner, 1987), which consists of thirteen affective verbal pain descriptors, was used to assess the unpleasantness of cold pressor pain. Numerical values, previously assigned to the descriptors using a cross-modality matching technique, result in a scale
with ratio characteristics, thus allowing a parametric assessment of participants’ pain experience (Gracely, Dubner, McGrath, 1979). The scale was anchored at the extremes by no discomfort (magnitude score = 0) and very intolerable (magnitude score = 44.8) and displayed in 72-font, vertical order with no discomfort at the bottom. Several studies (e.g., Duncan, Bushnell, Lavigne, 1989; Gracely, McGrath, & Dubner, 1978a, 1978b) have demonstrated that ratio scaling of the verbal descriptors is valid, reliable (test-retest reliability Pearson r = .97), and objective (measure of correlation between word meaning determined from an individual and a similar group Pearson r = .89). It is also valid for the measurement of clinical pain (Dupuis, Lemay, Bushnell, & Duncan, 1988).

A 12 Volt, 20-Watt light flashed on and off once every 15 seconds following cold pressor onset to prompt participants to provide a rating. Participants’ ratings were subsequently transcribed from the audiorecording. As participants varied in their cold pressor immersion time and consequently varied in the number of verbal ratings provided, scores from the VRS were derived in two ways: 1) For participants who had three or more ratings, first, mid-point, and last ratings were selected to explore differential audience effects over time; and 2) the mean VRS score was calculated (i.e., sum of all ratings divided by the number of ratings).

Pain intensity (see Appendix E). Following completion of the cold pressor, participants rated the intensity of their worst pain during the cold pressor task on a 10 cm visual analogue scale (VAS) anchored with endpoint labels no pain and most extreme pain. Scott and Huskisson (1976) reported that visual analogue scales with clearly delineated end points that are 10 to 15 cm in length are least open to biases. The VAS is
a reliable, valid, and widely used ratio measure of pain intensity (Jensen & Karoly, 1992; McGrath, 1990).

**Behavioural Measures of Pain**

**Pain tolerance.** To reflect pain tolerance levels, the length of time (in seconds) the participant's hand was immersed in the water was recorded. Two research assistants transcribed the on-screen time counter corresponding to participants' cold pressor immersion and withdrawal times. The inter-rater agreement within ±1 second was 98%. A ceiling time of 300 seconds was imposed.

**Facial Action Coding System (FACS).** Facial behaviour was videotaped continuously for 60 seconds prior to the onset of the cold pressor stimulus, during the cold pressor test, and for 60 seconds following the cessation of the cold pressor test via a camera behind a one-way mirror. Facial displays were coded using FACS (Ekman & Friesen, 1978). FACS is a widely used, comprehensive, atheoretical, anatomically based observational system and measures all visually discernible facial movements into 44 unique action units (AUs).

Based on considerable precedence in the FACS literature (e.g., Hadjistavropoulos & Craig, 1994; LaChapelle, Hadjistavropoulos, & Craig, 1999; Prkachin, 1992; Prkachin & Mercer, 1989), three sets of action units were combined to form new variables. “Cheek raiser” (AU 6) and “lid tightener” (AU 7) were combined because of their similar muscular basis, to form “orbit tightening”. “Nose wrinlker” (AU 9) and “upper lip raiser” (AU 10) were combined into “levator contraction”, as these actions involve contractions of different strands of the levator labii muscles, resemble each other, and have been hypothesized to represent different stages of the same expression (Prkachin &
Finally, "mouth open" (AU 25), "jaw drop" (AU 26), and "mouth stretch" (AU 27) were combined into "mouth open" with three levels of intensity (1 = lips apart, 2 = jaw drop, 3 = mouth stretch; LaChapelle et al., 1999; Prkachin & Mercer, 1989). All other AUs were recorded as in the FACS system.

Selected portions of the videotape were scored for facial activity. Up to nine periods each of 10 seconds in duration were coded for each participant. The 10-second period that occurred immediately prior to cold pressor immersion (Pre-cold pressor period) was coded. During the cold pressor the following 10-second periods were coded (when available): 0-10 (Pain Period 1), 45-55 (Pain Period 2), 90-100 (Pain Period 3), 135-145 (Pain Period 4), 180-190 (Pain Period 5), 225-235 (Pain Period 6), 270-280 (Pain Period 7). Finally, a 10-second period that occurred immediately following cold pressor withdrawal (Post-cold pressor period) was coded. Facial actions were identified for five 2-second segments during each of these nine 10-second periods. Each AU was scored as present or absent during each 2-second segment. Certain AUs were coded for intensity following a priori criteria specified by FACS (Ekman & Friesen, 1978). That is, AUs 9/10, 12, 17, 20, and 25/26/27 were coded on a 6-point intensity scale, which varied from 0 = no action to 5 = maximal action. AUs 1, 4, 6/7 were coded on a 3-point intensity scale (0 = no action, 1 = trace, 2 = definite action). Intensity coding is more subjective than frequency coding.

Two research assistants coded the videoclips. They had undergone extensive FACS training, successfully met criteria for accurate and reliability scoring, and passed the test of proficiency devised and administered by the developers of the system. The periods coded for each participant were coded in random order and the FACS coders
were blind to the experimental conditions. To establish the reliability of FACS coding, 20% of all segments were randomly selected and scored by a third certified coder. Inter-rater reliability was calculated using the formula recommended by Ekman and Friesen (1978), which assesses the proportion of agreement on actions recorded by two coders relative to the total number of actions coded as occurring by each coder. The FACS coders demonstrated a 78% inter-rater reliability. Agreement of 75% has been deemed satisfactory reliability of FACS scoring (e.g., Craig, Hyde, & Patrick, 1991; Ekman & Friesen, 1978; Ekman, Friesen, & Ancoli, 1980).

Intrapersonal Variables Associated with Pain

*Personal and family pain (see Appendix F).* The Family Health Questionnaire (Koutantji et al., 1998) assessed the participant's experience of current pain symptoms (i.e., headache, neck pain, back pain, etc.), as well as their frequency, intensity, and duration in the previous month. The total number of pain symptoms endorsed and the mean intensity of pain were calculated. The FHQ also assessed current and past complaints and/or illnesses of immediate relatives and "significant others". The family pain model was defined as the total number of immediate relatives with current pain complaints.

*Menstrual information (see Appendix G).* The Menstrual Distress Management Questionnaire (MDMQ; Campbell & McGrath, 1997) is a retrospective measure used to assess menstrual pain intensity, severity, and coping. The MDMQ consisted of four sections. Section 1, Menstrual History, asked a few background questions about the participant's menstrual history including her last date of menstrual onset prior to the experiment, and menstrual phase length.
Section 2, Menstrual Discomfort, focused on how much pain was experienced during the previous three menstrual periods. This section included the Symptom Severity Scale (SSS; Chesney & Tasto, 1975), which measured the severity of menstrual discomfort during the previous three menstrual periods. For the SSS, participants rated the severity of 15 common menstrual symptoms (e.g., cramps, backache, etc.) on a 5-point Likert scale (1 = symptom not present, 2 = slightly, 3 = moderately, 4 = severely, 5 = very severely). Participants were asked to limit their responses to the last three menstruations. Individual symptom severity scores were subsequently re-coded to 0 to 4, to reflect the interpretation of “0” as symptom not present. Only items clearly indicative of pain (e.g., cramps, headache, backache, leg ache, general aching, and abdominal pain) were summed to produce an overall symptom severity score of 0 to 24. Higher values indicated greater menstrual pain severity. Participants who reported no menstrual pain were assigned a 0 score.

Section 2 also included the Menstrual Symptom Questionnaire (MSQ; Chesney & Tasto, 1975), a 24-item questionnaire that assessed the frequency of symptoms experienced just before or during menstruation on a scale from 0 = never to 4 = always. Symptoms not reflecting dysmenorrhea (i.e., symptoms occurring before menstruation) were reverse-coded. Frequencies were summed to yield a total score ranging from 0 to 96. Higher scores reflected greater dysmenorrheic status. The MSQ has been used in several studies with college-aged women (e.g., Thompson & Gick, 2000) with test-retest reliability correlation coefficients ranging from .66 to .87 (Chesney & Tasto, 1975; Thompson & Gick, 2000). Sections 3 and 4 assessed the use of pharmacological and non-pharmacological methods to manage pain and discomfort.
Two weeks following the experiment, an email was sent to all participants requesting the date of their menstrual onset following the experimental session and number of menstruating days (see Appendix H). A follow-up email request was sent one week later to participants who either had not replied or had incomplete responses. Women who had not replied or had incomplete responses were sent a second follow-up email. No further attempts were made after the third email.

Calculation of menstrual cycle phase. Currently, no standardized operational definition or method for identifying menstrual cycle phase exists (Riley et al., 1999). In most women, menstruation recurs every 25 to 35 days, with a median cycle length of 28 days. The interval from the onset of menses to ovulation (follicular phase) is the most variable in duration and accounts for the range of cycle lengths observed in ovulating women. The interval from ovulation to the onset of menstrual bleeding is relatively constant and averages 14 days in most women. The greatest variability in cycle length is found in the first few years after menarche (Dorn, Nottelmann, & Susman, 1999) and the years immediately preceding menopause (O’Connor, Holman, & Wood, 2001). Researchers have used several terms for various cycle phases (e.g., pre-menstrual, menstrual, postmenstrual, ovulatory, follicular, luteal, etc.) each consisting of a different range of days. In many studies, the following conventions were observed (Riley et al., 1999). The first day of a woman’s cycle began upon self-report of onset of menses. Phases were then quantified by counting forward the days from this point. In some studies, further control was obtained by using fluctuation in basal temperature and use of urine testing (e.g., Fillingim et al., 1997; Veith et al., 1984).
In this study, the menstrual information obtained from the MDMQ and the follow-up email (i.e., last date of bleeding onset prior to the experiment, date of bleeding onset following the experiment, and menstrual phase length) was used to estimate the menstrual cycle phase using the Holding and Minkoff (1973) method, which standardizes the duration of the menstrual cycle to 28 days (i.e., by keeping the number of post-ovulatory days relatively constant). It can be used for women with menstrual cycles lasting between 21 and 35 days. Holding and Minkoff's method has been used in many studies (e.g., Baca-Garcia, Diaz-Sastre, DeLeon, & Saiz-Ruiz, 2000).
Results

Demographic Characteristics

Participants in the Friend condition ranged from 18.3 to 27.6 years ($M = 21.0$ years, $SD = 2.1$ years) and their friends ranged from 17.8 to 27.5 years ($M = 20.7$ years, $SD = 2.2$ years). Participants in the Stranger condition ranged from 18.4 to 23.5 years ($M = 20.2$ years, $SD = 1.2$ years) and their partners for the experiment ranged from 18.6 to 23.5 years ($M = 20.1$ years, $SD = 1.2$ years).

The self-described ethnic breakdown of all participants was as follows: 1) Asian (predominantly Chinese; $n = 94$); 2) Canadian or American ($n = 32$); 3) Canadian-Asian ($n = 29$); 4) South Asian ($n = 12$); 5) Canadian-European ($n = 8$); 6) European ($n = 7$); 7) Middle Eastern ($n = 7$); 8) Canadian-South Asian ($n = 6$); 9) Hispanic/Latin American ($n = 4$); 10) Canadian-Middle Eastern ($n = 3$); 11) Canadian-Eastern European ($n = 2$); 12) Eastern European ($n = 1$); and 13) Canadian-Australian ($n = 1$). These ethnic categories are not mutually exclusive, as some participants were both Asian and Canadian and some participants may not have used the word Canadian as a descriptor although they were probably legally Canadians. This ethnicity distribution is representative of the student population at the University of British Columbia. A chi-square analysis indicated no significant differences between the friend and stranger groups in ethnicity.

The ethnic make-up of all dyads was also examined. Each dyad was coded as "similar" or "dissimilar" in ethnicity based on their self-description and a chi-square analysis revealed no significance difference between the friend and stranger group. As some participants' self-description differed from their actual appearance (i.e., self-described as Canadian, but appeared Asian-Chinese), a research assistant reviewed the
videorecording of each dyad and rated their ethnic appearance as “similar” or “dissimilar.” Again, a chi-square analysis showed no significant difference between the friend and stranger group for the ethnic make-up of dyads.

Participants reported the highest level of education attained as follows: 1) high school graduation (n = 3); 2) first year university/college (n = 85); 3) second year university/college (n = 48); 4) third year university/college (n = 39); 5) fourth year university/college (n = 23); 6) graduated from university/college (n = 9); and 7) graduate school degree (n = 1). A chi-square analysis indicated no significant differences between the friend and stranger groups in the level of education attained.

A series of one-way analyses of variance revealed no significant differences between the Friend and Stranger groups in age of the second person undergoing the cold pressor task, age difference of participants in each dyad, or baseline FACS pain score (all ps > .05). However, results revealed that the first women to undergo the cold pressor task in the Friend Condition (M = 21.0 years; SD = 2.1) were significantly older than the first cold pressor women in the Stranger Condition (M = 20.2 years; SD = 1.2), Welch’s $F' (1, 82.571) = 5.479, p = .022$. Subsequent analyses were performed with age of the first cold pressor women as a covariate; no difference in the pattern of results emerged.

Preparations for Primary Analyses

Examination of Potential Confounds

Menstrual cycle. Despite three attempts to obtain menstrual information by email, only fifty-four percent of the participants provided sufficient information for menstrual phase calculations. No significant differences in the response rate emerged across friend and stranger groups. Analysis of variance and chi-square analyses revealed
no significant differences between the respondents and non-respondents on demographic characteristics (i.e., age, ethnicity, and education). Of the respondents, 85% had a menstrual cycle lasting between 21 and 35 days. After standardization, their cycles were divided into the follicular phase (days 1–11), mid-cycle (days 12-16), and luteal phase (days 17-28). To facilitate comparison with existing literature, the follicular phase was further divided into bleeding and non-bleeding follicular phases to yield a total of four phases: bleeding \( (n = 28) \), non-bleeding follicular \( (n = 15) \), mid-cycle \( (n = 20) \), and luteal phases \( (n = 32) \). Chi-square analysis revealed no significant friend and stranger group differences in the distribution of these cycles \( (p > .05) \).

