THE UNIVERSITY OF CALGARY

PAIN, COGNITIVE ACTIVITY AND CHILDBIRTH

BY

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ABSTRACT

This study examined the extent to which labour efficiency covaried with measures of subjective pain and cognitive activity taken during the latent (≤3 cm), mid-active (5-7 cm) and transition (8+ cm) periods of labour. The prospective design included measures of pregnancy/labour concerns assessed in the third trimester of pregnancy and measures of prenatal practice. Subjective pain was assessed with the Present Pain Intensity (PPI) scale. Cognitive activity was sampled via open-ended interviews of thought content during and between contractions. Measures of cognitive activity included rater-assigned scores on the dimension of "coping/catastrophizing" and a qualitative index based on attention focus. Pregnancy/labour concerns were assessed with the Lederman Prenatal Self Evaluation Inventory.

The nature of these relationships was phase specific. Each increase in level of pain in latent labour was associated with a significant increase in duration of latent and active phases of labour. Membership in the predominantly catastrophizing category of cognitive activity in latent labour was associated with significantly longer latent, active and descent phases of labour than was membership in the coping and equally coping/catastrophizing

groups. No relationship between pain or cognitive activity assessed in the mid-active or transition intervals and efficiency of any phase was found. Exploratory analyses of specific categories of coping indicated that women who focussed directly on the pain and sensations of labour were more efficient in latent and descent phases of labour than women who attempted to focus away from their pain.

Both PPI and coping/catastrophizing scores in latent labour were highly predictive of medication usage as well as rates of forceps deliveries and Caesarean Sections. Catastrophizing in latent labour was also associated with higher rates of abnormal fetal heart rate patterns in active labour and requests for Paediatric assistance.

Pain and cognitive activity in labour were predicted by pregnancy/labour concerns assessed in the third trimester. Two of Lederman's constructs in particular, Acceptance of pregnancy and Fear of pain/helplessness, were reliable predictors of pain and cognitive activity in labour.

The data suggest that protracted active and descent phases of labour are critically influenced by psychophysiological processes occuring in latent labour. This is discussed as a significant implication because of the relatively minor importance attributed to latent labour by obstetrical practitioners.

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D E D I C A T I O N

To my wife

Shelley Anne Marie

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INTRODUCTION

The phases which characterize normal labour represent a sequence of conditions marked by increasing physiological and psychological demand. Research indicates that women vary considerably in reported pain, emotional distress, rate of progress and incidence of complications within these phases. Studies which attempted to link personality factors and obstetrical complications have produced inconsistent results. However, some studies have drawn attention to the variability of pain and anxiety associated with labour. The findings reported in these studies suggest that the interplay between pain and cognitive activity during labour may have etiological importance in the pathogenesis of inefficient labour.

Normal labour may be described as an efficient process characterized by the optimal coordination of physiological systems which culminates in responsive cervical dilatation (Cibils, 1981). Contractile patterns of normal labour are expected to progress from the incoordinate and weak contractions of latent labour through increasingly more symmetrical, intense and rhythmic contractions of active labour (Cibils, 1981). Progress in rate of dilatation and fetal descent occurs with increasing rapidity as a function

of contractile adequacy, fetal size, pelvic architecture and degree of dilatation attained (cf. Friedman, 1978; 1983).

Expected rate of dilatation varies as a function of the phase of labour. The first stage begins when contractions become regular and ends at full dilatation, usually considered to be 10 centimetres. This stage consists of a latent phase and an active phase. The latent phase is usually defined as cervical dilatation of 3 centimetres or less and is marked by contractions which are less frequent and regular than those in active labour. Friedman's (1967; 1983a) descriptive studies with large samples indicated that the latent phase averages 9-10 hours in duration in normal nulliparous women. In contrast, the active phase, which is usually defined by dilatation between 3 and 10 cm, averages between 3 and 4 hours in length. Dilatation, which usually proceeds most rapidly from 4 to 7 cm of dilatation, slows down slightly as the last 2 cm of dilatation are attained. This portion of the active phase, termed the transition period, is often considered to be the most stressful because of the strong urge to push. The second stage or descent phase of labour is the time from full dilatation until delivery. This phase may last from a relatively few minutes to 1 to 2 hours.

Women often fail to progress in the phases of labour despite being seemingly normal in obstetrical parameters. O'Driscoll and colleagues (O'Driscoll, Foley & MacDonald, 1984) have reported evidence from over 8,000 deliveries which indicated that the majority of cases of dystocia (a generic term for failure to progress in labour) occurred in women who showed no exceptional obstetric parameters at the onset of labour. Friedman (1967; 1983b) has identified several diagnostic categories based on deviation from normal dilatation curves. The two most common of these, prolonged latent phase and protracted active phase, are each associated with higher rates of obstetrical intervention. Protraction disorders, which have no known cause in one-half to two thirds of cases, often proceed slowly even with augmentation (Friedman, 1983a). In contrast to efficient labour, protracted labour represents an inefficient process in which cervical dilatation proceeds slowly and unresponsively to contractions of varying intensity, duration, and rhythmicity. Inefficient labour is associated with a higher incidence of serious developmental anomalies (Bonica, 1967; Spring & Coons, 1982; Paneth & Stark, 1983), operative obstetrical procedures such as Caesarean and forceps deliveries and increased use of sedative or analgesic medication

(N.I.H. Statement on Caesarean Childbirth, 1981; Standley, Soule, Copans & Deichowny, 1979).

The observed variability in labour efficiency in obstetrically normal women is paralleled by observations in psychological research that women vary considerably both in their reported pain (Melzack, Taenzer, Feldman & Kinch, 1981; Melzack, Kinch, Dobbin, Lebrun & Taenzer, 1984) and their emotional distress during labour (Lederman, Lederman, Work & McCann, 1985). The variability in pain and cognitive activity is investigated in the present research as potentially significant elements in the psychophysiological interplay associated with labour efficiency. Specifically, this research addressed the extent to which pain and various measures of cognitive activity covaried with the efficiency of the different phases of labour. A secondary objective was to examine the extent to which pregnancy/labour concerns measured in the third trimester accounted for the variation in both pain and cognitive activity.

Review

Research with animals has produced evidence that uterine physiology is sensitive to stress. Animal studies have typically involved two forms of stressor as independent variables: 1) environmental disturbances involving loud noises, lights or pain during the birth process, or 2) infusion of hormonal substances directly into uterine tissue or blood during labour. In an early study Bleicher (1962) showed that environmental disturbances during whelping in dogs were associated with long delays between litter mates. Bleicher observed that labour would discontinue entirely during prolonged disturbance and resume after the stressors had been discontinued. More subtle forms of stress have also been found to produce disruptions in the labour process. Newton and colleagues (Newton, Foshee & Newton, 1966) introduced a stressor by handling labouring mice after the birth of the first pup. Handled mice were compared to controls which were allowed to labour alone. Labour times between pups two, three, and four were slower for the stressed group than for controls. Moreover, after cessation of handling, both groups showed similar labour times for subsequent pups. These studies provided indirect evidence regarding the sensitivity of labour in animals to stress. Several animal studies have investigated the relationship between

stress and uterine blood flow. Decreases in uterine blood flow in response to stressors such as loud noises or unfamiliar surroundings have been found to be as high as 25% - 33% in sheep (Greiss & Gobble, 1967). Both pain and exposure to bright light have similar effects on blood flow. Pain induced experimentally in pregnant monkeys and baboons results in a decrease in uterine blood flow, fetal bradycardia and fetal asphyxia (Morishima et al, 1977; 1978). Significantly, these consequences are reversed with pain relief. Analgesia is associated with improvement in maternal ventilation, blood gas content and uterine blood flow (Myers & Myers, 1979; Bonica, 1979; Morishima et al, 1978). In a review of animal studies Myers and Myers (1978) noted that direct infusion of catecholamines into uterine blood has been associated with decreases in blood flow of 30% to 65% in sheep and 30% to 100% in dogs. These authors suggested that a 'fight or flight' response of increased blood pressure, heart rate and blood flow to striated muscle with a concomitant decrease in blood flow to abdominal organs results whether stress consists of direct activation of the hypothalamus or 'psychological' stress. Indeed, there has been some tentative evidence from research with sheep that uterine blood vessels may be more sensitive to injected catecholamines than vessels in

other organs (Rosenfeld, Barton & Meschia, 1976). Myers and Myers concluded:

> the results of these studies...all agree that the blood vessels that supply the abdominal and pelvic organs including the uterus are exquisitely reactive (Myers & Myers, 1978, p. 93)

The fact that all muscle is more efficient with increased blood flow indicates a link to uterine efficiency. Relationships between stress and labour in animals are particularly suggestive when one considers that women's greater cortical capacity may heighten the sensitivity of this interplay. Findings that uterine blood vessels of non-human primates are more reactive to stress than uterine blood vessels in lower species indirectly supports this contention (Myers & Myers, 1978). Taken together, evidence from animal research suggests that the physiological systems underlying labour efficiency are sensitive to environmental and psychological influences. Specifically, animal studies have shown that stressful conditions surrounding labour are associated with biochemical changes which reduce blood flow and contractile activity.

Correlates of Obstetrical Complications

Three categories of dependent variable have been used in research with human subjects: (a) obstetrical complications; (b) indices of labour efficiency such as duration of labour; and (c) pain in labour.

Several studies have reported a relationship between anxiety and obstetric complications. In a study of 160 unmarried primigravidas, McDonald and Parham (1964) administered the MMPI and the Manifest Anxiety Scale (MAS) in the third trimester and 7-10 days post-partum. Women in a group containing multiple complications, including complications of pregnancy (e.g., bleeding, toxemia), scored higher than a normal group on a number of MMPI scales as well as on the MAS. Differences were maintained in the post-partum assessment. Similar relationships between third trimester anxiety and complications were reported by other authors using similar methodologies (Davids, DeVault and Talmadge, 1961 a,b; Davids and DeVault, 1962). These early studies provided the initial empirical evidence that labour in humans is sensitive to psychological influences.

Many of the early studies used complications of pregnancy as well as complications in labour. Complications of pregnancy (e.g., bleeding), however, reflect obstetrical problems that have begun prior to the

onset of labour. Heightened levels of anxiety in the third trimester may thus be a consequence of complications. Differences in the definition of complications and differences in the time in which psychological variables were assessed may also account for inconsistent findings reported in more recent studies. Some authors have reported strong predictive relationships between second and third trimester anxiety and obstetric complications (Gorsuch & Key, 1974; Crandon, 1978a,b) wheras others have reported no association between these variables when anxiety was assessed in the first (Norbeck & Tilden, 1983), second (Burstein, Kinch & Stern, 1973) or third trimester (Jones, 1978). Erickson attempted to clarify discrepancies in results by controlling for pre-existing health-related factors which may confound measures of complications (Erickson, 1975). Erickson administered the Pregnancy Research Questionnaire, an unpublished instrument designed to assess perinatal adjustment, to 730 women in all stages of pregnancy. Erickson found that "fears for self" and "fears for the baby" were predictive of complications. However a multivariate analysis of covariance in which the effects of age, lack of health before pregnancy, and lack of health during pregnancy were statistically entered first resulted in a loss of significance for the psychological factors. Erickson concluded that psychological variables

did not uniquely discriminate between complicated and uncomplicated groups after health variables were statistically controlled.

Correlates of Labour Duration

More consistent findings have been reported in studies of psychological influences on duration of labour. A premise of studies using duration of labour as the dependent variable is that measures of obstetric complications are not necessarily reflective of labour efficiency. Women with prolonged latent or active labour may still have uncomplicated spontaneous deliveries and healthy babies. In many of the studies cited earlier, such women would be included in an 'uncomplicated' group despite having laboured inefficiently.

Kapp and colleagues (Kapp, Hornstein & Graham, 1963) gave post-partum interviews to 18 primiparae who had had protracted labour (mean labour length 23.9 hours) and 43 primiparae who had had normal labour (mean length 10.8 hours). Both Groups were matched for race, marital status and fetal position. Blind raters assigned scores on several "areas of information" using 3 point scales ranging from "healthy" to "marked pathology". Kapp et al. concluded that the protracted labour group showed more pathology on a composite of factors including

identification with motherhood, acceptance of pregnancy and anxiety.

McDonald and coworkers (McDonald, Gynther & Christakos, 1963) administered the MAS in the third trimester to 86 women of mixed gravidity. The findings of Kapp et al. were essentially replicated as third trimester anxiety was associated with longer length of labour.

Lederman and colleagues (1978; 1979) administered the State Trait Anxiety Inventory (STAI) (Spielberger, Gorsuch & Lushene, 1970) to assess anxiety during active labour while incorporating simultaneous measures of labour efficiency. These authors also incorporated measures derived during the third trimester including acceptance of pregnancy and fears regarding labour. Measures of contractile activity (Montivideo Units) during active labour correlated -.49 with 'fear of helplessness', -.67 with 'fear of loss of control', and -.66 with fear of 'loss of self-esteem'. Contractile activity also correlated -.60 with fear of pain. Negative correlations indicated that higher fear of pain was associated with reduced levels of contractile activity. Significant correlations between state anxiety and epinephrine, and between epinephrine, uterine activity and length of active labour were also reported. The authors interpreted their findings as evidence that anxiety occurring during labour may influence

labour progress by stimulating heightened catecholamine output. These data are encouraging because they point to the transaction of labour-related thoughts, state anxiety, sympathetic arousal and measures of labour efficiency. Methodological considerations require that these data be taken as preliminary. Lederman and coworkers reported the difficulty in applying a uniform set of pharmacological criteria to deal with the confounding effect of medication usage. Correlations between hormonal substances and efficiency measures were based on small subsamples ranging from 13 to 23 subjects. Taken as preliminary evidence, however, their data supported the thesis that labour related concerns assessed in the third trimester, state anxiety and sympathetic arousal are each related to labour efficiency.

Lederman and colleagues have recently extended these findings by assessing thoughts and feelings during labour (Lederman et al., 1985). Incorporating assessment intervals at 3-6 cm (phase 1) and 7-10 cm (phase 2), these authors found that anxiety concerning coping, safety and pain as well as measures of 'objective stress' were related to epinephrine in phase 1. Concern regarding safety was also related to length of phase 1 and fetal heart rate pattern in phases 1 and 2. Observed stress was related to the anxiety measures concerning coping and pain (r=.52 and

.31 respectively) but not safety. The observed stress rating was unrelated to length of phase 1 but was modestly related to duration of phase 2 (r=.27). Anxiety regarding safety assessed during labour was highly correlated with a third trimester variable, Concern for well being of self and baby (r=.44, p<.01). The authors interpreted their findings as evidence that different dimensions of anxiety are related to catecholamine levels and duration of labour. The finding that concern for well-being of self and baby was related to anxiety regarding safety was interpreted as evidence that "concerns for well-being is a stable personality trait of mothers during pregnancy" (Lederman et al., 1985, p. 876). Their data also suggest that cognitive activity occurring during labour may play an important role in mediating efficiency. The fact that anxiety regarding coping, safety and pain covaried differently with both duration of labour and biochemical measures is the first evidence that variation in thought during labour may parallel the variability in labour efficiency described by O'Driscoll and colleagues (1984).

Variability of Labour Pain

Lederman's observations about third trimester concerns regarding pain in labour highlights the possible significance of actual pain during labour. In a review of empirical investigations of labour pain, Melzack (1984)

emphasized the consistency of findings that labour pain ranks as one of the severest forms of pain and that extraordinary variation in pain occurs both between and within women during labour. Melzack and colleagues (Melzack, Taenzer, Feldman & Kinch, 1981; Melzack, Kinch, Dobbin, Lebrun & Taenzer, 1984) were among the first to assess individual differences in labour pain using instruments of recognized validity. These authors documented labour pain ratings ranging from "mild" to "excruciating" with mean intensity of labour pain ranking among the highest recorded with the McGill Pain Questionnaire (MPQ). Other researchers who have administered the MPQ (Reading & Cox, 1985) or 5 point verbal rating scales (Bundsen, Peterson & Selstam, 1982) retrospectively have also reported mean pain ratings to be high compared to other pain syndromes.

Important to the present research are the individual differences in experienced pain found in different women and in different phases of labour. Melzack remarked on the considerable individual differences in patterns of pain:

> "there is a remarkable variety of patterns. Some women show the expected rising curve. Others show rises and falls in pain level. Some women have <u>extremely high levels of pain early in</u>

> labour, while others, up to the time of delivery, show fairly low, constant pain scores" (Melzack, 1984, p. 329, emphasis added)

Evidence that variability in pain may account for differences in labour efficiency comes from studies of the effects of analgesia. Pain reduction through analgesic medications has been associated with a decrease in epinephrine and cortisol, both of which are higher in anxious women and are associated with longer labour (Myers & Myers, 1979; Shnider, Abboud, Artal, Henriksen, Stefani & Levinson, 1983; Taylor, 1985). As noted in the review of animal studies, pain-induced changes in maternal ventilation, blood gas content, and uterine blood flow as well as signs of fetal asphyxia are reversed with the administration of pain relieving drugs (Morishima et al., 1977; 1978; Myers and Myers, 1979; Bonica, 1979). Converging evidence is available from Soviet studies on the effects of electroanalgesia in labour. In reviewing the literature, Persianinov (1983) noted that neurohormonal regulation of contractility and pain and emotions are centered in hypothalamic-limbic structures and that effective electroanalgesia is associated with improvement in both contractility and fetal heart rate. It follows that pain may play a critical role in stimulating hormonal,

vascular and physiologic systems which, in concert, may account for previously unexplained abnormal labour (Soulairac, 1977).

There is some evidence that the relationship between pain experience and contractility is phase specific and is mediated by cognitive-behavioural processes occurring during labour. Filler and colleagues (Filler et al., 1967) reported that contractility was enhanced by narcotic analgesia if contractility was less than optimal and if overt distress was exhibited. Given that contractility tends to be incoordinate (non-rhythmic) in early labour, these data suggest the phase of labour may be an important parameter in understanding the role of pain in labour efficiency.

Studies which have assessed the relationship between pain and labour length have usually incorporated retrospective pain measures. Davenport-Slack and Boylan (1974) found no relationship between pain assessed retrospectively and length of labour from 2.5 cm to full dilatation. Other studies which incorporated restrospective pain measures have also found no relationship between length of labour from the first painful contraction (Nettelbladt, Fagerstrom & Uddenberg, 1976) or total labour (Reading & Cox, 1985). One study has reported a relationship between total labour length and

retrospective pain (Bundsen, Peterson & Selstam, 1982). These authors described this relationship as "strong"; however, the size of the correlation in light of sample size ($r=.17$, $p=.0001$, $N=544$) was modest.

Melzack's group (Melzack et al., 1984) found no relationship between length of labour and MPQ scores taken within four hours of delivery. This was reported as an incidental finding as these authors were primarily interested in investigating factors which predict labour pain. Similarly, Bonnel and Boureau (1985) found no correlation between pain and labour length in their study of the relationship between subjective and behavioural pain measures in active labour. Because of the the variability of pain within phases (Melzack et al., 1984), an alternative to using pain assessed only in active labour would be to take advantage of the temporal sequence of phases which characterize normal labour. Partitioning efficiency into lengths of the clinical phases of labour would have the advantage of providing measures which are generalizable to the diagnostic categories discussed earlier; i.e., prolonged latent and protracted active labour patterns.

In summary, the literature suggests that women vary considerably in subjective pain experienced during labour as well as in their concerns experienced prior to and

during labour. Other studies have shown that high levels of pain and concerns for safety during labour are associated with heightened levels of biochemical substances which are known to attenuate contractile activity. This relationship in turn may be reversed with analgesia. The variability in subjective pain and cognitive activity which occur during labour may be linked to the variability found in labour efficiency. Considerable clarification of the interplay between these variables could be obtained by simultaneously measuring pain and cognitive activity within each of the phases of labour.