As cold pressor pain tolerance has been shown to vary, albeit modestly, across the menstrual cycle (e.g., Hapidou & DeCatanzaro, 1988; Veith et al., 1984), one-way analyses of variance were performed to examine differences among the menstrual phases in pain tolerance as well as other pain measures. No significant results emerged across the full range of self-report, nonverbal, and other behavioural measures \( (ps > .05) \). This may be attributable to the low number of participants who provided menstrual phase information and the loss of statistical power to detect a significant effect. That is, the statistical power to detect a medium effect given the sample size available was .50. Nonetheless, menstrual cycle was not entered as a covariate in subsequent analyses.

**Oral contraceptives.** Since women using oral contraceptives generally do not show menstrual cycle effects on experimental pain perception (Fillingim & Ness, 2000), a chi-square analysis was performed to determine whether group differences in birth control pill use existed that could be a confound in this study. No significant differences emerged \( (p > .05) \). Analyses of variance also revealed no significant differences in all
pain measures between participants who were taking birth control pills (13% of total sample) and those who were not ($ps > .05$). All participants were included in subsequent analyses and birth control pill use was not entered as a covariate.

*Personal and family pain history.* Finally, chi-square analyses revealed no significant friend and stranger group differences in the distribution of family pain models or significant group differences in the number of pain symptoms endorsed. An analysis of variance found no significant differences in reported mean pain intensity between the two groups ($ps > .05$; see Table 1). Intercorrelations between these variables and the pain measures were also examined to determine the extent of shared variances. No significant results emerged ($ps > .05$). In light of these findings, personal and family pain history variables were not entered as covariates in subsequent analyses.

Table 1

*Personal Pain History by Group*

<table>
<thead>
<tr>
<th></th>
<th>Stranger (n=104)</th>
<th>Friend (n=104)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Number of family models (max = 7)</strong></td>
<td>M</td>
<td>SD</td>
</tr>
<tr>
<td></td>
<td>2.2</td>
<td>1.6</td>
</tr>
<tr>
<td><strong>Number of pain symptoms</strong></td>
<td>4.2</td>
<td>2.3</td>
</tr>
<tr>
<td><strong>Intensity of pain symptoms (max = 10)</strong></td>
<td>5.1</td>
<td>1.6</td>
</tr>
</tbody>
</table>
**Missing Data**

Aside from the aforementioned missing menstrual cycle information, some participants' facial actions \(n = 2\) and/or verbal ratings \(n = 15\) were missed due to some video-recording difficulties (e.g., sound and/or video). A series of chi-square and one-way analyses of variance revealed no significant differences between participants with and without missing data on the aforementioned background characteristics \(p > .05\). No significant differences emerged in the distribution of missing data across groups \(p > .05\).

**Manipulation Check**

The participants' quality of friendship was examined to ensure that dyads in the Friend condition were indeed good friends. The results revealed scores within age-expected ranges for good quality friendships (Furman, 1996) on the Social Support Factor \(M = 3.08; SD = .865\) and Negative Interaction scale \(M = 1.32; SD = .416\). A one-way analysis of variance revealed no significant difference in the quality of friendship between these ratings and the ratings provided by women in the Stranger condition regarding their friends \(p > .05\), suggesting no significant systematic group differences in the quality of friendship they enjoy. Moreover, in the Stranger condition, the experimenter asked the participants selected for the cold pressor task whether they knew each other and in what capacity they may have previously interacted. No participant-stranger dyad reported meeting prior to the experiment. In summary, these analyses indicated that the experimental conditions were successful in obtaining good quality friendships in the Friend condition and new acquaintances in the Stranger condition.
**FACS Data**

Due to the large number of potentially scorable AUs, the analyses of facial activity associated with pain focused on empirically-supported prototypical combinations of AUs displayed for pain (as reported by Patrick, Craig, & Prkachin, 1986; Prkachin, 1992) and standard emotions (as reported by Ekman, Friesen, & Hager, 2002). Research across a range of experimental pain modalities (e.g., Craig & Patrick, 1985; LeResche, Dworkin, Wilson, & Ehrlich, 1992; Patrick, Craig, & Prkachin, 1986; Prkachin, 1992) and across different clinical pain conditions (e.g., Craig, Hyde, & Patrick, 1991; Hadjistavropoulos & Craig, 1994; LeResche, 1982) has identified specific facial movements associated with pain, including lowering the brow, narrowing or closing the eyes by tightening the lids and raising the cheeks, raising the upper lips, deepening the nasolabial fold and wrinkling the nose, as well as opening the lips and mouth in varying degrees. The expression of pain shares some facial action units with several standard emotion expressions (e.g., sadness, fear, anger, disgust, and surprise), but the constellation of actions can be differentiated from these emotions (Craig, 1992; LeResche, 1982) using the FACS. Supplemental analyses of standard negative emotions (i.e., anger, fear, sadness, disgust) and surprise were performed.

The combinations of AUs that contributed to each emotion prototype are displayed in Table 2 (adapted from Kappesser & Williams, 2002), which also shows the overlap of AUs between the prototypical pain face (e.g., Prkachin, 1992) and those of standard emotions (Ekman et al., 2002). A face was counted as representing a specific emotion or pain whenever the representative specific combination of AUs occurred within the 10-second segment.
<table>
<thead>
<tr>
<th>Emotions</th>
<th>1</th>
<th>2</th>
<th>4</th>
<th>5</th>
<th>6/7</th>
<th>9/10</th>
<th>15</th>
<th>17</th>
<th>23</th>
<th>25/26/27</th>
<th>43</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pain</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
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<td></td>
<td></td>
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<td>X</td>
</tr>
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<td>Sadness</td>
<td>X</td>
<td>X</td>
<td>X</td>
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<td>X</td>
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<tr>
<td>Fear</td>
<td>X</td>
<td>X</td>
<td>X</td>
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<td></td>
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<td>X</td>
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<tr>
<td>Anger</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
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<td></td>
<td>X</td>
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<tr>
<td>Disgust</td>
<td>X</td>
<td>X</td>
<td>X</td>
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<tr>
<td>Surprise</td>
<td>X</td>
<td>X</td>
<td>X</td>
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</tbody>
</table>

1 = inner brow raiser; 2 = outer brow raiser; 4 = brow lowerer; 5 = upper lid raiser; 6/7 = check raiser/lid tightener; 9/10 = nose wrinkle/upper lip raiser; 15 = lip corner depressor; 17 = chin raiser; 23 = lip tighten; 25/26/27 = lips part/jaw drop/mouth stretch; 43 = eyes closed.
For instance, a “pain face” consisted of a contiguous display of AU 4 = brow lowerer, AU 6/7 = cheek raiser/eye-lid tightening, AU 9/10 = nose wrinkler/upper upper lip raiser, and AU 43 = eyes closed. Incidents of the full constellation for each standard emotion and pain within each cold pressor period were summed. As participants varied in the length of immersion time, the sum of occurrences during the cold pressor task was subsequently divided by each participant's number of pain periods scored to obtain a mean frequency score per pain period. Similarly, facial pain intensity scores were calculated by using the intensity ratings instead of frequency counts.

Although “eyes closed” (AU 43) has been consistently associated with the prototypical pain face, it was plausible that this AU only occurs during more intense pain experiences and therefore the prototypical pain face described above (i.e., AUs 4, 6/7, 9/10, and 43) may be less sensitive to less intense pain experiences. Thus, an alternate, less intense pain face was considered. A face was counted as representing less intense pain whenever the combination of AUs 4, 6/7, and 9/10 occurred contiguously within a 10-second segment. The occurrence of AU 43 also contributed to the frequency count although it was not a necessary component of the less intense pain face. The frequency scores per pain period were calculated in the same manner as described above.

Table 3 shows the means and standard deviations of the “more intense” and “less intense” pain faces before, during, and after the cold pressor task. The non-zero frequency count of the less intense pain face before the cold pressor suggests that this method may be less specific to pain than the more intense prototype. Moreover, there was a moderately high correlation (Pearson $r = .62, p < .001, 38%$ shared variance)
between the frequency scores obtained during the cold pressor task. Consequently, only the more intense prototype was used in subsequently analyses.

Table 3

_Pain Facial Frequency: "More Intense" and "Less Intense" Prototypes_

<table>
<thead>
<tr>
<th></th>
<th>More Intense (n=104)</th>
<th>Less Intense (n=104)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>M</td>
<td>SD</td>
</tr>
<tr>
<td>Before cold pressor</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>During cold pressor</td>
<td>1.12</td>
<td>3.27</td>
</tr>
<tr>
<td>After cold pressor</td>
<td>1.29</td>
<td>3.61</td>
</tr>
</tbody>
</table>

Examination of Statistical Assumptions

Kolmogorov-Smirnov Goodness of Fit Tests were statistically significant for pain tolerance time, \( Z(104) = 2.45, p < .001 \) (i.e., bimodal); self-reported pain intensity rating, \( Z(104) = 2.09, p < .001 \) (i.e., negatively skewed); and FACS pain score, \( Z(100) = 4.67, p < .001 \) (i.e., positively skewed), indicating that these distributions deviated significantly from standard normal distributions. Since robustness studies suggest that non-normality has negligible consequences on Type-I and Type-II error probabilities in non-directional tests (Glass & Hopkins, 1996), no transformation was performed. The bi-modal distribution of pain tolerance time was consistent with findings from other studies (e.g., Chen, Dworkin, Haug, & Gehrig, 1989a, 1989b). The Kolmogorov-Smirnov Goodness of Fit Test was not statistically significant for self-reported unpleasantness ratings.
Objective #1: Audience Effects

The first purpose of the study was to examine whether there was a difference in the first cold pressor participants' pain intensity, pain unpleasantness, pain tolerance, and pain facial display in the presence of a friend versus a stranger (i.e., differential audience effects).

Relationships Among Dependent Measures

To assess the degree of convergence among the various dependent measures and to enable decisions to be made regarding the structure of subsequent statistical analyses, correlational analyses were performed among these dependent measures. The Pearson product moment correlation coefficients are presented in Table 4. An overall Type I error rate of .01 was used to determine the significance of correlations. Not surprisingly, participants who reported higher levels of unpleasantness removed their hand from the cold pressor sooner and also subsequently rated the pain as more intense. Mean, first, middle, and last unpleasantness ratings were also significantly correlated in the expected direction. However, self report pain intensity scores were not significantly correlated with pain tolerance. There was sufficient apparent independence among these measures to justify performing separate analyses on each of the dependent variables. However, due to the significantly high correlation ($r = .990, p < .001$) between pain facial frequency and intensity, only the frequency scores were examined.
### Table 4

*Intercorrelations Between Pain Measures*

<table>
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<th>1</th>
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<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Mean intensity ratings&lt;sup&gt;a&lt;/sup&gt;</td>
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<td></td>
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</tr>
<tr>
<td>2. Pain tolerance&lt;sup&gt;b&lt;/sup&gt;</td>
<td>-.199</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. Mean unpleasantness ratings&lt;sup&gt;c&lt;/sup&gt;</td>
<td>.334*</td>
<td>-.289*</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. First unpleasantness rating&lt;sup&gt;c&lt;/sup&gt;</td>
<td>.211</td>
<td>-.336*</td>
<td>.651*</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. Mid unpleasantness rating&lt;sup&gt;c&lt;/sup&gt;</td>
<td>.287*</td>
<td>-.233</td>
<td>.841*</td>
<td>.488*</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6. Last unpleasantness rating&lt;sup&gt;c&lt;/sup&gt;</td>
<td>.392*</td>
<td>-.418*</td>
<td>.777*</td>
<td>.286*</td>
<td>.512*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7. Pain facial frequency&lt;sup&gt;d&lt;/sup&gt; during CP</td>
<td>.150</td>
<td>-.240</td>
<td>-.040</td>
<td>.112</td>
<td>.043</td>
<td>-.121</td>
<td></td>
</tr>
<tr>
<td>8. Pain facial intensity&lt;sup&gt;d&lt;/sup&gt; during-CP</td>
<td>.156</td>
<td>-.211</td>
<td>.027</td>
<td>.111</td>
<td>.036</td>
<td>-.107</td>
<td>.990*</td>
</tr>
</tbody>
</table>

Note. Pearson *r* correlation coefficients between measures for the first person exposed to the cold pressor (CP)

<sup>a</sup> = assessed by VAS; <sup>b</sup> = duration of CP immersion time; <sup>c</sup> = assessed by Verbal Rating Scale;
<sup>d</sup> = assessed by facial action coding.

* *p < .01.*
Primary Analyses

An overall Type I error rate was set at .01 for subsequent analyses of audience effects. Table 5 shows the group means and standard deviations for each pain measure.

Pain tolerance. Results from a one-way analyses of variance (ANOVAs) showed no significant difference between friend and stranger audience types in the first cold-pressor participants' pain tolerance $F(1, 103) = .066, p = .80$. Due to the bimodal distribution of pain tolerance time, a chi-square analysis was performed to examine friend versus stranger group differences. Participants were divided into high- (greater than 120 seconds) or low- (equal or less than 120 seconds) tolerance groups. Sixty-eight percent fell in the high-tolerance group. No significant differences emerged, $p = .83$.

Pain intensity. Results from a one-way analyses of variance (ANOVAs) showed no significant difference between friend and stranger audience types in self-reported pain intensity rating $F(1, 103) = .015, p = .90$.

Given that the mean pain unpleasantness rating was significantly correlated with self-reported intensity and duration of cold pressor immersion, these analyses were performed a second time with the mean unpleasantness rating as a covariate. The inclusion of the covariate did not change the results ($ps > .05$). The analyses were repeated once more with the first participant's age as a covariate based on earlier significant results from the demographic analyses. The pattern of results remained the same.
Table 5

Means and Standard Deviations of Pain Measures by Audience Type

<table>
<thead>
<tr>
<th></th>
<th>Stranger</th>
<th></th>
<th>Friend</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>M</td>
<td>SD</td>
<td>M</td>
<td>SD</td>
</tr>
<tr>
<td>Self-report pain intensity(^a)</td>
<td>73.66</td>
<td>18.88</td>
<td>73.26</td>
<td>14.05</td>
</tr>
<tr>
<td>Pain tolerance(^b) (seconds)</td>
<td>128.31</td>
<td>106.14</td>
<td>122.83</td>
<td>110.8</td>
</tr>
<tr>
<td>Average pain unpleasantness(^c)</td>
<td>17.69(^f)</td>
<td>10.71</td>
<td>17.66(^f)</td>
<td>11.17</td>
</tr>
<tr>
<td>First unpleasantness rating(^c)</td>
<td>11.25(^g)</td>
<td>10.49</td>
<td>7.56(^h)</td>
<td>5.43</td>
</tr>
<tr>
<td>Mid-point unpleasantness rating(^c)</td>
<td>16.47(^f)</td>
<td>12.66</td>
<td>16.45(^f)</td>
<td>9.59</td>
</tr>
<tr>
<td>Last unpleasantness rating(^c)</td>
<td>26.33(^i)</td>
<td>15.89</td>
<td>26.49(^i)</td>
<td>15.53</td>
</tr>
<tr>
<td>Pre-CP pain facial frequency(^d)</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>During CP pain facial frequency(^d)</td>
<td>1.12</td>
<td>3.49</td>
<td>1.12</td>
<td>3.06</td>
</tr>
<tr>
<td>Post-CP pain facial frequency(^d)</td>
<td>1.10</td>
<td>3.47</td>
<td>1.48</td>
<td>3.75</td>
</tr>
<tr>
<td>Pre-CP(^4) pain facial intensity(^e)</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>During CP pain facial intensity(^e)</td>
<td>3.69</td>
<td>12.83</td>
<td>3.33</td>
<td>10.41</td>
</tr>
<tr>
<td>Post-CP pain facial intensity(^e)</td>
<td>3.27</td>
<td>11.57</td>
<td>2.89</td>
<td>9.61</td>
</tr>
</tbody>
</table>

Note. CP = Cold pressor.

\(^a\)Possible range = 1 to 100; \(^b\)Possible range = 0 to 300 seconds; \(^c\)Possible range = 0 to 44.8; \(^d\)mean frequency count per 10 second period; \(^e\)mean intensity per 10 second period; \(^f\)corresponds closely to very distressing on the Verbal Rating Scale; \(^g\)corresponds closely to distressing; \(^h\)corresponds to halfway between slightly distressing and very unpleasant; \(^i\)corresponds to halfway between very distressing and intolerable.
Pain unpleasantness. A 2 (audience type: friend vs. stranger) X 3 (time point: first, mid-point, and last) repeated measures ANOVA was performed on pain unpleasantness ratings. Audience type was the between-subjects factor and time point was a within-subject factor. Only participants (78%) who provided three or more ratings were entered into this analysis. Results of the omnibus mixed-model ANOVA yielded a significant main effect of time point, $F(2, 146) = 48.613, p < .001, \eta^2 = .400$. No significant main effect of audience type, $F(1, 73) = .329, p = .568, \eta^2 < .01$ or interaction of audience type by time point, $F(2, 146) = .788, p = .457, \eta^2 = .01$ emerged. Post-hoc Least Significance Difference pairwise comparisons of means revealed that participants’ last rating was significantly higher than the midpont rating ($p < .001$) which, in turn, was significantly greater than the first rating ($p < .001$; see Figure 2).

To supplement the foregoing analysis and include participants who provided fewer than three ratings, a one-way (audience type: friend vs. stranger) ANOVA on mean pain unpleasantness rating was performed. No significant audience type difference emerged, $F(1, 103) = 0, p = .990$ (see Table 5).
Figure 2

*Pain Unpleasantness Ratings by Audience Effect (Stranger vs. Friend) and Time*

Note. The position of unpleasantness rating refers to the position of the unpleasantness rating within the series of ratings provided by the participants.
**Pain facial activity.** A 2 (audience type: friend vs. stranger) X 2 (time point: during and post- cold pressor) repeated measures ANOVA was performed on the frequency of pain facial activity. Audience type was the between-subjects factor and time point was a within-subject factor. The pre-cold pressor time point was excluded because no facial activity was observed \( (M = 0; SD = 0) \). The results of the omnibus mixed-model ANOVA yielded no significant main effect of time point, \( F(1, 100) = .256, p = .614, \eta^2 < .01 \), no significant main effect of audience type, \( F(1, 100) = .112, p = .739, \eta^2 < .01 \), and no significant interaction effect of audience type by time point, \( F(1, 100) = .191, p = .663, \eta^2 < .01 \). The group means and standard deviations of facial frequency and intensity appear in Table 5.

**Supplemental Analyses**

**Standard emotion facial activity.** A 2 (audience type: friends vs. strangers) X 3 (time point: pre-, during, and post- cold pressor) repeated measures ANOVA was performed on each emotion facial activity (i.e., disgust, fear, anger, sad, and surprise). A summary of the findings appears in Table 6. A significant main effect of audience type was found only for disgust, \( F(1, 102) = 4.977, p = .028, \eta^2 = .047 \). Least Significant Difference pairwise comparisons of means revealed that participants observed by friends were significantly more expressive than were those observed by strangers.

A significant main effect of time was found for expressivity of the following emotions: disgust, \( F(2, 204) = 7.393, p = .001, \eta^2 = .068 \); fear, \( F(2, 204) = 9.197, p = .001, \eta^2 = .083 \); anger, \( F(2, 204) = 23.361, p < .001, \eta^2 = 1.86 \); and surprise, \( F(2, 204) = 3.393, p = .040, \eta^2 = .032 \); but not sadness, \( F(2, 204) = 1.564, p = .216, \eta^2 = .015 \). No significant interaction of audience type and time point emerged, \( ps > .05 \).
Table 6

Means and Standard Deviations of Facial Emotion Activity Frequency per 10-second Period by Audience Type and Time

<table>
<thead>
<tr>
<th>Emotions</th>
<th>Cold Pressor</th>
<th>Stranger</th>
<th>Friend</th>
<th>Significant Effects</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Time</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>M</td>
<td>SD</td>
<td>M</td>
<td>SD</td>
</tr>
<tr>
<td>Anger</td>
<td>Before</td>
<td>.42</td>
<td>1.78</td>
<td>1.06</td>
</tr>
<tr>
<td></td>
<td>During</td>
<td>3.13</td>
<td>3.87</td>
<td>4.58</td>
</tr>
<tr>
<td></td>
<td>After</td>
<td>2.56</td>
<td>4.08</td>
<td>3.13</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Time: $F$ (2, 204) = 23.36*</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>During &gt; After &gt; Before</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Disgust</td>
<td>Before</td>
<td>.33</td>
<td>1.53</td>
<td>.81</td>
</tr>
<tr>
<td></td>
<td>During</td>
<td>.85</td>
<td>1.39</td>
<td>1.52</td>
</tr>
<tr>
<td></td>
<td>After</td>
<td>.27</td>
<td>1.19</td>
<td>.63</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Time: $F$ (2, 204) = 7.39**</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>During &gt; After = Before;</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Group: $F$ (1, 102) = 4.98*</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Friend &gt; Stranger</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fear</td>
<td>Before</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>During</td>
<td>.53</td>
<td>1.56</td>
<td>.51</td>
</tr>
<tr>
<td></td>
<td>After</td>
<td>.10</td>
<td>.69</td>
<td>.13</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Time: $F$ (2, 204) = 9.20**</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>During &gt; After = Before</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sadness</td>
<td>Before</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>During</td>
<td>.05</td>
<td>.24</td>
<td>.20</td>
</tr>
<tr>
<td></td>
<td>After</td>
<td>.12</td>
<td>.83</td>
<td>.12</td>
</tr>
<tr>
<td></td>
<td></td>
<td>No significant effects</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Surprise</td>
<td>Before</td>
<td>.22</td>
<td>1.53</td>
<td>.64</td>
</tr>
<tr>
<td></td>
<td>During</td>
<td>.64</td>
<td>1.38</td>
<td>.96</td>
</tr>
<tr>
<td></td>
<td>After</td>
<td>.42</td>
<td>1.94</td>
<td>.25</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Time: $F$ (2, 204) = 3.39**</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>During &gt; After = Before</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* $p < .05$; ** $p < .01$.  

66
Least Significant Difference pairwise comparisons of means revealed that participants expressed significantly more disgust, fear, and surprise during the cold pressor than before or after the task. Participants expressed significantly more anger during the cold pressor than after which, in turn, was significantly more than pre-cold pressor. Taken together, although the amount of pain facial activity could not be distinguished between during and post- cold pressor, the expressivity of standard emotions generally was greater during cold pressor than before or after the task.

In summary, contrary to the hypotheses, there was no significant audience effect on participants’ self-reported pain intensity, the length of time they kept their hands in the water, or on their facial pain expression. An audience effect was observed, however, for expression of disgust, where friends were more expressive than strangers.
Objective #2:

Social Modeling Effect

Unlike the audience condition, which was manipulated via random assignment, social modeling behaviour was not manipulated. Thus, regression analyses were the most appropriate method for examining social modeling.

Hierarchical regression analyses were performed to examine the relative contributions of social modeling, the relationship with the social model, and dysmenorrheic status and severity to the variance in each of the pain measures (i.e., mean verbal unpleasantness rating, pain tolerance, and facial pain activity during cold pressor task) provided by the second person undergoing the cold pressor task. The variables were entered based on their temporal order.

Step 1 of the hierarchical regression examined the participant’s dysmenorrheic status and severity. Variables associated with the social model were entered in step 2. Specifically, the social model’s pain tolerance, unpleasantness rating, facial activity during the cold pressor, and the relationship context (i.e., friend or stranger) were entered to examine the unique contribution of the social model’s behaviour over and above the woman’s experience of dysmenorrhea. All of the pain measures were included as predictors to explore cross-modality modeling effects. The relationship context was a dichotomous variable with the Stranger condition as the reference group (i.e., 0 = strangers and 1 = friends). The third step consisted of an interaction term of the social model’s modality-specific index pain variable (e.g., social model’s pain tolerance if the dependent variable were pain tolerance) and the relationship context. As facial pain
frequency and intensity were highly correlated \((r = .997, p < .001)\), only facial pain frequency was examined.

**Examination of Statistical Assumptions**

As mentioned earlier, individuals' cold pressor pain tolerance distributes in a bimodal manner (e.g., Chen, Dworkin, Haug, & Gehrig, 1989a, 1989b), leading to a relatively natural split in whether they appear to be high or low pain tolerant. Participants were divided into high- or low- tolerance groups based on the bimodal distribution of their pain tolerance times (see Figure 3) and on conventions from existing research (e.g., Chen, et al., 1989a, 1989b). Individuals were categorized as low-tolerance if their pain tolerance cold pressor time was 110 seconds or less; those with an immersion time greater than 110 seconds were designated as high-tolerance. Using this criterion, 65% fell in the low-tolerance group and 35% fell in the high-tolerance group.

A chi-square analysis revealed no significant audience group differences (friend vs. stranger) in this distribution, \(p > .05\). Separate one-way analyses of variance revealed no significant tolerance group differences in pain intensity, facial activity frequency, or intensity, \(ps > .05\). However, a one-way analysis of variance revealed significant tolerance group differences in affective discomfort, \(F(1, 103) = 10.858, p = .001\); low-tolerance participants rated the pain as more unpleasant than high-tolerance participants (see Table 7). Thus, the participants' cold pressor immersion time (rather than the high- or low-tolerance dichotomous variable) was entered as a covariate in the hierarchical regression predicting pain unpleasantness ratings.
Figure 3

Histogram of the Second Person’s Cold Pressor Tolerance Time (N = 104)
Table 7

Means and Standard Deviations of Pain Measures for Low- (n = 68) and High-Tolerance (n = 36) Groups

<table>
<thead>
<tr>
<th>Pain Measure</th>
<th>Low Tolerance</th>
<th>High Tolerance</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>M</td>
<td>SD</td>
</tr>
<tr>
<td>Self-report pain intensity(^a)</td>
<td>75.85</td>
<td>11.56</td>
</tr>
<tr>
<td>Pain unpleasantness(^b)</td>
<td>23.13(^d)*</td>
<td>11.80</td>
</tr>
<tr>
<td>Pain facial frequency (per 10s period)(^c)</td>
<td>1.00</td>
<td>3.29</td>
</tr>
<tr>
<td>Pain facial intensity (per 10s period)(^c)</td>
<td>3.63</td>
<td>12.5</td>
</tr>
</tbody>
</table>

\(^a\) assessed by VAS; \(^b\) assessed by Verbal Rating Scale (VRS); \(^c\) assessed by facial action coding; \(^d\) closely corresponds to halfway between very distressing and intolerable; \(^e\) closely corresponds to halfway between slightly intolerable and very distressing.

\(^*\) \(p = .004\).