Statement of the Problem

The present study was designed to investigate the significance of pain and cognitive activity in labour by assessing each of these variables in the latent (≤3 cm), mid-active (5-7 cm) and transition (8+ cm) time periods. If pain and cognitions influence labour efficiency, then differences in these variables within phases should be reflected in differences in efficiency as labour proceeds. The length of the latent and active phases of the first stage as well as the length of second (descent) stage provided operational measures of efficiency.

A secondary goal was to investigate how individual differences in pain and cognitive activity are in turn

accounted for by pregnancy/labour concerns assessed in the third trimester. In light of evidence regarding relationships with both hormonal and anxiety measures taken in labour, variables such as Lederman's 'fears for self and baby' were expected to contribute to differences in cognitive activity and pain through the course of labour. Moreover, because women are taught specific techniques for the control of pain and distress during labour, their practice and self-efficacy (Bandura, 1977) in the use of these techniques were examined as possible mediating variables.

Pain was assessed with two measures of subjective pain as well as a measure of pain behaviour. The availability of clinical data concerning requests for medications for pain, fetal heart rate patterns and type of delivery afforded an opportunity to examine the clinical significance of differences in pain and cognitive activity.

A variant of a "think aloud" approach (Genest & Turk, 1981; Turk & Kerns, 1985) was used to assess cognitive activity during labour. Genest and Turk (1981) have discussed two measures that can be derived from think-aloud data: 1) an overall index of cognitive activity consisting of global ratings assigned by judges, and, 2) a qualitative measure consisting of categorical ratings on dimensions of theoretical interest. Global ratings of "catastrophizing"

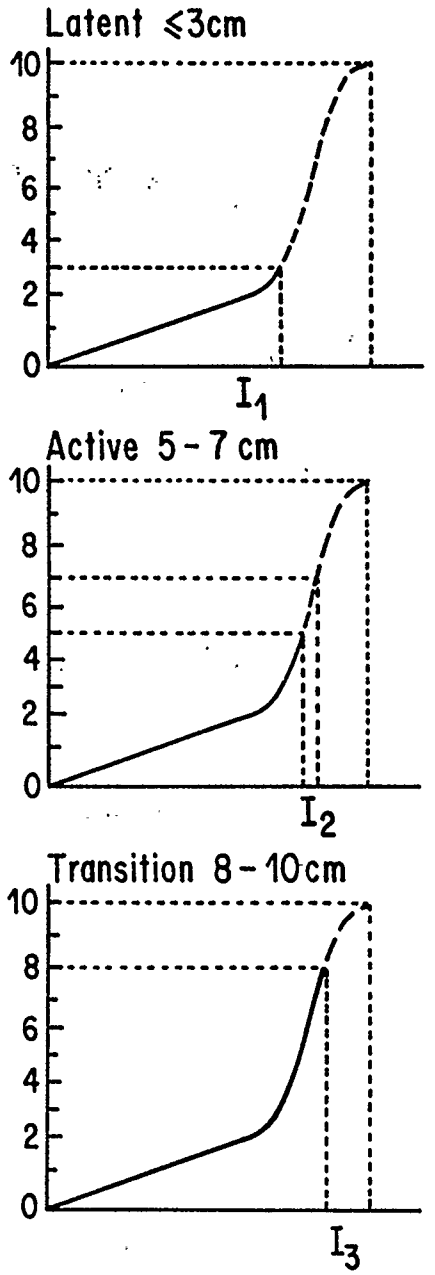
have been found to be associated with low tolerance for cold pressor pain (Genest, 1978, as cited in Turk, Meichenbaum & Genest, 1983), higher levels of post-surgical pain (Taenzer, 1983), and failure to reduce pain with hypnotic suggestion (Spanos et al., 1979). In reviewing evidence concerning the importance of catastrophizing on perception of nociceptive stimulation, Taenzer (1983) described this variable as "an important yet overlooked individual difference dimension". Whether catastrophizing is associated with increased physiological cost due to pain is not known. The mediating influence of qualitatively different styles of cognitive activity in labour adds yet another element to this dimension. Reliable qualitative measures of cognitive activity can be derived from raters' assessments concerning the presence or absence of specific cognitive coping strategies (Genest & Turk, 1981). Most experimental studies have not found specific strategies to be as predictive as global ratings of coping/catastrophizing (Turk, Meichenbaum & Genest, 1983). Unlike experimental settings, however, women in labour have often extensively practiced techniques which are accorded high face validity through prepared childbirth programs. The labour setting provided an ideal milieu in which to examine the influence of self-generated thought in terms of

its' comparability to styles taught within prepared childbirth programs.

The interplay between labour efficiency, pain and cognitive-behavioural variables was examined prospectively by incorporating a sequence of repeated psychological and physiological measures. Measures of concerns regarding labour were given in the third trimester. Measures of practice in prepared childbirth techniques were administered early in labour. Assessment of cognitive activity, pain and uterine contractions was conducted during three successive phases of labour: at ≤3 cm, 5 to 7 cm and 8+ cm of dilatation (Figure 1). Women were asked their thoughts during the same visits in which pain was assessed. To assess the relative importance of thoughts occurring during contractions versus those which occur between contractions, subjects were asked to give separate accounts of "during" and "between" thoughts. Transcripts were later rated with both an overall score on coping/catastrophizing and categorical ratings concerning specific coping techniques. This method provided a means of examining both the relationship between pain and cognitions and the relationship between both variables and labour efficiency.

The length of the latent and active phases and the second stage provided an operational measure of efficiency.

RECORDING INTERVAL	MEASURE
Third trimester	- Lederman questionnaire
Hospital admission	- Practice in Prepared Childbirth Training - Self efficacy in Prepared Childbirth Training
LABOUR	
Latent ≤3cm	- Present Pain Intensity - Visual Analogue Scale - Behavioural Pain Inventory - Thoughts
Active 5 - 7 cm	- Present Pain Intensity - Visual Analogue Scale - Behavioural Pain Inventory - Thoughts
Transition 8 - 10cm	- Present Pain Intensity - Visual Analogue Scale - Behavioural Pain Inventory - Thoughts



$I_{1,2,3}$ represents windows during which assessments of pain and cognitive activity were taken.

Figure 1 - Sequence of measures

Considerable controversy exists concerning the measurement and importance of contractile activity vis a vis labour efficiency. Cibils (1981) has argued that efficiency is best viewed as a function of uterine work, specifically as the rate of dilatation divided by amount of uterine work. This position is disputed by Friedman (1978) who suggested that too much variance exists in contraction patterns among normally progressing women to warrant such a central role for contractile activity. Instead Friedman advocated the use of rate of cervical dilatation and fetal descent as the best, albeit indirect, measure of labour efficiency. Dilatation curves, described by Friedman as the best "means of assessing the overall effect of the forces of labour acting on the cervix to affect dilatation" (Friedman, 1978; p. 32), were used to display efficiency of latent, active and total labour. Given this debate, an attempt was made to measure variation in labour efficiency as sensitively as possible by incorporating quantitative and qualitative measures of contractile activity as well as dilatation and descent curves.

METHOD

Subjects

One hundred and fifteen nulliparous women were initially recruited through medical doctors, a private Lamaze instructor and the Foothills Hospital Prenatal Program. A demographic and obstetrical description of subjects is contained in Table 1. Median age of subjects was 27 years, and mean age was 27.5 years. The mean and median educational levels were 14.2 and 14.0 years respectively. Occupational categories suggested the sample fit a predominantly middle class socio-economic profile, with primary occupations including housewife, nurse, teacher, medical doctor and sales-person categories. English was the first language of all but four subjects; the latter however were proficient in English. At the time of recruitment all subjects thought themselves to be of 'low' obstetrical risk. Criteria for exclusion from the study included history of premature labour between 16 and 36 weeks, major uterine surgery, multiple gestation, history of diabetes, heart disease, renal disease or drug abuse. Post-partum chart reviews indicated 13 women to be in a high risk category, primarily due to borderline pregnancy-induced hypertension in the last week of

Table 1

Demographic/Obstetrical Profiles: Entire Sample

Variable		Mean	S.D.	Range	N	Percent
Age		27.5	4.05	17-42	115	
Religion	Catholic				20	17.5
	Protestant				47	40.9
	Muslim, Buddhist				5	4.3
	None				43	37.5
Education (yrs)		14.2	2.05	10-19		
Obstetrical risk	low				99	86.1
	high				13	11.3
	none assigned				3	2.6
Gravida	1				86	75.0
	2				26	22.6
	3				2	1.7
Fetal Position	OA				55	47.8
	OT				15	13.0
	OP				28	24.3
	unknown				17	14.8
Weight (kg)		73.3	8.70	50-98	110	
Weight/Height		0.44	0.05	0.34-0.65	109	
Labor	spon-no augment.				63	55.3
	spon-augment.				35	30.7
	induced				15	13.2
Delivery	spontaneous				61	53.0
	forceps				44	38.3
	Ceasarean-section				10	8.7

pregnancy. T-tests revealed that high risk subjects did not differ from low risk subjects on measures of pain or labour efficiency.

Of the 115 volunteers, pain data were obtained from 86 women in latent labour, 89 women in mid active labour, and 75 women in the transitional phase. Fifteen women were induced and excluded from the analysis of efficiency. Several factors contributed to the reduction in sample size: (i) 6 subjects arrived too late in labour, ii) 3 subjects were excluded because of diagnosed cephalopelvic disproportion, iii) 6 subjects were delivered by caesarean section during latent or active labour, iv) 10 subjects were missed by the experimenter. Differences in n's between the three recording intervals were due to subjects and/or experimenter arriving during the active or transition phases (which precluded earlier pain ratings) or lack of convenient recording time during the transition phase.

Cognitive data were obtained for 76 subjects in latent labour, 87 subjects in active labour and 64 in transition. The difference in sample size for pain and cognitive data reflect interruptions during interviews prior to questions concerning thoughts (4 during latent labour, 2 during active labour, 4 during transition), unrecognizable tape recordings (3 in latent, 2 during transition) or

non-codable responses (3 in latent, 2 in transition). The decrease in sample size from the active to transition phase reflected occasional difficulty in finding an appropriate time (e.g., subject vomiting, or an epidural in progress). Other reasons included subjects dropping out during this time (n = 3) or the interviewer electing not to distract the subject (n = 5).

Indices of Efficiency

The duration of each phase in minutes provided a continuous dependent measure. Latent labour was defined as the time from first regular contractions to the time dilatation first exceeded 3 cm. Contractions were considered regular from the point at which they were consistently 12 to 15 minutes apart. Active labour was defined as the time between 3cm and 10 cm. The descent phase was the time from 10 cm dilatation until delivery. The phases are displayed in Figure 2.

A second index of efficiency was to have been based on tokographic records of uterine contractility. The quality of tokographic records were often poor and a systematic bias was found regarding subjects who actually received monitoring versus those who did not. Women who were progressing efficiently tended not to have contractions monitored or to have contractions monitored for less

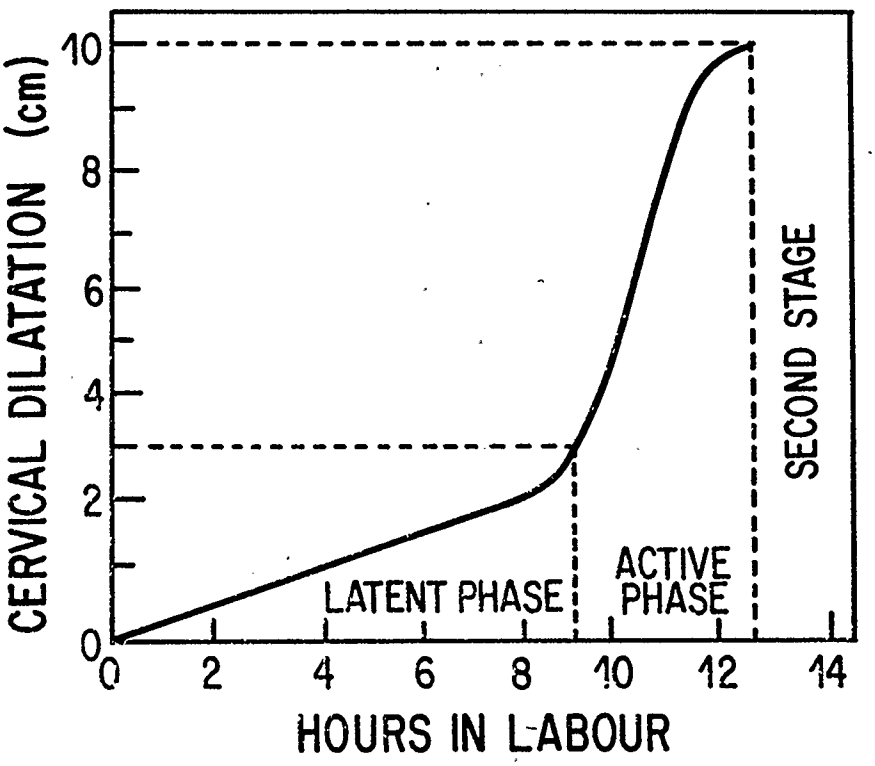


Figure 2- Measures of efficiency were length of latent (0-3 cm), active (3.5-10 cm) and second stage of labour.

than the 20 minute time period. Given these problems, analyses of contractility were not possible.

Indices of Pain

i) Subjective Measures. Two different scales were used to assess subjective pain: the Present Pain Intensity (PPI; Melzack, 1983) and a variation of the Visual Analogue Scale (VAS; Huskisson, 1983). The PPI, which is often given as part of the McGill Pain Questionnaire, consists of six adjectives: no pain, mild, discomforting, distressing, horrible and excruciating. The PPI has the advantage of well documented validity (Melzack 1983), is quick to administer and contains adjectives of increasing affective intensity. A modified VAS marked off from 0 to 10 in units of 1 cm was also administered. The traditional VAS is usually marked only at end points and administered by having subjects point to a spot on the line, however, the modified version was more appropriate given the physical stress of labour. Subjects were simply asked "tell me the number which best describes your pain." The MPQ was not used in this study because subjects were also to be asked about their thoughts.

ii) Objective Pain Behaviour Ratings. The Behavioral Pain Inventory (BPI) developed by Bonnel and Boureau (1984) was used to assess pain behaviour during and between contractions. This scale provides a cumulative index based

on three manifestations of pain: respiratory responses, motor responses and agitation (Appendix A). For the present study, the BPI was used to observe a sequence of three consecutive 'contraction-resting interval' units. Because the BPI involves description of overt behaviour during and between contractions, nurses who were blind to both the intent of the study and to subjective pain ratings were used to record this measure. Subject to nurse availability, the BPI observations were conducted shortly after the subjective interviews.

iii) Requests for Medications. Two measures of analgesic/anesthetic drug usage were derived. These measures consisted of dilatation at which the first request for analgesic assistance was made and of the total number of such requests throughout labour.

Indices of Cognitive Activity. Cognitive activity was assessed via open-ended interview questions during each of the labour phases. Subjects were asked "Would you please tell me anything you can about what you think about or what is going on in your mind during a contraction?". This was followed with a query "Anything else?". They were then asked "And between contractions, can you tell me what is going on in your mind then? Anything else?".

Lederman Prenatal Self Evaluation Inventory

Appraisals regarding labour concerns were assessed

with the Prenatal Self-Evaluation Inventory (Lederman, 1979). This questionnaire provides subscale scores on the following constructs: Well-being of self and baby, Acceptance of pregnancy, Identification of motherhood role, Preparation for labor, Fear of pain/helplessness, Relationship with mother, and Relationship with husband.

Self-Efficacy and Practice in Prepared Childbirth Techniques

In an effort to assess the impact of prenatal training a measure of practice in specific techniques was incorporated. Subjects were asked to indicate how many classes they attended and how often per week they practiced breathing exercises, effleurage, pelvic floor exercises, relaxation exercises and 'other'. Subjects' attitude toward pain-relieving drugs in labour was assessed with the following question: "How important is it for you to be able to cope with your labour pain without medication?". Range of possible responses was from 1 'not at all' to 9 'extremely'.

Self-efficacy in specific procedures taught in prepared childbirth programs was assessed using a method paralleling the assessment of self-efficacy expectations (cf. Bandura, 1977). This method contains a high face validity, and predictive validity has been found to be good when used to investigate the usage of analgesics during

labour (Manning & Wright, 1983). The questionnaires used to assess Practice and Self-Efficacy are contained in Appendix B.

Procedure

Women meeting language and medical criteria were informed during their prenatal program or by their doctor that research was being conducted about ways women cope with labour. They were told that participation would involve filling out a questionnaire during the third trimester and also filling out a very brief questionnaire early in labour. They were informed that on 3 occasions during labour they might be asked to give verbal descriptions of their pain and to provide a brief description of their thoughts. They were told that data from the tracings of an external contraction monitor might be requested for 3 twenty minute intervals after their pain description. Subjects were assured that they could withdraw at any time and that all information would be stored in confidential files available only to the investigator. Informed volunteers who met inclusion criteria and who signed consent forms (Appendix C) were included in the study.

Upon arriving at the hospital, subjects were asked to complete a short questionnaire on Prenatal Practice and Self-Efficacy Expectations. The PPI, BPI and thought

interview were conducted verbally by the experimenter. Subjects' responses were tape recorded with a Dictaphone tape recorder equipped with a conference microphone. During taping, the experimenter initially displayed the tape recorder and then held it at bed level below the subject's line of vision. In latent labour the entire interview was usually conducted between two contractions. In the mid-active (5-7cm) and transition (8+cm) periods, the interview was usually completed between two contractions; however, it was often interrupted by the onset of a contraction. When this occurred, the experimenter would stand back to allow the subject to redirect her attention to herself or to her labour companion. Soon after the interview the nurse re-entered the room and completed the BPI rating for three consecutive contractions. Between contractions the nurse marked her score and responded to her patient as required. Interviews were repeated when a vaginal exam indicated the appropriate level of dilatation had been reached or, in lieu of a vaginal exam, the nurse and/or experimenter suspected the subject had progressed. In the latter instances, the completed 'partogram' (Friedman curve for each subject) was used to confirm that interviews corresponded to the appropriate level of dilatation. The sequence of subjective interview, BPI rating and external monitoring

was conducted 3 times: at (1) less than or equal to 3 cm, (2) 5 - 7 cm, and (3) 8 cm or greater.

Throughout the course of labour the interviewer was in and out of the labour room. Often these visits consisted of informal banter between the couple and the experimenter, or, especially during later phases of labour, quiet observation from some point in the labour room. Post-partum interviews indicated that the majority of subjects felt comfortable with the experimenter and found him to be non-intrusive and sensitive.

During the post-partum period, charts were reviewed to obtain information on medication types, amounts and dilatation at which requests were made.

RESULTS

Pain Measures and Subject Selection

Of the entire sample, 26 subjects remained non-medicated, 30 had I.M. Demerol and 57 had epidural anesthesia. Most of the subjects having Demerol reported that the drug had little or no analgesic effect or that the effect was very short lasting. Mean PPI, VAS and BPI scores for non-medicated and Demerol groups for latent, mid-active, and transition assessment intervals are contained in Table 2. T-tests indicated that the non-medicated and Demerol groups did not differ on pain and efficiency measures. Subjects with Demerol were therefore combined with non-medicated subjects for all analyses involving pain and labour efficiency.

Some subjects had their pain assessed on more than one occasion within a given phase. This occurred when the interviewer and nurse were not sure if the subject had dilated after an earlier assessment and there was no obstetrical reason for conducting a cervical exam. If more than one pain rating was obtained, the highest rating was used in the analyses. Thus, all pain ratings reflected the criterion of the highest pain report given by subjects in each phase.

Table 2

Descriptive Statistics: Pain Scores by Medication Type

	PPI (1-5)			VAS (1-10)			BPI (1-4)		
	$\bar{x}$	S.D.	n	$\bar{x}$	S.D.	n	$\bar{x}$	S.D.	n
Latent									
No meds	2.9	1.0	69	6.5	2.2	70	2.0	1.1	82
Demerol	3.0	.7	5	7.6	1.1	5	2.5	1.0	5
Active									
No meds	3.7	.8	46	8.2	1.4	46	2.4	1.0	57
Demerol	3.7	1.1	17	8.1	1.9	16	2.7	.9	19
Transition									
No meds	4.0	.9	18	9.1	1.1	18	2.6	1.0	26
Demerol	4.4	.8	21	9.4	1.1	21	3.0	.8	27

Note. No differences reached significance.

Validity of the PPI

The concurrent validity of the PPI was examined by correlating scores on this scale with scores obtained for the VAS and BPI. The PPI and VAS correlated .85, .76, and .70 for the latent, active, and transition phases (Table 3). The correlations between PPI and BPI were significant for latent ($r = .64$, $p \leq .0001$,) and active labour ($r = .50$, $p \leq .0001$), but not for the transition phase. These correlations indicated that the PPI was a valid measure of subjective pain throughout labour and that both measures of subjective pain were related, albeit to a lesser extent, to behavioural indices of pain during latent and active labour.

Correlated t-tests were used to test the significance of changes in subjective pain and pain behaviour across the three phases. For this analysis, only subjects who remained without epidural anesthesia for all three assessment intervals were included. This criterion ensured that the t-tests would be conducted on the same women across phases and that the results were not be confounded by anesthesia. The t-tests conducted on the mean scores for each phase revealed that that PPI, VAS, and BPI scores increased significantly with each succeeding phase of labour (Table 4).

Table 3

Correlations: PPI with VAS and BPI

PPI	VAS	n	BPI	n
Latent	.85****	74	.64****	71
Active	.76****	44	.50****	45
Transition	.70****	29	.27	28

**** $p < .0001$

Table 4

Temporal Evolution of Pain: Correlated t-Tests.

Subjects with No Medications and/or with I. M. Demerol

Measure		N	Mean	S.D.	t Value	df	Prob. 2 tail	Corr
	L		2.39	0.70				
		32			-9.35	31	0.0001	0.58
PPI	A		3.59	0.85				
		36			-4.67	35	0.0001	0.43
	T		4.23	0.91				
	L		5.26	1.79				
		31			-8.83	30	0.0001	0.54
VAS	A		7.87	1.61				
		35			-6.42	34	0.0001	0.47
	T		9.27	1.14				
	L		4.65	2.32				
		46			-4.96	45	0.0001	0.33
BPI	A		6.87	2.84				
		52			-3.33	51	0.002	0.62
	T		8.06	2.76				

All correlations reported are significant at $p<.02$ or better.

Note. Letters L,A,T denote the Latent, Active and Transition recording intervals

Relationship between Pain and Labour Efficiency

As an initial step in investigating the relationship between subjective pain and efficiency, Pearson product-moment correlations between PPI scores and duration of each phase were calculated (Table 5). PPI during latent labour was positively correlated with duration of latent and active labour ($r = .58$, $p < .0001$; $r = .50$, $p < .0001$). Positive correlations indicated that pain was related to longer or more inefficient labour. PPI was also correlated with requirement for augmentation ($r = .33$, $p < .01$), indicating that higher pain in latent labour was associated with the need to augment active labour. PPI during latent labour was not related to length of the descent phase of labour.

PPI taken in the mid-active interval was not related to efficiency of active or descent phases of labour. PPI taken in the transition period also did not correlate with efficiency of active or descent phases.

PPI was related to efficiency in a phase specific manner. Of the three assessment intervals in which pain was assessed, PPI in latent labour correlated highest with efficiency of latent, active and total labour and with requirement for augmentation. Pain measures taken in the active or transition phases did not correlate with duration

Table 5

Correlations Between PPI and Indices of Efficiency[1]

Pain Measure	Phase[2]	Efficiency Measure: Latent	Active	Total	Descent	Cm Aug[3]
PPI	L	.58****	.50****	.60****	.04	.33**
		(70)	(47)	(51)	(50)	(51)
	A	-	.18	.18	-.09	.14
			(42)	(42)	(44)	(45)
	T	-	-	.10	-.28	-.19
				(29)	(29)	(29)

Note 1. Subjects with no medications or I.M. Demerol at time of recording.
Note 2. Letters denote phase of labour in which pain measure was taken.
Note 3. Centimeters of augmentation

**p<.01, ****p<.0001

of labour in the concomitant or adjacent phase.

In order to control for the effects of obstetrical variables, the relationship between level of pain in latent labour and efficiency of the dilatation phases was examined with analysis of covariance. The data analytic strategy involved three steps: (1) identification of relevant covariates; (2) re-analysis of the relationship between pain in latent labour and duration of the dilatation phases; and (3) examination of a possible confound attributable to the length of time individual subjects were in labour prior to the assessment of pain.

To identify covariates, the correlations of obstetrical and subject variables with efficiency measures were examined (Table 6). Overall, these correlations indicated that obstetrical variables were more highly related to the descent phase than to the dilatation phases. An exception was gestational age, which was related to both latent labour ($r = .19$, $p < .05$) and active labour ($r = .40$, $p < .001$). Size of baby correlated with efficiency of active labour ($r = .31$, $p < .001$); however, as this variable is generally a function of gestational age, only the latter variable was selected as a candidate covariate for analyses of labour efficiency.

A grouping variable consisting of three levels of pain in latent labour was formed by classifying PPI scores into

Table 6

Inter- Correlations: Subject Variables with Measures of Efficiency

	Phase				
Variable	Latent	Active	Total	Descent	CmAug
Position		.25*		.31***	
Age				.19*	
Risk					
Wt Gain				.23**	
Weight				.23**	
Height		-.20*			
Weight/Height		.20*		.24**	
Cm/Rupture					-.30**
Size of Baby		.31***	.26**	.20*	
Gestational Age	.19*	.40***	.29***	.22*	

n=74-93

Correlations are for subjects in spontaneous labour. Only significant product moment correlations have been included.
CmAug refers to number of centimetres augmented.

* p<.05
** p<.01
*** p<.001

Discomforting, Distressing, and Horrible/Excruciating pain scores. The 6 women who reported mild pain were included in the Discomforting group. Similarly, the 6 women who reported excruciating pain were included in the Horrible/Excruciating group. Pharmacologic criteria for inclusion in these analyses were that subjects were non-medicated during pain ratings in latent labour and also that they did not receive augmentation with syntocinon. Final n's for the three Groups were 23, 20 and 8.

A central objective of this study was to determine if pain and labour efficiency covary. The correlations reported earlier do not provide information about the importance of each level of pain. To examine the influence of pain levels while controlling for gestational age, the data were analyzed with a Groups (Discomforting, Distressing, Horrible/Excruciating) by Phase of labour (latent, active) split-plot factorial design with gestational age as covariate. Mean lengths of the latent phase for the three Groups were 391.5, 585.5 and 866.8 minutes respectively (Table 7). For length of active labour the means were 230.3, 382.5 and 574.8 minutes respectively. The means are plotted as a function of phase of labour in Figure 3. Main effects for Groups ($F(2,47) = 10.24$, $p < 0.0002$) and phase ($F(2,48) = 15.38$, $p < 0.0003$) were highly significant (Table 8). The significant effect

Table 7

Mean Duration of Latent and Active Labour as a Function of Pain Group

Phase	Discomforting		Distressing		Horrible/Excruc	
	$\bar{x}$	S.D.	$\bar{x}$	S.D.	$\bar{x}$	S.D.
Latent	391.2	250.4	585.5	349.4	866.8	240.4
Active	230.3	143.4	382.5	289.0	574.8	328.3
n	23		20		8	

Note. Measure is in minutes. Higher values reflect less efficient labour.

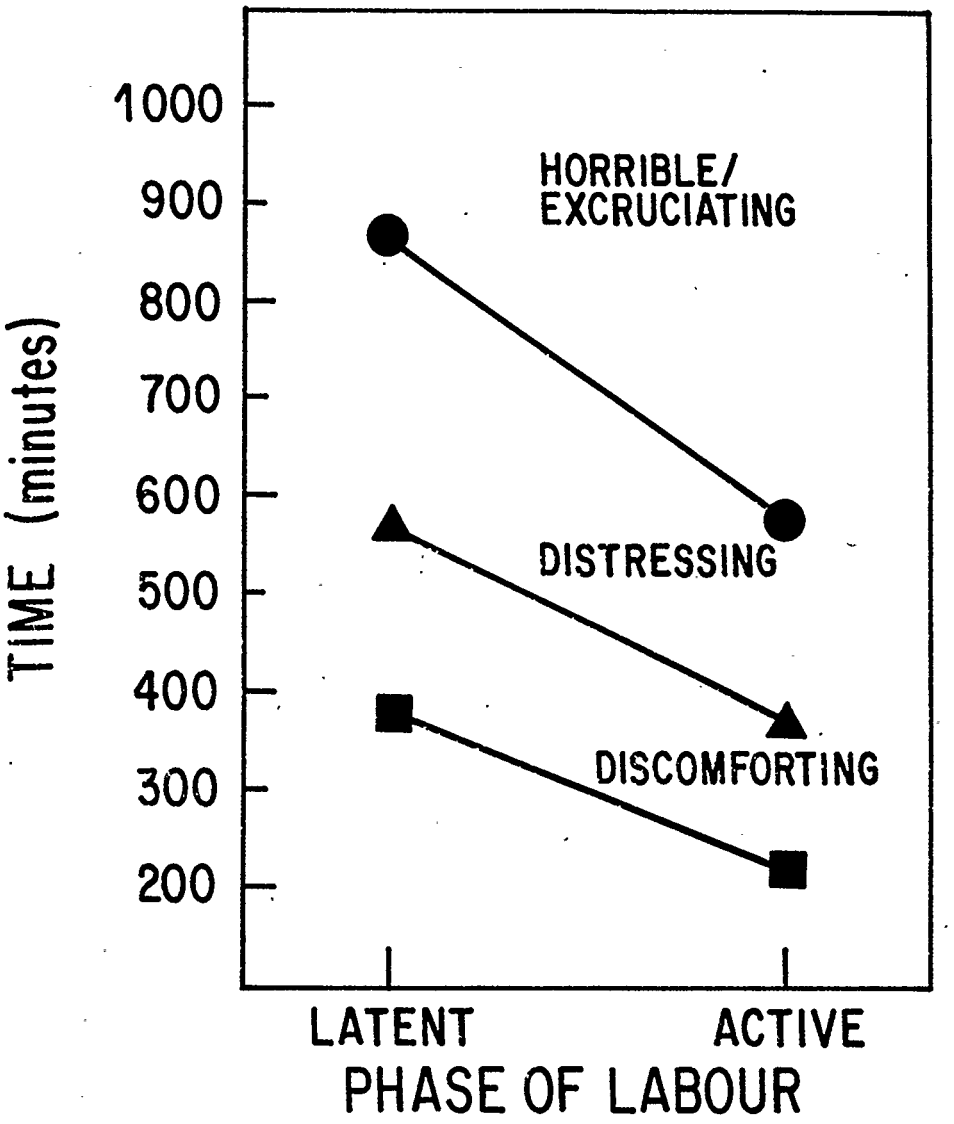


Figure 3 - Efficiency of latent and active labour by pain rating in latent labour.

Table 8

Summary Table: Split Plot Factorial ANCOVA of Labour Efficiency: PPI (Latent) by Phase Controlling for Gestational Age

Source	df	Ms	F	prob
Between groups (Pain)	2	788376.4	10.24	.0002
Gestational age	1	208930.4	2.7	.11, ns
Error	47	76978.3		
Within groups (Phase of Labour)	1	984587.5	15.38	.0003
Pain by phase	2	25705.7	0.40	.67, ns
Error	48	63999.2		

due to Phase of labour represents the expected difference in lengths of latent and active labour. There was no interaction between pain rating and phase nor was there a significant effect due to gestational age. All contrasts for simple-effects means between adjacent groups (Kirk, 1982) produced significant t's ($p < .01$). The contribution of Gestational Age was not significant. In summary, the analysis of covariance revealed significant differences among the Discomforting, Distressing and Horrible/excruciating Groups on efficiency of latent and active labour.

Within obstetrics, the dilatation curve is an accepted clinical index of labour efficiency. Friedman's (1978) curve was validated with a sample of over 20,000 women from several American hospitals and has gained acceptance as the expected curve for primiparae. The relationship between pain in latent labour and efficiency of the dilatation phases was documented by comparing the labour curve associated with the mean pain rating in latent labour with Friedman's curve for primiparous women. 'Distressing' was the mean pain rating in latent labour for the present sample. By overlaying Friedman's curve on the extrapolated labour curves for the three pain Groups (Figure 4), it can be seen that the 'distressing' group had a labour curve

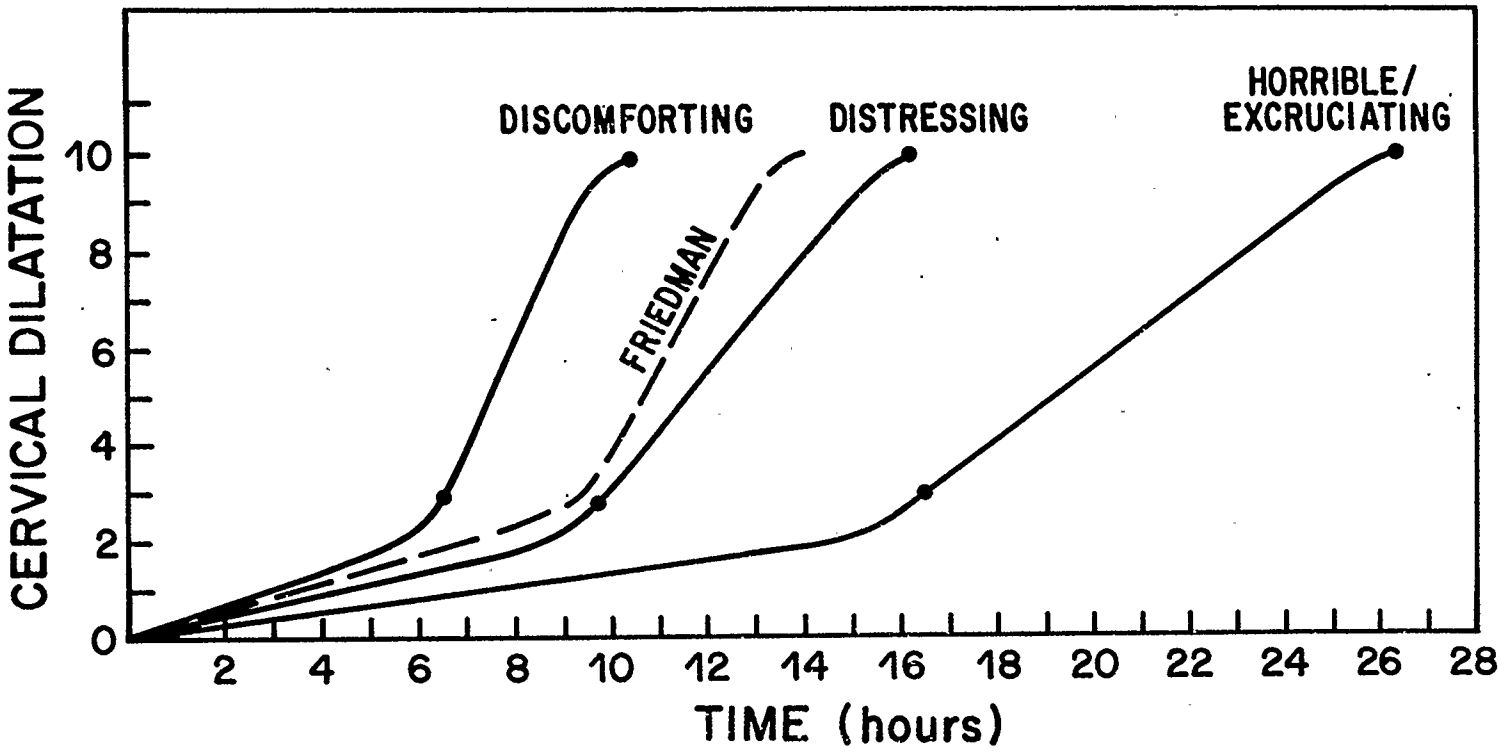


Figure 4 - Relationship between Friedman curve and dilation curves according to pain.

which most closely approximated the expected curve. The average dilatation curve associated with 'discomforting' pain was 4 hours shorter than the Friedman curve. The dilatation curve associated with 'horrible/excruciating' pain was 12 hours longer than the Friedman curve.

A possible confounding variable was the time in labour prior to the assessment interviews. To examine the possibility that differences in pain ratings were simply due to differences in duration in which subjects were in labour when pain ratings were taken, the times from onset of regular contractions were ranked and a Kruskall-Wallis non-parametric ANOVA performed on the rankings. Mean ranks (24.50, 34.43 and 32.65 respectively) did not differ ($\chi 2$ = 3.62, p = .164). Median durations of labour prior to assessment interviews were 300, 540 and 495 minutes respectively. The similarity in rankings across the three groups indicates that differences in pain ratings were not solely attributable to time in labour prior to the assessment of pain.

Too ensure that the observed differences in pain were not due to underlying obstetrical differences, the 3 groups were compared across several subject variables. One-way ANOVAs on gestational age, fetal size, weight, height, weight over height ratio, obstetrical risk score, dilatation at membrane rupture and gestational age were

performed. There were no significant differences between Groups (Table 9). It was concluded that differences in efficiency across the three pain groups were not due to any of the common obstetrical variables measured in this study.

Clinical Significance of Pain

To examine the clinical significance of subjective pain ratings during latent labour, analyses of the relationship between PPI in latent labour and requests for medications, type of delivery and fetal heart rate patterns were performed. Of 19 women reporting horrible to excruciating pain in latent labour, none (0) remained non-medicated for pain and 18 (94.7%) subsequently had epidural anesthesia (Table 10). Thirteen of 27 women (48.1%) who reported discomforting pain remained non-medicated and 6 (22.2%) subsequently had epidural anesthesia in a later phase. Measures of medication usage also revealed consistent differences across the pain groups (Table 11). The horrible/excruciating group requested analgesics earlier in labour than the discomforting group ($F(2,73) = 19.04$, $p < .0001$) and requested a greater number of analgesics through the course of labour ($F(2,71) = 16.72$, $p < .0001$).

PPI scores in latent labour were also predictive of type of delivery. Women in the horrible/excruciating pain

Table 9

Comparability of Pain Groups on Obstetrical/Demographic Variables

Variable	Discomforting		Distressing		Horrible/Excruc				p
	Mean	S.D.	Mean	S.D.	Mean	S.D.	df	F	Value
Weight (kg)	72.20	7.60	73.80	8.00	72.10	10.00	2,68	.31	n.s.
Height (cm)	165.30	8.60	166.90	6.60	165.70	7.09	2,69	.33	n.s.
Weight/Ht	.43	.03	.43	.03	.43	.05	2,67	.01	n.s.
Risk	1.03	.19	1.11	.32	1.22	.42	2,69	1.89	n.s.
Membranes (Cm ruptured)	3.70	3.10	3.60	2.70	3.50	2.80	2,70	.02	n.s.
Size of baby	3462.70	389.90	3435.20	373.10	3575.60	440.30	2,71	.75	n.s.
Gestational age	39.50	.97	39.80	1.24	39.80	1.00	2,65	.94	n.s.
Education	14.50	1.83	13.90	2.40	14.20	2.07	2,70	.49	n.s.

Note. Pain groups are for PPI scores in latent labour.