Table 8 shows the correlation matrix between predictor variables and each of the three dependent pain measures. Leverage values, Cook’s D, and studentized residuals were examined to detect univariate and multivariate outliers. Assumptions of normality, linearity, and homoscedasticity were examined using residual scatterplots. No outliers or violations of assumption were observed. An overall Type I error rate was set at \(p < .01\) for the hierarchical regression analyses.
<table>
<thead>
<tr>
<th></th>
<th>P1</th>
<th>P2</th>
<th>P3</th>
<th>P4</th>
<th>P5</th>
<th>P6</th>
<th>D1</th>
<th>D2</th>
<th>D3</th>
</tr>
</thead>
<tbody>
<tr>
<td>P1. Dysmenorrhea Status</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>P2. Menstrual Pain Severity</td>
<td></td>
<td>.386**</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>P3. SM Pain Tolerance</td>
<td></td>
<td></td>
<td>-.279**</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>P4. SM Unpleasantness Rating</td>
<td></td>
<td>.190</td>
<td>.016</td>
<td>-.289**</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>P5. SM Pain Facial Frequency</td>
<td></td>
<td>.102</td>
<td>.183</td>
<td>-.240*</td>
<td>-.040</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>P6. SM Pain Facial Intensity</td>
<td></td>
<td>.090</td>
<td>.161</td>
<td>-.211*</td>
<td>.027</td>
<td>.990**</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>D1. Pain Tolerance</td>
<td></td>
<td>-.122</td>
<td>-.048</td>
<td>.573**</td>
<td>-.125</td>
<td>-.180</td>
<td>-.160</td>
<td></td>
<td></td>
</tr>
<tr>
<td>D2. Mean Unpleasantness Ratings</td>
<td></td>
<td>.214*</td>
<td>.011</td>
<td>-.181</td>
<td>.279**</td>
<td>-.021</td>
<td>-.014</td>
<td>-.358**</td>
<td></td>
</tr>
<tr>
<td>D3. Pain Facial Frequency</td>
<td></td>
<td>.026</td>
<td>-.065</td>
<td>.012</td>
<td>.099</td>
<td>.245*</td>
<td>.260**</td>
<td>-.125</td>
<td>.209*</td>
</tr>
<tr>
<td>D4. Pain Facial Intensity</td>
<td></td>
<td>.063</td>
<td>-.086</td>
<td>.050</td>
<td>.004</td>
<td>.264**</td>
<td>.277**</td>
<td>-.120</td>
<td>.153</td>
</tr>
</tbody>
</table>

*Note. SM = Social Model’s measure; P = Predictor; D = Dependent Measure.*

* p < .05; ** p < .01.
Analysis of Pain Tolerance

As seen in Table 9, in the hierarchical analysis of the second woman’s cold pressor pain tolerance, dysmenorrheic status and severity failed to account for significant variance, Adjusted $R^2 = .02$; $F(2, 89) = 1.09, p = .340$. The addition of relationship context and the social model’s pain tolerance, affective discomfort, and facial frequency, however, contributed significantly to the prediction of the second woman’s pain tolerance, $\Delta R^2 = .38; \Delta F(4, 85) = 13.33, p < .001$. The interaction term of relationship and pain tolerance in step 3 failed to contribute unique variance, $\Delta R^2 = .001; \Delta F(1, 84) = .12, p = .736$. The model with dysmenorrhea status and menstrual pain severity, relationship context, and social model’s pain expression variables accounted for 36% of the variance in the second woman’s pain tolerance, $F$ model $(6, 85) = 9.45, p < .001$, with the first woman’s pain tolerance, $t = 6.541, p < .001$, as the only significant predictor. That is, the social model’s cold pressor immersion time positively predicted the second woman’s duration in the cold pressor.

Analysis of Pain Unpleasantness Rating

In the hierarchical analysis of verbal unpleasantness ratings (see Table 10), the participants’ cold pressor tolerance time, entered as a covariate step, accounted for significant variance, Adjusted $R^2 = .12; F(1, 90) = 13.11, p < .001$. In the first step, dysmenorrheic status and severity failed to add significant variance, $\Delta R^2 = .04; \Delta F(2, 88) = 1.89, p = .156$. In the next step, relationship context and social model’s pain tolerance, affective discomfort and facial frequency, however, contributed significantly to the prediction of the second woman’s pain tolerance beyond the covariate, $\Delta R^2 = .15; \Delta F(4, 84) = 4.64, p = .002$. The interaction of relationship context and social model’s pain
Table 9

Summary of Hierarchical Regression Analysis for Predicting Pain Tolerance (N = 91)

<table>
<thead>
<tr>
<th>Predictors a</th>
<th>Block 1</th>
<th>Block 2</th>
<th>Block 3</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>β (SEβ)</td>
<td>p</td>
<td>r²Y(1,2)</td>
</tr>
<tr>
<td>Dysmenorrhea factors</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Status</td>
<td>-.08 (.74)</td>
<td>.450</td>
<td>&lt;.01</td>
</tr>
<tr>
<td>Severity</td>
<td>-.10 (1.4)</td>
<td>.386</td>
<td>&lt;.01</td>
</tr>
<tr>
<td>Social model factors</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pain tolerance</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pain unpleasantness</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Pain facial frequency</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Relationship context</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Interaction term</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Relationship context x pain tolerance</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

R² = .002, p = .340
R² = .36, p < .001;
ΔR² = .38, p < .001
R² = .35, p < .001;
ΔR² = 0, p = .736
Table 10

Summary of Hierarchical Regression Analysis for Predicting Pain Unpleasantness with Tolerance as Covariate (N = 91)

<table>
<thead>
<tr>
<th>Predictors a</th>
<th>Block Covariate</th>
<th>Block 1</th>
<th>Block 2</th>
<th>Block 3</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>β (SEβ)</td>
<td>p</td>
<td>r²_Y(1,2)</td>
<td>β (SEβ)</td>
</tr>
<tr>
<td>Covariate: 2nd person's pain tolerance</td>
<td>-0.36 &lt; .001 .13 (0.01)</td>
<td>-0.34 .001 .11 (0.01)</td>
<td>-0.37 .002 .08 (0.01)</td>
<td>-0.37 .002 .08 (0.01)</td>
</tr>
<tr>
<td>Dysmenorrhea factors</td>
<td>Status</td>
<td>.21 .055 .04 (0.07)</td>
<td>.15 .159 .02 (0.07)</td>
<td>.15 .160 .02 (0.07)</td>
</tr>
<tr>
<td></td>
<td>Severity</td>
<td>-0.06 .550 &lt; .01 (0.13)</td>
<td>.01 .889 &lt; .01 (0.13)</td>
<td>.01 .892 &lt; .01 (0.13)</td>
</tr>
<tr>
<td>Social model factors</td>
<td>Pain tolerance</td>
<td>.18 .140 .02 (0.01)</td>
<td>.19 .142 .02 (0.01)</td>
<td>.19 .142 .02 (0.01)</td>
</tr>
<tr>
<td></td>
<td>Pain unpleasantness</td>
<td>.37 &lt; .001 .12 (0.11)</td>
<td>.36 .009 .06 (0.15)</td>
<td>.36 .009 .06 (0.15)</td>
</tr>
<tr>
<td></td>
<td>Pain facial frequency</td>
<td>-0.03 .730 &lt; .01 (0.37)</td>
<td>-0.03 .733 &lt; .01 (0.37)</td>
<td>-0.03 .733 &lt; .01 (0.37)</td>
</tr>
<tr>
<td></td>
<td>Relationship context</td>
<td>-0.17 .064 .03 (2.1)</td>
<td>-0.17 .065 .03 (2.1)</td>
<td>-0.17 .065 .03 (2.1)</td>
</tr>
<tr>
<td>Interaction term</td>
<td>Relationship context x pain unpleasantness</td>
<td>R² = .12, p &lt; .001</td>
<td>R² = .14, p = .001; ΔR² = .04, p = .156</td>
<td>R² = .26, p &lt; .001; ΔR² = .15, p = .002</td>
</tr>
</tbody>
</table>
affective ratings in the last step failed to contribute unique variance, $\Delta R^2 = 0$; $\Delta F(1, 83) = .012, p = .912$, and was excluded from the model predicting the second cold pressor woman’s unpleasantness ratings. The model with the second woman’s pain tolerance as covariate, dysmenorrhea status and menstrual pain severity, relationship context, and social model’s pain unpleasantness rating accounted for 26% of the variance in second woman’s pain unpleasantness rating, $F_{model}(8, 83) = 4.765, p < .001$, with the covariate ($t = -3.203, p = .002$) and social model’s pain unpleasantness rating ($t = 3.814, p < .001$) as significant predictors. That is, the second woman’s affective discomfort rating was negatively associated with her own cold pressor tolerance time and positively associated with the social model’s unpleasantness rating.

Analyses of Facial Pain Frequency

As shown in Table 11, in the hierarchical analysis of facial pain frequency during the cold pressor, dysmenorrheic status failed to contribute significant variance, Adjusted $R^2 = .005; F(2, 89) = .23, p = .798$. However, the entry of relation context and social model’s pain tolerance, affective rating, and facial pain activity accounted for significant variance, $\Delta R^2 = .21; \Delta F(4, 85) = 5.56, p = .001$. Interestingly, the interaction term of social model’s facial pain activity and relationship context contributed unique variance, $\Delta R^2 = .13; \Delta F(1, 84) = 17.26, p < .001$. The overall model accounted for 29% of the variance in the second woman’s facial pain expression, $F_{model}(7, 84) = 6.34, p < .001$. Significant predictors included the social model’s facial pain display ($t = 6.25, p < .001$) and the interaction term ($t = -4.16, p < .001$). Post-hoc analysis and graphical representation (see Figure 4) of the interaction term revealed that
Table 11

Summary of Hierarchical Regression Analysis for Predicting Facial Pain Frequency (N = 91)

<table>
<thead>
<tr>
<th>Predictors</th>
<th>Block 1</th>
<th>Block 2</th>
<th>Block 3</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>β (SE)</td>
<td>p</td>
<td>r²(1,2)</td>
</tr>
<tr>
<td>Dysmenorrhea factors</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Status</td>
<td>.05 (.02)</td>
<td>.640    &lt;.01</td>
<td>.01 (.02)</td>
</tr>
<tr>
<td>Severity</td>
<td>-.07 (.03)</td>
<td>.533    &lt;.01</td>
<td>-.17 (.03)</td>
</tr>
<tr>
<td>Social model factors</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pain tolerance</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pain unpleasantness</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Pain facial frequency</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Relationship context</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Interaction term</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

R² = .0, p = .798  
R² = .16, p = .002;  
ΔR² = .21, p = .001  
R² = .29, p < .001;  
ΔR² = .13, p < .001
**Figure 4**

*Interaction Between Pain Facial Activity Frequency and Relationship Context*

**Note.** Predicted pain facial frequency by varying levels of social model’s pain facial frequency.
the second woman’s pain facial expressivity was more positively associated with the facial activity of a stranger-social model than a friend-social model’s facial activity.

In summary, the social modeling effect was robust across all measures of pain and appeared to be modality-specific. The relationship context appeared to moderate the social modeling effect on facial pain activity. That is, the second woman’s facial pain activity was more strongly associated with a stranger-social model than with a friend-social model.
Discussion

This research examined sensitivity of pain expression and, by inference, pain experience, to the immediate social context. Human and non-human animals often confront somatic experiences that have at least some ambiguous features and are required to make decisions in these situations to enhance adaptive functioning. The extent to which the outcome is optimized depends on the resources they use, including the opportunities to benefit from the resources of others (Danchin, Giraldeau, Valone, & Wagner, 2004).

Different levels of social influence were examined: a) audience effects, or the presence of others differing in the friendship relationship to the woman experiencing pain; and b) social modeling, or the impact of opportunities to observe another woman experiencing pain in advance of personal experiences with the same event. Interactions between these forms of social influence, as well as variables associated with menstrual pain also were explored.

The impact of these potential sources of social influence on pain was examined using measures of pain that differ in the likelihood that the women would engage in conscious efforts to present themselves in a particular manner. Self-report of pain intensity and affective discomfort requires relatively high levels of cognitive processing (e.g., executive processing, attention, memory, purposeful decision-making, etc.). In contrast, non-verbal expression, assessed through objective coding of facial expression, is less amenable to voluntary control. Although voluntary control of facial displays allows for impression management or dissembling, nonverbal expression is less closely self-
monitored than verbal production and seems to represent somatically-driven emotional states more directly.

The outcome of the investigation was more complex than predicted. Variation in the relationship (friends vs. strangers) had little direct impact on the measures of pain expression. However, the relationship between the participant and those who served as social models did moderate the substantial impact of the exposure to social models. These findings are discussed in detail below.

Interpretation of Audience Effects

The investigation arose from the observation that pain report and possibly pain experience reflect the social context in which they are experienced. As young women come to rely heavily upon friends for information, advice, and direction during adolescence, their expression of pain may vary depending upon whether it is experienced in the company of a friend or a stranger.

Contrary to the hypotheses and despite the moderately high quality of friendship endorsed by participants in the friend group, there were no significant group differences as a function of audience type on participants' self-reported intensity and affect, observed pain tolerance time, and pain facial display. These results are inconsistent with studies that have reported an effect of the audience's sex (Levine & De Simone, 1991) and status (Kallai et al., 2004) on individuals' pain response. However, the findings are consistent with research demonstrating that the presence of an audience does affect pain expression, but the audience's sex (Badali & Craig, 2002; Kleck et al., 1976) and level of audience involvement (Craig, 1978) is unrelated to pain expressivity. The findings indicate further that the relationship with the audience as operationalized here generally failed to affect
women's pain expression. It remains likely that in less public settings, for example, when alone with another woman, not videotaped, and allowed to converse freely, personal disclosure of intimate feelings of painful discomfort would be more probable with a woman who is a close friend.

Social Support

Arguably, the presence of another person who was about to undergo the same task may have been perceived as a supportive other, with this becoming a more salient influence than the relationship context of friend or stranger. Although this study did not explicitly manipulate the level of support offered by the audience, studies of acute clinical pain, such as pain associated with childbirth (e.g., Chalmers, Wolman, Nikodem, Gulmezoglu, & Hofmeyer, 1995; Cogan & Spinnato, 1988), cardiac pain (e.g., Fontana & Kerns, 1989), and postoperative pain (e.g., Kulik & Mahler, 1989) have revealed a beneficial role for the availability of others providing social support. For example, the provision of social support during childbirth is associated with lower levels of labor pain, as indicated by reduced pain reports and analgesic use (e.g., Chalmers et al., 1995; Cogan & Spinnato, 1988). Few experimental studies have examined the effect of social support on voluntarily accepted acute pain. The majority of laboratory-based studies examining the social support of friends versus strangers have focused on its effect on cardiovascular activity and they have produced mixed results; the evaluative feature of the social context appears to be implicated (e.g., Fontana, Diegman, Villeneuve, & Lepore, 1999; Kors, Linden, & Gerin, 1997).