Table 10

Medications as a Function of PPI in Latent Labour

PPI		Type of Medication			
		None	Demerol	Epidural	Epid & Dem
Discomforting	n	13	8	3	3
	pct	48.1	29.6	11.1	11.1
Distressing	n	5	6	5	12
	pct	17.9	21.4	17.9	42.9
Hor-Excruc	n	0	1	7	11
	pct	0.0	5.3	36.8	57.9

N = 74

$\chi^2 = 26.18$, df = 6, p = 0.0002

Table 11

Requests for Pain Medication by PPI Score:

Descriptive Statistics and F Ratios

Variable	Discomforting		Distressing		Horr/Excruc				
	$\bar{x}$	S.D.	$\bar{x}$	S.D.	$\bar{x}$	S.D.	df	F	Prob
Cm of dilatation at which request was made	7.9	3.7	4.5	3.0	2.47	1.3	2,73	19.04	.0001
Total number of requests	.81	1.0	2.2	2.0	4.29	2.71	2,71	16.72	.0001

group accounted for 5 of the 7 Caesarean sections (71.4%) whereas none (0%) of the women in the discomforting group were delivered by Caesarean Section (Table 12). Seventy percent of the latter group delivered spontaneously (neither forceps nor C-section) in contrast to a spontaneous delivery rate of 31.6% for the horrible/excruciating group.

Within obstetrics, fetal heart rate patterns are usually considered to be of greater diagnostic and prognostic importance than baseline fetal heart rate. A dichotomous variable designating fetal heart rate patterns as normal or abnormal was derived from delivery records. Medical-nursing personnel checked whether deceleration patterns characteristic of fetal distress had occurred during active or second stage of labour. Chi-square analyses of frequency of abnormal fetal heart rate patterns across the three pain Groups revealed no significant relationships.

In sum, there was evidence that subjective pain differences obtained during the latent phase were predictive of duration of the dilatation phases, medication requests, and clinical/obstetric complications. Specifically, the subjects who reported horrible/excruciating pain experienced less efficient labour, had higher rates of medications for pain, and had a

Table 12

Type of Delivery as a Function of PPI Score in Latent Labour

PPI		Delivery		
		Spontaneous	Forceps	C-Section
Discomforting	n	19	8	0
	pct	70.4	29.6	0.0
Distressing	n	15	11	2
	pct	53.6	39.3	7.1
Hor-Excruc	n	6	8	5
	pct	31.6	42.1	26.3

N = 74

$\chi^2 = 12.09$, df = 4, p = 0.01

higher probability of instrumental delivery than subjects who reported lower levels of pain.

Pain Behaviour and Labour Efficiency

It was possible that behavioral aspects of the pain experience, as measured by the BPI, would add to the understanding of labour efficiency. Initial inter-rater reliability checks of the BPI ratings between the experimenter and nurses for the first 3 subjects produced a reliability coefficient (number of agreements divided by total number of contractions observed) of 70%. The BPI was revised with more descriptive detail provided; e.g., examples of agitation were included. Further reliability checks conducted on 30 women for 60 simultaneously observed contractions throughout the course of the study revealed that the average inter-rater reliability of the BPI improved to 83.3%.

Pearson correlations calculated between BPI scores and efficiency measures revealed that BPI (latent) was correlated with the duration of the latent and active phases ($r = .39$, $p < .0001$; $r = .44$, $p < .001$) and with requirement for augmentation ($r = .24$, $p < .05$). To test whether the BPI added independent information to that obtained from the PPI in the prediction of efficiency, a stepwise regression analysis with PPI and BPI entered as predictor variables was run on efficiency of latent and

active labor. The BPI failed to reach the entry criterion ($p = .05$) for either analysis and therefore failed to account for additional variance beyond that obtained with the PPI.

Cognitive Activity

Tape recorded interviews of women's coping thoughts during labour were transcribed and coded by three female graduate students in psychology. A modified version of Taenzer's (1983) coding manual for interviews of post surgical pain patients was used to define 14 categories of cognitive activity. Modifications were made to have the manual reflect labour content (Appendix D). The Somaticizing category was replaced with the categories Passive Sensation Acknowledgement and Active Sensation Acknowledgement. Also, a new category, Time References, was added. Reliability checks conducted on randomly selected transcripts consistently provided reliability coefficients of greater than .80 on individual thought units. Thought units were coded separately for "during contraction" and "between contraction" intervals for each of the 3 assessment intervals. Thought units coded identically by 2 out of 3 raters were retained. These categories were used to derive qualitative categories of cognitive activity.

Categories within the manual are postulated to represent "coping" and "catastrophizing" ideation. After coding each transcript for the presence of qualitative categories, the raters assigned the subject a score on a coping/catastrophizing dimension. Scores on coping/catastrophizing, which ranged from (1)Solely Coping to (5)Solely Catastrophizing, were assigned for each of the three assessment intervals. Inter-rater reliabilities, derived separately for each interval, averaged .94.

Relationship between Cognitive Activity and Labour Efficiency

Coping/catastrophizing scores for latent labour were associated with efficiency of latent ($r = .31$, $p < .01$) and active labour ($r = .67$, $p < .0001$) (Table 13). Coping/catastrophizing in latent labour was also strongly associated with length of the descent phase ($r = .61$, $p < .0001$). Scores on this measure for the active and transition phases were not associated with efficiency of these phases. Thus, cognitive activity in latent labour was related to efficiency of latent, active and second stage of labour. Measures of cognitive activity taken after latent labour were not related to efficiency.

A sequence of analyses was conducted to examine the influence of latent labour cognitive activity on efficiency of the dilatation phases while controlling for obstetrical

Table 13

Intercorrelations: Cognitive Activity and Efficiency of Each Phase

		Latent	Active	Descent
Cognitive Activity	L	.31** (58)	.67**** (38)	.61**** (40)
	A	-	.19 (42)	-.08 (43)
	T		.11 (26)	.07 (28)

Cognitive measure is the 1-5 score assigned by raters on the coping-catastrophizing dimension. L, A, and T refer to latent, active and transition assessment intervals.

** $p < .01$
**** $p < .0001$

variables. A group measure was created by classifying the coping-catastrophizing scores for latent labour into three categories: Predominantly Coping, Equally Coping-Catastrophizing, and Predominantly Catastrophizing. After deleting subjects who received syntocinon augmentation, the n's for these groups were 24, 8 and 10 respectively. As with analyses involving pain groups, times from onset of regular contractions until the assessment interview were determined and a Kruskal-Wallis non-parametric ANOVA was performed on the rankings. Mean ranks (24.65, 17.33,and 27.71 respectively) did not differ ($\chi 2$ =2.2, p = .33), indicating that subject classification was not simply due to time in labour prior to the interviews.

The possibility that the three groups differed on underlying obstetrical/subject variables was investigated with a series of oneway ANOVAs on weight, height, weight/height ratio, risk, membrane status, size of baby, gestational age and education. The results, summarized in Table 14, indicated that the three levels of cognitive activity did not differ on any of these variables.

The relationship between the three categories of cognitive activity and efficiency of the dilatation phases was analyzed with an analysis of covariance. Gestational age was entered as a covariate because of its correlation

Table 14

Comparability of Cognitive Activity Groups on Obstetrical/Demographic Variables

Variable	Predominantly Coping		Equal		Predominantly Catastrophizing				
	Mean	S.D.	Mean	S.D.	Mean	S.D.	df	F	p Value
Weight	70.50	6.40	75.10	9.80	74.20	6.70	2,60	2.60	n.s.[1]
Height	165.80	6.60	166.20	7.70	166.30	7.00	2,62	0.03	n.s.
Weight/Ht	.42	.03	.45	.05	.44	.04	2,60	2.60	n.s.[1]
Risk	1.08	.27	1.09	.30	1.29	.47	2,62	2.40	n.s.[2]
Membranes	4.00	2.80	2.09	1.70	3.40	2.80	2,63	2.10	n.s.
Size of baby	3434.30	403.50	3439.80	324.10	3588.10	456.40	2,64	.92	n.s.
Gestational age	39.50	1.20	39.60	1.00	40.10	1.10	2,59	1.40	n.s.
Education	14.50	2.10	14.10	2.60	13.60	1.60	2,64	1.10	n.s.

Note 1. $p = .08$

Note 2. $p = .10$

with both latent and active labour efficiency. This was a Groups by Phase split-plot factorial design. The mean durations of phases for the three Groups are contained in Table 15. Extrapolated labour curves for the three groups are displayed in Figure 5. Main effects for Groups ($F(2,38) = 5.34$, $p = .009$) and Phase ($F(1,39) = 5.49$, $p = .024$) were significant (Table 16). There was no interaction between Groups and Phase nor was there an effect due to gestational age. Contrasts for simple-effects means (Kirk, 1982) revealed the Predominantly Catastrophizing Group had longer latent labour than the Predominantly Coping Group ($t(78) = 2.25$, $p < .05$, 2 tailed) and the Equally Coping/Catastrophizing Group ($t(78) = 3.05$, $p < .01$). The Predominantly Catastrophizing group also had a longer active labour that the other two groups ($t(78) = 3.78$, $p < .01$; $t(78)$ 2.52, $p < .02$, respectively). The Predominantly Coping and Equally Coping/Catastrophizing groups did not differ for either latent or active labour. In summary, the analysis of covariance revealed significant main effects for Groups and Phase of labour. The Predominantly Catatastrophizing group was less efficient in latent and active labour than either the Predominantly Coping or the Equally Coping/Catastrophizing groups. The latter two groups did not differ in efficiency of latent or active labour. The

Table 15

Mean Duration of Latent and Active Labour by Three Levels of Cognitive Activity

	Predominantly Coping		Equal		Predominantly Catastrophizing	
	$\bar{x}$	S.D.	$\bar{x}$	S.D.	$\bar{x}$	S.D.
Latent	547.0	349.7	378.7	250.8	783.5	269.9
Active	256.5	164.0	371.1	250.8	654.0	343.0
n	24		8		10	

Note. Measure is in minutes. Higher values reflect less efficient labour.

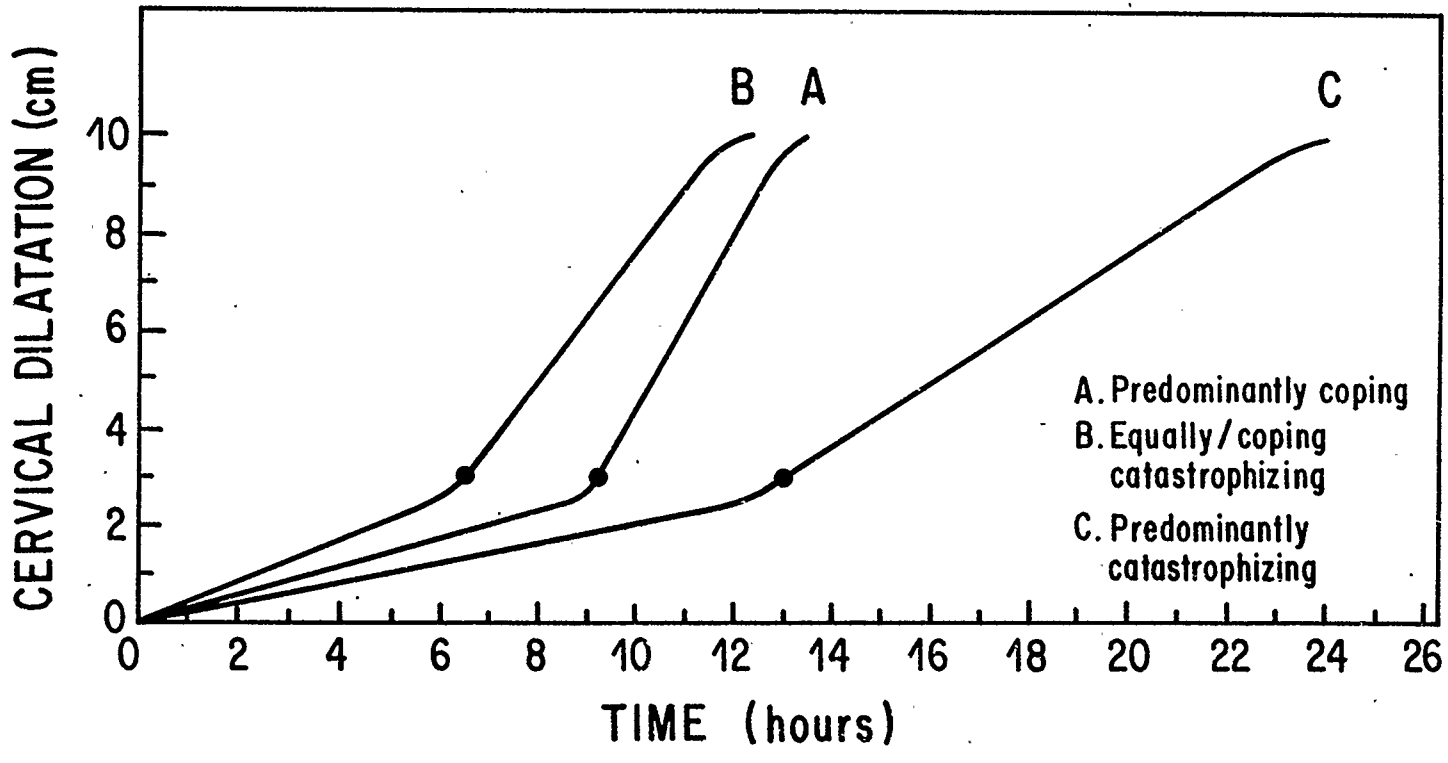


Figure 5 – Relationship between 3 levels of cognitive activity and dilatation curves.

Table 16

Summary Table: Split Plot Factorial ANCOVA of Labour Efficiency: Cognitive Activity (Latent) by Phase Controlling for Gestational Age

Source	df	Ms	F	Prob
Between groups (Coping, Equal, Catast)	2	487387.5	5.34	.009
Gestational Age	1	120554.8	1.32	.26
Error	38	91347.0		
Within groups (Phase)	1	342801.6	5.49	.024
Cog by phase	2	135506.4	2.17	.13
Error	39	62449.4		

effect due to Phase reflected the difference in duration of active and latent labour.

The influence of specific types of cognitive activity contained within the 'coping' category was investigated by grouping the original set of coping codes according to cognitive focus. Inspection of the thought categories considered to represent a focus on coping revealed that some codes reflected a cognitive attempt to divert attention away from the sensations of labour (attention diversion, imaginal inattention and coping self-statement) while other codes reflected an acceptance of the sensations or pain of labour (active sensation acknowledgment and passive sensations acknowledgment). Examination of individual cases revealed there was virtually no overlap between these two types of cognitive activity; that is, subjects who reported attempts to divert attention or to use coping self statements rarely reported simultaneous thoughts which were accepting of, or which "went with", the pain. Given these considerations, two categories of cognitive activity during latent labour, Sensation Avoidance and Sensation Acceptance, were formed. Examples of thought content from these groups are contained in Figure 6. Exploratory frequency analyses were conducted on the sample of subjects who engaged in either Sensation Avoidance or Sensation Acceptance during latent labour.

Figure 6

Styles of Attention Focus Within Coping Categories of Cognitive Activity During Labour

Category	Description	Examples
Sensation Avoidance	Attention diversion, coping self statements, positive thoughts, self motivating thoughts	"I think of relaxing on a beach" "I say to myself 'now just stay calm, it won't last forever'" "I focus on this picture of my dogs"
Sensation Acceptance	thoughts which acknowledge or focus on the pain and sensations of labour with no attempt to focus away	"I think of the pain and center it on my cervix" "I just watch for the contractions, and ride with it, I don't fight it" "I just let go with it"

These analyses were conducted separately for thoughts during and between contractions. Grouping variables on the efficiency measures of latent, active and second stage of labour were formed by using a median-split criterion to group subjects as efficient or inefficient. The six subjects who used Sensation Acceptance <u>during</u> contractions were all efficient during the descent phase of labour. Of the 10 subjects who used Sensation Avoidance during contractions, 7 were classified as inefficient in the descent phase (Fisher exact test, $p = .01$). A check to determine if the slower descent phase for this group was attributable to epidural anesthesia revealed that only 3 of these subjects had an epidural. There were no differences between these groups on efficiency of latent or active labour.

For thoughts occurring <u>between</u> contractions, 7 of the 9 subjects in the Sensation Acceptance group were efficient in latent labour whereas 4 of the 14 subjects in the Sensation Avoidance group were efficient (Fisher exact test, $p = .03$). There were no differences between these groups on efficiency of the active or the descent phase. In summary, differential relationships were revealed between coping styles occurring <u>during</u> contractions and efficiency of the descent phase of labour, and between coping styles occurring <u>between</u> contractions and efficiency

of latent labour. Sensation Acceptance during contractions was associated with an efficient descent phase whereas Sensation Avoidance was associated with an inefficient descent phase. Sensation Acceptance between contractions was related to efficient latent labour. The use of Sensation Avoidance between contractions was predictive of inefficient labour.

Clinical Significance of Cognitive Activity

The clinical significance of differences in cognitive activity was examined in regard to medication requests, type of delivery, fetal heart rate patterns and requirement for paediatric assistance for the neonate. Of 18 women classified in the Predominantly Catastrophizing group in latent labour, 17 (94%) received epidural anesthesia and none (0) remained non-medicated. Seventeen women (45.9%) in the Predominantly Coping group received epidural anesthesia and 11 women (29.1%) remained non-medicated (χ 2(6)= 14.5, p = .024), Table 17). Differences were also found between these groups on type of delivery. Six women (33.3%) in the Catastrophizing group delivered by Caesarean section, 7 women (38.9%) required forceps, and 5 women (27.8%) had a spontaneous delivery. In the Predominantly Coping group, 1 woman (2.7%) delivered by Caesarean section, 9 women (24.3%) required forceps and 27 women

Table 17

Medications as a Function of Cognitive Activity in Latent Labour

		Type of Medication			
		No Meds	Dem	Epid	Epid & Dem
Pred Cop	n	11	9	7	10
	pct	29.7	24.3	18.9	27.0
Equal	n	2	2	5	3
	pct	16.7	16.7	41.7	25.0
Pred Cat	n	0	1	6	11
	pct	0.0	5.6	33.3	61.1

N = 67

$\chi^2_{(6)} = 14.5$, $p = .024$

(73%) had a spontaneous delivery ($\chi 2(4) = 18.97$, $p = .0008$, Table 18). In summary, women who catastrophized in latent labour were more likely than non-catastrophizers to receive epidural anesthesia in later stages of labour and to require an operative delivery.

Chi-square analyses of the distribution of normal/abnormal fetal heart rate patterns in active labour across cognitive activity in latent labour revealed significant differences between groups. Subjects who catastrophized in latent labour had fetuses with a 50% incidence of abnormal fetal heart rate patterns in active labour compared to a 10.8% incidence in fetuses of Predominantly Coping mothers ($\chi 2(2) = 10.31$, $p = .005$, (Table 19).

A consequence of fetal asphyxia is the need for paediatric assistance to resuscitate the neonate immediately after delivery. Neonates of mothers who Catastrophized in latent labour were considerably more likely to require pediatric resuscitation ($\chi 2(2) = 11.41$, $p = .003$, Table 20). These results provide evidence that maternal cognitive activity in latent labour is predictive of physiological differences as reflected in fetal heart rate pattern abnormalities.

Table 18

Delivery by Cognitive Activity in Latent Labour

		Spontaneous	Forceps	C-Section
Pred Cop	n	27	9	1
	pct	73.0	24.3	2.7
Equal	n	6	6	0
	pct	50.0	50.0	0.0
Pred Cat	n	5	7	6
	pct	27.8	38.9	33.3

$\chi^2_{(4)}=18.97$, $p = .0008$

Table 19

Fetal Heart Rate Pattern (Active Labour)

By Cognitive Activity in Latent Labour

		Normal	Abnormal
Pred Cop	n	33	4
	pct	89.2	10.8
Equal	n	8	4
	pct	66.7	33.3
Pred Cat	n	9	9
	pct	50.0	50.0

N = 67

$\chi^2_{(2)} = 10.31$, $p = .006$

Table 20

Need for Paediatric Assistance

in the Delivery Room

By Cognitive Activity in Latent Labour

		No Assistance	Assistance
Pred Cop	n	30	6
	pct	83.3	16.7
Equal	n	9	3
	pct	75.0	25.0
Pred Cat	n	7	11
	pct	38.9	61.1

N = 66

$\chi^2_{(2)} = 11.42$, $p = .003$

Relationship between Pain and Cognitive Activity

Examination of inter-correlations between PPI and coping/catastrophizing (Table 21) indicated that pain and coping/catastrophizing were most closely related in the latent phase ($r = .58$, $p < .0001$). There was no relationship between pain and coping/catastrophizing in active labour ($r = .20$, n.s.) although both variables were again correlated in the transition interval ($r = .42$, $p < .01$). Correlations between pain measures in adjacent intervals revealed that this variable was correlated (PPI-L, PPI-A, $r = .53$, $p < .0001$; PPI-A, PPI-L, $r = .58$, $p < .001$) yet coping/catastrophizing scores were virtually unrelated between intervals (Cog-L, Cog-A, $r = .27$, n.s.; Cog-A, Cog-T, $r = .02$,).

To examine the comparative importance of subjective pain and cognitive activity vis a vis labour efficiency, a series of hierarchical stepwise multiple regression analyses were conducted. This technique allows for the inclusion of logically consistent sets, with ordering of input determined by the time sequence in which measures were originally collected (Cohen & Cohen, 1983). The raw PPI and Coping/catastrophizing scores were used as independent variables in these analyses. F to enter criterion for variables within each pain/cognitive activity

Table 21

Intercorrelations: PPI and Cognitive Activity for Each Phase

	PPI-L	COG-L	PPI-A	COG-A	PPI-T	COG-T
PPI-L	1.000	.58****	.53****	.43**	.30	.12
		(61)	(45)	(44)	(29)	(28)
COG-L		1.000	.311	.27	.00	-.11
			(39)	(39)	(23)	(22)
PPI-A			1.000	.20	.58***	.20
				(42)	(29)	(28)
COG-A				1.000	.19	.02
					(27)	(26)
PPI-T					1.000	.42**
						(27)

L,A,T denote latent, active and transition phases
* p=.05 1p=.058
** p=.01
*** p=.001
**** p=.0001

set was specified at .05. Results (Table 22) indicated that PPI (latent) was the sole predictor of efficiency of latent phase (R2 = .33). Coping/catastrophizing (latent) was the strongest predictor of efficiency of active labour (r2 = .45) with PPI (latent) accounting for an additional 6% of variance. To verify that this statistical finding represents independent contributions of subjective pain and cognitive activity, the regression of active labour was redone with PPI forced into the equation before Coping/catastrophizing. PPI on the first step accounted for an r2 of .25. Coping/catastrophizing entered on the second step contributed an r2 change of .26. These analyses indicated that latent labour pain and cognitive activity contributed differentially to efficiency of active labour. Coping/catastrophizing (latent) was also a powerful predictor of efficiency of the descent phase (R2 = .377). Taken together these results provided evidence that the subjective pain and cognitive activity measures are not simply measures of the same phenomena but may vary independently throughout labour.

Third Trimester Predictors of Pain and Cognitive Activity

The next set of analyses examined whether variables assessed in the third trimester were predictive of pain and cognitive activity in labour. Four sets of variables were included in these analyses: (1) Lederman Prenatal

Table 22

Summary Table: Hierarchical Stepwise Multiple Regression Analyses--Comparison of the Contributions of Subjective Pain and Cognitive Activity to Efficiency of Labour*

Criterion	Variable	r^2	R^2	β	overall F	df	sig F
Latent	PPI-L	.33	.33	.576	27.87	1,56	.0001
	Cognitive-L	not entered					
Active	Cognitive-L	.45	.51	.560	20.50	2,35	.0001
	PPI-L	.06		.292			
	Cognitive-A	not entered					
	PPI-A	not entered					
Descent	Cognitive-L	.38	.38	.61	22.47	1,37	.0001
	PPI-L	not entered					
	PPI-A	not entered					
	Cognitive-A	not entered					

* Subjects who had no medication or demerol and who were not augmented for the respective phase.

-L measure taken in latent labour
-A measure taken in active labour

Self-Evaluation Inventory; (2) Practice in prenatal techniques; (3) Self-efficacy in the use of prenatal techniques; and, (4) Education and religion.

(i) Lederman Prenatal Self-Evaluation Inventory

The means, variances and alpha coefficients of the 7 Lederman scales are comparable to those obtained by Lederman in her original sample (Table 23). Lederman's (1984) previous work suggested her seven subscales have high predictive validity regarding events in labour; however, the internal validity of the inventory has not been assessed. Several analytical steps were undertaken to examine the comparability of subscale scores derived with Lederman's scoring system with those obtained from factor derived scales. The purpose of this procedure was to determine whether the Lederman sub-scale scores or factor derived sub-scale scores should be used. The 79 items on the Questionnaire were subjected to a principal components analysis using a maximum likelihood equation. The first 7 factors in the unrestricted initial solution accounted for 47.4% of the common variance. A varimax (orthogonal) rotation was performed on the first 7 factors. Eigen values and rotated factor pattern are reported in Tables 24 and 25. Items loading .30 or greater on each factor were selected to create seven new factor derived scales.

Intercorrelations between the Lederman and the factor

Table 23

Comparability of Descriptive Statistics of Present Lederman Scales with Descriptive Data Reported by Lederman (1984)

Data	Scales						
	Acceptance of Pregnancy	Identification Motherhood Role	Relationship with Mother	Relationship with Husband	Preparation for Labour	Fear/Pain/ Helplessness/ Loss Control	Concern for Well-being Self-Baby
Present study							
Mean	18.30	20.50	14.60	13.40	16.00	16.90	16.50
S.D.	4.30	4.50	5.00	3.30	4.70	4.00	3.60
alpha	.83	.80	.87	.73	.86	.78	.75
n	108	108	98	108	108	108	108
Lederman (1985)							
Mean	16.50	20.20	17.30	16.20	15.90	18.20	16.50
S.D.	4.80	4.60	6.90	6.90	4.50	4.20	4.80
alpha	.90	.79	.92	.82	.80	.75	.83
n	119	119	115	115	119	118	119

Table 24

Lederman Prenatal Self-Evaluation Questionnaire

Eigenvalues of 7 Factors

Factor	Eigenvalue	Pct of Var	Cum Pct
1	11.17	14.1	14.1
2	8.55	10.8	25.0
3	5.08	6.4	31.4
4	3.93	5.0	36.4
5	3.14	4.0	40.4
6	2.86	3.6	44.0
7	2.69	3.4	47.4

Factor Descriptions

Factor 1 Concerns regarding labour

Factor 2 Concerns regarding motherhood role

Factor 3 Relationship with mother

Factor 4 Acceptance of pregnancy

Factor 5 Regret

Factor 6 Relationship with husband

Factor 7 Concerns for well-being

Table 25

Lederman Prenatal Self Evaluation Questionnaire: Sorted Rotated Factor Pattern

Item		1	2	3	4	5	6	7
47	prepared for what happens in labour	.77						
25	understand how to work with contr.	.69						
24	know what to expect labour/del	.65						
52	stress of labour will be too much	.65						
08	I can cope well with pain	.64						
18	realizing labour has to end	.64						
53	can bear discomfort of labour	.64						
49	will be able to push	.64						
26	look forward to childbirth	.59						
64	difficult to regain control	.55				.31		
12	labour/del will progress normally	.55					-.34	
72	childbirth is natural/exciting	.55						
15	confidence in main. composure	.54						
56	feel well informed	.54						
38	preparing to do well	.53				.38		
68	focus on terrible things	.53			.39			
71	confident in normal childbirth	.48						.43
11	can perform well under stress	.47						
39	sure I will lose control	.42						
13	little I can do to prepare	.39		.36			.31	
41	afraid I will be harmed	.39						
79	happy about this pregnancy		.64	.33				
6	rearing children is rewarding		.62					
70	husband share in care of baby		.61					
75	can be a good mother		.61					
19	look forward to caring for baby		.57		.30			
33	like having children around		.56					
32	glad to be pregnant		.54	.34		.32		
73	feel I love the baby		.52					

Factor Pattern (con't)

Item		1	2	3	4	5	6	7
2	like to watch other parents		.52					
78	feel I will enjoy the baby		.48					
34	will be hard to balance childcare		.48					.35
4	husband and I talk		.39			.35		
42	babies aren't fun to care for		.32	.30				
31	my mother looks forward to grandchild			.82				
14	my mother shows interest			.79				
20	my mother is happy about pregnancy			.75				
59	my mother encourages me			.68				
28	easy to talk to my mother		.33	.65				
65	my mother criticizes my decisions			.61				
21	my mother offers suggestions		.43	.60				
37	feel good when with my mother		.43	.56				
55	mother reassures me		.48	.54				
22	have enjoyed this pregnancy				.76			
77	find things about preg. disagreeable				.74			
69	pregnancy source of frustration				.69			
66	problem adjusting to pregnancy				.69			
61	easy pregnancy so far				.66	.37		
74	found this pregnancy gratifying		.50		.62			
3	can tolerate discomforts of preg.				.59			
9	hard to get used to changes				.48			
1	good time to be pregnant				.32			
58	difficult to accept this preg.					.64		
76	have regrets about being preg.					.76		
62	wish I wasn't having baby					.69		
46	think baby will burden me		.40			.63		
44	mother and I tend to argue					.55		
54	baby will little time for self					.47		.42
17	think the worst...pain	.37				.44		
27	doctors/nurses indifferent					.35		

Factor Pattern (con't)

Item		1	2	3	4	5	6	7
10	husband is understanding						.69	
35	husband helps me		.39				.53	
40	count on husband's support						.50	
5	husband has been critical						.49	
23	husband is interested						.48	
43	husband feels I burden him						.47	
36	hard to talk to husband					.38	.40	
60	satisfactory sexual adjustment						.39	
7	necessary to know about labour			.32			.35	
63	worry I will lose the baby							.66
51	anxious about complications			.30				.57
57	worried something will go wrong	.47						.49
30	dwell on problems							.46
16	worried baby will be abnormal							.46
50	kind of mother I will be		-.30					-.39
29	doubts about being mother							.38
67	worried baby will not like me							.35

derived scales are presented in Table 26. Six of the seven Lederman scales correlated .87 or higher with at least one of the factor derived scales. Reliabilities (Cronbach's alpha) of both sets of scales were computed and are compared in Table 27. The factor derived method of scoring resulted in one more scale with a reliability over .80 and one scale with a low reliability (Concerns for well-being = .59). Reliabilities of the Lederman Scales range from .73 to .87 with five scales having reliabilities of .78 or greater. Given the strong association between both sets of scales as well as adequate and comparable reliability estimates, it was decided to use the original Lederman scales in the analyses involving the prediction of pain and cognitive activity.

Correlations of Lederman Scales with Measures of Pain and Cognitive Activity

Correlations of Lederman scales with PPI and Coping/Catastrophizing measures are contained in Table 28. Four scales, Acceptance of pregnancy, Identification with motherhood, Preparation for labour and Fear of pain/helplessness, correlated with PPI scores in latent labour (average r = .26). The Lederman questionnaire is scored such that high scores on a given scale represent maladjustment; positive correlations then indicate that maladjustment was associated with higher pain. Two scales,

Table 26

Correlations Between Lederman Scales and Comparable Factor Derived Scales

	Lederman Scale	r1	Factor Derived Scale
1	Well-being self/baby	.78	Concerns for well-being
2	Acceptance of pregnancy	.95	Acceptance of pregnancy
3	Identification motherhood	.87	Concerns re motherhood
4	Preparation for labour	.88	Concerns re labour
5	Helpless/Loss of control	.90	Concerns re labour
6	Relationship with mother	.97	Relationship with mother
7	Relationship with husband	.91	Relationship with husband
			Regret2

Note 1 The first 7 correlations are significant at $p < .0001$.

Note 2 Regret has no equivalent Lederman scale; however, this factor derived scale correlates with all seven Lederman scales (range of r's .23 to .60).

Range of n's = 97 - 107.

Table 27

Reliability: Lederman Scales and Factor Derived Scales

Lederman Scale		Cronbach's α
L1	Well being self/baby	.75
L2	Acceptance of pregnancy	.83
L3	Identification motherhood role	.80
L4	Preparation for labour	.86
L5	Helplessness/loss of control	.78
L6	Relationship with mother	.87
L7	Relationship with husband	.73
Factor Derived Scale		**Cronbach's α**
F7	Concerns for well being	.59
F4	Acceptance of pregnancy	.82
F2	Concerns re: motherhood	.88
F1	Concerns re: labour	.92
F3	Relationship with mother	.83
F6	Relationship with husband	.67
F5	Regret	.83

Table 28

Correlations of Lederman Scales with Pain and Coping/Catastrophizing

During Three Phases of Labour

Variable	PPI-L (n=63-73)	PPI-A (n=57-64)	PPI-T (n=35-39)	COG-L (n=70-76)	COG-A (n=60-64)	COG-T (n=35-38)
Lederman Scales						
Well-being/self/baby			.52***			
Accept/pregnancy	.27**	.24*	.28*		.35**	.41**
Ident/motherhood	.21*					
Prep/labour	.30**	.23*	.35*			
Fear/pain/help1	.27**		.35*	.28*	.30*	
Relat/mother						
Relat/husband						-.27

Subjects who received no medication or demerol at the time of recording. *p<.05, **p<.01, ***p<.001

Acceptance of pregnancy and Preparation for labour correlated with active labour PPI scores (average r = .24) and 4 scales, Concerns for well-being of self and baby, Acceptance of pregnancy, Preparation for labour and Fear of pain/helplessness, correlated with transition PPI scores (average r = .37).

With respect to the cognitive activity measures, Fear of pain/helplessness correlated with coping/catastrophizing in the latent interval ($r = .28$, $p < .05$) and in the mid-active interval ($r = .30$, $p < .05$). Acceptance of pregnancy correlated with coping/catastrophizing in the mid-active interval ($r = .35$, $p < .05$) and in the transition interval ($r = .41$, $p < .01$). Acceptance of pregnancy and Fear of pain/helplessness were the most consistent predictors of both pain and cognitive activity. For both pain and cognitive activity the highest correlations with the third trimester concerns occurred in the transition interval.

ii) Practice and Self-Efficacy in Prepared Childbirth Techniques

Descriptive statistics of measures of Prenatal Practice are reported in Table 29. There was reasonably wide variability in the extent to which this sample, the majority of which attended prenatal classes, actually practiced the techniques. Ranges are high on each

Table 29

Practice in Prepared Childbirth Techniques:

Descriptive Statistics

Variable	Mean	S.D.	Median	Range
Breathing	2.32	2.67	2.0	0-21
Effleurage	2.41	3.36	1.33	0-21
Pelvic	3.67	3.77	2.61	0-20
Relaxation	2.27	2.59	1.42	0-10
Practice Total	10.73	8.22	10.0	0-42

Numbers refer to number of times per week in which method was practised.
N = 112

measure--for example, practice of breathing exercises ranged from 0 to 21 times per week. Twenty-three percent of subjects did not practice breathing techniques while 44% did not practice relaxation exercises.

Descriptive statistics of Self Efficacy measures (Table 30) indicated that subjects tended to cluster around the midway point on the scale. Ranges of scores encompassed the entire scale for all items.

Correlations of Practice and Self-Efficacy Expectations with Measures of Pain and Cognitive Activity

Practice in prepared childbirth techniques was not related with PPI scores in any interval for subjects who had no medications or Demerol at the time of recording. Correlations between practice and pain for a reduced sample of subjects who remained unmedicated through each phase of labour are presented in Table 31. Total practice, practice in effleurage and pelvic tone exercises were positively correlated with PPI (average $r = .46$, $p < .01$). Positive correlations indicated that greater practice was associated with higher subjective pain for this sample of women.

Practice in breathing was negatively correlated with coping/catastrophizing scores in latent labour ($r = -.23$, $p < .05$). Practice in prepared childbirth techniques was not related to coping/catastrophizing in the active or transition intervals.

Table 30

Self Efficacy Expectations in Psychoprophylactic Techniques: Descriptive Statistics

Variable	Mean	S.D.	Median	Range*
Breathing	6.24	1.46	6.41	2-9
Effleurage	5.69	2.11	5.87	1-9
Distraction	5.37	2.00	5.77	1-9
Relaxation	4.99	1.99	5.19	1-9
Self Eff. Total	22.35	5.85	23.37	8-36

*Note: The range on the scale itself is 1 to 9.

N = 101

Table 31

Pearson Correlations: Practice in Psychoprophylactic Techniques and Subjective Pain

Pain Measure	Technique					
	Breathing	Effleurage	Pelvic	Relaxation	Total Practice	
PPI-L	-.17	.39*	.53**	.21	.47**	n=21
PPI-A	.23	.24	.18	.36	.38	n=17
PPI-T	-.16	.24	-.18	-.11	-.11	n=16

Table note 1: Sample of women who remained unmedicated for pain throughout labour.

note 2: Unstarred correlations greater than .30 approach significance (range of probabilities between .06 and .08).

* p<.05
**p<.01

Self efficacy measures correlated with PPI in latent labour (range of r's -.20 to -.29, $p < .05$). Negative correlations indicated that higher Self-Efficacy was associated with lower pain report. Self-efficacy was not related to pain in the active or transition intervals. There was no relationship between self-efficacy expectations and coping/catastrophizing scores for any phase of labour.

iii)Correlations of Subject Variables with Measures of Pain and Cognitive Activity

Analyses were conducted to determine if the subject variables age, education and religion were related to pain and cognitive activity. Age did not correlate with pain or cognitive activity. Education was related to subjective pain in the active ($r = -.28$, $p < .01$) and transition ($r = -.24$, $p < .05$) intervals. Negative correlations indicated that higher levels of education were associated with lower pain report. Education was also correlated with coping/catastrophizing in the latent ($r = -.23$, $p < .05$) and transition ($r = -.37$, $p < 05$) intervals.

The effect of the categorical variable, religion, was examined via analysis of variance. A one way ANOVA across religious groupings (Catholic, Protestant, No Religion) was significant ($F(2,65) = 4.59$, $p < .05$). Multiple comparison

tests indicated that Catholics reported less pain than subjects in either of the other two groups (Table 32).

Determination of Reliable Predictors of Pain and Cognitive Activity

To determine strength and reliability of the relationships between predictor variables and pain and cognitive activity, separate stepwise multiple regression analyses were conducted with raw PPI and coping/catastrophizing scores for latent, active, and transition phases serving as criterion variables. Predictor variables for these analyses were the Lederman, Self-Efficacy and Subject variables which correlated significantly with the pain or coping/catastrophizing measure in the respective phase. Results of these analyses are reported in Table 33.

Lederman's scale Preparation for labour reached the entry criterion (p to enter = .05) in the regression analysis of PPI scores in latent labour (R^2 = .09, $F(1,59)$ = 5.69, p = .02). Examination of the beta slope indicated that women who felt less prepared subsequently reported higher pain in latent labour. No other variables reached the entry criterion in the regression of PPI in latent labour.

In the regression for active labour PPI, Education was the only continuous variable in the equation (R^2 = .08,

Table 32

Analysis of Variance Summary Table:

Pain in Active Labour by Religious Affiliation

Source	D.F.	S.S.	M.S.	F	sig
Between Groups	2	7.20	3.60	4.59	.013
Within Groups	65	50.98	0.78		
Total	67	58.19			

L.S.D. Multiple Comparisons Summary Table:

Differences Among Means

N	$\bar{x}$		Cath.	Prot.	None
14	3.14	Catholic	-	.77*	.84*
29	3.91	Protestant		-	.07
25	3.98	No Religion			-

*p < .05

Table 33

Prediction of PPI:

Stepwise Multiple Regression Analyses of Three Phases of Labour

Criterion	Variable	β	Overall F	df	Sig F	R^2
PPI (Latent)	LED (Prep. for Labour)	.30	5.69	1,59	.02	.09
PPI (Active)	Education	-.28	5.25	1,62	.02	.08
PPI (Trans)	LED (Fear Self/Baby)	.51	13.49	1,38	.0007	.26

$F(1,62) = 5.25$, $p < .02$). The negative beta indicated that lower levels of education were associated with higher pain in this phase.

Amount of variance accounted for in the stressful transition phase was higher than in the earlier two time periods. Fears for self and baby was predictive of higher pain scores in transition ($R2 = .26$, $F = 13.49$, $p < .0007$). No other continuous variables reached entry criterion.

In summary, Lederman's Preparation for labour and Fears for well-being of self and baby were predictive of subjective pain in the latent and transition intervals. The subject variables education and religion were predictive of pain in the mid-active interval. The amount of variance accounted for was highest during the most stressful phase of labour.

Lederman's Fear of Pain/Helplessness and Practice in breathing techniques were predictive of cognitive activity in latent labour ($R2 = .14$, $F(2,60) = 5.21$, $p < .008$) (Table 34). Examination of beta indicated that Fear of Pain/Helplessness was associated with a greater tendency to catastrophize during latent labour. Also, Practice in breathing was associated with less catastrophizing. It would appear from these results that practice in breathing may have a moderating effect on the negative relationship between fears and catastrophizing in latent labour.

Table 34

Prediction of Cognitive Activity:
Stepwise Regression Analyses of Three Phases of Labour

Criterion*		Predictor	β	t	sig t	overall F	df	sig F	R^2
Cognition Latent	LED	Pain/ Helplessness	.34	2.46	.007	5.21	2,60	.008	.14
		Practice Breathing	-.27	-2.24	.02				
Cognition Active	LED	Acceptance of Pregnancy	.35	2.76	.007	7.64	1,55	.008	.12
Cognition Transition	LED	Acceptance of Pregnancy	.41	2.48	.019	6.12	1,30	.019	.17

*Note 1: The measure of cognitive activity is the Rater's Assessment of the entire transcript for the appropriate phase. This was a continuous variable ranging from 0 (solely coping) to 5 (solely catastrophizing).

Acceptance of pregnancy was predictive of cognitive activity in active labour ($R2 = .12$, $F(1,55) = 7.64$, $p < .008$). Here poorer acceptance of pregnancy was associated with a greater tendency to catastrophize in active labour. Unlike latent labour however, there were no variables which appeared to moderate this relationship.

Acceptance of pregnancy was predictive of cognitive activity in the transition interval. As with the prediction of pain, the variance accounted for in predicting cognitive activity in this phase was greater than for earlier intervals ($R2 = .17$, $F(1,30) = 6.12$, $p = .019$). Poorer acceptance of pregnancy was associated with a greater tendancy to catastrophize in the transition period.

In summary, Lederman scales were the best predictors of cognitive activity in labour. Fear of Pain/Helplessness was predictive of cognitive activity in latent labour while Acceptance of pregnancy was the most reliable predictor of cognitive activity in the most stressful phases of labour. Examination of Beta revealed that higher fears concerning pain and helplessness and poorer acceptance of pregnancy were associated with a greater tendancy to catastrophize during these phases.

DISCUSSION

The present study examined the extent to which subjective pain and cognitive activity covaried with labour progress in obstetrically normal women. Labour progress was viewed in terms of efficiency. Labour efficiency was operationally defined as the duration of the dilatation phases (latent and active labour), and the duration of the descent phase. Subjective pain was measured with the PPI, which was validated with a visual analogue pain measure and a behavioural pain measure. Measures of cognitive activity included rater-assigned scores on a dimension of coping/catastrophizing as well as group placement in categories of attention focus. The prospective research design included measurement of third trimester pregnancy/labour related concerns, which were examined as predictors of pain and cognitive activity.

Women in this study showed considerable individual differences in labour efficiency, a finding consistent with previous research (O'Driscoll et al., 1984; Friedman, 1978; Cibils, 1981). Length of latent labour ranged from 30 minutes to 1740 minutes, a difference of nearly sixty fold. Length of active labour ranged from 60 minutes to 1215 minutes, or a twenty-fold difference between the fastest

and slowest subjects. Even the descent phase showed considerable individual differences with times to delivery ranging from 10 to 272 minutes in duration.

The degree of subjective pain also varied considerably across the phases of labour. The range of PPI values was from 'mild' to 'excruciating' in latent labour and from 'discomforting' to 'excruciating' in active labour. These findings are similar to observations by Melzack and colleagues (Melzack 1985; Melzack et al., 1981; 1984) and reinforces the notion that labour pain is characterized by substantial individual differences.

The cognitive activity measures showed wide variation in focus and content of thought during labour. Latent labour thoughts among some subjects were characterized by catastrophizing only, whereas other subjects showed complete absence of catastrophizing. The diversity of content included positive self statements, self-generated reminders to breathe, fears for the baby, fear of pain, concerns about accepting or rejecting medications and concerns about how one's husband was doing. A similar range of content has been reported in research based on retrospective interviews (Leifer, 1980).

The central research question in this study was whether variation in labour efficiency for the phases of labour was associated with variation in pain and cognitive

activity. A strong relationship between subjective pain in latent labour and latent labour efficiency was demonstrated. During this phase, each increase in pain level from discomforting through distressing to horrible/excruciating was associated with an increase in duration of at least 3 hours. There was also evidence that pain in latent labour influenced active labour efficiency. Increased levels of pain in latent labour were predictive of slower, less efficient active labour.

Further support of the importance of pain in labour efficiency came from comparisons of extrapolated dilatation curves based on normative data. Friedman (1967) has shown that average length of latent labour for nulliparous women is between 9 and 10 hours from the start of regular contractions and that full dilatation occurs after an average of 14 hours. Women in this study who most closely matched these parameters used the average PPI rating, 'distressing', to describe their pain. For the 'distressing' group, latent labour lasted an average of 10 hours and full dilatation was attained after 16 hours. In contrast, total labour length for the 'discomforting' group was 10 hours and for the 'horrible/excruciating' group total labour was approximately 26 hours. It is important to note that the subjects who reported horrible/excruciating had the overall dilatation curve

which most closely approximated the clinical diagnoses of prolonged latent and protracted active labour discussed by Friedman (1983 b). Again there were substantial individual differences within these groups, a finding that is also consistent with Friedman's (1967) large normative sample.

The predictive relationship between subjective pain and labour efficiency was specific to pain assessed in latent labour. No relationship was found between pain assessed in active labour and labour efficiency. Subjective pain scores taken at 5 cm to 7 cm and at 8+ cm did not correlate with duration of active or second stage of labour. The phase specificity of the relationship between pain and labour efficiency is important for understanding the outcome of previous attempts to link pain with labour progress. Several studies have found no relationship between active labour pain and efficiency (Davenport-Slack & Boylan, 1974; Nettelbladt et al., 1976; Reading & Cox, 1985; Melzack et al., 1984; Bonnel & Boureau, 1985). Melzack et al. (1984) used pain scores in their analyses that were taken within 4 hours of delivery; thus correlations were calculated with subjects who were already in active labour. Similarly, pain ratings taken retrospectively are also more likely to reflect active labour pain (Davenport-Slack & Boylan, 1974; Nettlebladt et al., 1976; Reading & Cox, 1985). The present findings

suggest the critical link between pain and efficiency is forged earlier in the labour process than has previously been thought.

The importance of subjective pain during latent labour went beyond predicting later physiologic progress as the same variable also predicted a number of obstetric complications. Level of subjective pain in latent labour was predictive of rates of forceps and Caesarean deliveries. More than 68% of subjects reporting 'horrible to excruciating' pain during this phase eventually required an instrumental delivery whereas 29% of subjects reporting 'discomforting' pain required this type of delivery. The frequency of instrumental delivery in the distressing group was midway between the frequencies for the highest and lowest pain groups. The higher need for obstetrical intervention among subjects reporting high pain levels was underscored by the finding that virtually all of these women required epidural anesthesia.

The prognostic significance of subjective pain in this study suggests this variable has promising clinical potential. Labour efficiency was not well predicted by obstetrical factors, a finding noted by a number of previous investigators (Friedman, 1983b; O'Driscoll et al., 1984; N. I. H. Statement of Caesarean Childbirth, 1981). On the whole, obstetrical factors were related to

efficiency of the second stage. If, on replication it can be determined that a critical time period in latent labour exists such that administration of the PPI is reliably prognostic of labour efficiency, then clinical decision making could be enhanced considerably. Moreover, replication would also raise the question of whether some form of cognitive-behavioural intervention during latent labour could be used to alter the influence of pain on efficiency and resulting outcomes.

The correlations of cognitive activity measures with labour efficiency yielded a pattern of results which was both similar and dissimilar to that found for pain. Subjects who predominantly catastrophized during latent labour were less efficient in latent and active labour than subjects in the predominantly coping or equally coping/catastrophizing groups. In clinical terms, average latent labour for this group was four hours longer than that for the predominantly coping group. Inspection of individual cases revealed that <u>every</u> subject who was rated as "predominantly catastrophizing" in latent labour was also to become inefficient in active labour. Active labour was almost seven hours longer for the catastrophizing group than for the coping group.

The relationship between coping/catastrophizing and labour efficiency was also phase specific.

Coping/catastrophizing in the mid-active and transition intervals had no relationship with labour efficiency. Results seem to indicate that once labour has become active, the efficiency of the system follows a course that is less sensitive to immediate pain and cognitive activity.

When examined in relation to obstetric complications, the coping/catastrophizing measure for latent labour yielded findings which were comparable to those found for subjective pain. Similar to findings with the PPI, coping/catastrophizing scores were highly predictive of medication use and type of delivery. Unlike the PPI, coping/catastrophizing in latent labour was also predictive of fetal heart rate pattern abnormalities. Fifty percent of mothers who predominantly catastrophized in latent labour had fetuses with abnormal fetal heart rate patterns in active labour. This was in contrast to a frequency of 10.8% for the predominantly coping group. Moreover, 61.1% of mothers rated as predominantly catastrophizing in latent labour were to have paediatric personnel called to attend the delivery. This is in contrast to 16.7% of the predominantly coping mothers who required similar assistance during delivery. Paediatric assistance is routinely requested if medical attendants feel that fetal heart rate patterns suggest the neonate may require resuscitation upon delivery. Although fetal heart rate

abnormalities may be due to compression of the umbilical cord, one would not expect this to differentiate between maternal cognitive activity in latent labour. An alternative explanation is that these differences reflect reduced uterine blood flow due to heightened catecholamine output (Myers & Myers, 1979; Morishima et al., 1977) in the catastrophizing women. Findings that differences in fetal heart rate patterns were related to concerns expressed in labour were also reported by Lederman and colleagues (1985). These authors found that concern regarding safety assessed at the onset of active labour was predictive of both abnormal fetal heart rate patterns and higher levels of epinephrine in active labour.

The finding that predominantly coping and equally coping/catastrophizing groups in latent labour did not differ in latent or active labour efficiency suggests that a certain amount of worry or distress in latent labour is not necessarily 'worse' than no worry at all. Janis (1958; 1983) suggested that a moderate degree of anticipatory fear is helpful for successful adaptation to stressful encounters. Janis proposed the construct of 'work of worry' as a latent mechanism which prepares the individual for confrontation with the actual encounter. In a study of patients undergoing surgery, Janis found that patients who showed no anticipatory fear and those who showed extreme

levels of fear adapted more poorly to surgery both physically and emotionally than patients who showed moderate levels of fear. In the present study, catastrophizers were less efficient and required more anesthetic and analgesic medications than predominantly coping and 'moderate' or equally coping/catastrophizing women. Unlike Janis' findings, however, the coping group did not fare more poorly than the equally coping/catastrophizing women on measures of 'adaptation' such as medication usage or on measures of efficiency. This would suggest that the key to effective adaptation in labour is not to engage in ideation that is overwhelmingly negative. Similar conclusions have been reached by authors studying experimental pain (Spanos et al. 1981; cf.,Turk, Meichenbaum & Genest, 1983), post-surgical pain (Taenzer, 1983) and stress in a dental setting (Chaves & Brown, 1978).

The cognitive data also pointed to the presence of important differences within styles of coping. There was high variability within the predominantly coping group on efficiency measures, indicating that some individuals within this group were very efficient whereas others were very inefficient. The cognitive basis of these differences was explored through the categorization of the focus of thought within the coping group. Sensation acceptance was

characterized by thoughts which were internally focussed and which made no attempt to distract attention from pain. The majority of subjects who used sensation acceptance between contractions in latent labour were efficient in latent labour, whereas the majority of subjects using sensation avoidance were inefficient during this phase. Both groups had efficient active labours, but the avoidance group took longer for their labours to become active. The empirical difference between the two strategies in latent labour is consistent with the clinical observation that women who attempted to distract themselves via external focus seemed to have difficulty going into active labour. Conversely, it was observed that women who were introspective and internally focussed during latent labour appeared to go into active labour very quickly. Similar clinical observations have been made by the French obstetrician, Michel Odent, who described this state as a deeper level of consciousness characterized by a withdrawal from external events (Odent, 1984).

This study also found that cognitive processes which influence the dilatation phases have an impact on the descent phase. Studies reviewed earlier indirectly pointed to a link between efficiency of the dilatation phases and cognitive activity, however, there has been little previous evidence to suggest a psychophysiologic component to the

descent phase. The exploratory analyses concerning the relative importance of Sensation Acceptance versus Sensation Avoidance suggested a mechanism by which thoughts might influence efficiency of the descent phase. Every subject whose thoughts were characterized by Sensation Acceptance during contractions in latent labour was efficient during the second stage. The contrasting style of coping, Sensation Avoidance, was associated with inefficient labour for the same time period. The difference between groups could not be solely due to loss of the urge to push due to anesthesia because fewer than half of the Sensation Avoidance groups had epidurals in situ. Unlike the dilatation phases in which efficiency results from smooth muscle contractions, the descent phase also requires active maternal coordination of skeletal muscle. The present data would indicate that this active or behavioural component of descent phase efficiency is characterized by a cognitive style which is more accepting of the pain and sensations of childbirth.

The notion of behavioural control in labour has previously been discussed as an element of 'childbirth competence'. Standley and Nicholson (1980) defined childbirth competence as the "woman's ability to control her behaviour and assist in the labour and delivery of her child without showing signs of psychological or functional

disability (p. 18). The present research suggests that behavioural control in early labour requires, paradoxically, passively "letting go" and not attempting to actively direct the process of labour. Conversely, active control as evidenced by coordinated pushing is an essential aspect of an efficient descent phase. Both facets of efficiency appear to be facilitated by a psychobiologic style in latent labour which acknowledges labour sensations and which is not associated with conscious attempts to control associated pain. This formulation can be illustrated by differences in thoughts expressed in latent labour. One subject said that she didnt want to feel anything, dreaded being fully dilated and didn't "want to have to push". The delivery room nurse later revealed that this subject repeated this concern during the second stage and ultimately required a forceps delivery. Another subject said "I just watch for the contraction and just go along with it". This subject was relatively passive and withdrawn during the dilatation phases and actively pushed after being fully dilated and had a very short descent phase.

As with the findings for pain, the essential temporal link between cognition and efficiency was based on thoughts and feelings occurring early in the labour sequence. Research on the relationship between cognitive processes

and physiological response has suggested a mechanism by which anticipatory thoughts can exacerbate both pain and physiological sequelae to pain. There is evidence that the strength of physiologic reactions to stress appraisals can equal that of reactions to the actual stressful encounter (Turk, Meichenbaum & Genest, 1983; Mason, 1971). Turk and Rudy (1986) have noted that "thoughts in anticipation of distress may actually produce muscle tension that for pain patients may exacerbate pain" (p. 763). For example, Flor, Turk and Birbaumer (1985) showed that chronic back pain patients displayed elevations and delayed recovery in electromyographic (EMG) activity in paravertebral areas when simply discussing pain or personally relevant stress. The extent of this abnormal activity was better predicted by cognitive coping style and depression than by pain variables. Measures of underlying physiologic activity were not taken in the present study, and the variability within pain and cognitive activity groups on measures of efficiency suggests that future studies should incorporate a measure of physiological arousal. A measure of muscle tonus would help clarify the role of physiological reactivity or "bracing" (Whatmore & Kohli, 1974) and provide a better understanding of the psychophysiology of labour. It is conceivable that differences in muscle

tension may contribute to the variability within pain and cognitive activity observed in the present study.

The finding that both pain and cognitive activity in latent labour were predictive of efficiency and complications leads to the question of whether the use of one measure alone would be a more parsimonious approach. Subjectve pain ratings referred to sensations of hurt as they were being experienced. On the other hand, cognitive activity was more expansive and included a wide variety of thoughts, some of which described the present situation and some of which were anticipatory of future events or harm. That is, the cognitive assessment strategy appeared to tap anticipatory fears and expectations concerning the entire labour process. Anticipatory thoughts have been implicated as a major characteristic of cognitive processes involved in pain (Turk & Rudy, 1986). Analyses of correlations between pain and coping/catastrophizing revealed that these experiential processes evolved differently through the course of labour. Whereas pain measures in adjacent phases were always correlated, measures of coping/catastrophizing were not correlated across adjacent phases. Women maintained their relative positions regarding level of pain, however the meaning they imparted to pain may have been more under the influence of situational variables. Regression analyses indicated that subjective pain in

latent labour was the most reliable predictor of efficiency of latent labour. Coping/catastrophizing in latent labour was the best predictor of active phase and descent phase efficiency and was also highly predictive of abnormal fetal heart rate patterns occurring in active labour. Subjective pain in latent labour accounted for additional variance in efficiency of active labour, however the size of contribution was smaller. Moreover, subjective pain did not predict frequency of abnormal heart rate patterns in active labour.

The differential impact of pain and cognitive content may reflect the operation of a two component psychophysiologic system during labour. Subjective pain appears to exert an immediate effect which inhibits the initiation of active labour and which has a residual effect once the system has become active. Thus differences between pain groups in latent labour appear to be reflected in differences in efficiency of active labour as well. On the other hand, cognitive activity may have a maximal impact only when the anticipated stress (e.g., actual pain of active labour) has been realized. This interpretation is consistent with cognitive theories of stress which view appraisals of threat as latent variables which are best understood within the context of the actual stressful encounter (Janis, 1958; Lazarus 1966; Lazarus & Launier,

1978; Bandura, 1977). It is recognized that both pain and cognitive activity as discussed here are considered to involve cognitive processes. However, the coping/catastrophizing component of cognitive activity involves representations other than the intensity of the present pain experience.

Previous attempts to predict pain in labour have shown significant albeit modest relationships between pain and prepared childbirth training (P.C.T; Melzack, 1981; 1984), education (Nettelbladt et al., 1976) and anxiety in the third trimester (Reading & Cox, 1985). Some studies have found no relationships between P.C.T. and labour pain (Davenport-Slack & Boylan, 1974; Nettelbladt, 1976; Reading & Cox, 1985). In the present study, practice in P.C.T. had no impact on subjective pain and was not a reliable predictor of pain behaviour. Education was found to be a reliable predictor of both subjective pain and pain behaviour in active labour. With a few exceptions, the Lederman scales were the best overall set of predictors of both pain and cognitive activity, a finding which is consistent with previous reports concerning the relationship between third trimester anxiety and labour pain.

Lederman et al. (1979) reported that Acceptance of pregnancy correlated with state anxiety, epinephrine,

labour length and adjacent Montivideo units (measures of contractility) in active labour. Fear of pain/helplessness also correlated positively with anxiety and negatively with Montivideo units in active labour. In a more recent study Lederman et al. (1985) found that Fears for well being of self and baby correlated with anxiety about safety during active labour. The present study confirmed and extended the findings of the Lederman group concerning the importance of pregnancy/labour concerns in understanding psychological processes in labour. Fear of pain/helplessness and Acceptance of pregnancy were the most reliable predictors of coping/catastrophizing for all phases of labour. Fear of pain/helplessness was predictive of coping/catastrophizing in latent labour. The more fearful of pain and helplessness women felt in the third trimester the more they catastrophized in latent labour.

Acceptance of pregnancy was predictive of cognitive activity in both the active and transition periods. These results indicated that women who have misgivings about being pregnant are also more likely to engage in catastrophizing thought during active labour. Greater variance was accounted for in the transition interval than in earlier intervals. This is consistent with the finding by Lederman that Acceptance of pregnancy was predictive of state anxiety in active labour and provides convergent

validity for the coping/catastrophizing measures used in this study.

In the present study Lederman's Fears for self and baby was a strong predictor of both subjective and behavioural pain in the transition period. Twenty-six percent of the variance in subjective pain in the transition period was predicted by this variable. These data then support the contention by the Lederman group that concerns regarding well-being of self and baby is a stable characteristic of mothers during pregnancy and labour (Lederman et al., 1985). This is interpreted as additional support for the notion that cognitive processes reflect a latent variable which is most influential when the anticipated stress is realized.

Lederman's scale Preparation for labour was found to be predictive of subjective pain in latent labour. This scale reflects women's attitudes toward prenatal preparation, e.g., "I feel it necessary to know a lot about labour", as well as perceptions of knowledge about labour, e.g., "I feel well informed about labour". Regression analyses indicated that women who felt less prepared also reported higher subjective pain and exhibited higher pain behaviour in latent labour. Actual practice in psychoprophylactic techniques did not correlate with pain or with Preparation for labour. An interpretation of these

findings is that Lederman's Preparation for labour represents a perceived ability to control events in labour and that this perception is independent of the amount to which psychoprophylactic techniques are practiced. One reason for this might be that women had confidence in external sources of control such as medical personnel or medications for pain (Scott-Palmer & Skevington, 1981).

The variable of education produced some interesting findings which warrant further study. Education was the most reliable predictor of subjective pain in active labour, yet this variable was unrelated to the coping/catastrophizing dimension for the same phase. Because highly educated women were just as likely to catastrophize, an explanation of its influence on pain may involve social/demand characteristics. Many of the more highly educated women in this sample were nurses or teachers. One can speculate that inhibitions against appearing to be a troublesome patient may be more salient for highly educated women. This could be investigated in future research by incorporating a premeasure of women's attitudes concerning the experience and expression of pain during labour.

In summary, pregnancy/labour concerns assessed in the third trimester were generally predictive of pain and cognitive activity in labour although strength of

prediction was modest for early labour. This supports Lederman's contention that antenatal concerns represent stable characteristics in pregnant women. The relationship between third trimester concerns and thought and pain in labour was strongest in the stressful transition period. Data presented also suggests that practice and confidence in psychoprophylactic techniques are not powerful enough to ameliorate the effects of these third trimester concerns once labour has begun.

This research has implications for both the clinical management of labour and for the design of prepared childbirth training programs. Non-nursing obstetrical personnel place little emphasis on how women labour, especially in the latent period. Obstetricians have not had the benefit of research indicating that what women have to say in labour has any pertinence to understanding labour efficiency. Conversely, there is great emphasis placed on 'known' obstetrical parameters such as fetal positioning, condition of the cervix and adequacy of pelvic architecture. Latent labour has been considered relatively unimportant if membranes are intact. Several times during the course of this study nurses or residents asked the interviewer why he wanted to interview a subject when "She's not even in labour yet". The strongest finding in the present study is that influential processes which

appear to predict both efficiency and complications in all phases of labour are occurring while the woman is in this latent phase. Findings presented here are particularly noteworthy because most of the predictive measures were derived from what women themselves had to say.

Future research should attempt to identify situational factors which contribute to variance in labour efficiency and which may be ultimately used to alter the course of labour. Maternal position could not be controlled, however, this may contribute to variability in efficiency (Roberts, Malasnos & Mendez-Bauer, 1981). Interventions by midwives were also probable moderators of efficiency. It was often observed, for example, that some women in severe pain who were asking for analgesia and who were not progressing from three centimetres would be placed in the shower by the nurse-midwife, more often than not to return in thirty to forty minutes at eight plus centimetres and refuse medication.

Another anecdotal observation points to the apparent sensitivity of women to other persons in the labour room. Of four women who had their mothers present as well as their husbands, three had prolonged latent labour. Progressive dilatation for these women occurred after their mothers had left for meals. In latent labour particularly it was occasionally observed that women's contractions

would subside after being connected to the tokograph only to have contractions reappear when the monitor was disconnected. Similar examples have been documented by Friedman (1967). These observations are not unlike those of early experimental studies (Bleicher, 1962; Newton et at, 1966) which found that uterine physiology was sensitive to environmental influences.

Many prepared childbirth programs train women in the use of distraction or attention diversion techniques. Programs often emphasize the view that women must discipline themselves to use these techniques effectively (Bing, 1977; Stone, Demchik-Stone, & Horan, 1977). A belief underlying many P.C.T. programs is that severe labour pain results from conditioned expectations and that reconditioning and muscle relaxation can significantly reduce this pain (Dick-Read, 1944; Lamaze, 1970). Components of the Lamaze method have been studied in terms of their effectiveness with experimental pain. Based on data examining the effectiveness of dissociation and distraction techniques, Stevens (1977) and Stevens and Heide (1977) concluded that "psychological strategies in prepared childbirth cause true psychoanalgesia in their users and with proper training women could substitute this for chemical analgesia" (Stevens & Heide, p.160). In the present study, no women actually used dissociation

techniques in any phase of labour. There were no differences in pain perception between women who used distraction and those who focussed directly on the sensations of labour. It may be that inappropriate validity is attributed to distraction techniques by trainers and women as well. In an experimental pain study, McCaul and Haugveldt (1982) found that the majority of subjects who were instructed to attend to their sensations or pain would have preferred distraction even though they reported less distress than subjects in the distraction group. In a labour setting, Leventhal and colleagues (1981; as cited by McCaul and Malott, 1984) found that women also preferred distraction even though less distress was reported when using sensation monitoring. Rosenstiel and Keefe (1983) found that back pain sufferers often use strategies involving attention diversion despite the fact that such strategies are ineffective in alleviating their pain. This suggests that it is not pain that is conditioned by societal expectations so much as ineffective coping strategies for dealing with pain. Some support in the present study comes from the finding that among the subsample of subjects who remained unmedicated throughout labour, those who practiced psychoprophylactic techniques the most reported the highest pain.

The small group of women in this study who focussed directly on the sensations of labour went into active labour more quickly than women who attempted to divert attention from their labour. These women were also the most instrumental in pushing effectively in the second stage. Follow-up research should be directed at identifying the underlying physiological components of this and other styles in labour. Women who do not attempt to combat the pain and sensations of labour may be less likely to "brace" than women who do. Although the process is not understood, some writers are now advocating that women come into labour with as few preconceptions as possible and simply do whatever comes naturally to them (Odent, 1984; Jones, 1987).

In summary, the present data provide promising evidence concerning the importance of pain and cognitive activity in labour efficiency. These findings suggest that the course of labour is primed by pain and cognitive activity in latent labour. This has strong implications for obstetrical practice because of the comparatively small importance attributed to latent labour by obstetrical practitioners. Previous writers have shown that cognitive activity is an integral part of the pain experience; however, the relative importance of different cognitive strategies in the mediation of clinical pain remains

unclear (Turk, Meichenbaum & Genest, 1983). This shortcoming is particularly salient in regard to labour pain because it is perhaps the only common form of clinical pain in which specific strategies are almost universally prescribed within western culture.

References

Abouleish, E. (1977). Pain control in obstetrics. Philadelphia: J.B. Lippincott.

Bandura, A. (1977). Self-efficacy: toward a unifying theory of behavioral change. Psychological Review, 84, 191-215.

Bandura, A., & Adams, N.E. (1977). Analysis of self-efficacy theory of behavioral change. Cognitive Therapy and Research, 1, 287-308.

Barden, T.B., & Stander, R.W. (1968). Effects of adrenergic blocking agents and catecholamines in human pregnancy. American Journal Obstetrics and Gynecology, 102, 226-235.

Beck, N.C., & Siegel, L.J. (1980). Preparation for childbirth and contemporary research on pain, anxiety, and stress reduction: A review and critique. Psychosomatic Medicine, 42, (4) 429-447.

Beck, N.C. Siegel, L.J. Davidson, N.P. Kormeier, S., Breitenstein, A., & Hall, D.G. (1980). The prediction of pregnancy outcome: maternal preparation, anxiety and attitudinal sets. Journal of Psychosomatic Research, 24, 343-351.

Bing, E. (1967). Six practical lessons for an easier childbirth. New York: Grosset & Dunlap.

Bleicher, N. (1962). Behavior of the bitch during parturition. Journal of the American Veterinary Medicine Academy.

Bonica, J.J. (1967). Principles and Practice of Obstetric: Analgesia and Anesthesia Vol 1. Oxford: Blackwell Scientific Publications.

Bonica, J.J. (1973). Maternal respiratory changes during pregnancy and parturition, Parturition and Perinatology In G.F.Marx (Ed). Philadelphia: F.A.Davis.

Bonica, J.J. (1979). Important clinical aspects of acute and chronic pain, Mechanisms of Pain and Analgesic Compounds R.F.Beers & E.G.Bassett (Eds). New York: Raven Press.

Bonica, J.J., & Hunter, C.A. (1965). Dysfunction of the forces of labor, Clinical Anesthesia: Obstetric Complications In J.J.Bonica (Ed). Philadelphia: F.A.Davis.

Bonnel, A.M., & Boureau, F. (1985). Labor pain assessment: Validity of a behavioral index. Pain, 22, 81-90.

Brewin, C., & Bradley, C. (1982). Perceived control and the experience of childbirth. British Journal of Clinical Psychology, 21, 263-269.

Bundsen, P., Petersen, L.E., & Selstam, U. (1982). Pain relief during delivery: An evaluation of conventional methods. Acta Obstet Gynecol Scandinavica, 61(4), 289-297.

Burns, J.K. (1977). Stress hormones and oestriol in relation to human labour. In L. Carenza & L. Zichella (Eds.), Emotion & Reproduction, vol 20b. New York: Academic Press.

Burstein, I., Kinch, R.A., & Stern, L. (1973). Anxiety, pregnancy, labor and the neonate. American Journal of Obstetrics and Gynecology, 118, 195-199.

Butani, P., & Hodnett, E. (1980). Mothers perceptions of their labor experiences. Maternal Child Nursing Journal, 9, 73-82.

Caldwell, D.F. (1962). Stillbirths from adrenal de-medullated mice subjected to chronic stress throughout gestation. Journal of Embryology and Experimental Morphology, 10, 471.

Chaves, J.F., & Brown, J.M. (1978, August). Self-generated strategies for the control of pain and stress. Paper presented at the annual meeting of the American Psychological Association, Toronto, ON.

Cibils, L.A. (1981). Electronic fetal monitoring. Boston: PSG Publishing.

Crandon, A.J (1979a). Maternal anxiety and obstetric complications. Journal of Psychosomatic Research, 23, 109-111.

Crandon, A.J. (1979b). Maternal anxiety and neonatal condition. Journal of Psychosomatic Research, 23, 113-115.

Davenport-Slack, B., & Hamilton-Boylan, C. (1974). Psychological correlates of childbirth pain. Psychosomatic Medicine, 36, 215.

Davids, A., & DeVault, S. (1962). Maternal anxiety during pregnancy and childbirth abnormalities. Psychosomatic Medicine, 24, 464.

Davids, A., & DeVault, S. (1962). Maternal anxiety during pregnancy and childbirth abnormalities. Psychosomatic Medicine, 24, 464.

Davids, A., DeVault, A., & Talmadge, M. (1961a). Anxiety, pregnancy, and childbirth abnormalities. Journal of Consulting Psychology, 25, 74.

Davids, A., DeVault, A., & Talmadge, M. (1961b). Psychological study of emotional factors in pregnancy: A preliminary report. Psychosomatic Medicine, 23, 93.

Dick-Read, G. (1944). Childbirth Without Fear. New York: Harper Brothers.

Erickson, M.T. (1975). The influence of health factors on psychological variables predicting complications of pregnancy, labor and delivery. Journal of Psychosomatic Research, 20, 21-24.

Filler, W.W., Hall, W.C., & Filler, N.W. (1967). The effect of analgesia on uterine contractility and fetal heart beat. American Journal of Obstetrics and Gynecology, 98, 832-846.

Flor, H., Turk, D.C., & Birbaumer, D. (1985). Assessment of stress related psychophysiological reactions in chronic back pain patients. Journal of Consulting and Clinical Psychology, 53, 354-364.

Folkman, S., & Lazarus, R.S. (1980). An analysis of coping in a middle-aged community sample. Journal of Health and Social Behavior, 21, 219-239.

Friedman, D.D., Essman, W.B., & Fisichelli, V. (1977). Plasma catecholamines during pregnancy and parturition: A new approach to their relationship. In L. Carenza &

L. Zichella, (Eds.),Emotion and Reproduction,vol 20b. New York: Academic Press.

Friedman, E.A. (1967). Labor: Evaluation and Management.

Friedman, E.A. (1978). Labor: Clinical Eval & Management 2nd Labor: Clinical Eval & Management Ed. New York: Appleton Century Crofts.

Friedman, E.A. (1983). Effects of labor and delivery procedures on the fetus, Management of Labor In W.R.Cohen & E.A.Friedman. Baltimore: University Park Press.

Friedman, E.A. (1983a). Physiology of Labor, Management of Labor In W.R.Cohen & E.A.Friedman (Eds). Baltimore: University Park Press.

Friedman, E.A. (1983b). Dysfunctional Labor, Management of Labor In W.R.Cohen & E.A.Friedman. Baltimore: University Park Press.

Garcia, C.A., & Garcia, C.S. (1955). Epinephrine like substances in the blood and their relation to uterine inertia. American Journal of Obstetrics and Gynecology, 69, 812.

Genest, M., & Turk, D. (1981). Think-aloud approaches to cognitive assessment, Cognitive Assessment In T.V.Merluzzi, C.Glass & M.Genest (Eds.). Guilford Press, New York.

Gorsuch, R.C., & Key, M.K. (1974). Abnormalities of pregnancy as a function of anxiety and life stress. Psychosomatic Medicine, 36, 352-362.

Greiss, F.C., & Gobble, F.L. (1967). Effect of sympathetic nerve stimulation on the uterine vascular bed. American Journal of Obstetrics and Gynecology, 97, 962.

Guillozet, N. (1975). The risks of paracervical anesthesia: intoxication and neurological injury of the newborn. Pediatrics, 55, (4):533-536.

Hughey, M.J., McElin, T.W., & Young, T. (1978). Maternal and fetal outcome of Lamaze prepared patients. Obstetrics and Gynecology, 51, 643-647.

Humenick, S.S. (1981). Mastery: the key to childbirth satisfaction? A review. Birth and the Family Journal.

Huskisson, E.C. (1983). Visual analogue scales, Pain measurement and assessment In R. Melzack (Ed.). New York: Raven Press.

Janis, I. (1958). Psychological Stress. New York: Wiley.

Janis, I. (1983). Stress innoculation in health care, Stress Reduction and Prevention In D.Merchenbaum & M.Jaremko (Eds.). New York: Plenum.

Jones, A.C. (1978). Life change and psychological distress as predictors of pregnancy outcome. Psychosomatic Medicine, 40, 402-412.

Jones, C. (1987). Mind over Labor. Markham: Penguin Books.

Kapp, F.T., Hornstein, S., & Graham, V.T. (1963). Some psychologic factors iin prolonged labour due to inefficient uterine action. 9, Comprehensive Psychiatry, 4.

Kirk, R.E. (1982). Experimental Design: Procedures for the Behavioral Sciences. (2nd ed.) Monterey: Brooks/Cole.

Klusman, L.E. (1975). Reduction of pain in childbirth by alleviation of anxiety during pregnancy. Journal of Clinical Psychology, 43, 162-165.

LaCroix (1968). Monitoring labor by an external tokodynamometer. 101, 1, 111-119.

Lamaze, F. (1970). Painless Childbirth: Psychoprophylactic Method. Chicago: Regnery.

Lazarus, R.S., & Folkman, S. (1984). Stress, Appraisal and Coping. New York: Springer.

Lazarus, R.S. (1966). Psychological stress and the coping process. New York:McGraw-Hill.

Lazarus, R.S. (1981). The stress and coping paradigm, Models for clinical psychopathology C.Eisdorfer, D.Cohen, A.Kleinman, & P.Marxim (Eds.). New York: SP Medical and Scientific Books.

Lederman, R., Lederman, E., Work Jr., B.A., & McCann, D.S. (1979). Relationship of psychological factors in pregnancy to progress in labour. Nursing Research, 28 2, 94-97.

Lederman, R.P, Lederman, E., Work, B.A., & McCann, D.S. (1978). The relationship of maternal anxiety, plasma catecholamines, and plasma cortisol to progress in labor. American Journal of Obstetrics and Gynecology, 132, 495-500.

Lederman, R.P. (1984). Psychosocial Adaptation in Pregnancy. Englewood Cliffs, N.J: Prentice-Hall.

Lederman, R.P., Lederman, E., Work, B.A., & McCann, D.S. (1981). The relationship of maternal prenatal development to progress in labor and fetal newborn health. Birth Defects, 17(6), 5-28.

Lederman, R.P., Lederman, E., Worke, B., Jr., & McCann, D.S. (1985). Anxiety and epinephrine in mutiparous women in labor: Relationship to duration of labor and fetal heart rate pattern. American Journal of Obstetrics and Gynecology, 153(8), 820-827.

Leifer, M. (1980). Psychological Effects of Motherhood. New York: Praeger.

Leventhal, H., Shacham, S., Boothe, L.S., & Leventhal, E. (1981). The role of attention in distress and control during childbirth. Unpublished manuscript, University of Madison-Wisconsin.

Levinson, G., Shnider, S.M. (1979). Catecholamines: the effects of maternal fear and its treatment on uterine function and circulation. Birth and the Family Journal, 6, 8-16.

Manning, M.M., & Wright, T.L. (1983). Self-Efficacy expectancies, outcome expectancies, and the persistance of pain control in childbirth. Journal of Personality and Social Psychology, 45 2:, 421-431.

Mason, J.W. (1971). A re-evaluation of the concept of "non-specificity" in stress theory. Journal of Psychiatric Research, 8, 323-333.

Mason, J.W. (1975). Emotions as reflected in patterns of endocrine integration, Emotions: Their Parameters and Measurement In L.Levi,. New York: Raven Press.

McCaul, K.D., & Haugveldt, C. (1982). Attention, distraction and cold-pressor pain. Journal of Personality and Social Psychology, 43, 154-162.

McCaul, K.D., & Malott, J.M. (1984). Distraction and coping with pain. Psychological Bulletin, 95(3), 516-533.

McDonald, R.C. (1968). The role of emotional factors in obstetric complications: A review. Psychosomatic Medicine, 30, 222-237.

McDonald, R.C., & Cristakos, A.C. (1963). Relationship of emotional adjustment during pregnancy to obstetrical complications. American Journal of Gynecology, 86, 341-348.

McDonald, R.L., & Parham, K.J. (1964). Relation of emotional changes during pregnancy to obstetric complications during pregnancy to obstetric complications in unmarried primigravidas. American Journal of Obstetrics and Gynecology, 90, 195-201.

McDonald, R.L., Gynther, M.D., & Christakos, A.C. (1963). Relations between maternal anxiety and obstetric complications. Psychsomatic Medicine, 25, 347.

Melzack, R. (1975). The McGill Pain Questionnaire: Major properties and scoring methods. Pain, 1, 279-299.

Melzack, R. (1983). The McGill pain questionnaire. In R. Melzack (Ed.) Pain measurement and assessment. New York: Raven Press.

Melzack, R., & Wall, P.D. (1965). Pain mechanisms: A theory. Science, 150, 971-979.

Melzack, R., Kinch, R., Dobkin, P. Lebrun, M., & Taenzer, P. (1984). Severity of labour pain: Influence of physical as well as psychologic variables. Canadian Medical Association Journal, 130, 579-584.

Melzack, R., Taenzer, P., Feldman, P., & Kinch, R.A. (1981). Labour is still painful after prepared childbirth training. Canadian Medical Association Journal, 125, 357-363.

Melzack, R. (Ed.) (1982). Pain Measurement and Assessment. New York: Raven Press.

Merchenbaum, D. (1977). Cognitive Behavior Modification. New York: Plenum Press.

Molfese, V.J., Bricker, M.C., Manion, L., Yaple, K., & Beadnell, B. (1987). Stress in pregnancy: The influence of psychological and social mediatros in perinatal experiences. Journal of Psychosomatic Obstetrics and Gynecology, 6(1), 33-42.

Morishima, H., Pedersen, H., & Finster, M. (1978). The influence of maternal psychological stress on the fetus. American Journal of Obstetrics and Gynecology, 131, 286-290.

Morishima, H.O., Yeh, M., & James, L.S. (1977, October). The effects of maternal pain and hyperexcitability upon the fetus: Possible benefits of maternal sedation. Annual Meeting, American Society of Anesthesiologists (Abstract)

Myers, R.E., & Myers, S.E. (1979). Use of sedative, analgesic, and anesthetic drugs during labor and delivery: Bane or boon?. American Journal of Obstetrics and Gynecology, 133, 83-104.

National Institutes of Health Consensus Development Statement on cesarean childbirth (1981). Obstetrics and Gynecology, 57, 537-545.

Nettelbladt, P., Fagerstrom, C.F., & Uddenberg, N. (1976). The significance of reported childbirth pain. Journal of Psychosomatic Research, 20, 215-221.

Newton, N., Foshee, D., & Newton, M. (1966). Experimental inhibition of labor through environmental disturbance. Obstetrics and Gynecology, 27, 371-377.

Norbeck,J.S., & Petersen Tilden, V. (1983). Life stress, social support, & emotional disequalibrium: A prospective multivariate study. Journal of Health and Social Behavior, 24, 30-46.

O'Driscoll, K., Foley, M., & MacDonald, D. (1984). Active management of labor as an alternative to cesarean section for dystocia. Obstetrics and Gynecology, 634, 485-490.

Obayuwana, A.O., Carter, A.L., & Barnett, R.M. (1984). Psychosocial distress and pregnancy outcome: a three

year prospective study. Journal of Psychosomatic Obstetrics and Gynecology, 3, 173-184.

Odent, M. (1984). Birth Reborn. New York: Random House.

Pash, M.P., Davies, J.M., & Strunin, L. (1985). Analgesia and anesthesia in obstetrics, Current Problems in Obstetrics, Gynecology and Fertility. 7(4), 5-42.

Persianinov, L.S. (1975). The use of electro-analgesia in obstetrics and gynecology. Acta Obstet Gynecol Scand, 54, 373-384.

Reading, A.E., & Cox, D.N. (1985,July). Psychosocial predictors of labor pain. Pain, 22(3), 309-315.

Roberts, J., Malasanos, L., & Mendez-Bauer, C. (1981). Maternal positions in labor analysis in relation to comfort and efficiency. Birth Defects, 17(6), 97-128.

Rosenfeld, C.R., Barton, M.D., & Meschin, G. (1976). Effects of epinephrine on distribution of blood flow in the pregnant ewe. American Journal of Obstetrics and Gynecology, 124, 156.

Rosenstiel, A.K., & Keefe, F.J. (1983). The use of coping strategies in chronic low back pain patients: Relationships to patient characteristics and current adjustment. Pain, 17, 33-44.

Russell, K.P. (1982). The course and conduct of normal labor and delivery. In R. C. Benson (Ed.), Current Obstetric Gynecologic Diagnosis and Treatment (4th ed.) (Chapter 31) Los Altos, CA: Lange Medical Publications.

Scott, J.R., & Rose, N.B. (1976). Effect of psychoprophylaxis (Lamaze preparation) on labor and delivery in primiparas. New England Journal of Medicine, 294, 1205-1207.

Scott-Palmer, J., & Skevington, S.M. (1981). Pain during childbirth and menstruation: A study of locus of control. Journal of Psychosomatic Research, 25, 151-155.

Snider, S.M., Abboud, T.K., Antal, R., Henriksen, E.H., Stefani, S.J., & Levinson, G. (1983). Maternal catecholamines decrease during labor after lumbar epidural anesthesia. American Journal of Obstetrics and Gynecology, 147(1), 13-15.

Soulairac, A. (1977). Analysis of pain mechanisms in obstetrics and gynecology., Emotion and Reproduction In L.Carenza & L.Zichella (Eds.). New York: Academic Press vol 20 b.

Spielberger, C.C., Gorsuch, R.L., & Lushene, R.E. (1970). Manual for the State-Trait Anxiety Inventory. Palo Alto, Calif: Consulting Psychologist Press.

Spanos, N.P., Radtke-Bodorik, H.L., Ferguson, J.D., & Jones, B. (1979). The effects of hypnotic suggestibility, suggestions for analgesia, and the utilization of cognitive strategies on reducation of pain. Journal of Abnormal Psychology, 88(3), 282-292.

Spring, B., & Coons, N. (1982). Stress as a precursor to schizophrenic episodes., Psychological Stress and Psychopathology In R.W.J.Neufeld (Ed). New York: McGraw Hill.

Standley, K., & Nicholson, J. (1980). Observing the childbirth environment: A research model. Birth and the Family Journal, 7(1), 15-20.

Standley, K. Soule, A.B., Copans, S.A., & Duchowny, M.S. (1974). Local-regional anesthesia during childbirth; effect on newborn behaviors. Science, 186, 634-635.

Stevens, R. (1976). Psychological strategies for management of pain in prepared childbirth I: A review of research. Birth and the Family Journal, 3(4), 157-165.

Stevens, R., & Heide, J.F. (1977). Analgesic characteristics of prepared childbirth techniques: Attention focusing and systematic relaxation. Journal of Psychosomatic Research, 21, 429-438.

Stevens, R.J., Plymesser, L., & Langreder, T.W. (1977). Analgesic characteristics of prepared childbirth breathing and attention focusing strategies., Emotion and Reproduction In L. Carenza & L. Zichella, (Eds.),. New York: Academic Press vol 20b.

Stone, C.I., Cemchik-Stone, D.A., & Horan, J.J. (1977). Coping with pain: A component analysis of Lamaze and cognitive-behavioral procedures. Journal of Psychosomatic Research, 21, 450-456.

Taenzer, P. (1983). Self-control of postoperative pain: Effects of hypnosis and waking suggestion. Unpublished doctoral dissertation, McGill University, Montreal, Canada.

Taylor, H.J. (1985). Choice of analgesia/anesthesia during labor and delivery. Clin Invest Med, 8(4), 345-351.

Thompson, S. (1981). Will it hurt less if I can control it? A complex answer to a simple question. Psychological Bulletin, 90(1), 89-101.

Turk, D., & Kerns, R.D. (1985). Assessment in health psychology: A cognitive-behavioral perspective, Measurement Strategies in Health Psychology In P.Karoly (Ed.). New York: J.Wiley & Sons, Inc.

Turk, D.C., & Rudy, T.E. (1986). Assessment of cognitive factors in chronic pain: A worthwhile enterprise?. Journal of Consulting and Clinical Psychology, 54(6), 760-765.

Turk, D.C., Meichenbaum, D., & Genest, M. (1981). Pain and Behavioural Medicine. New York: Guilford Press.

Vellay, P. (1977). The action of conscious and unconscious stress on uterine contractions. In L. Carenza & L. Zichella, (Eds.), Emotion and Reproduction, vol 20b. New York: Academic Press.

Wack, J.T., & Turk, D.C. (1984). Latent structure of strategies used to cope with nociceptive stimulation. Health Psychology. 3(1), 27-43.

Whatmore, G.B., & Kohli, D.R. (1974). The Physiopathology and Treatment of Functional Disorders. New York: Grune & Stratton.

Zichella, L., Luchetti, A., Salmaggi, D., Bartoleschi, A. Sprecavisciole, M., Vinciguerra, M., Pretrobattista, P. Pancheri, P., Connolly, A. & Sachetti, B. (1977). Psychological and psychoneuroendocrine correlates of normal labour. In L. Carenza & L. Zichella, (Eds.), Emotion and Reproduction, vol 20b. New York: Academic Press.

APPENDIX A
BEHAVIOURAL PAIN INVENTORY

Intensity 0	Normal respiration, no grasping, no agitation, both during and between contractions
Intensity 1	The frequency or amplitude of respiratory rates is modified during contractions. All changes are considered to be manifestations of pain, whether they are intentional (ie., in relation to a breathing technique), or purely reactional. Note that this level refers to respiratory changes only.
Intensity 2	In addition to changes in respiration, signs of tension appear during contractions: these include grasping reactions, such as grasping of the sheet, the bed, or the hand of another person. Other bodily signs of tension might be a tensing or jerking of the legs which occurs during a contraction. These reactions cease during contraction relaxation.
Intensity 3	The manifestations defined in level 2 persist between contractions, indicating an absence of relaxation
Intensity 4	Signs of agitation arise either during contractions or between them. These signs include abrupt uncontrolled movements such as startle reactions, calling out or other verbal signs of agitation ie., "Make it stop!" "Oh God!" etc. Also, helpless physical signs such as assuming a rigid fetal posture, rocking or moaning would be included here.

Please rate the patient's behavour using the behavioural signs above for 3 consecutive contractions. Circle a number from 1 to 4 immediately after the resting interval for each contraction.

Patient Name_____

INTERVAL 1		INTERVAL 2		INTERVAL 3	
C 1	0 1 2 3 4	C 1	0 1 2 3 4	C1	0 1 2 3 4
C 2	0 1 2 3 4	C 2	0 1 2 3 4	C1	0 1 2 3 4
C 3	0 1 2 3 4	C 3	0 1 2 3 4	C1	0 1 2 3 4
Dilatation_____		Dilatation_____		Dilatation_____	
Pulse_____		Pulse_____		Pulse_____	

APPENDIX B

CHILDBIRTH STUDY

NAME..... AGE.....

PHONE..... ADDRESS.....

HUSBAND'S NAME..... .....

DOCTOR'S NAME..... DOCTOR'S PHONE.....

The following questions are designed to provide information about the concerns and thoughts of women as they approach childbirth. Every expectant woman is unique--what is important to some may not be important to others. Because everyone is so different you are encouraged to remember that there are no "right" or "wrong" answers. Please fill out the following questionnaire keeping in mind that your answers will be kept strictly confidential.

How many prenatal sessions did you attend?.....

Did you practice the techniques you have learned while at home? YES/NO

Please specify the extent to which you practiced the following:

-breathing exercises YES/NO How often per week?.....

-massage (effleurage) YES/NO How often per week?.....

-pelvic floor exercises YES/NO How often per week?.....

-Relaxation exercises YES/NO How often per week?.....

-Other (specify..... How often per week?.....

-..... How often per week?.....

How important is it for you to be able to cope with your labour pain without medication?

1 2 3 4 5 6 7 8 9

Not at all Extremely

APPENDIX B

Listed below are methods women sometimes use to cope with pain in labour. How confident are you that you can use each one successfully to cope with your labour pain?

	STRATEGY	CONFIDENCE								
a)	Breathing Exercises	1 Not at all Confident	2	3	4	5	6	7	8	9 Extremely Confident
b)	Distraction (focussing attention on another person/object)	1 Not at all Confident	2	3	4	5	6	7	8	9 Extremely Confident
c)	Relaxation Exercises	1 Not at all Confident	2	3	4	5	6	7	8	9 Extremely Confident
d)	effleurage or massage by partner	1	2	3	4	5	6	7	8	9
e)	Other _____ _____ _____	1 Not at all Confident	2	3	4	5	6	7	8	9 Extremely Confident

Appendix C

Department of Psychology
Department of Obstetrics and Gynaecology,
University of Calgary

CHILDBIRTH STUDY

I,.....in agreeing to participate in this research project hereby agree that I have read and fully understand that:

i) the purpose of this study is to examine the differing ways women cope with labour. To more fully understand this, information on women's thoughts, pain and contractions during labour are required.

ii) my participation will involve first filling out a questionnaire in my third trimester, followed by a brief questionnaire early in labour. On up to 3 three occasions during labour I will be asked to describe my pain using a 0-10 rating, this takes a few seconds to complete. On these occasions I will also be asked a few questions about my thoughts--this will again be brief and will be done between 2 or 3 contractions. My contractions may be monitored at these times with equipment used routinely at the Foothills hospital.

iii) the usual routine for childbirth at the Foothills Hospital will be maintained. The procedure described above is in addition to the usual routine.

iv) the purpose, methods and procedure have been reviewed by the Foothills Hospital.

v) my participation is voluntary and I recognize my right to withdraw at any time.

vi) all information collected in the course of my participation will be used in strictest confidence. To ensure anonymity, all information pertaining to my participation will be coded and contained in files accessible only to the principal investigator, Michael I. Wuitchik.

vii) the project is the independent research of the investigator and summaries of the study, methods and findings, in terms of group characteristics, may appear in both scientific and popular publications.

....
Signature Date Witness

Appendix D

Scoring Manual for Cognitive Activity Sampled During Labor

Each subject provided verbal accounts of her thoughts during labour. Each was asked the following: "Can you tell me anything at all about what you think about or what goes on in your mind when you have a contraction?" In response to subject answers, the Interviewer then paraphrased subjects responses and queried, "Anything else." This format was followed until the subject said "no". Then subjects were asked, "and now can you tell me anything at all about what you think about or what goes on in your mind between contractions?" Again these were paraphrased and queried, "Anything else", until the subject said "no".

Your task is to rate each subjects' responses on a dimension of cognitive activity related to coping. Four major categories are included:

1) Cognitive strategies for the self control of pain.
2) Catastrophizing or non-coping cognitive activity.
3) Both of the above.
4) Irrelevant or no cognitive activity.

I COGNITIVE STRATEGIES

This category includes any cognitive activity which the subject uses to help her deal with labour. These may be directed toward reduction of pain or to reducing the emotional reaction to pain. Cognitive coping includes each of the following:

> Distraction includes any strategy to divert attention away from the pain. These include strategies that involve internal focus of attention (thought diversion, imaginal inattention) or external focus of attention (attention diversion, physical distraction). The distinction between internal and external focus is important and should be used in differentiating between strategies.

a) Thought diversion: thinking about things to get one's mind off pain: i.e., reciting prayers, poems, repeating mantras or words such as 'calm' or 'relax'.

b) Imaginal inattention: focusing on a memory or image incompatible with pain: i.e., "I think of relaxing on a beach".

c) Attention diversion: focusing attention on something in the immediate environment and not on the pain. Examples include watching TV, listening to the radio, conversing with others, focusing on an external object, on one point.

d) Physical distraction: involves any physical activity to help the subject take his/her mind from the pain. For example: taking a walk or using breathing exercises.

e) Coping Self-Statements: Talking to oneself in a way to produce confidence, regain perspective, remind oneself of one's strengths and abilities or giving oneself helpful instructions: i.e. "now just stay calm, don't worry it won't last forever", "I've coped with worse so I can cope with this." "I put my resources together." Also positive thoughts about the baby, wondering what the baby will look like or what its sex is, should be coded here.

f) Somaticizing/Sensation Acknowledgement: Active Concentrating on or noting physical sensations in an effort to affect labour or reduce pain, i.e., "I think of the pain and try to center it on my cervix." This also includes redefinition of sensation "as it builds I think of myself riding my horse up the crest of a hill." Consider this code and code 4 when pain is noted without obvious references to distress.

g) Somaticizing/Sensation Acknowledgment: Passive - Concentrating on or noting physical sensations without reference to an attempt to change the pain, i.e., "I think of the pain, of that area of my body." "I just watch for the contraction and try to ride with it, I don't fight it." "I just try to let go with it."

h) Dissociation: Separating one's self from one's body or the part of the body that is painful: i.e., imagining that the painful area isn't really a part of them and therefore any pain is not really happening to them. An example of this is "I tell myself it doesn't hurt." Note: this is in contrast to, "I tell myself it could be worse" which is a coping self statement.

i) Unspecific Coping: This classification is to be used for transcripts that clearly involve coping responses but where there is not enough information to use a specific category: i.e., "I handle it," or "you just have to cope with it, that's all, "or "just try to relax." This category implies that the subject was engaging in coping activities of some sort but what specifically these activities were is not clear.

II. CATASTROPHIZING OR NON-COPING STRATEGIES

Some people engage in cognitive activities which would seem to be associated with negative emotional reactions to pain or fear and which likely inhibit the use of coping strategies. These include:

1) Negative Self-Statements: i.e., I can't stand this; This pain is going to kill me; I'm no good; I can't stand it any longer. Note: "the pain, just the pain" would be rated as a negative self statement if distress is implied within the context. Otherwise this statement might be rated as somatizing if the context suggest it is a strategy of directing attention toward the pain and/or other bodily processes.

2) Catastrophizing Thoughts: Thoughts about terrible things that have happened in the past or that might happen in the future: i.e., thinking that they might panic, lose control or become too

agitated are coded here. "I'm thinking this is never going to end." Ruminating thoughts over things the subject can have no control over should be coded here. "I keep wondering if the baby will have all ten fingers".

3) Time References: References to time, how long labour is taking or going to take. "I wonder how long it's going to be." "I just want it to be over." "I wonder whether I'm dilating." Note: Occasionally women will refer to the length of a contraction. A thought regarding contraction length may be a coping thought. i.e., "I'm watching for the next one", as if to prepare for it. Watch for context here. References to the baby's welfare should be coded as a ruminating thought if it reflects worry or concern.

III. BOTH COPING AND CATASTROPHIZING STRATEGIES PRESENT

When a transcript contains both coping and catastrophizing use this classification and indicate which subclasses of coping and catastrophizing are present. Assess the relative intensity of each to determine if the transcripts are predominantly coping, predominantly catastrophizing, or equally coping and catastrophizing. The following are guidelines for making this distinction:

a) Disregard neutral and irrelevant statements.

b) Examine the coping and catastrophizing statements with respect to implied intensity and choose the most intense dimension for your rating. For instance, if the person responds, "I tried the relaxation exercise but it didn't help too much....then I really panicked." You would rate this response as predominantly catastrophizing due to the intensity of the catastrophizing thoughts and the weakness of the coping effort.

c) If the coping and catastrophizing aspects of a transcript are in your opinion equal, rate the response as equal.

IV_1 Denies any Cognitive Activity

Use this classification if the subject claims that they did not think of anything, "my mind's blank".

2 Coping/Labour Irrelevant Use this code if S is thinking of non-labour related thoughts, "I'm easily distracted." "I think of all kinds of different things." Note that the context suggests S is simply thinking of different things but not doing this as a strategy to avoid labour intentionally, thus "I am trying to think of a warm beach" is a form of distract in whereas "a radio commerical keeps running through my head" is labour irrelevant.

1. Sometimes it is difficult to classify a statement as coping or catastrophizing. It is sometimes helpful to turn the statement around and see if it is then clearly one or the other. For example, "It's worse than I thought" seems like it might be catastrophizing. Turning it into "It's better than I thought" is clearly coping - a positive

self-statement. It is appropriate to classify "It's worse than I thought" as a negative self-statement. Similarly, "I wish the time between them (contractions) was longer" reflects a thought that "the time between them is too short" - a negative self-statement.

2. If after puzzling over a transcript you still can't decide if there is evidence for a cognitive strategy make a note of it under "comments".

Before you are given the actual research transcripts to rate you will be given some practice transcripts. Rate the first 5 with the other rater. Discuss your ratings together and resolve any disagreements. Rate the last 5 practice transcripts independently and resolve any disagreements afterwards.

For each research transcript you will be given an answer sheet with the patient's experimental number and spaces for you to indicate your ratings and for notations and comments. Be sure to read each response carefully before you make your rating. You and the other raters will be asked to resolve any differences in your ratings once the rating of all the transcripts has been completed.