The findings of this study also can be compared with the study by Brown et al. (2003), which shared some similarities. As reviewed earlier, Brown and her colleagues
examined undergraduate students’ performance on the cold pressor task when either alone or accompanied by a friend or stranger who provided active support, passive support, or naturalistic interaction. The current study was most comparable to the interactive condition, although participants were instructed not to talk. Their findings were consistent with the present results in that there were no differences in the impact of friends and strangers. Their findings were also consistent with those of Fontana et al. (1999), who demonstrated that the presence of a nonevaluative (i.e., non-judgmental) stranger is as effective in reducing cardiovascular reactivity as the presence of a nonevaluative friend. In light of the results of this study, the familiarity of the supportive other to the participant may not be a significant factor in pain reduction when the evaluation potential of the supportive other is minimized. In the absence of findings for a differential impact in the current study, it is plausible that the observers in both the Stranger and Friend conditions were equally non-evaluative to the person undergoing the cold pressor task.

One could still argue, however, that in general, strangers would be construed as capable of being more critically evaluative or negatively judgmental than friends. If strangers could be viewed as more critical than friends, observers in the stranger condition would have been expected to verbalize and/or display more negative feedback. Future research could examine the facial actions of both the actors and observers to address this possibility. In this study, the supplemental analyses on emotional expressivity of the person undergoing the cold pressor task may provide clues to the emotional valence of the interaction between the actor and the observer. Since emotional matching generally occurs between interactional partners (Andersen & Guerrero, 1998),
the lack of significant group differences in anger, fear, sadness, and surprise displayed by
the actors first exposed to the cold pressor task suggests that it was unlikely that strangers
received more negative feedback than did friends. Moreover, the null findings suggest
that a certain level of “empathic understanding” Chovil’s (1991) was elicited in both
groups which not only suggests a positive valence in the dyadic interactions but also may
account for reduced differences observed in the expressivity of friends versus strangers.

Interestingly, friends did express more disgust than strangers. The expression of
disgust is commonly associated with a reaction to aversive stimuli such as taste or smell
and generally less associated with interpersonal stimuli, although its expression in an
interpersonal context may signal rejection with someone with whom a close association
exists (Miller, 1993). Conceivably, the friends’ facial expression of disgust may have
conveyed negative information about the cold pressor task or communicated displeasure
to their friends for agreeing to undergo a painful experience. The link between disgust
and pain is unclear in the present context. Nonetheless, it appears plausible that friends
received more negative feedback than did strangers, given that participants exposed to the
cold pressor in the presence of friends exhibited more facial expressions of disgust than
did those observed by strangers.

In summary, the findings of this study on audience type effects were consistent
with previous research and seem to indicate a minimal differential impact of friend or
stranger on all modalities of pain expression.
Interpretation of Social Modeling Influences

The robustness of the social modeling influence was clearly demonstrated in this study and is consistent with the previously reviewed works by Craig and his colleagues (e.g., Craig, Best, & Ward, 1975; Craig & Patrick, 1985; Prkachin & Craig, 1986) as well as recent research by others (Chambers et al., 2002; Goodman & McGrath, 2003). When the associate (friend or stranger) had provided a concrete depiction of how one could react to the induced pain, it had a potent effect on characterizations of the pain and affective discomfort, pain tolerance, and pain facial activity to the induced pain experience.

Friendship Relationship

As predicted, the friendship relationship moderated the social modeling effect for pain facial expressions. Contrary to the hypothesis, however, the social model’s pain facial expression was more strongly associated with the strangers’ pain expression than friends’. The hypotheses for differential friends’ versus strangers’ social modeling effects in tolerance and affect, however, were not supported.

The finding for facial expression appears, at first glance, to contradict the nonconscious mimicry literature, which was interpreted to predict a more potent social modeling effect for friends than for strangers. This was based on the notion that friends had a higher level of rapport and greater sense of affiliation than strangers did. It is conceivable, however, that the strangers’ desire to establish rapport and affiliation in this study was actually greater than friends. After all, the strangers had arrived at the laboratory with their friends with the expectation of participating in this study together only to be separated from each other shortly upon arrival. Although all participants in the
Stranger condition were agreeable to this separation, they, nonetheless, may have experienced some negative affect, including anxiety. This, in turn, may have heightened their affiliative need and consequently they may have engaged in more mimicking behaviour.

*Communication Modality*

As hypothesized, the social modeling influence on pain expression was predominantly modality specific. That is, the social model’s cold pressor tolerance, but no other pain measures, contributed to the second person’s cold pressor tolerance. The social model’s pain unpleasantness rating was the only significant predictor of the second woman’s pain affect discomfort ratings, beyond the latter’s tolerance time. Finally, the frequency and intensity of the second woman’s pain facial activity was strongly associated with the facial activity of a stranger-social model’s pain facial activity. These findings are consistent with existing research that supports modality-specific learning.

As reviewed earlier, information about pain tolerance that was presented by mothers in a nonverbal manner resulted in changes only in children’s nonverbal displays of pain (Goodman & McGrath, 2003). Similarly, Chambers et al. (2002) found that when mothers in their study presented information about painful experience verbally, their daughters appeared to have responded by being influenced in their verbal report of the pain experience.

*Mimicry.* As mentioned earlier, the apparent modality-specific nature in the transmission of signals may have evolutionary significance related to nonconscious mimicry, or the tendency to adopt the behaviours, postures, or mannerisms of interaction partners without awareness or intent (Lakin et al., 2003). In this study, participants may
have expressed their pain in a manner similar to their social model’s behaviours as a result of their empathy for the social model and affiliation tendency.

*Empathy.* The evidence for a substantial impact of modeled behaviour on the observers suggests the latter carefully attended to the behaviour of the former and were capable of discerning key features of their experience. Current attention to the role of empathy in social communications appears relevant (Morrison, Lloyd, Di Pellegrino, & Roberts, 2004). Empathy literally means “feeling into” (Wispe, 1991), although its definition has generated much debate and is beyond the scope of this discussion (see Preston & de Waal, 2002 for further details). Recently, Preston and deWaal (2002) proposed a perception-action model of empathy, which is defined broadly as “any process where the attended perception of the object’s state generates a state in the subject that is more applicable to the object’s state or situation than to the subject’s own prior state or situation (p. 4).” The object is the primary person who experienced the emotion or state, and the subject is the person who experiences empathy. In the context of this experiment, the object refers to the first person (social model) undergoing the cold pressor task and the subject refers to the second person (audience/observer) undergoing the task. Empirical studies of children and adults in distress situations have found that the greater the familiarity or similarity of the subject and object, the higher the level of empathy (e.g., Rosekrans, 1967; Toi & Baston, 1982). For example, the manipulation of demographic descriptions was sufficient for human subjects, who witnessed the shock of a confederate, to influence willingness to offer to take the shocks for the object (Toi & Baston, 1982). Moreover, research has found that the degree of cue salience is associated with greater empathy (e.g., Colby & Goldberg, 1999).
In this study, the predominant absence of differences in pain measures when dyads were composed of either friends or strangers suggests that a similar level of empathy was elicited in both groups and this observation is consistent with the "empathic understanding" account of the null findings for audience effects. The dyads in the friend condition could be considered familiar with each other on the basis of their friendship, but it is also possible that participants in the stranger condition could be considered similar because they shared a number of common characteristics (i.e., both were female university students of similar age and usually of similar ethnic appearance undergoing a painful experience). This would reduce the distinction between friends and strangers. Added to this similarity between strangers was the possibility that they experienced more anxiety at the beginning of the study as they became separated from their friends. This initial anxiety may have increased their affiliative tendency (Schachter, 1959) and further enhanced empathic response. Conceivably, there was a sufficient bond between women university students interacting in the unusual laboratory setting designed to deliver pain to one of them that friendship, or its absence, was relatively unimportant. Women university students share similar lifestyles and demands, hence, an implicit friendship may have been operating. In general, it may be the case that affiliation is enhanced when strangers share a novel, affect-arousing experience (Byrne, Allgeier, & Winslow, 1975).

Finally, the experimental condition was high in sociality. The object in both conditions provided salient cues to her pain experience as she verbally rated the unpleasantness of her pain, visibly withdrew her hand from the cold pressor apparatus, and visibly displayed her facial expression. Thus, the conditions deemed necessary and sufficient to elicit empathy were present in both groups and may have consequently
limited findings of significant variability between audience types. Incidentally, if empathy was indeed present, the current findings could contribute to the literature on emotion expression (as reviewed earlier) by supporting the proposition that the establishment of empathic understanding may lead to both physical presence and communication potential having an effect on facial displays, regardless of whether the participants are strangers or friends.

Artifact of measurement? The observed modality-specific learning, however, also may be an artifact of the limitations in capturing the pain experience, a highly subjective, multidimensional phenomenon. As no current measure is capable of providing a direct read-out of an individual’s pain experience, pain can only be inferred from its expression. Pain measurement strategies typically assess levels of pain expression and are modality specific. The data from these measures are inferred to provide information regarding an individual’s pain experience. In the social transmission of pain, even if the social model’s verbal ratings, behavioural responses, and facial activity to pain were fully integrated into the second cold pressor person’s internal experience of pain, the latter person likely had to dismantle and translate her experience into discrete modalities of expression. At this point in the translation, imitation of previously observed behaviours may be a useful heuristic, especially in a novel context. Future research could systematically examine the modality of pain communication to determine the robustness of modality-specific social transmission.
Interpretation of Intrapersonal Factors

Dysmenorrhea status and menstrual pain severity. The exploratory hypothesis concerning the relationship of dysmenorrhea status and menstrual pain severity to cold pressor pain was not supported. These variables were not significant predictors of the women's experimental pain verbal and nonverbal expressions. As reviewed earlier, the evidence on the relationship between dysmenorrhea and pain perception has been mixed. Some researchers have found dysmenorrheic women to be more sensitive to pain across the menstrual cycle (e.g., Granot et al., 2001) but another research team reported that dysmenorrheic women reported less pain than non-dysmenorrheic women (Hapidou & De Catanzaro, 1988). The current findings are consistent with studies that reported no significant differences in pain sensitivity between dysmenorrheic and nondysmenorrheic women (e.g., Aberger et al., 1983; Amodei & Nelson-Gray, 1989).

Methodological differences likely account for some of the variability in these findings. Although there was congruence in the definition of dysmenorrhea, the manner in which women are classified as "dysmenorrheic" or "non-dysmenorrheic" varies considerably. For example, one study used women's self-reported response to a question about the presence or absence of menstrual pain/cramps to determine dysmenorrheic status (Hapidou & De Catanzaro, 1988), whereas another study presumably recruited women who had received a medical diagnosis of dysmenorrhea prior to the study (Granot et al., 2001). Most researchers, however, rely on questionnaires (e.g., Aberger et al., 1983), such as the Menstrual Symptom Questionnaire (MSQ) that was used in this study. Due to inconsistencies in calculating and reporting data, it is difficult to ascertain the severity of dysmenorrhea in the participants from other studies and whether the severity
of dysmenorrhea in the sample of women in this study was comparable to that in studies that have found a relationship between dysmenorrhea and pain perception.

Even if the severity were comparable, the extent to which menstrual pain interferes with daily activities and degree of symptom relief likely would vary from sample to sample and consequently limit the generalizability of findings. On average, the women in this study reported 75% to 99% relief of menstrual pain symptoms using over-the-counter medication, and 80% relief with non-pharmacological methods (e.g., relaxation, heat). With respect to daily activities, less than 15% of the women in this sample reported menstrual symptoms interfering with their jobs and other duties and responsibilities. Fewer than 17% reported some limitations with social activities. Fewer than 10% of the women sampled missed a half-day of school as a result of their menstrual symptoms. It appears that women in this study experienced a high level of efficacy in the management of their menstrual pain and discomfort. It is possible that menstrual pain and dysmenorrhea may need to be particularly severe for them to affect pain experience.

Theoretical Perspectives

These results support the position that women have a fundamental propensity to integrate information available in the social context when experiencing pain and contribute to our understanding of the role of the social context in the transmission of pain information. As reviewed earlier, the social communication model of pain incorporates the influence of intrapersonal and interpersonal factors on the subjective experience of pain, its outward display, and how interested observers interpret these expressions and decide to respond behaviourally (Craig, 2002).
The communication process typically begins with a noxious event, which is associated in experience with a subjective state of pain (see Figure 1). This personal experience is a function of the quality of the noxious stimulus and intrapersonal and contextual influences. Next, individuals encode this experience in verbal and nonverbal expressions, again moderated by interpersonal and contextual factors. It is important to distinguish between the experience of pain and its expression, as the latter is not necessarily a direct read-out of the internal experience. Finally, observers decode the information with varying success depending on the quality of the message and the observers' set of intrapersonal and interpersonal influences. Thus, the process of pain communication can be viewed as information transmission from internal experience through pain behaviour to social interpretation, with intrapersonal and interpersonal influences acting at all points of this transmission.

Although the social learning theory (Bandura, 1971) has been applied to advance knowledge regarding the mechanisms underlying the social communication of pain (e.g., Craig, 2002), a recent model proposed by Danchin et al. (2004) offers an evolutionary perspective on the nature of social communication. According to Danchin et al. (2004), one's ability to acquire and use information in the social environment reduces uncertainty and enhances survival and fitness. Information capable of subsequently influencing an individual's behaviour can be acquired through personal interaction with the environment (personal information) or by observing another's interactions with the environment (social information).
Social information can be intentionally (i.e., signals) or inadvertently (i.e., cue) produced. For example, in the process of personal interaction with the environment, individuals may intentionally communicate information to others (i.e., signals) while some personal information may “leak out” into the public domain (i.e., cues) and therefore become available to others. Evidence in the animal literature (see Danchin et al., 2004) is consistent with findings leading Craig and Badali (2004) to conclude that this “leaked” information is actually perceived as more reliable, as it is the byproduct of automatic processing (e.g., facial pain activity) and not subject to modulation by higher level mental processing programs (e.g., self-report measures). Under the overarching social communication model of pain, the expression and use of this social information would vary depending on the nature of the social context and intrapersonal factors.

In this study, the second woman exposed to the cold pressor had the opportunity to acquire social information (i.e., about the cold pressor and its subjective and behavioural impact) produced by either a female friend or stranger and subsequently gain personal information from her own interaction with the noxious stimulus. The general absence of differential effects between friends and strangers, despite the significance of friendship for peoples’ lives, suggests that when the information has potentially significant consequences for well-being and survival, individuals can afford to be less discriminating about the source of the information. Under these circumstances, the benefits of using social information outweigh the costs of personally encountering the experience.
It is also conceivable that when inadvertent social information is available from an ambiguous source, people attend to it. For example, the social model’s pain facial activity was more strongly associated with the second woman’s facial activity in the stranger context than in the friendship context. As Williams (2002) points out, “The fact that facial expression conveys information does not necessarily imply either conscious control before or during the expression, or intentional signaling….The expressive individual may or may not be aware of this communication. (p. 443).” This differential modeling effect of friends vs. strangers in pain facial activity suggests that strangers may be more vigilant for inadvertently “leaked” information that is perceived as less amenable to or influenced by conscious motives and therefore more reliable. In contrast, people may have confidence in intentionally generated information (e.g., self-report ratings and to some extent, immersion time) from their friends and consequently rely on this information rather than mobilizing resources to seek additional evidence.

Human’s fundamental drive to form relationships with others may also contribute to the stronger association of strangers’ facial pain expression than friends’. Although conventional wisdom suggests that we are best at reading the nonverbal cues of those people who are closest to us, sensitivity to others’ nonverbal cues, however, may be a case where less is more. As mentioned earlier, normative expectations seem to dictate that one should overlook the negative affect expressed in others, particularly if the individual tries to conceal it. These expectations are underscored by evidence that individuals seek to neutralize both positive and negative affect in anticipation of interaction (Erber, Wegner, & Therriault, 1996).
Rosenthal and DePaulo (1979) coined the term “eavesdropping on nonverbal cues” to describe the observers’ ability to accurately interpret information that actors leak through the less controlled channels of communication. Despite individuals’ intent to modulate their expressions, they nonetheless “leak” covert feelings through less controllable nonverbal channels (Zuckerman, DePaulo, & Rosenthal, 1986). Rosenthal and DePaulo found that females generally were more polite than males in their interpretation of nonverbal cues, relying heavily on the face for emotional information and that females showed a decline in eavesdropping on less controlled channels of communication relative to males. These findings have been interpreted in the context of normative expectations for women to smooth interpersonal relations (Hall et al., 2000). Indeed, Puccinelli and Tickle-Degnen (2004) found that the participants felt less rapport the more their interacting partners eavesdropped on their nonverbal cues. Taken together, the women in this study may have “overlooked” their friends’ facial expression of pain because they have learned that doing so helps to maintain a harmonious relationship. In contrast, strangers were presumably less invested in sustaining a relationship beyond the experimental procedure and therefore engaged in behaviours that were more conducive to fulfilling the immediate needs of affiliating others and gaining information about the pain stimulus.

In sum, the social communication model of pain (Craig, 2002) and Danchin et al.’s (2004) social transmission model could be integrated to provide a useful framework for generating testable hypotheses to advance our knowledge of social contextual influences in pain experience and expression.
Limitations of the Study

The findings from this research should be tempered with careful consideration of the limitations of this study. First, the participants were mainly healthy undergraduate women voluntarily undergoing a brief, controlled noxious stimulus in a laboratory setting. For the purpose of the study, these features were advantageous because they enhanced the homogeneity of physical features within each dyad and enhanced experimental control. The results, however, may not generalize to other populations or contexts. For example, male same-sex friends and opposite-sex friends may differ significantly from female-female friends on a number of factors such as perceived evaluative potential, level of social support, and affiliative needs. Moreover, this study represented an episode of interaction between friends that does not closely approximate the naturalistic occurrence and experience of pain between friends. It would be of interest to engage in unobtrusive behavioural observation of people accompanied by friends or in the presence of strangers in medical clinic or hospital emergency facilities, but ethical considerations would limit such studies. Although the quality of friendship in the friend condition was moderately high, further research is needed to systematically delineate and identify the aspects of friendship that are potent agents of influence.

To shed more light on the impact of relationship context, it might be useful to determine how pain expression in the presence of a friend or a stranger compares with that for participants undergoing the cold pressor task alone. Although studies demonstrating audience effect differences between alone and observed conditions are available (e.g., Badali & Craig, 2002), these findings pose interpretive challenges; the alone condition probably always has some form of an implicit observer (Fridlund, 1991).
Thus, adding an alone condition to this study would not necessarily provide adequate control for comparison, but one still could examine differential effects of being alone versus accompanied to address different experimental hypotheses.

In addition, facial expression was only examined in participants undergoing the cold pressor. Future studies should attempt to capture the interaction within the dyad. The nature of social influence is bidirectional and there may be subtle exchanges between friends and strangers that differ on the basis of the relationship context that were not captured.

With respect to menstrual factors, the response rate on menstrual information via email in this study was poor and an added incentive may have encouraged more responses. Moreover, variability in methodology further precludes integration of findings on the impact of menstrual factors on women’s pain experience and expression. Researchers investigating the relationship between the menstrual cycle and status have the added challenge of determining menstrual phase in women with irregular menstrual cycles and usually without the aid of hormonal assays. Standardized methodology will enable integration of research findings and facilitate the development of a coherent theoretical framework to better understand the dysmenorrhea phenomenon and its relationship to women’s pain experience.
Suggestions for Future Research

It appears that social modeling influences are generally robust and modality-specific. Future research is needed to continue to examine the complex interplay of intrapersonal and interpersonal processes involved in the socialization of pain responses. Suggestions for additional research have been provided throughout discussion of the findings, but areas particularly deserving of research attention are highlighted below.

A systematic program of research is needed to delineate and identify factors that influence individuals in the acquisition and use of information available in the social domain. For example, a better understanding of intrapersonal factors such as catastrophizing tendencies and genetic predispositions to pain could fine-tune testable hypotheses investigating the costs and benefits associated with decision-making about pain experiences. For example, in a relatively non-threatening environment, “leakage” of unintentional information may have insignificant costs whereas an inability to minimize “leakage” under more ominous conditions may jeopardize one’s well-being. Perceived social support and level of empathy seem to be implicated in this process. Variability in cultural definitions and expectations of friendship also warrant attention. The friendship context in its various forms (i.e., male-male, female-female, and male-female) should continue to be explored for its richness in relationship complexity and significance across the lifespan and across cultures.
Conclusions

People are often confronted with decisions that have important consequences to their well-being. Given the potentially threatening nature of pain, the ability to benefit from information from others has obvious advantages, including minimizing potential harm to self. Thus, the answer to the question posed in the title (i.e., influential friends?) is a qualified "no". It appears that friendship with an observing person is not essential to its having an influence on pain expression, particularly when social modeling impact is considered. This study builds upon previous research by demonstrating the robustness of social modeling influence among peers; friends and strangers both serve as potent socialization agents under interactive contexts. The present results also contribute to the mixed findings on the relationship of menstrual factors to current pain experience and advocates for a standardized research protocol to facilitate the integration of knowledge gained from this body of research, which has important clinical implications for women's pain and suffering. Finally, the socio-communication framework continues to serve well not only with respect to generating testable hypotheses but also to accommodating findings that cross intrapersonal and interpersonal boundaries.
References


Kleck, R.E., Vaughan, R.C., Cartwright-Smith, J., Vaughan, K.B., Colby, C.Z., & Lanzetta, J.T. (1976). Effects of being observed on expressive, subjective, and


Appendix B
Participant Information Sheet

In order to describe the participants of this study as a group we need a little information about you. This information will in no way allow us, or anyone else to identify you as an individual.

1. Your birth date (mm-dd-yy): ______________

2. What country were you born in? ______________

3. If you were not born in this country, at what age did you move here? ____ years

4. What language do you usually speak at home? ______________

5. What other language(s) do you speak on a regular basis at home? ______________

6. In addition to English and the other languages you speak at home, what additional languages do you speak? ______________

7. To what ethnic or cultural group(s) did your ancestors belong? ______________
   (Specify as many groups as applicable. For example, Canadian, French, English, Chinese, Italian, German, Scottish, Irish, Cree, Haida, Métis, Inuit, East Indian, Ukrainian, Dutch, Polish, Portuguese, Filipino, Jewish, Greek, Jamaican, Vietnamese, Lebanese, Chilean, Somali, etc.)

8. To what cultural group(s) do you belong? ______________

9. What is your highest level of education? ______________
   (Example, in 1st year undergrad at UBC, in 2nd year at community college, etc.)

10. Your occupation ______________

11. How long have you and the person you came with been friends? ___ year(s) ___ month(s)

12. How did you meet one another? ______________

13. How often do you see one another?

    Once a Month  once a week  several times a week  everyday

14. Do you currently live with this friend? YES NO

15. We would like to contact you approximately one month from today to ask you a few more questions. Which email address could we use? (please print clearly)

   email: ______________
Appendix C: Relationship Inventory

We would like you to answer the following questions about your good female friend, the person you came to the laboratory with.

<table>
<thead>
<tr>
<th></th>
<th>Little or None</th>
<th>Some</th>
<th>Very much</th>
<th>Extremely much</th>
<th>The most</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. How much free time do you spend with this person?</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>2. How much do you and this person get upset with or mad at each other?</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>3. How much does this person teach you how to do things that you don't know?</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>4. How much do you and this person get on each other's nerves?</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>5. How much do you talk about everything with this person?</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>6. How much do you help this person with things she/he can't do by her/himself?</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>7. How much does this person like or love you?</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>8. How much does this person treat you like you're admired and respected?</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>9. Who tells the other person what to do more often, you or this person?</td>
<td>Little or None</td>
<td>Some</td>
<td>Very much</td>
<td>Extremely much</td>
<td>The most</td>
</tr>
<tr>
<td>10. How sure are you that this relationship will last no matter what?</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>11. How much do you play around and have fun with this person?</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>12. How much do you and this person disagree and quarrel?</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>13. How much does this person help you figure out or fix things?</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>14. How much do you and this person get annoyed with each other's behavior?</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>15. How much do you share your secrets and private feelings with this person?</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>16. How much do you protect and look out for this person?</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>17. How much does this person really care about you?</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>18. How much does this person treat you like you're good at many things?</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>19. Between you and this person, who tends to be the BOSS in this relationship?</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Little or None</td>
<td>Some what</td>
<td>Very much</td>
<td>Extre -mely much</td>
</tr>
<tr>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>20. How sure are you that your relationship will last in spite of fights?</td>
<td></td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>21. How often do you go places and do enjoyable things with this person?</td>
<td></td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>22. How much do you and this person argue with each other?</td>
<td></td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>23. How often does this person help you when you need to get something done?</td>
<td></td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>24. How much do you and this person hassle or nag one another?</td>
<td></td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>25. How much do you talk to this person about things that you don’t want others to know?</td>
<td></td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>26. How much do you take care of this person?</td>
<td></td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>27. How much does this person have a strong feeling of affection (loving or liking) toward you?</td>
<td></td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>28. How much does this person like or approve of the things you do?</td>
<td></td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>29. In your relationship with this person, who tends to take charge and decide what should be done?</td>
<td></td>
<td>She always does</td>
<td>She often does</td>
<td>About the same</td>
<td>I often do</td>
</tr>
<tr>
<td>30. How sure are you that your relationship will continue in the years to come?</td>
<td></td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
</tbody>
</table>

Appendix D:
Gracely Scale
(Gracely, McGrath, & Dubner, 1978)

Please use the following words to describe your pain – from “No discomfort” to “Very intolerable”. Please select the word that best describes your pain as your pain changes. Please note that you may terminate the experiment at anytime by withdrawing your hand.

Very intolerable (44.8)
Intolerable (32.3)
Very distressing (18.3)
Slightly intolerable (13.6)
Very annoying (12.1)
Distressing (11.4)
Very unpleasant (10.7)
Slightly distressing (6.2)
Annoying (5.7)
Unpleasant (5.6)
Slightly annoying (3.5)
Slightly unpleasant (2.8)
No Discomfort (0)
Appendix E
Quick Questions

1. Please place an “X” on the line below indicating how much pain or discomfort you felt during the Cold Pressor Task:

   no pain
   most extreme pain

2. In your own words, please describe how you felt during the task:

3. Compared to you, how much pain do you think the other person felt?

<table>
<thead>
<tr>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
</tr>
</thead>
</table>
   Much less than me Somewh at less Slightly less than Slightly Same as me More than me Somewh Slightly More than me Much more than me

4. Because we are interested in women’s experience of pain…
   a) Have you experienced menstrual pain? YES or NO
   
   b) If yes, how similar was the pain from the cold pressor compared to your menstrual pain, on a scale of 0 to 10 (0 = not similar at all, to 10 = virtually identical)?

5. If you have menstrual pain,
   a) Who do you typically talk to about it? Please list the person(s) below and rate how helpful it is on a scale of 0 to 10 (0=not helpful at all, to 10 = extremely helpful)?

<table>
<thead>
<tr>
<th>Who</th>
<th>Helpfulness</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

   b) How often do you talk about menstrual pain with the friend you came with?
   Never Rarely Sometimes Often Almost Always

   c) How helpful is it to talk to the friend you came with (please rate on a scale of 0 to 10 where 0 = not helpful at all and 10 = extremely helpful)?
Appendix F
Family Health Questionnaire
(Koutantji, Pearce, & Oakley, 1998)

We are conducting a survey on family health and we would be grateful if you could answer the following questions as honestly as possible. The information given will be strictly confidential.

Date of Birth:
Height:
Weight:
Gender:
Ethnicity:
Occupation:

I. In the last month have you experienced any kind of pain? **YES** or **NO**
   Please circle the appropriate answer and give if necessary, further details as specified below, using numbers:

<table>
<thead>
<tr>
<th></th>
<th>In the last month, <strong>how often</strong> have you had this pain?</th>
<th>How intense was each episode on average, on a scale from <strong>0 = no pain to 10 = extremely painful?</strong></th>
<th>On average, <strong>how long</strong> did the pain last? (Specify in minutes, hours, or days)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Headache</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Neck pain</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Back pain</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Joint pain</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Muscle pain</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Chest pain</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Abdominal pain</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Menstrual pain</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tooth/ear pain</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Internal pain</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(indicate where)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>OTHER pain</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(please specify)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Family Health Questionnaire (continued)

II. Have any of your family members, close relatives or any other important people in your childhood and current life circumstances evidence any “persistent” pain or illness?

Please specify the type of pain or what combination of the above common pain symptoms they evidence or from what kind of illness they suffered.

<table>
<thead>
<tr>
<th>Kind of Relationship</th>
<th>Kinds of symptoms and/or illness</th>
<th>How often was/is the person complaining (specify the number of times either per day, week, or month)</th>
<th>For how many months or years had the person suffered from these symptoms?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mother</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Father</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sister/s</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Brother/s</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Grandmother</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Grandfather</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Uncle</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Aunt</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Close friend/s</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Family friend/s</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other person/s</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>important to you</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(please specify)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Appendix G

Menstrual Distress Management Questionnaire
(Campbell & McGrath, 1998)

We are interested in what you think, do, and feel about your period (also known as menstruation), to learn more about the types of things women your age do to manage period pain or discomfort. If you do not wish to answer a question please put a line through that question. Remember there are no right or wrong answers. All the information you provide us for this study will be confidential.

Menstrual History

A) Have you had your first period? (circle one answer) YES NO

If you have not had your first period please skip to question 38. If you have had your first period please continue with the questions below.

It would be a great help to us if you could provide background information about your period. Please answer the following questions ...

1. How old were you at the time of your VERY FIRST period? ____________ (in years).

2. How much information did you have about periods when you had yours for the VERY FIRST time? (circle one answer)

<table>
<thead>
<tr>
<th>No Information</th>
<th>A Little Information</th>
<th>Some Information</th>
<th>A Good Deal of Information</th>
<th>A Lot of Information</th>
</tr>
</thead>
</table>

3. Why do you have periods? (circle one answer)

   A. To relieve the body of poisons.
   B. To shed the lining of the uterus.
   C. To get rid of excess blood in the body.
   D. Because something is wrong with my body.
   E. Other (please state): ____________________________

4. Since the time of your first period have you EVER had any pain or discomfort during your period? (circle one answer)

   No    Hardly Ever    Sometimes    Often    Very Often    All the Time

5a. What was the first day of your most recent period (MM-DD-YY)? ________

5b. How many days do you typically bleed? ________

6. Has a medical doctor told you that a disease or condition is causing the pain during your period (like endometriosis, pelvic inflammatory disease)? (circle one answer)

   Yes    No

   If Yes, please describe
In order to learn more about the different things that might affect menstrual pain or discomfort we ask you the following group of questions...

7. Do you feel that you have been under a lot of stress in the past 3 months? (circle one answer)

   No stress at all   A little stress   Some stress   Much stress   A lot of stress

8. How often have you exercised (vigorously for at least 20 min.) in the past 3 months? (circle one answer)

   not at all   only once   1 or 2 times a week   three times a week   more than three times a week

9. Do you currently smoke cigarettes? (circle one answer)    Yes    No

10. Generally, did you drink coffee, tea, or pop with caffeine in it on a daily basis in the past three months? (circle one answer)

     Yes    No

11. In the past three months, did you drink alcohol (like Beer, Wine, Rum, etc.)? (circle one answer)

     not at all   less than once a month   once a month   once a week   almost daily

12a. To your knowledge, how much pain or discomfort does your mother have during her periods? (circle one answer)

     I don't know at all   None   A little   A fair amount   much   very much

12b. If your mother experiences pain and/or discomfort during her periods, to your knowledge, what does she do about her pain or discomfort? Please list or describe below and rate its effectiveness:

     Method

     Effectiveness (0% to 100%)
**Current Menstrual Discomfort**

We would like some information about your period that currently reflects how you feel and what you do. Therefore the next group of questions focus only on your last three periods.

13. Have you had pain at least once during your LAST THREE PERIODS? (circle one)

Yes  No

STOP! If you have experienced pain or discomfort during your last THREE periods please answer the questions below. If you have NOT had any pain or discomfort during your last THREE periods please skip to question 38.

14. We would like to know where on your body, during your last three periods you have felt pain or discomfort. Please place an 'X' on the areas of the body picture below to indicate where you experienced the pain. (mark more than one area if necessary)
15. Please place an 'X' on the line below indicating how much pain or discomfort you felt during the **most painful** one of your LAST THREE PERIODS.

<table>
<thead>
<tr>
<th>no pain</th>
<th>most extreme pain</th>
</tr>
</thead>
</table>

16a. Please place a check in the appropriate column beside each symptom to indicate the degree to which you have experienced that specific symptom during your last THREE periods.

**sss**

<table>
<thead>
<tr>
<th>Symptom</th>
<th>Not Present</th>
<th>Slightly</th>
<th>Moderately</th>
<th>Severely</th>
<th>Very Severely</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cramps</td>
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<tr>
<td>Nausea</td>
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<tr>
<td>Vomiting</td>
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<tr>
<td>Loss of appetite</td>
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<tr>
<td>Headache</td>
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<td>Backache</td>
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<tr>
<td>Leg ache</td>
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<tr>
<td>Dizziness</td>
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<tr>
<td>Weakness</td>
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<tr>
<td>Diarrhea</td>
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<tr>
<td>Facial Blemishes</td>
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<tr>
<td>Depression</td>
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<tr>
<td>Irritability</td>
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<tr>
<td>General aching</td>
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<tr>
<td>Abdominal pain</td>
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</table>

16b. For each of the 24 items below, please indicate how often you have had the experience, using the following scale. Please record your answers in the space to the left of the items.

1 = Never  
2 = Rarely  
3 = Sometimes  
4 = Often  
5 = Always

A. I feel irritable, easily agitated, and impatient a few days before my period.

B. I have cramps that begin on the first day of my period.

C. I feel depressed for several days before my period.

D. I have abdominal pain or discomfort which begins one day before my period.

E. For several days before my period I feel exhausted, lethargic, or tired.

F. I only know that my period is coming by looking at the calendar.

H. I take a prescription drug for the pain during my period.

I. I feel weak and dizzy during my period.

J. I feel tense and nervous before my period.

K. I have diarrhea during my period.

L. I have backaches several days before my period.

M. I take over-the-counter medication for the pain during my period.

N. My breasts feel tender and sore a few days before my period.

O. My lower back, abdomen, and inner sides of my thighs begin to hurt or be tender on the first day of my period.

P. During the first day or so of my period, I feel like curling up in bed, using a hot water bottle on my abdomen, or taking a hot bath.

Q. I gain weight before my period.

R. I am constipated during my period.

S. Beginning on the first day of my period, I have pains which may diminish, or disappear for several minutes and then reappear.

T. The pain I have with my period is not intense, but a continuous dull aching.

U. I have abdominal discomfort for more than one day before my period.

V. I have backaches which begin the same day as my period.

W. My abdominal area feels bloated for a few days before my period.

X. I feel nauseated during the first day or so of my period.

Y. I have headaches for a few days before my period.

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Please read each of the two descriptions below and indicate the type most closely experienced by you.

16c). TYPE 1: The pain begins on the first day of menstruation, often coming within an hour of the first signs of menstruation. The pain is most severe on the first day and may or may not continue on subsequent days. Felt as spasms, the pain may lessen or subside for a while and then reappear. A few find this pain so severe as to cause vomiting, fainting, or dizziness; some others report that they are most comfortable in bed or taking a hot bath. The pain is limited to the lower abdomen, back and inner sides of the thighs.

TYPE 2: There is advanced warning of the onset of menstruation during which the woman feels an increasing heaviness, and a dull aching in the lower abdomen. This pain is sometimes accompanied by nausea, lack of appetite, and constipation. Headaches, backaches, and breast pain are also characteristic of this type of menstrual discomfort.

The type that most closely fits my experience is: (please circle one answer)

Neither Type 1 Type 2 Both

16d). How difficult was it to choose between Type 1 and Type 2?

Not at all difficult A little difficult Somewhat difficult Difficult Very difficult Extremely difficult

17. On average, how long does the pain last during a period? (circle one answer)

Less than half a day 1/2 day 1 day 1 1/2 days 2 days 3 days More than 3 days

18a). How often have you seen a medical doctor about the pain during your periods? (circle one answer)

0 1 2 3 4 5 More than 5 times

b). If you saw a medical doctor at least once about pain during your period, how useful was the doctor in relieving the pain?

Not at all useful A little useful Somewhat useful Useful Very useful Extremely useful
In order to discover more about the effects of pain during periods on everyday activities we ask you the following questions...

19. How much, during your LAST THREE PERIODS, has period pain or discomfort limited your social activities (like visiting relatives, or going to the movies)? (circle one answer)

<table>
<thead>
<tr>
<th>Not limited at all</th>
<th>A little limitation</th>
<th>Some limitation</th>
<th>Much limitation</th>
<th>A lot of limitation</th>
<th>Completely limited</th>
</tr>
</thead>
</table>

20. During your LAST THREE PERIODS, how much time did you spend in bed/resting because of period pain or discomfort? (circle one answer)

<table>
<thead>
<tr>
<th>No time at all</th>
<th>Rarely</th>
<th>A little bit of time</th>
<th>Some of the time</th>
<th>A great deal of time</th>
<th>All of the time</th>
</tr>
</thead>
</table>

21. How much has period pain or discomfort interfered with your job during your LAST THREE PERIODS? (circle one answer)

<table>
<thead>
<tr>
<th>I don't have a job</th>
<th>No interference</th>
<th>A little</th>
<th>Some</th>
<th>Much</th>
<th>A Lot</th>
</tr>
</thead>
</table>

22. Did the pain or discomfort during your LAST THREE PERIODS interfere with any of your duties or responsibilities (like cleaning your room, bathing the dog)? (circle one answer)

<table>
<thead>
<tr>
<th>No interference</th>
<th>A little</th>
<th>Some</th>
<th>Much</th>
<th>A Lot</th>
</tr>
</thead>
</table>

23. On average, how much time during a single period did you miss from school because of the pain or discomfort in the last three months? (circle one answer)

<table>
<thead>
<tr>
<th>I'm not in school</th>
<th>No time missed at all</th>
<th>Less than half a day missed</th>
<th>A half day missed</th>
<th>One day missed</th>
<th>Two days missed</th>
<th>More than Two days missed</th>
</tr>
</thead>
</table>

131
Over - The - Counter Medication

To learn more about the various medications that some women use to relieve period pain or discomfort we need to ask you some questions about Over-the-Counter and prescription drugs.

24. Did you take any OVER-THE-COUNTER medication (drugs that do not require a prescription from a doctor) during your last THREE periods to get relief from pain or discomfort?

Yes  No

STOP! Only answer the following questions if you have taken Over-the-Counter medication to try to relieve the pain during your last three periods. If you have NOT taken Over-the-Counter medication to try to relieve the pain during your last three periods please SKIP to question 30.

25. From where or from who did you get information about OVER-THE-COUNTER medication that may help relieve the pain or discomfort during your periods? (circle as many as you need)

A). I did NOT get any information about over-the-counter medication
B). Mother
C). Sister
D). Other Relative (aunt/uncle/cousin)
E). Medical Doctor / Nurse
F). Friend
G). Teacher
H). Advertisements / T.V. / Magazines
I). The Bottle/Package
J). Pharmacist
K). Other: (please state):  

26. What OVER-THE-COUNTER medication(s) have you used to relief period pain or discomfort during your LAST THREE PERIODS.

<table>
<thead>
<tr>
<th>DRUG</th>
<th>STRENGTH</th>
<th>AMOUNT TAKEN</th>
</tr>
</thead>
<tbody>
<tr>
<td>(Please circle any medications you have used to try to relieve period pain/discomfort.)</td>
<td>(Please circle the strength of the drug you used; where appropriate, indicate regular or extra strength.)</td>
<td>(Please circle how many pills of the drug you have taken at any one time)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Ibuprofen</th>
<th>1/2</th>
<th>1</th>
<th>1 1/2</th>
<th>2</th>
<th>3</th>
<th>More than 3 pills</th>
</tr>
</thead>
<tbody>
<tr>
<td>A. Advil</td>
<td>a pill</td>
<td>pill</td>
<td>pills</td>
<td>pills</td>
<td>pills</td>
<td>pills</td>
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<tr>
<td>B. Apo-Ibuprofen</td>
<td>1/2</td>
<td>1</td>
<td>1 1/2</td>
<td>2</td>
<td>3</td>
<td>More than 3 pills</td>
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<td>C. Medipren</td>
<td>a pill</td>
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<td>pills</td>
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<td>pills</td>
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<td>D. Motrin IB</td>
<td>a pill</td>
<td>pill</td>
<td>pills</td>
<td>pills</td>
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<td>pills</td>
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<td>E. Novo-Profen</td>
<td>1/2</td>
<td>1</td>
<td>1 1/2</td>
<td>2</td>
<td>3</td>
<td>More than 3 pills</td>
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<td>F. Nuprin</td>
<td>a pill</td>
<td>pill</td>
<td>pills</td>
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<td>pills</td>
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<tr>
<td>G. Amersol</td>
<td>1/2</td>
<td>1</td>
<td>1 1/2</td>
<td>2</td>
<td>3</td>
<td>More than 3 pills</td>
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<td>H. Ibuprofen</td>
<td>1/2</td>
<td>1</td>
<td>1 1/2</td>
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<td>3</td>
<td>More than 3 pills</td>
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<tr>
<td>DRUG</td>
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<td>(Please circle any medications you have used to try to relieve period pain/discomfort.)</td>
<td>(Please circle the strength of the drug you used; where appropriate, indicate regular or extra strength.)</td>
<td>(Please circle how many pills of the drug you have taken at any one time)</td>
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<td>Acetaminophen</td>
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<td>A. Acetaminophen</td>
<td>regular / extra strength</td>
<td>1/2 pill 1 1 1/2 pills 2 pills 3 pills More than 3 pills</td>
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<tr>
<td>B. Acetaminophen with codeine</td>
<td>regular / extra strength</td>
<td>1/2 pill 1 1 1/2 pills 2 pills 3 pills More than 3 pills</td>
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<tr>
<td>C. Anacin 3</td>
<td>regular / extra strength</td>
<td>1/2 pill 1 1 1/2 pills 2 pills 3 pills More than 3 pills</td>
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<tr>
<td>D. Apo-Acetaminophen</td>
<td>regular / extra strength</td>
<td>1/2 pill 1 1 1/2 pills 2 pills 3 pills More than 3 pills</td>
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<tr>
<td>E. Atasol</td>
<td>regular / Forte</td>
<td>1/2 pill 1 1 1/2 pills 2 pills 3 pills More than 3 pills</td>
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<td>F. Atasol 8 (with codeine)</td>
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<td>1/2 pill 1 1 1/2 pills 2 pills 3 pills More than 3 pills</td>
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<tr>
<td>G. 222 AF</td>
<td>regular / extra strength</td>
<td>1/2 pill 1 1 1/2 pills 2 pills 3 pills More than 3 pills</td>
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<tr>
<td>H. Tylenol</td>
<td>regular / extra strength</td>
<td>1/2 pill 1 1 1/2 pills 2 pills 3 pills More than 3 pills</td>
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<tr>
<td>I. Tylenol with Codeine No.1</td>
<td>No.1 / No.1 Forte</td>
<td>1/2 pill 1 1 1/2 pills 2 pills 3 pills More than 3 pills</td>
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<tr>
<td>J. Excedrin</td>
<td>regular / extra strength</td>
<td>1/2 pill 1 1 1/2 pills 2 pills 3 pills More than 3 pills</td>
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<tr>
<td>K. Extra Strength Midol</td>
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<td>1/2 pill 1 1 1/2 pills 2 pills 3 pills More than 3 pills</td>
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<tr>
<td>L. Pamprin</td>
<td>regular / extra strength</td>
<td>1/2 pill 1 1 1/2 pills 2 pills 3 pills More than 3 pills</td>
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<tr>
<td>M. Panadol</td>
<td>regular / extra strength</td>
<td>1/2 pill 1 1 1/2 pills 2 pills 3 pills More than 3 pills</td>
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<tr>
<td>N. AF Anancin (ASA Free)</td>
<td>regular / extra strength</td>
<td>1/2 pill 1 1 1/2 pills 2 pills 3 pills More than 3 pills</td>
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<td>DRUG</td>
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<td>medications you</td>
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<td>have used to try</td>
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<td>pain/discomfort.)</td>
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<td>Acetylsalicylic Acid</td>
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<td>B. Aspirin</td>
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<td>C. Entrophen</td>
<td>extra strength</td>
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<td>regular strength</td>
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<td>D. Novasen</td>
<td>super extra strength</td>
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<td>F. Anacin</td>
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<td>G. Anacin with</td>
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<td>strength</td>
<td>pills pills pills</td>
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<tr>
<td>J. Midol</td>
<td>1/2 1 1 1/2 2 3 More</td>
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<td>than a pill pill pills</td>
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<td>OTHER (please state):</td>
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<td>regular / extra strength</td>
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<tr>
<td>27. How long do you</td>
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<tr>
<td>wait, after pain/</td>
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<tr>
<td>discomfort has</td>
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<tr>
<td>started, to take</td>
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<tr>
<td>medication?</td>
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<tr>
<td>Before pain starts</td>
<td>minutes hours</td>
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<tr>
<td>28. What percentage</td>
<td></td>
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<tr>
<td>of pain/discomfort</td>
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<tr>
<td>relief did you have</td>
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<td>after you took the</td>
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<tr>
<td>OVER-THE-COUNTER</td>
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<tr>
<td>medication during</td>
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<tr>
<td>your LAST THREE</td>
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<tr>
<td>periods? (circle one</td>
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<tr>
<td>answer)</td>
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<tr>
<td>0%</td>
<td>1-24% 25-49% 50-74% 75-99%</td>
<td></td>
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<td></td>
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<td></td>
</tr>
<tr>
<td>(no relief)</td>
<td>100% (complete relief)</td>
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<td>29. Generally, how</td>
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<tr>
<td>many times would you</td>
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<td>take the dose or</td>
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<tr>
<td>amount of medication</td>
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<td>in one day? (circle</td>
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<tr>
<td>one answer)</td>
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<tr>
<td>Once per day</td>
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<tr>
<td>Twice per day</td>
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<tr>
<td>Three times per day</td>
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<tr>
<td>Four times per day</td>
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<tr>
<td>Five times per day</td>
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<tr>
<td>Six times per day</td>
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<tr>
<td>Seven or more times</td>
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</tbody>
</table>
Prescription Medication

30. Did you take any PRESCRIPTION medication (drugs that you can only get with a doctor's prescription) to get relief from the pain/discomfort during your LAST THREE PERIODS? (circle one answer)

Yes  No

STOP! Only if you have taken PRESCRIPTION medication to relieve any pain/discomfort during your last three periods, continue with the questions below. If you have NOT taken PRESCRIPTION medication during your last three periods to relieve any pain/discomfort skip to Question 35.

31. What PRESCRIPTION medication have you have used to relieve the pain/discomfort during your LAST THREE PERIODS. (circle as many as you need)

A). I did NOT take any prescription medication.
B). I DID take prescription medication but I don't know or can't remember the name.
C). Indomethacin (like Indocin)
D). Naflron
E). Prescription Strength Atasol (like Atasol 15, Atasol 30)
F). Naproxen (like Naprosyn or Anaprox)
G). Hormone Pills.
H). Diuretics (like Dyazid, and Hydrodiuril)
I). Fenamates (like Ponstel, and Meclomen)
J). Ibuprofen (like Motrin)
K). Prescription Strength TYLENOL with Codeine (e.g., TYLENOL No.2, TYLENOL No.3, or TYLENOL No. 4)
L). Other (please state): __________________________

32. What percentage of pain/discomfort relief did you have after you took the PRESCRIPTION medication during your last THREE periods? (circle one answer)

<table>
<thead>
<tr>
<th>Percentage</th>
<th>0%</th>
<th>1-24%</th>
<th>25-49%</th>
<th>50-74%</th>
<th>75-99%</th>
<th>100%</th>
</tr>
</thead>
<tbody>
<tr>
<td>(no relief)</td>
<td></td>
<td></td>
<td></td>
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</tr>
</tbody>
</table>

33. On average during your last THREE periods, how much prescription medication did you take? (circle one answer)

Less than prescribed  Same as prescribed  More than prescribed

34. From where or from who did you get information about PRESCRIPTION medication that may help relieve the pain/discomfort during your periods? (circle as many as you need)

A). I did NOT get any information about prescription medications
B). Mother
C). Sister
D). Other Relative (aunt/uncle/cousin)
E). Pharmacist
F). Medical Doctor / Nurse
G). Friend
H). Teacher
I). Advertisements /T.V. /Newspaper/Magazines
J). The Bottle/Package
K). Other (please state): __________________________
Non-Medical Methods

Some women use NON-MEDICAL methods (like distractions, special drinks, exercise, or a hot water bottle) to cope with or relieve the pain/discomfort during their periods. In order to learn more about these methods we ask you the following questions ...

35. In the list below please indicate next to each non-medical method whether: you have used it to try to relieve the pain/discomfort during your last THREE periods; how effective that method was; and where you heard about it.

<table>
<thead>
<tr>
<th>Item</th>
<th>Have you used it? (Circle YES if you have used the item. Circle NO if you haven't used the item).</th>
<th>Effectiveness (If YES, rate effectiveness from 0% (no pain relief) to 100% (complete pain relief)).</th>
<th>Source of Method (If YES, like: a parent, friend, teacher, Doctor, Nurse, Book etc.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>A). Heat (like hot water bottle, heating pad, or warm bath).</td>
<td>Yes No</td>
<td>_____ %</td>
<td></td>
</tr>
<tr>
<td>B). Cold (like ice packs etc.).</td>
<td>Yes No</td>
<td>_____ %</td>
<td></td>
</tr>
<tr>
<td>C). Exercise (like swimming, walking, running etc.).</td>
<td>Yes No</td>
<td>_____ %</td>
<td></td>
</tr>
<tr>
<td>D). Meditation (like deep breathing, Yoga)</td>
<td>Yes No</td>
<td>_____ %</td>
<td></td>
</tr>
<tr>
<td>E). Relaxation exercises.</td>
<td>Yes No</td>
<td>_____ %</td>
<td></td>
</tr>
<tr>
<td>F). Rest (like lying down, sleeping etc.).</td>
<td>Yes No</td>
<td>_____ %</td>
<td></td>
</tr>
<tr>
<td>G). Rub/massage where it hurts.</td>
<td>Yes No</td>
<td>_____ %</td>
<td></td>
</tr>
<tr>
<td>H). Distraction from cramps (like thinking of something else, watch T.V., etc.).</td>
<td>Yes No</td>
<td>_____ %</td>
<td></td>
</tr>
<tr>
<td>I). Keep busy (like doing homework, cleaning room, running errands).</td>
<td>Yes No</td>
<td>_____ %</td>
<td></td>
</tr>
<tr>
<td>Item</td>
<td>Have you used it?</td>
<td>Effectiveness</td>
<td>Source of Method</td>
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<tr>
<td>------</td>
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<tr>
<td></td>
<td>(Circle YES if you have used the item. Circle NO if you haven't used the item).</td>
<td>(If YES, rate effectiveness from 0% (no pain relief) to 100% (complete pain relief).)</td>
<td>(If YES, (like: a parent, friend, teacher, Doctor, Nurse, Book etc.).)</td>
</tr>
<tr>
<td>J). Pray/Hope (like, to stop the pain or live through the pain).</td>
<td>Yes No</td>
<td>____ %</td>
<td></td>
</tr>
<tr>
<td>K). Ignore the pain.</td>
<td>Yes No</td>
<td>____ %</td>
<td></td>
</tr>
<tr>
<td>L). Imagine the pain becoming more hurtful.</td>
<td>Yes No</td>
<td>____ %</td>
<td></td>
</tr>
<tr>
<td>M). Imagine the pain is not as bad as it really is.</td>
<td>Yes No</td>
<td>____ %</td>
<td></td>
</tr>
<tr>
<td>N). Imagine mentally removing the pain from your body</td>
<td>Yes No</td>
<td>____ %</td>
<td></td>
</tr>
<tr>
<td>O). Try to imagine that it is important for you to endure the pain.</td>
<td>Yes No</td>
<td>____ %</td>
<td></td>
</tr>
<tr>
<td>P). Talk to other people about the pain (like mother, sister, friends).</td>
<td>Yes No</td>
<td>____ %</td>
<td></td>
</tr>
<tr>
<td>Q). Wear tight clothing (like spandex shorts/ pants, pantyhose).</td>
<td>Yes No</td>
<td>____ %</td>
<td></td>
</tr>
<tr>
<td>R). Wear loose clothing (like baggy pants/ shorts).</td>
<td>Yes No</td>
<td>____ %</td>
<td></td>
</tr>
<tr>
<td>S). Use less salt.</td>
<td>Yes No</td>
<td>____ %</td>
<td></td>
</tr>
<tr>
<td>T). Drink less alcohol.</td>
<td>Yes No</td>
<td>____ %</td>
<td></td>
</tr>
<tr>
<td>U). Drink more alcohol.</td>
<td>Yes No</td>
<td>____ %</td>
<td></td>
</tr>
<tr>
<td>V). Drink less caffeine (like coffee, tea, caffeinated pop).</td>
<td>Yes No</td>
<td>____ %</td>
<td></td>
</tr>
<tr>
<td>Item</td>
<td>Have you used it?</td>
<td>Effectiveness</td>
<td>Source of Method</td>
</tr>
<tr>
<td>-----------------------------</td>
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</tr>
<tr>
<td></td>
<td>(Circle YES if you have used the item. Circle NO if you haven't used the item).</td>
<td>(If YES, rate effectiveness from 0% (no pain relief) to 100% (complete pain relief)).</td>
<td>(If YES, (like a parent, friend, teacher, Doctor, Nurse, Book etc.).</td>
</tr>
<tr>
<td>W). Change in the amount of fluids you drink (like water).</td>
<td>Yes No</td>
<td>%</td>
<td></td>
</tr>
<tr>
<td>X). Drink Special drinks (like herbal tea).</td>
<td>Yes No</td>
<td>%</td>
<td></td>
</tr>
<tr>
<td>Y). Eat more sugar (like sweets)</td>
<td>Yes No</td>
<td>%</td>
<td></td>
</tr>
<tr>
<td>Z). Express pain verbally or physically (like throwing things, yelling, screaming).</td>
<td>Yes No</td>
<td>%</td>
<td></td>
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<tr>
<td>Other: (please state):</td>
<td></td>
<td>%</td>
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</tbody>
</table>

36. Why do you use non-medical methods to relieve pain/discomfort during your period? (circle as many as you need)

A). I don't like the side-effects of drugs.  
B). I have a medical problem that PREVENTS me from using available medications.  
C). I do not like putting drugs into my body.  
D). It's more convenient than other methods of pain relief.  
E). Available medications don't relieve my pain.  
F). Non-medical methods make medication work faster.  
G). Non-medical methods work quickly.  
H). Non-medical remedies ease the pain (make me feel better).  
I). Other: (please state)

37. You have just answered a number of questions about your period and what you do to cope with or relieve the pain/discomfort. Is there anything else you would like to tell us about what you do, feel, or think about your period?

Yes No

If Yes, please write in the space below:
Because having a baby and some methods of birth control have been known to affect the pain you feel during your period, we would like to ask you the following three questions ...

38. Are you currently taking Birth Control Pills (the 'Pill')?   Yes  No
39. Are you using an Intrauterine Device ('IUD') as a form of birth control?  Yes  No
40. Have you given birth to a baby? (circle one)  Yes  No

THANK YOU VERY MUCH!!

If you have any comments about the study please feel free to write them in the space below: