Illness Behavior and the Preoperative Prediction of Postoperative Pain in Cholecystectomy Patients.

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Illness behavior and the preoperative prediction of postoperative pain in cholecystectomy patients

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The Louisiana State University and Agricultural and Mechanical Col., 1989

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ILLNESS BEHAVIOR AND
THE PREOPERATIVE PREDICTION OF POSTOPERATIVE PAIN
IN CHOLECYSTECTOMY PATIENTS

Dissertation
Submitted to the Graduate Faculty of the
Louisiana State University and
Agricultural and Mechanical College
in partial fulfillment of the
requirements for the degree of
Doctor of Philosophy
in
The Department of Psychology

by
Lannis Lee Tynes, Jr.
B.S., Baylor University, 1980
M.S., University of Southwestern Louisiana, 1983
May, 1989
I would like to dedicate this work ... 

... to my family,
... in memory of Marty,
and,
... especially, to my wife Susan - my sail when the weather's fair
and my anchor when it's not.
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Eighty (80) elective cholecystectomy patients volunteered to participate in the present study which assessed the relation between past illness behavior and the report of pain following surgery. A review of the literature indicated that demographic variables (e.g., sex, age) and general psychological variables (e.g., state anxiety) have been the subject of many studies attempting to predict postoperative pain, yet learning and behavioral factors such as past illness behavior and familial modelling of illness behavior have not. Preoperative assessments included the Illness Behavior Inventory (IBI; Turkat, 1983), the Familial Illness Behavior Inventory (IBI-F; derived from the IBI), the State Trait Anxiety Inventory (STAI) and the Eysenck Personality Inventory (EPI). Postoperative pain scores consisted of a Visual Analogue Scale of pain, the McGill Pain Questionnaire, and the amount of postoperative narcotic analgesics required. Results of multiple regression analyses revealed that the Social Illness Behavior factor of the IBI and the mother rating of the IBI-F were significant predictors of postoperative pain scores. The psychological variables of state anxiety, trait anxiety, and neuroticism (EPI) had been obtained in order to compare their efficacy with the illness behavior variables in the prediction of postoperative pain. These particular psychological variables had been demonstrated by other researchers to be relatively reliable predictors of pain report following surgery. When the illness behavior measures and the psychological measures were both entered as independent variables, postoperative pain was predicted most generally from both state anxiety (STAI) and the Social Illness Behavior factor of
the IBI. Apparently, illness behavior and anxiety are valuable predictors of pain both singly and in combination. Implications of these data for future research in the prediction and management of postoperative pain are discussed.
Surgery is perhaps the most stressful of contemporary medical procedures, demanding both physical and psychological resilience on the part of the patient who desires a maximally successful outcome. The surgical patient's life has been disrupted and has become one involving pain, physical discomfort, and threat of death (Auerbach & Kilmann, 1977). Researchers in the field of behavioral medicine (the application of behavioral principles in medical research and practice) have long been interested in the psychological parameters of the surgical process. Researchers have related postoperative recovery to several psychological variables (Glen & Cox, 1968; Martínez-Urrutia, 1975) measured both before and after surgery. As a result of this finding, research has focused upon the identification of groups of patients more likely to experience prolonged or more complicated postoperative course (Andrew, 1970; Dalrymple, Parbrook, & Steel, 1972; Wilson, 1981). More recently, attention has been drawn to postoperative pain, the management of which is a primary concern for health care providers (Scott, Clum, & Peoples, 1983). The reliable identification of patients at risk for higher levels of pain following surgery would undoubtedly prove invaluable in the effort to minimize postsurgical discomfort and maximize the efficient use of medical staff and facilities.

Fortunately, the surgical procedure is one in which research may readily take place. It lends itself well to the collection of data or the implementation of an intervention, both prior to and following a major stressor. Indeed, much of the previous research focuses upon preoperative intervention and its effects upon pre- and postoperative emotional status as well as postoperative indices of recovery (see Mathews & Ridgeway, 1981). Accordingly, the following review will
present data taken from studies in which the primary concern was the assessment of psychological experience, those whose main focus was the relation between those psychological variables and surgical recovery, as well as those studies involving an intervention and the assessment of surgical recovery as a function of that intervention. A general background concerning psychological variables, hospitalization, and surgical outcome, as well as the clinical assessment and determinants of pain, will be provided before looking finally at the research involving preoperative prediction of postoperative pain.

Hospitalization

Hospitalization itself appears to have its own psychological consequences. In a study of 408 hospitalized medical and surgical patients, differences in anxiety were found to relate to the hospital environment and the personality of the patient rather than to their diagnosis or severity of their condition (Lucente & Fleck, 1972). Other researchers have documented depressive symptoms in a substantial number of medical patients. For instance, Rosenberg, Peterson, Hayes, Hatcher and Headen (1988) report that in 71 general medical in-patients, 38% exhibited at least mild depressive symptoms. Additionally, the patient's perception of physician supportiveness and of his or her own illness severity were significant predictors of the severity of those depressive symptoms. Many sources of psychological stress for the hospitalized patient have been identified including unfamiliarity of surroundings, loss of independence, separation from spouse, lack of information, problems with medication and others (Volcier, 1978). In this study, the Hospital Stress Rating Scale (Volcier & Bohannon, 1975) was given to 535 patients, about half of whom were surgical. The
results indicated that higher stress ratings were correlated with higher reported pain levels and poorer reported physical status.

**Psychological Factors and Surgical Recovery**

In addition to the aforementioned variables, patients facing surgery must be prepared to cope with the stress of that procedure. Not surprisingly, in a study of 468 hospitalized patients, surgical patients evidenced more psychological disturbance than nonsurgical medical patients, despite the fact that, on the average, their conditions were rated less serious (Volcier & Burns, 1977).

Anxiety has been a major focus of research and work continues to center upon the relation between anxiety and recovery from surgery. Most commonly, preoperative levels of anxiety or fear have been employed as predictors of postoperative recovery. The latter variable is generally defined in terms of physician ratings of overall physical status following surgery, data from medical chart notes, nurse ratings of postoperative adjustment, length of hospital stay, subjective ratings of pain, pain questionnaires, and number of postoperative analgesics required.

Sime (1976) reported that presurgical fear was positively correlated with postsurgical "negative affect" in 57 female abdominal surgery patients. Johnson, Leventhal, and Dabbs (1971) found that preoperative anxiety predicted the amount of fear on the first postoperative day and also demonstrated a (nonsignificant) trend in the direction of a positive relation with postsurgical pain ratings. Other researchers have also provided support for the relation between anxiety and pain in surgery patients (e.g., Lim, Edis, Kranz, Mendelson, Selwood, & Scott, 1983; Martinez-Urrutia, 1975). These studies will be
presented later when the focus of the review turns specifically to these two variables:

In addition to anxiety, several other preoperative variables have been studied along with their relation to postoperative indices of surgical recovery. Neuroticism (generally measured by the Eysenck Personality Inventory, EPI) is one such variable that has received attention from investigators in the field.

Glen and Cox (1968) investigated 66 surgical patients with duodenal ulcer, using a "late insulin-positive" status at postoperative day 14 as an indicator of poorer recovery. These authors report that a high neuroticism score (EPI) was found in those patients displaying the "late insulin-positive" status. Dalrymple, Parbrook, & Steel (1972) assessed 50 female cholecystectomy patients and found that higher neuroticism scores (EPI) were significantly correlated with higher frequencies of postsurgical chest complications and impairments of vital capacity (the volume of air that can be expelled from the lungs by the most forcible expiration following the deepest inspiration possible; this measure is often used as an indication of general postoperative recovery). The same authors (Parbrook, Steel, & Dalrymple, 1973) later studied 50 male surgery patients and found that neuroticism scores were correlated with pain, number of analgesic injections in the 24 hours following surgery, chest complications, and vital capacity.

Cronin, Redfern, and Utting (1973) administered the EPI to 100 general surgery patients and found that neuroticism scores were correlated with frequency of general complaints, but not with pain complaints or number of analgesics. Ridgeway and Mathews (1982) found no relation between neuroticism scores and postoperative physical
symptoms, nausea, vomiting, sleep patterns, mood state, or pain. More recently, however, Lim et al. (1983), administered the EPI to a sample of 30 upper abdominal surgery patients before their operation and found a significant correlation between neuroticism and postoperative analgesic requirement. In a word, neuroticism has been demonstrated to be a relatively consistent predictor of poorer surgical recovery.

Several researchers have assessed "coping" strategies in surgical patients and compared postsurgical outcome of groups of patients differing in preferred means of dealing with the stress of surgery. The classification of coping style is often quite arbitrary, but generally results in two groups of patients, one on either end of a coping continuum, and sometimes a third or "neutral" group. The groups produced by this assessment are called by several different names that, by and large, exhibit similar patterns of "coping". Common names for these groups are "avoiders", "repressers", or "deniers" and "copers", "sensitizers", or "vigilants" (Mathews & Ridgeway, 1981). "Avoiders" tend to use denial as a defense against stress, respond to inquiry with stereotyped answers, and distance their feelings, while "sensitizers" readily acknowledge their feelings, respond to stress with vigilance and overt anxiety, and are alert to threatening cues (Andrew, 1970; Shipley, Butt, Horwitz, & Farbry, 1978).

Andrew (1970) divided 40 male patients having surgery for hernia repair into "sensitizers", "avoiders", and "neutrals" based upon the Sentence Completion Test (Goldstein, 1959). Within the control group which received no special preparation for surgery, "neutrals" demonstrated the poorest surgical recovery as evidenced by a longer length of hospitalization and more medication usage. "Sensitizers"
showed slightly better recovery than "avoiders" on the same variables. In a study that divided female surgery patients into "copers", "avoiders", and intermediates, DeLong (1971) found that the intermediate (neutral) group exhibited the best recovery in general, followed by the "avoiders" and then the "copers" (sensitizers). Recovery was assessed via a recovery index which included length of stay, patient complaints, and medication usage. Cohen and Lazarus (1973) assessed coping style in surgery patients as well as several postoperative recovery indices including length of stay, number of analgesics utilized, and medical complications. "Vigilants" (sensitizers) were found to exhibit the poorest postsurgical recovery with longer hospital stays and more medical complications while "avoiders" evidenced the most satisfactory recovery.

More recently, Sime (1976) developed a "Preoperative Coping Scale" to assess the degree to which surgery patients sought information concerning surgical variables. Information seeking was presumed to be a major component of "active" coping, while the absence of information seeking corresponded to a "denying" style of coping. The author reported that no relation between information seeking and the postoperative indices of recovery (negative affect, length of stay, number of analgesics used, number of sedatives used) was found. Wilson (1981) assessed the level of "denial" in 70 cholecystectomy and abdominal hysterectomy patients and found that patients with higher "denial" scores had significantly shorter length of stays and used significantly fewer pain medications than those with lower "denial" scores.
Finally, in a recent study, Scott and Clum (1984) divided 64 cholecystectomy and hysterectomy patients into "sensitizers" and "avoiders" based upon a structured interview. Apparently there were no main effects for coping style, though "sensitizers" fared better on outcome measures (McGill Pain Questionnaire, State-Trait Anxiety Inventory, and analgesics required) when utilizing a relaxation intervention.

Taken together, this data would seem to indicate that the best surgical recovery was evident in the "avoiders", while the worst recovery was predicted by a "sensitizing" coping style. These results are not surprising when one considers the data presented above concerning anxiety (a feature of the "sensitizing" style of coping) and its relation with postsurgical recovery (see Mathews & Ridgeway, 1984). There is still, however, quite a bit of discrepancy in results across studies, no doubt due to the somewhat arbitrary means of assessing "coping" (e.g., the Sentence Completion Test). This dilemma is not likely to be resolved, and investigators might be well-advised to utilize more objective means of assessing features of the various coping styles (e.g., the State-Trait Anxiety Inventory).

Several studies have investigated locus of control and its relation to postoperative recovery variables. Generally speaking, locus of control describes the extent to which subjects believe they are in control of their environment and its reinforcements. Locus of control is most often measured by Rotter's Internal-External (I-E) Scale (Rotter, 1966). Investigators have assessed locus of control in an attempt to verify a relation between internal locus and the tendency to actively attempt to control postoperative recovery.
Johnson et al. (1971), examined scores on a short form of Rotter's I-E Scale and postoperative analgesic use in 62 hysterectomy and cholecystectomy patients. Analysis revealed a significant main effect for locus of control with those patients scoring in the "high" range (indicating internal control) utilizing more analgesics than (in decreasing order) those in the "low" and "medium" groups. Conversely, Auerbach, Kendall, Cutler, and Levitt (1976), in their study of 63 dental extraction surgery patients evaluated locus of control as measured by Rotter's scale and subsequent surgeon's rating of adjustment to surgery. No main effect for locus of control was found. Levesque and Charlebois (1977) also failed to find a significant relation between locus of control (Rotter's I-E Scale) and indices of surgical recovery, namely vital capacity, number of analgesics, and length of stay.

As can be seen from this review, the results from quite a few studies have been reported which substantiate significant relations between psychological variables and postsurgical welfare. Although the majority of these focus upon anxiety or a closely related variable (e.g., "neuroticism", "sensitizing" coping style), others have also been investigated (e.g., "locus of control", "extraversion"). Further research is certainly indicated in order to clarify the relation between the aforementioned variables and recovery from surgery.

One particularly salient postoperative recovery variable is that of pain. Research concerning the accurate prediction of postoperative pain is quite important for the appropriate management of surgical patients. This is true not only because early identification of patients at risk for different pain levels may lead to differential (and hopefully, more effective) treatment strategies to minimize patient discomfort, but also
because pain can lead indirectly to postoperative complications. Patients who experience greater levels of postoperative pain are less likely to move and cough sufficiently and are more likely to develop complications, especially those of pulmonary compromise (Parbrook, Steel, & Dalrymple, 1973).

The Clinical Assessment of Pain

The International Association for the Study of Pain Subcommittee on Taxonomy (1979) has defined pain as "an unpleasant sensory and emotional experience associated with actual or potential tissue damage, or described in terms of such damage". Recent research in the study of pain has demonstrated an increasing awareness of the multidimensional and subjective nature of pain as reflected in this definition (Gracely, McGrath, & Dubner, 1978a; Melzack, 1975; White, Bradley, & Prokop, 1985). The accurate assessment of pain is essential for the conduction of research into pain mechanisms and the evaluation of methods to control or alleviate pain (Melzack, 1983). Great strides have been realized in the technology of pain assessment in recent years which allow a more complete measurement of the experience of pain (Brantley & Bruce, 1986). These assessment techniques fall into two broad categories, the assessment of induced pain and the assessment of clinical pain. The former involves the induction of pain states in "normal" subjects (who are otherwise pain-free) within a laboratory environment. The assessment of clinical pain involves the measurement of the pain experience in subjects who are suffering from pain in vivo as a result of some condition such as an acute injury, surgery, a disease state, etc. Both of these types of pain require similar approaches to pain assessment, but since the present study and review
involve the measurement of pain in surgery patients, the emphasis of this section will be upon current available alternatives for the assessment of clinical pain.

Rating Scales. These techniques of pain assessment represent the more traditional (and rudimentary) methods of measuring clinical pain. The numerical rating scales typically consist of a request for the patient to rate intensity of pain along a 0 ("no pain") to 5, 7, 10, or 100 ("extreme pain") point scale. Similarly, the adjective rating scales present the patient with several pain descriptors rank ordered in terms of intensity (e.g., "no pain", "slight pain", "moderate pain", "severe pain"). The use of these scales in pain assessment presents several problems. The primary shortcoming evident in rating scale assessment is that of lack of sensitivity (Huskisson, 1974; Wolff, 1978). This is due mainly to the fact that the number of categories presented must be restricted in order to get efficient discrimination between the categories (Bradley, Prokop, Gentry, Van der Heide, & Prieto, 1981). While it might be suspected that the numeric scales would be less susceptible to this problem, it appears that certain numbers in the continuum are preferred responses and may appear too often to satisfy statistical guidelines for probability and homogeneous distribution (Murrin & Rosen, 1981), thus resulting, again, in a reduction of sensitivity. In addition to these problems, it cannot be assumed that the information gleaned from the use of rating scales is interval data, since it is unknown whether the differences between the categories presented are equal (Gracely, 1979). Efforts to alleviate these drawbacks to the use of rating scales for pain assessment have
resulted in the widespread use of more advanced methods of measurement. One such example is the visual analogue scale.

**Visual Analogue Scale.** The visual analogue scale (VAS) typically consists of a horizontal line (although the vertical is sometimes used), 10 cm in length, with each end of the line representing the extremes of the pain experience and labeled "no pain" and "severe pain". The patient is asked to place a mark on the line which represents his pain severity. A score is obtained by measuring the distance from one end of the line (typically the "no pain" end) to the patient's mark. One obvious advantage of this method of pain assessment is that it is quick and simple to administer. Patients from age 5 to adult can readily understand and complete the measure (Huskisson, 1983). Additionally, the infinite number of points represented by the solid line eliminates the problem of limited categories associated with numerical and verbal scales.

Research to date indicates that the VAS is highly correlated with numeric pain scales (e.g., Kremer, Atkinson, and Ignelzi, 1981; Reading, 1979) and adjective or verbal pain scales (Joyce, Zutish, Hrubes, and Mason, 1975; Kremer et al., 1981; Matyas, 1982; Ohnhaus and Adler, 1975). Syrjala and Chapman (1984) warn, however, against assuming that the VAS and these scales are equivalent. A case in point is the finding of several investigators (Atkinson, Kremer, Ignelzi, 1982; Reading, 1979) that patients often report a lower pain intensity on the VAS than on adjective pain scales. Additional data suggest that the VAS is more reliable (with test-retest correlations as high as .99) and at least as valid as the verbal scales (Joyce et al., 1975; Kremer et al., 1981; Ohnhaus & Adler, 1975; Scott & Huskisson, 1979; Wolff, 1978).
Furthermore, research utilizing analgesics to induce change in pain intensity indicates that the VAS is sensitive to small changes in perceived intensity of pain (Scott & Huskisson, 1976; Twycross, 1976).

Despite the data presented above, the visual analogue scale is not without drawbacks. There is some indication that older patients with limited abstract thinking capability may experience difficulty in completing the scale (Syrjala & Chapman, 1984). In addition, although the correlations between successive administrations of the VAS are typically high, Dixon and Bird (1981) have presented evidence that patients, when asked to reproduce their VAS response, demonstrate a wider variation of reproduction when the original mark appears around 6.2 cm along a 10 cm line. Not surprisingly, less variability becomes apparent when the original response was at the extremes or in the middle. By far the most serious drawback of the VAS is the fact that the scale is unidimensional. Use of the VAS produces one score, primarily reflecting pain intensity, but potentially influenced by affective components of pain (see below). Several alternative strategies to pain assessment have been derived in response to this drawback and these will be presented below.

**McGill Pain Questionnaire.** The McGill Pain Questionnaire (MPQ) consists of 78 adjectives comprising 20 subclasses of verbal descriptors of pain. These descriptors address three dimensions of pain experience: (1) sensory (e.g., temporal, spatial, thermal aspects), (2) affective (e.g., tension, fear, autonomic aspects), and (3) evaluative (subjective intensity). The MPQ provides three pain scores. The Pain Rating Index (PRI) is the sum of the rank values for the descriptors in each of the three classes (plus a "miscellaneous" class) as well as the total across
the entire test. The number of words chosen (NWC) is the sum of the descriptors assigned by an individual to his pain. Finally, the Present Pain Index (PPI) is the rating of the pain at the time of assessment along a 5-point scale from 0 ("No Pain") to 5 ("Excruciating" pain). The questionnaire may be administered orally or in written form, although Wolff (1978) warns that patients with lower educational levels may need a definition of some of the descriptors.

Several investigations of the construct validity of the MPQ have been undertaken. The results of these studies have been generally supportive. Three studies have demonstrated that the PPI and the PRI are sensitive to changes in patients' pain perceptions following the administration of analgesics (Fox & Melzack, 1976; Melzack & Perry, 1975; VanBuren & Kleinknecht, 1979). More importantly, construct validity has been investigated through factor analysis. Studies by McCreary, Turner, and Dawson (1981), Prieto, Hopson, Bradley, Byrne, Geisinger, Midax, and Marchisello (1980), and Reading (1979) have all demonstrated four factor solutions, two of which were comprised solely of sensory and affective category scales (respectively). The Prieto et al. study produced three factors composed entirely of sensory, affective, and evaluative category scales as well as a fourth factor which included both sensory and affective scales. The same investigators attempted a cross-validation study (Byrne, Troy, Bradley, Marchisello, Geisinger, Van der Heide, & Prieto, 1982) in which the same factors were produced except that the affective factor did not reappear in the solution.

Concurrent validity of the MPQ has received some attention. Mendelson and Selwood (1981) correlated VAS pain ratings and PRI scores
(MPQ) of chronic pain patients receiving acupuncture. The measures were taken at three different times during the course of treatment. Results indicated significant correlations between the VAS ratings and all PRI scores at each assessment. Taenzer (1983) administered the MPQ and the VAS to postsurgical patients and found highly significant correlations between the VAS pain scores and the PRI score for each category as well as the total PRI and PPI scores.

The concurrent validity of the MPQ has also been addressed using a discriminant analysis format. Dubuisson and Melzack (1976) administered the measure to 95 patients suffering from one of eight pain syndromes. These included postherpetic neuralgia, phantom limb pain, metastatic carcinoma, toothache, degenerative disc disease, rheumatoid or osteoarthritis, labor pain, and menstrual pain. A multiple group discriminant analysis was performed with the results indicating a significant difference between the pattern of responses reported by each pain group. Further analysis revealed that, based upon the data obtained through the MPQ, 77% of the subjects could be correctly classified according to pain syndrome present. It must be noted, however, that this classification was performed on the original sample and was not cross-validated with a new sample of pain patients.

Surprisingly few reliability studies have been performed on the MPQ. Recently, Graham, Bond, Gerkovich, and Cook (1980) employed cancer patients undergoing training in biofeedback and hypnosis for pain management as subjects in a study of the reliability of the MPQ. Eighteen subjects were administered the MPQ at weekly intervals prior to their intervention. Four assessments were completed for each subject. The mean consistency rating across the first two administrations was
75%. The consistency between the second and third and third and fourth assessments were 66% and 84% respectively. These findings were consistent with the data presented by Melzack (1975) in which consistency ratings averaged 70.3% over three administrations within one week, although only 10 subjects were utilized. Obviously, the data concerning the reliability of the MPQ are sorely lacking. Much continued research is needed to assess reliability across greater sample sizes utilizing a variety of pain patients.

**Cross-Modality Matching.** Cross-modality matching (Gracely, McGrath, & Dubner, 1978a; Tursky, 1976) represents an attempt to provide relatively bias-free ratio scales for the quantification of the pain experience. This method is based upon the psychophysics research performed by Stevens (1975) and has been validated primarily in the laboratory (Syrjala & Chapman, 1984). Briefly, the assessment involves the presentation to the subject of a pain descriptor taken from a list of such adjectives, typically based upon the work of Melzack and Torgerson (1971). The subject is asked to assign a value, usually designating a number or drawing a line, that represents this reference descriptor. Next, the rest of the pain adjectives are presented and a value assigned in proportion to that given the reference descriptor. This procedure is followed for each set of descriptors representing two or three factors (i.e., sensory, affective, and intensity factors). With this procedure, the descriptors can not only be ranked (e.g., from least to most severe pain intensity), but can also be assigned numerical values reflecting the adjective's position along the continuum and its relative "spacing" in regard to the other descriptors. In this way, several statistical problems associated with category scaling
techniques such as the MPQ are purportedly absolved. These include bias due to stimulus frequency, range and distribution effects, as well as category end effects (Gracely et al., 1978a).

In addition to this assessment, it has been recommended that a cross-modality matching calibration procedure also be utilized. This procedure is similar to the above protocol except that a quantifiable source of painful stimulation is administered (e.g., electric shock) at various intensities and in random order. The subject assigns values (numbers, lines, etc.) to these stimuli and the results provide an index as to the individual's ability to reliably judge differing levels of nociceptive impact (Tursky, Jamner, & Friedman, 1982).

The cross-modality matching paradigm for the assessment of pain has not emerged without criticism. Recently, Hall (1981) has presented evidence questioning the assertion that this procedure indeed produces "bias-free", ratio data. In response, Gracely and Dubner (1981) have clarified their position that cross-modality matching provides data that is "relatively bias-free" in that they are "less sensitive" than category scales to sources of bias. These authors go on to say that the question of whether or not their assessment produces ratio scale data is an issue that "probably cannot be either proven or disproven" and that they have only once reported a statistical analysis which assumed that the data was ratio data.

As mentioned above, the cross-modality matching procedures have been used primarily for experimental pain assessment. Reliability and validity studies in clinical populations are sorely needed. Test-retest reliability scores for cross-modality matching have been presented by Gracely et al. (1978a) and have ranged as high as .98, but these were
based on a very small sample of subjects tested twice, 7 days apart. Validity for this procedure has been asserted through several studies that have demonstrated a differential effect of pharmacologic agents upon the data obtained through cross-modality matching techniques (Gracely et al., 1978b; Gracely, McGrath, & Dubner, 1979). The results of these studies indicated that diazepam (a commonly prescribed anxiolytic) reduced the response to affective descriptors of the pain experience (tooth pulp stimulation) while having little effect upon the responses to the sensory intensity descriptors. Conversely, fentanyl (a narcotic) reduced the response to the sensory intensity descriptors elicited by painful electrical or thermal stimulation but had little effect upon the response to the affective descriptors.

Determinants of Pain

Through years of research, it has been firmly established that the experience of pain is influenced by a myriad of factors other than the physiological stimuli resulting from tissue damage or threat of such damage. These can be grouped into three broad categories which include (1) demographic and cultural factors, (2) general psychological variables (e.g., cognitive variables, "coping style", anxiety, etc.), and (3) a more recent focus, learning (or behavioral) factors. This section provides a brief but succinct review of these factors in order that the reader may become familiar with the array of variables impinging upon an individual's experience of pain.

Demographic and cultural factors. Research investigating demographic and cultural variables and their influence upon pain have revealed some interesting findings. Woodrow, Freidman, Sieglaub, and Collen (1972) studied over 40,000 subjects and their response to
experimental pain (increasing pressure on the Achilles tendon). The authors found that males evidenced a higher pain tolerance than females. Additionally, younger subjects tolerated more pain than older subjects. Whites had the highest pain tolerance with Blacks and Orientals next, respectively. Additional studies focusing upon sex differences have yielded mixed results with regard to pain threshold (Della Corte, Procacci, Bozza, & Buzzelli, 1965; Notermans & Tophoff, 1967), but are typically in concordance with the results of Woodrow et al. with regard to pain tolerance. For instance, in a study employing electric shock, Notermans and Tophoff (1967) demonstrated a higher pain tolerance in males than in females. Similar results were obtained in another study of pressure stimulation by Merskey and Spear (1964). Clinically, females are reported to outnumber men in terms of incidence of abdominal pain, temporomandibular joint pain, myofascial pain dysfunction syndrome, and headache (Bakal, 1975; Laskin, 1969; Merskey & Spear, 1967; and Robins, 1973).

Research concerning age differences in the pain experience is much less conclusive with some investigators (e.g., Woodrow et al., 1972) reporting a decrease in pain tolerance with age, some reporting an increase in pain threshold and tolerance with age (Chapman & Jones, 1944; Procacci, Bozza, Buzzelli, & Della Corte, 1970) and others reporting no age differences (Hardy, Wolff, & Goodell, 1952; Notermans, 1966). Clark and Mehl (1971) have presented evidence to suggest that increases in pain threshold associated with increasing age is mostly accounted for by the reluctance to label noxious stimulation as pain.

Other studies have revealed that individuals from large families report lower pain levels than those from families with one to three
children in response to a cold pressor test (Sweeney & Fine, 1970), while firstborn and only children appear to have the lowest pain tolerance (Schachter, 1959).

Research has also revealed significant cultural differences in the experience of pain. For instance, Hardy, Wolff, and Goodell (1952) found that levels of radiant heat that were reported as being painful by subjects of Mediterranean descent (e.g., Italians, Jews) are described as warmth by Northern Europeans. In a study involving the assessment of tolerance to a painful electric shock and cultural attitudes toward pain, Sternbach and Tursky (1965) found that different ethnic groups differ in response to pain stimuli. The investigators report that the Yankee subjects (white, Anglo-Saxon, protestant) tended to be "matter-of-fact" in their attitude toward pain while the Jewish subjects were apprehensive. The Italians focused upon the pain in its present state and sought immediate relief, while the Irish subjects were stoic and did not express emotions concerning pain. Additionally, the Italian subjects tolerated less pain than the other subjects.

Zborowski (1952) studied several ethnic groups and their response to clinical pain in a hospital setting. The Yankee patients tended to be optimistic about the implications of the pain and to focus less on pain relief while the Italian patients again focused primarily on the immediate attainment of symptom relief. The Jewish patients tended to be skeptical about and concerned about pain even after relief. Social behavior was also influenced differentially by culture. The Jewish and Italian patients tended to seek support and sympathy from others while the Yankees tended to withdraw.
General psychological variables. Researchers have long been aware of another set of important variables which influence the experience of pain, namely cognitive variables. One cognitive variable of note is that of the placebo (or the effect of "expectancy"). A placebo is "a substance given for a purpose for which it has no pharmacologic effect" (Norton, 1982). Beecher (1956, 1960, 1972) has demonstrated that placebos are effective in reducing pain in approximately 35% of the clinical cases studied but only 3% of the experimental cases (e.g., radiant heat, electric shock, muscle ischemia). He attributes this difference to the reactive effects of psychological factors such as anxiety that are present in the clinical situation but absent in the experimental one. It appears that the placebo is acting upon these psychological factors to effect its analgesic action. Other research has demonstrated that placebo medication can be up to 56% as effective as morphine in producing pain relief (Evans, 1974).

Pain tolerance has also been manipulated through information and distraction. Buss and Portnoy (1967) successfully raised the (experimental) pain tolerance level of male college students by informing some that Russians can tolerate more pain than Americans and others that women could stand more pain than men. Blitz and Dinnerstein (1971) demonstrated that cognitive distraction techniques could increase the pain threshold (the level at which pain was identified) but not pain tolerance. Subjects were administered a cold pressor test and, in one condition, asked to state when they felt pain and, in another condition, asked to focus upon the temperature of the water, imagine a hot day, imagine that the water is refreshing, etc. The latter set of instructions produced a significant increase in the pain threshold level.
but the amount of time at which the subject could no longer stand the
pain was not altered. Other studies have achieved similar results using
cognitive strategies such as emotive imagery (Horan & Dellinger, 1974)
and imagery of pleasant events (Chaves & Barber, 1974).

The relation between introversion-extraversion, neuroticism and
pain has also received attention in the experimental literature. The
Eysenck Personality Inventory (EPI; Eysenck & Eysenck, 1968a) and the
Eysenck Personality Questionnaire (EPQ; Eysenck & Eysenck, 1975), a more
recent version of the EPI, measure two independent dimensions of
personality: extraversion and neuroticism. The extraversion dimension
reflects the degree to which the subject is outgoing, cheerful,
sociable, and uninhibited (Kline, 1983). The subject scoring high on
this dimension is carefree, easygoing, uninhibited, outgoing, impulsive,
likes to laugh, and tends to be aggressive and lose his temper quickly
(Eysenck & Eysenck, 1968a). Neuroticism reflects worry, nervousness,
anxiety, and mood instability (Kline, 1983). The subject scoring high
on the neuroticism dimension typically exhibits emotional lability and
overreactivity, tends to be emotionally overresponsive, and may voice
vague somatic complaints such as headaches, backaches, sleep problems
and digestive tract problems (Eysenck & Eysenck, 1968a). Additionally,
Eysenck views this personality dimension as a primarily inherited
lability of the autonomic nervous system with high neuroticism scores
associated with greater responsivity, specifically of the sympathetic
nervous system (Eysenck, 1963, 1967). There appears to be substantial
data supporting the notion of the heritability of neuroticism (Fulker,
1981); however, support for differential psychophysical responsiveness
and autonomic activation along the neuroticism dimension has not been
demonstrated consistently (Stelmack, 1981). As one might suspect, neuroticism has been found to correlate highly (upper .70s) with measures of trait anxiety such as the Taylor Manifest Anxiety Scale and the IPAT Anxiety scale (Bull & Strongman, 1971; Meites, Lovallo, & Pishkin, 1980; Rath, 1978).

Lynn and Eysenck (1961) demonstrated a significant positive correlation between extraversion and radiant heat pain tolerance and a significant negative correlation between neuroticism and pain tolerance. The authors present patients high in neuroticism as characterized by autonomic lability and postulate that a lower pain tolerance reflects this autonomic reactivity which "summates" with the physiological stimulation produced by the pain itself. In a later study, Haslam (1967) used radiant heat to demonstrate a significantly lower pain threshold for introverts than extroverts. On the other hand, Levine, Tursky, and Nichols (1966) failed to find any relation between extraversion and neuroticism and pain tolerance of electric shock. Clinically, Bond and Pearson (1969) administered the Eysenck Personality Inventory to women with advanced cancer of the cervix. The data revealed that women who experienced pain but did not tell the staff (and thus received no analgesics) tended to have higher neuroticism scores but lower extraversion scores. Those that experienced pain and received analgesics (willing to communicate and complain of pain) tended to have both higher neuroticism and higher extraversion scores.

Some studies have divided subjects into categories depending upon how they react to painful stimulation. Petrie (1967) divided subjects into augmenters or reducers. Briefly, each individual is thought to exhibit a "characteristic perceptual reactance" which varies along a
continuum from those subjects who augment- or subjectively increase perceived stimulation- to those who reduce- or subjectively decrease perceived stimulation. The category to which any individual belongs is assessed by a complicated procedure involving the estimation using the left hand of the size of a reference block which is held in the right. The degree of under or overestimation determine the subject's characteristic perceptual "type".

Petrie found that, when using radiant heat as a source of painful stimulation, reducers tolerated more stimulation than augmenters. Other investigators have obtained similar results using electric shock (Dinnerstein, Lowenthal, Marion, & Olivo, 1962). Another coping continuum that has been investigated is that of "sensitizers" or "copers" versus "repressors" or "avoiders". Sensitizers tend to respond to painful stimulation with active attempts to cope with the discomfort while "avoiders" tend to use denial and avoidance strategies to cope with pain (see earlier discussion, p. 5).

Davidson and Bobey (1970) classified subjects as repressors or sensitizers via the Repression-Sensitization Scale (Byrne, 1961) and exposed them to two sessions of painful stimulation using radiant heat and pressure stimulation. Sensitizers reacted similarly during both exposures with no apparent change in pain tolerance. Repressors, on the other hand, recorded a higher pain tolerance than sensitizers during the first period of stimulation, but evidenced a significant decrease in tolerance in the second period. These results were replicated by Neufeld and Davidson (1971).

In the past, emphasis has been placed upon other psychological variables such as anxiety and depression and their impact upon the pain
experience. However, there appears to be a great deal of inconsistency in the definition and assessment of these variables and, therefore, the interpretation of research findings can be difficult. The general results of this research will be summarized below with a focus on the difficulties inherent in their application to pain patients.

The relation of both state and trait anxiety to pain has been investigated in the laboratory as well as in the clinic. Laboratory research (Bobey & Davidson, 1970; Bowers, 1970; Clark & Goodman, 1974; and Haslam, 1966) has generally supported the conclusion that the greater the anxiety, the lower the pain threshold and tolerance (Sternbach, 1968). Recently, Malow (1981) questioned the validity of laboratory studies of anxiety and pain on the grounds that most studies do not verify through both verbal and physiological indices the actual existence of anxiety in the subject population. Malow employed signal detection theory and analysis which allows an assessment of both stimulus discriminability and response bias. In this study involving focal pressure (experimental) pain, he found that the induction of anxiety did not alter pain threshold (elapsed time between stimulus onset and report of pain), but decreased subject discriminability of pain and tendency to report sensations as painful.

Data obtained from psychiatric populations have revealed a high incidence of pain (as high as 65%) in psychiatric populations in general (Spear, 1964, 1967) as well as a strong relation between pain complaint in patients with anxiety and neuroses, especially hysteria (Merskey, 1965a, 1965b; Spear, 1967). The majority of data supporting the influence of anxiety upon pain has been reported in studies of clinical pain, particularly surgery patients. The research in this area provides
evidence that patients with higher levels of trait or state anxiety tend to evidence an increased pain reactivity. A thorough treatment of this literature will be presented elsewhere in this paper.

Depression appears to be an infrequent correlate of acute pain, but is a generally accepted feature of the chronic pain syndrome (Bonica, 1979; Shacham, Dar, & Cleeland, 1984). The nature of depression renders it an unlikely candidate for studies of experimental pain and, not surprisingly, most of the studies of depression and pain focus upon clinical pain. Pain is a frequent complaint in depressed patients (Gallemore & Wilson, 1969; Von Knorring, 1975; and Ward, Bloom, & Friedel, 1979). These studies report an incidence of pain complaint in 30 to 100% of depressed subjects. Furthermore, research has shown that the percentage of chronic pain patients evidencing clinically diagnosable depression ranges from 31-100% (Kralinger, Swanson, & Maruta, 1983; Large, 1980; Lascelles 1966; and Lindsay & Wyckoff, 1981). There is considerable debate as to the question of whether the depressive symptomatology predates the pain complaints or vice versa (Blumer & Heilbronn, 1982; Turk & Salovey, 1984). Retrospective data presented in two studies designed to address this issue reveal that approximately 50% of depressed patients with chronic pain experienced simultaneous onset of the two conditions, while 38-46% developed depression after the onset of pain (Bradley, 1963; Lindsay & Wyckoff, 1981).

In considering the existence of any relation between depression and chronic pain, a recent, extensive review of the pertinent research led Romano and Turner (1985) to describe the question as a "controversial issue which empirical studies have failed to resolve completely".
Partly as a result of the difficulties inherent in defining and assessing emotional states and constructs such as anxiety, depression, and neuroticism, research in the psychology of pain has begun to focus upon the application of behavioral principles to the assessment of the pain experience.

Learning and behavioral factors. The recent promulgation of the behavioral approach to pain research stems primarily from the work of Fordyce (1978, 1983) who conceptualizes pain, particularly chronic clinical pain, in terms of overt, observable behavior. For instance, the pain experience may be described in terms of grimaces, moans, rubbing or holding the affected area, pain verbalizations, etc. These behaviors are conceived to be under respondent or operant control. Briefly, respondent pain behavior occurs when a nociceptive (painful) stimulus reliably results in a behavioral reaction. Environmental stimuli may become associated with the nociceptive stimulus and eventually elicit the pain behavior without the initial nociception. Operant pain behavior occurs when a behavior is followed by a pleasant event or the avoidance of a negative event.

The primary emphasis of this approach to the pain experience is that an understanding of pain necessarily relies upon attending to what the person does—his overt behavior—as opposed to what he says he is experiencing "inside". Research regarding the evaluation and treatment of pain conditions indicate that environmental contingencies can and do indeed impact upon the incidence of pain behavior emitted by pain patients (Fey & Fordyce, 1983; Fordyce, Fowler, Lehmann, DeLateur, Sand, & Trieschmann, 1973; Roberts, 1983).
Closely related to the behavioral conceptualization of the pain experience is the aspect of social learning and its influence upon pain behavior (Craig, 1978, 1983). The social learning perspective focuses upon the social context as it affects pain experience and expression through the individual's interpretation of painful events, the skills used to control pain, and the impact of the pain behavior upon others. This approach considers the effects of developmental experiences with pain, parental instruction and behavior regarding pain and illness, and observational learning processes. Research in experimental pain and the influence of modeling have demonstrated that pain expression can be altered with tolerant (stoic) or intolerant (hypersensitive) models, affecting both verbal and nonverbal pain behavior (Craig, 1983; Craig & Weiss, 1971, 1972).

The emphasis upon developmental experiences and environmental contingencies in the formulation of current pain and illness behavior has been further bolstered by evidence that pain patients often have parental models for their condition. For instance, Gentry, Shows, and Thomas (1974) found that 59% of their chronic back pain sample had at least one close family member with back pain or another debilitating disease and 23% identified a significant other with back pain unrelieved by conventional medical treatment. Violon and Giurgea (1984) also reported a significantly higher incidence of family members with pain in a group of chronic pain patients compared with a chronic illness (without pain) patient group. Johnson (1968, 1971) found that mothers reporting high levels of dental anxiety often had children who exhibited more negative and uncooperative behavior during examinations and tooth extractions. Similar evidence for shaping and modeling of pain and
illness response has been demonstrated with abdominal pain (Apley, 1975), asthma (Tieramaa, 1979), diabetes (Turkat, 1982), menstrual distress (Brooks-Gunn & Ruble, 1982; Whitehead, Busch, Heller, & Costa, 1986), and healthy individuals (Turkat & Noskin, 1983).

A growing emphasis in research involving patients with pain and other medical problems is that of illness behavior. Mechanic (1962) defined illness behavior as the various ways in which "symptoms may be differentially perceived, evaluated, and acted (or not acted) upon by the individual". Pilowsky and Spence (1981, 1983) utilized this general definition in the construction of the Illness Behavior Questionnaire (IBQ), an extension of previous work aimed at assessing hypochondriasis by questionnaire (Pilowsky, 1967). The IBQ provides a measure of seven aspects of "illness behavior": (1) general hypochondriasis, (2) disease conviction, (3) psychological vs. somatic concern, (4) affective inhibition, (5) affective disturbance, (6) denial, and (7) irritability. Higher scores on these scales indicate abnormal or inappropriate ways of perceiving, evaluating, or acting upon the individual's state of health (Speculand, Goss, Hughes, Spence, & Pilowsky, 1983).

More recently, Turkat and Pettegrew (1983) have defined illness behavior in more objective terms as "an overt behavior performed by an individual which indicates that he or she is physically ill or in physical discomfort". In other words, observable behavior such as limping, grimacing, and taking medicine would be considered illness behavior, while covert behavior such as thoughts or attitudes about illness would not.

The authors reviewed the literature available on "illness behavior" and concluded that the earlier work by Pilowsky and his associates
relied too heavily upon "intrapsychic concepts which have no direct correspondence to socially situated individual behaviors". They next began efforts to construct an assessment instrument for overt illness behavior by generating items based upon clinical observation in both an inpatient and outpatient setting. The ultimate product of their efforts was the construction of the Illness Behavior Inventory (Turkat & Pettigrew, 1983), a 20-item self-report instrument which produces a score for two dimensions of illness behavior: (1) Work-related Illness Behavior and (2) Social Illness Behavior. This inventory will be discussed in more detail in a later section.

Turkat (1982) has argued that the application of learning theory to the understanding of illness behavior is long overdue. Indeed, the data (presented above) in the area of social learning and illness or pain behavior would certainly seem to support the conceptualization of illness behavior as a learned response. Simply put, this model asserts that prior learning history, whether vicarious or operant in nature, establishes a functional relation between the stimulus (illness, pain, etc.) and the behavioral response (illness behavior). Thus, a behavioral response to a current illness stimulus is explained or predicted in terms of the individual's learning history and established behavioral patterns.

Adams (1985) has recently conceptualized chronic headache pain behavior in similar terms. He formulates the entire development of a chronic headache pain syndrome in terms of predisposing, precipitating, and maintaining factors and subsequent elaborations. Predisposing factors include (in addition to biological factors) operant learning and modeling history; precipitating factors are essentially those
surrounding the onset of illness; maintaining factors are operant factors occurring concurrently; and, subsequent elaborations are the emotional and psychosocial sequelae to chronic pain.

Research emphasizing illness behavior in pain patients has begun, but, to date, centers primarily on patients' attitudes about their illness, their perception of the reaction of significant others to their illness, and their view of their current psychosocial situation (Gordon & Hitchcock, 1983; Speculand et al., 1983). Two exceptions include a recent study of current pain experience in 288 college students. The authors report that a significant positive relation exists between the number of pain models in a subject's family and the frequency of the subject's current pain report (Edwards, Zeichner, Kuczmierczyk, & Boczkowski, 1985). Another study (Turkat, Kuczmierczyk, & Adams, 1984) compared nonmigrainous headache sufferers to control subjects. The authors found that headache sufferers reported significantly more immediate family members with headache than controls and that family headache history was a valuable predictor in the discrimination between the two groups. Although these results are consistent with a learning theory model of acquisition of pain complaint behavior, the influence of genetic factors cannot be ruled out (Edwards, et al., 1985; Turkat et al., 1984).

As the above review indicates, factors influencing the experience of pain go far beyond the mere physiological stimulus. These factors may be broadly grouped into demographic and cultural factors, general psychological variables, and learning or behavioral factors. The first two groups have received substantial attention by researchers in years past, while the third group of factors (learning factors) has only
recently gained momentum as a more objective, quantifiable approach to the etiology and prediction of illness behavior in general and pain behavior in particular. Preliminary data suggest that this approach may prove to be an efficient and parsimonious method of delineating those variables, defined objectively in behavioral terms, that influence a given individual's characteristic response to pain.

The following section reviews the research literature to date concerning the preoperative prediction of postoperative pain in surgical patients. The preponderance of data obtained within the realm of demographic and cultural factors as well as general psychological variables is evident, while interestingly, the data in the area of learning factors is conspicuously absent.

**Psychological Factors in the Prediction of Postoperative Pain**

**Demographic factors.** A closer look at the research involving the preoperative prediction of postoperative pain reveals that demographic correlates to pain are not consistently reported. Among those studies reporting such data, several findings emerge. Wolfer and Davis (1970) assessed 146 gynecological and abdominal surgery patients before their operation and found that women exhibited a lower preoperative pain tolerance than men and received significantly more postoperative analgesic medications. Although the women in the study reported higher amounts (duration) and intensities (severity) of pain than men, these differences were not statistically significant. Recently, Taenzer, Melzack, and Jeans (1986) also found that, in their sample of 40 cholecystectomy patients, females required significantly more postoperative analgesics than men but did not report significantly
different levels of pain on self-report measures (i.e., McGill Pain Questionnaire, visual analogue scale of pain).

The data concerning age and postsurgical pain are mixed. Some researchers have been unable to demonstrate a relation between age and pain following surgery as measured by the MPQ (McGill Pain Questionnaire) and the number of administrations of analgesics required (Scott, Clum, & Peoples, 1983). On the other hand, when Taenzer et al. (1986) used the MPQ, a visual analogue scale of pain, and analgesics administered as postoperative pain measures, they noted that age was a significant negative correlate with analgesic requirement, but was not related significantly to the other pain measures.

Bruegel (1971) investigated socioeconomic status (SES) in surgical patients and found that the higher the SES, the higher the amount of postoperative analgesic medication received. Closely related (but with contradictory results) is the study by Taenzer et al. (1986) in which education level was found to be negatively correlated with self-report measures of pain following surgery (the pain Rating Index of the MPQ and scores from a visual analogue scale of pain).

Some additional research has focused upon the number of prior surgeries a patient has experienced as well as the amount of accurate information the patient has acquired concerning surgery. The findings, however, are equivocal. Bruegel (1971) found no relation between previous surgery experience and postoperative pain as measured by the Chambers-Price Modified Pain Scale (Chambers & Price, 1967) and the number of analgesics received during the first 48 hours following surgery. Conversely, Scott et al. (1983) reported that the number of previous surgeries was highly correlated with the postsurgical Present
Pain Intensity score from the MPQ. Interestingly, Taenzer et al. (1986) focused upon two related variables, the number of previous major illnesses and the presence of a chronic pain condition, and reported that both correlated with postoperative visual analogue scale of pain scores.

The data concerning the level of preoperative information (about surgery) and consequent postoperative pain scores have also been inconsistent. Scott et al. (1983) found that patients' scores on a surgery information questionnaire (derived by the authors) correlated significantly with the postsurgical Present Pain Intensity (MPQ) score as well as the number of postoperative analgesics required. Sime (1976) reported no relation between level of information and postoperative analgesic requirement (no other pain measures were taken).

**General psychological variables.** Several psychological variables have emerged as relatively consistent predictors of postoperative pain. For instance, state (situational) anxiety seems to be quite consistent in predicting pain following surgery.

Martinez-Urrutia (1975) examined anxiety and pain levels in 59 male (unspecified) surgery patients. The author administered the Melzack-Torgerson Pain Questionnaire, the State-Trait Anxiety Inventory (STAI), and a "Fear of Surgery Scale" apparently developed for this study. The Melzack-Torgerson Pain Questionnaire is comprised of 16 subscales under four major categories of pain description: sensory, affective, evaluative, and intensity. All tests were administered the day prior to surgery and 10 days after surgery. Unfortunately, no predictive analyses were performed. Correlational analyses revealed that
postoperative state anxiety correlated significantly with sensory component pain scores, also obtained postoperatively.

Chapman and Cox (1977) reported the results of a large study which assessed the pattern of change of anxiety, depression, and pain in kidney donors, kidney recipients, and general surgery patients. As part of a larger subject pool, the investigators assessed 44 general surgery patients. These subjects were administered the STAI on the day before surgery and on postoperative day 1 and day 3. Pain was assessed via a rating scale in which the patient was asked to rate his level of pain from 0 ("no pain") to 100 ("unbearable pain"). Additionally, a 20-item pain questionnaire, derived by the first author and similar in format to the STAI was given. The authors report that, consistent with previous research state anxiety was positively and significantly correlated with pain scores for the two postoperative days. Postoperative pain was not predicted from preoperative state anxiety.

More recently, Lim et al. (1983) studied 34 patients admitted for upper abdominal surgery (cholecystectomy and partial gastrectomy). This study was methodologically superior to the two previously reported in that a more homogenous patient group controls for differences in surgical procedures (e.g., incision site and size, suture requirements, and organ displacement required) and their consequent impact upon postoperative recovery variables (Mathews and Ridgeway, 1984). On the day prior to surgery, the patients were administered the Eysenck Personality Inventory, the STAI, and Zung's Self-Rating Depression Scale (Zung, 1965). Postoperative pain indices included a visual analogue scale (VAS) administered at 2, 4, 6, 24, and 48 hours after surgery. The scores were averaged to form one single VAS pain rating. The second
postoperative pain variable recorded was 48 hour cumulative morphine requirement (M48). Analyses revealed a high correlation between VAS and M48, so the authors used only the M48 as an indicator of pain in the subsequent analyses. The results revealed that preoperative state anxiety correlated significantly with postoperative M48. These data suggested that postoperative pain parameters might indeed be predictable from preoperative levels of state anxiety.

Scott et al. (1983) contributed further support for this notion with a study including 48 cholecystectomy patients. Preoperative measures included the McGill Pain Questionnaire (MPQ), the STAI, the Fear of Surgery Question originally employed by Martinez-Urrutia (1975), and a Surgery Information Questionnaire. Postoperative assessment included the MPQ, the state form of the STAI, the Fear of Surgery Question, and the number of administrations of analgesics. Analyses revealed that preoperative state anxiety was significantly correlated with postoperative Present Pain Intensity scores (MPQ), but not with other MPQ scores nor postoperative analgesic requirement. Unlike most of the studies presented in this review, the authors reported the results of analyses beyond simple product moment correlations between preoperative predictors and postoperative indices of pain. Stepwise multiple regression analyses of the postoperative self-report measures of pain revealed that the postoperative Pain Rating Index (MPQ) was predicted significantly only by the preoperative Pain Rating Index. More germane to the present review, postoperative Present Pain Intensity (MPQ) was predicted significantly only by two variables, the first of which was scores on the Surgery Information Questionnaire and second, preoperative state anxiety (STAI).
The most recent study was performed by Taenzer et al. (1986) who assessed 40 cholecystectomy patients. Preoperative measures included the STAI, Beck Depression Inventory (BDI, Beck, Rush, Shaw, & Emery, 1979), Eysenck Personality Inventory (EPI), Rotter Locus of Control Scale, Health Locus of Control (HLOC, Wallston, Wallston, Kaplan, & Maides, 1976), and the Marlowe-Crowne Scale (Crowne & Marlowe, 1960) to assess repressing-sensitizing defensive (coping) style. Other preoperative measures included the Medication Bias Assessment, a visual analogue scale format for answering one question (not presented in the publication) regarding the subject's attitude toward taking medication, and the Wolfer-Davis Scale (Wolfer & Davis, 1970), a 9-item inventory devised to assess the patient's perception of preoperative physical status. Postoperative pain was assessed via a visual analogue scale of pain, the MPQ, and analgesics administered postoperatively (converted to morphine equivalents). Interestingly, the results of this extensive study revealed that preoperative state anxiety was significantly correlated to postoperative analgesic requirement, but not to any of the other pain measures.

Trait or "characterologic" anxiety has also been a frequent predictor of postoperative pain, though not with the consistency of state anxiety, as demonstrated by the absence of significant predictive value in some studies. Bruegel (1971) reported the results of a study in which 85 abdominal and hernia surgery patients were assessed prior to surgery. The IPAT Anxiety Scale Questionnaire was administered presurgically to assess the level of trait anxiety present. Ratings of pain were established using the Chambers-Price Modified Pain Scale administered 32 hours after surgery. Also obtained was the number of
analgesics received during the first 48 hours following the operation. No significant relation between preoperative anxiety (IPAT) and 32 hour pain score or 48 hour number of analgesics was found. Since the IPAT Anxiety Scale measures a trait or "characteristic" level of anxiety, Bruegel concluded that this type of anxiety did not significantly influence postoperative pain.

Johnson, Leventhal, and Dabbs (1971) assessed postoperative pain in 62 female abdominal hysterectomy and cholecystectomy patients. Preoperative assessment included a scale composed of nine items selected from Taylor's Manifest Anxiety Scale (MAS). The items were selected from the MAS (a trait measure of anxiety) if they "reflected sensitivity to one's emotional response". Some of the items were also reworded so that there would be a balance in items scored positively and negatively in the anxious direction. Obviously, such changes in the structure of an established assessment instrument like the MAS render the results comparable to that of a newly derived instrument. They must be interpreted with due caution, not as if they were obtained from the original scale. The postoperative pain variables in this study were self-report pain ratings for the worst pain felt and least pain felt during the postoperative period. This rating was assessed via a 0-100 point "pain thermometer" anchored at 0 points ("No pain or discomfort whatsoever") and 100 points ("The worst pain you can imagine"). Additionally, the number of analgesics administered every 24 hours postoperatively was recorded. The authors reported that preoperative trait anxiety (as measured by the shortened MAS) was not related to postoperative pain ratings. No data were reported for preoperative anxiety and postoperative analgesic consumption.
Martinez-Urrutia (1975), in a study mentioned previously, administered the STAI and the Melzack-Torgerson Pain Questionnaire both the day before and 10 days after surgery. The analyses revealed a significant main effect for STAI (trait) scores reflecting the tendency for high trait anxiety subjects to have higher sensory component pain scores than the low trait anxiety subjects. Unfortunately, no predictive analyses were performed and therefore, no conclusions can be drawn concerning postoperative pain reports and their relation to preoperative psychological variables.

In the Chapman and Cox (1977) study, presurgical trait anxiety (STAI) scores were correlated significantly with pain scores on postsurgical day 1 but not day 3. Pain was assessed via a pain rating scale and a 20-item pain questionnaire. This pain questionnaire was derived by the first author but was, unfortunately, not presented in the publication. An additional problem evidenced by the study was the combination of the two scores (pain rating and pain questionnaire) into a "pain index" score for each postoperative assessment day. Thus, the final pain score reflected an assessment of a complex phenomenon that was not the result of established protocol for that assessment. This was unfortunate not because a newly derived measure was utilized, but because a widely used and accepted assessment (the pain rating) was combined with the new measure and not analyzed separately. Despite these methodological concerns, the data presented in this study suggested that trait anxiety scores might be a useful predictor of postoperative pain.

Similar results were reported in the Lim et al. (1983) study of upper abdominal surgery patients. These researchers found preoperative
trait anxiety (STAI) to be significantly correlated with postoperative analgesic requirement. Interestingly, Scott et al. (1983) reported that preoperative trait anxiety (STAI) was related to preoperative Pain Rating Index and Present Pain Intensity (both from the McGill Pain Questionnaire) but to none of the postoperative pain measures. It is worth noting that the postoperative pain assessment was done on the fifth postoperative day whereas the vast majority of researchers in the field collect this data on the first through third postoperative days.

For instance, Taenzer et al. (1986) assessed postoperative pain on the first, second, third, and sixth day following surgery and averaged those results. The authors found that preoperative trait anxiety (STAI) correlated significantly with postoperative Present Pain Intensity (MPQ), Pain Rating Index (MPQ), visual analogue scale of pain, and number of analgesics required. These authors also provided more extensive analyses in the form of hierarchical step-wise multiple regression analysis for each postoperative pain assessment. Preoperative trait anxiety emerged as the first significant predictor of the postoperative Pain Rating Index (MPQ), the second for postoperative Present Pain Intensity (MPQ), and the third significant predictor for postoperative analgesic requirement. Trait anxiety was not a significant predictor of visual analogue scale of pain scores. Thus, despite some inconsistency, the majority of the research findings to date seem to indicate that trait anxiety scores are relatively reliable predictors of postoperative pain variables.

Neuroticism score, which tends to be highly correlated with trait anxiety score, has also been demonstrated as a valuable predictor of postsurgical pain. Neuroticism is typically assessed via one of
Eysenck’s personality assessment instruments, most commonly the EPI (Eysenck Personality Inventory). Parbrook, Steel, and Dalrymple (1973) examined postoperative pain in 50 male peptic ulcer surgery patients. Preoperative assessment included the Eysenck’s PEN Inventory which produces scores for three personality dimensions analogous to those produced by the EPI (psychoticism, extraversion, and neuroticism). Postoperative variables included a visual analogue scale with "I have no pain" and "My pain is as bad as it can be" as the left and right hand anchors. Other assessments were vital capacity (impairment of which can be indicative of painful breathing) and number of narcotic analgesic injections, all taken 24 hours following surgery. The authors report significant, positive correlations between the neuroticism score and visual analogue scale of pain scores, vital capacity impairment, and number of analgesic injections required. Boyle and Parbrook (1977) later reported that, combining the data from four of their studies on surgery patients (including the one above), neuroticism was significantly correlated with both vital capacity and visual analogue scale of pain scores in 190 surgery patients.

In the Lim et al. (1983) study, the EPI was also given preoperatively to upper abdominal surgery patients. The authors report that (along with trait and state anxiety), neuroticism scores correlated significantly with morphine requirement in the 48 hours following surgery. No multiple regression or other higher order analyses were performed. Similar findings were reported in the Taenzer et al. (1986) study in which cholecystectomy patients were administered the EPI prior to surgery. Analyses revealed that neuroticism was significantly
correlated with postoperative Present Pain Intensity (MPQ), visual analogue scale of pain scores, and analgesic requirement.

Preoperative fear has been assessed in some studies, but presents a cloudy picture when comparisons are attempted due primarily to the fact that often, measures of fear are derived by the authors of the respective studies. One exception is found in the study by Johnson et al. (1971). These authors administered the Mood Adjective Checklist (MACL, Meyers, 1966) preoperatively to 62 hysterectomy and cholecystectomy patients and did not find a significant relation between fear and postoperative medication usage. Preoperative MACL fear scores did, however, predict postoperative pain ratings (assessed via a 100-point rating scale) in that "low" scorers had significantly lower pain ratings than "high" scorers. Sime (1976) used a derived rating scale to measure preoperative fear and found a significant main effect for this variable when using number of postoperative analgesics as a dependent variable. These findings have not been consistently replicated, however. Other investigators have failed to demonstrate a relation between preoperative fear and postoperative pain using derived measures of fear (e.g., Scott et al., 1983; Wilson, 1981).

Depression has also been investigated as a preoperative predictor of postoperative pain. Thus far, the results have not suggested that depression scores are reliable predictors of pain following surgery. Wise, Hall, and Wong (1978) administered the Symptom Checklist (SCL-90, Derogatis, Rickels, & Uhlenruth, 1974) to 33 cholecystectomy patients prior to their surgery. The authors reported that preoperative depression score (SCL-90) was significantly correlated with postoperative analgesics utilized but not with postoperative visual
analogue scale of pain scores. Conversely, in the Lim et al. (1983) investigation, the researchers found that preoperative depression measured via the Zung Self-Rating Depression Scale was not significantly correlated with postoperative narcotic analgesic requirement.

Taenzer et al. (1986) included the Beck Depression Inventory (BDI, Beck, Ward, Mendelson, Mock, & Erbaugh, 1961) as a preoperative measure in their extensive study with cholecystectomy patients. Correlational analyses revealed that presurgical depression score was correlated significantly with postoperative Present Pain Intensity and Pain Rating Index scores (both from the MPQ), visual analogue scale of pain scores, and postoperative analgesic requirement. Despite these results, when hierarchical step-wise regression analysis was employed using depression as one of several preoperative predictors, the authors found that scores on the BDI were not a significant predictor of any of the postoperative pain scores.

Finally, one other psychological variable, extraversion, is worth noting in that research has failed to confirm its potency as a predictor of postoperative pain. Although extraversion (Eysenck Personality Inventory) was found by Taenzer et al. (1986) to correlate significantly with postoperative Present Pain Intensity (MPQ) and analgesic requirement, these results were inconsistent with data presented by other researchers. Cronin et al. (1973) found no correlation between preoperative extraversion score and postoperative pain complaint or analgesic requirement. Similarly, Parbrook et al. (1973) were unable to find a significant correlation between preoperative extraversion scores and postsurgical visual analogue scale of pain scores or number of analgesic injections received. Lim et al. (1983) also reported that
presurgical extraversion scores did not correlate significantly with postoperative analgesic requirement. Thus, despite the data presented earlier linking extraversion and pain induced in the laboratory, clinical research with surgery patients has failed to confirm a correlation between these two variables.

Learning and behavioral factors. Earlier mention was made of learning factors present in the review of pain in surgery patients presented above. Although no one has directly assessed learning factors in these studies, several investigators produced significant predictors of postoperative pain that could, conceptually at least, be thought of as "learning" or "behavioral" predictors.

Demographic variables such as sex and socioeconomic status, for instance, could easily be interpreted as reflecting a tendency toward socially learned "roles" that dictate appropriate response to pain and serious illness depending upon one's position along these variables. But even more specific is the finding that factors such as number of previous surgeries or major illnesses, the presence of a chronic pain condition, and a bias toward medication usage may all influence postoperative pain (Scott et al., 1983; Taenzer et al., 1986). Perhaps a patient's experience with previous operations results in a behavioral response to surgery which includes a higher report of pain and request for medications. This pattern could easily be learned via social modeling from other patients or through operant or classical conditioning. In an operant conditioning paradigm, the effects of staff attention to pain complaint and medication administration may function as powerful reinforcers for pain behavior. Additionally, a classical conditioning model would suggest that the hospital room, bed, etc. may
function as a conditioned stimulus which becomes paired with the unconditioned stimulus of postoperative pain and consequently elicits pain behavior. The finding that the presence of a chronic pain condition predicts postoperative pain also supports this hypothesis in that these patients are likely to represent a group of subjects that have learned to respond to illness and discomfort with complaints of pain (Fordyce, 1983; Roberts, 1983). Finally, a bias toward the utilization of analgesics may reflect an "attitude", but in behavioral terms, these subjects have learned to respond to pain or discomfort with medication usage and it is not surprising that they report more pain to medical staff.

Summary. In sum, of the three general areas of pain determinants described above, demographic and psychological factors have been investigated rather thoroughly, with some support for the influence of the first category (mainly sex) and a good bit of support for a few variables in the second (mainly state anxiety, trait anxiety, and neuroticism). Conversely, the third category, learning and behavioral factors, has been virtually ignored with only a few studies indirectly examining variables that might be considered as primarily learned.

This is surprising given the quality of evidence that suggests that learning factors (e.g., learning history, vicarious and operant learning) hold tremendous potential for the understanding and predicting of illness and pain behavior. Certainly, a more complete understanding of the determinants of postoperative pain will be necessary if a therapeutic program is to be designed to effectively target the salient variables (what is the treatment for "neuroticism"?). Indeed, a recent review of research concerning psychotherapeutic techniques and their
effect on postoperative recovery (particularly pain variables), led the authors (Mathews & Ridgeway, 1984) to conclude that cognitive therapy approaches and interventions involving behavioral instructions were most effective in improving recovery. In addition, accounting for the success of the cognitive interventions was their tendency to produce changes in the postoperative behavior of the treated patients, an effect not produced by other strategies such as relaxation. If learning factors do indeed contribute significantly to the etiology of postoperative pain, there is certainly no dearth of behavioral techniques which have been successfully employed with chronic pain patients (Fordyce, 1983) that could be tailored to the case of the problem surgery patient. These might include medication masking, reduction of social attention and reinforcement, teaching of substitute behaviors, or stress management (Fey & Fordyce, 1983).

In a nutshell, no one has examined the influence of behavioral patterns established by the individual in response to previous illness upon the prediction of the behavioral response to a future illness situation (painful surgical trauma). Does past behavior predict future behavior in surgery patients? To date, there has been no investigation of this rather simple hypothesis.

**Purpose of the Present Study**

In response to the almost complete lack of research examining learning factors and postoperative pain, the purpose of the present study, in general, was to assess the relation between illness behavior (an established pattern of responding to illness and discomfort), presence of developmental sick role models, and postoperative pain in surgery patients. Additionally, several variables which were
demonstrated by the review above to be relatively consistent predictors of postoperative pain were included in order to examine their relation to illness behavior. The importance of this assessment was documented in a recent study which demonstrated a significant relation between social learning and menstrual distress (Whitehead et al., 1986). The authors made the following statement concerning the potential relation between psychological variables and illness behavior:

We have shown that social learning makes a contribution to symptom reports ... that may be independent of personality traits such as anxiety, depression, and neuroticism. Additional research is needed to explore possible interactions between personality traits, biological differences between subjects, and social learning of sick role behaviors ... (p.21)

Postoperative pain was fully assessed through established pain assessment procedures taken on 2 postoperative days. These data were thoroughly analyzed in a statistical framework which allowed comparison of the relative efficacy of both illness behavior scores and traditional psychological variables as predictors of each of the several parameters of postoperative pain report.

Specifically, preoperative variables included work-related illness behavior, social illness behavior, familial illness behavior (father, mother, spouse/roommate), state anxiety, trait anxiety, and neuroticism. Other variables included the demographic variables of age, sex, race, education, marital status, number of previous surgeries, and time since last surgery (where applicable). Postoperative pain assessment included the McGill Pain Questionnaire, a visual analogue scale of pain, and a
record of the number of narcotic analgesics required by the patient (expressed in morphine equivalents).

To achieve the stated purpose of the present study, the following two hypotheses were evaluated. First, what is the relation between illness behavior, illness models, and postoperative pain measures? Based upon the review presented above, it was hypothesized that the presence of familial illness models and past illness behavior would significantly predict the postoperative illness behavior of pain complaint with higher levels of the former variables associated with higher reported pain.

Second, what is the relation between these learning factors and the more general psychological measures known to predict postoperative pain? Data were presented above which describe the tendency of individuals scoring high in the psychological measures (state anxiety, trait anxiety, and neuroticism) to also report lower pain threshold, lower pain tolerance, and higher levels of pain in clinical as well as laboratory studies (i.e., exhibit more pain behavior). Therefore, it was hypothesized that the learning (behavioral) scores would be significantly correlated with the general psychological variables. The relation between the two was examined for the existence of a profile of psychological variables associated with high and low scores on the illness behavior measures.

Finally, the data gathered in this study were examined to determine if the prediction of postoperative pain from preoperative illness behavior scores significantly enhanced that provided by consideration of the psychological variables alone. The goal of these analyses was to
determine the optimal combination of psychological measures and illness behavior factors which best accounted for postoperative pain report.

METHOD

Subjects

Subjects for this study were surgery patients scheduled for elective cholecystectomy at one of three Harvard Medical School affiliated hospitals in the Boston, Massachusetts area over a 10 month period beginning in September of 1987. The study sites were Beth Israel Hospital, Brigham and Women's Hospital, and Mount Auburn Hospital. Elective cholecystectomy patients are typically admitted to the hospital on the morning of their surgery, a system which necessitates a prior assessment in which the patient must undergo blood analysis, an EKG, and, in some cases, a chest x-ray. This assessment is scheduled for 2 to 3 days before surgery whenever possible. At this initial hospital visit, patients were asked to participate in a study which involved completing several questionnaires concerning some basic psychological variables, their past experience with illness, their level of comfort both before and after surgery, and several pertinent medical variables. They were told that the goal of the project was to understand more completely the surgery experience from the patient's perspective.

Ultimately, eighty adult elective cholecystectomy patients volunteered to participate in the study. An additional 9 eligible patients refused to participate. Subjects were excluded if they reported a history of hospitalization for a psychiatric or substance abuse disorder, or a history of serious head injury. Subjects were also excluded if they did not speak and read English. The final sample included 38 patients from Beth Israel Hospital, 22 from Brigham and
Women's Hospital, and 20 from Mount Auburn Hospital (total = 80). Their preoperative assessment took place an average of 2.9 days before surgery with a range of 1 to 7 and a standard deviation of 1.3 days. Sixty-four patients were female (80.0%), 51 were married (63.8%), and the age of the subjects ranged from 21 to 83 years with a mean of 42.2 and standard deviation of 14.7 (see Table 1 for demographic characteristics of the patient sample). Seventy-one patients were caucasian (88.8%), 4 were black (5.0%), one subject reported not falling into either category and 4 subjects declined to report their race. The subjects had received an average of 14.8 total years of formal education (standard deviation of 2.9) with individuals ranging from 7 to 20 years. Fifty-eight of the

Table 1
Demographic Characteristics of the Patient Sample

<table>
<thead>
<tr>
<th></th>
<th>M = 42.2</th>
<th>SD = 14.7</th>
<th>Range: 21-83</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Age (yrs.)</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Sex</strong></td>
<td>Male: 16</td>
<td>Female: 64</td>
<td></td>
</tr>
<tr>
<td><strong>Marital Status</strong></td>
<td>Single: 16</td>
<td>Married: 51</td>
<td>Divorced: 8</td>
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<tr>
<td><strong>Race</strong></td>
<td>Caucasian: 71</td>
<td>Black: 4</td>
<td>Other: 1</td>
</tr>
<tr>
<td><strong>Education (yrs)</strong></td>
<td>M = 14.8</td>
<td>SD = 2.9</td>
<td>Range: 7-20</td>
</tr>
<tr>
<td><strong>Native Language</strong></td>
<td>English: 73</td>
<td>Non-English: 7</td>
<td></td>
</tr>
<tr>
<td><strong>No. Previous Surgeries</strong></td>
<td>None: 22</td>
<td>One: 20</td>
<td>Two: 20</td>
</tr>
<tr>
<td></td>
<td>Not reported: 2</td>
<td>Range: 0-9</td>
<td></td>
</tr>
</tbody>
</table>

Note. M = mean, SD = standard deviation.

patients had experienced at least one previous surgery and, in the case of one subject, as many as 9. Of these 58, 4 patients had had surgery in the previous year, 9 in the year prior to that, and 42 received operations prior to the previous two years (3 patients neglected to
record a prior surgery date). Finally, while all subjects spoke and read English, 7 patients reported that it was not their native language.

Assessment Instruments

Illness Behavior Inventory (IBI). The theoretical conceptualization and operational definition underlying the "illness behavior" construct has been discussed earlier; however, a more detailed description of the IBI is in order. This instrument (see Appendix B) was constructed by first generating a list of behaviors manifested by inpatient and outpatient medical clients that were indicative of illness or pain (Turkat & Pettegrew, 1983).

The resulting list of 46 items was administered to 40 graduate students in a six-point Likert scale format anchored with the terms "strong agreement" and "strong disagreement". At this point, the authors desired to eliminate redundant and inferior items and to explore the underlying structure of the data. Factor analysis proved to be an unacceptable technique due to the large number of items and the relatively small sample size (Nunnally, 1978). Thus, Elementary Linkage Analysis (ELA; McQuitty, 1957) was used. ELA employs product moment correlations among a set of items to produce item clusters similar to the factors produced by factor analysis. Each item in a cluster correlates more highly with another item in the cluster than with any item not in the cluster. In the case of the IBI, correlations ("linkages") between items of less than 0.50 were discarded in order to produce strong item clusters and parsimonious representation of the data.

This procedure reduced the original list to 20 items and two item
clusters or factors clearly emerged. The two factors were labelled "Work-related Illness Behavior" and "Social Illness Behavior".

"Work-related Illness Behavior" scores indicate the curtailment of work and activity when feeling ill (slowing or stopping work, staying in bed, and avoiding aspects of one's job when ill). "Social Illness Behavior" denotes illness behavior in social situations (acting more ill than one feels, illness complaints, and bringing up one's illness in conversations).

Further analyses were performed to assess the reliability of the IBI. Internal consistency proved to be strong with the Work-related and Social Illness Behavior factors achieving Cronbach's alphas of 0.89 and 0.88 respectively. Two week test-retest reliabilities for the two factors were also strong at 0.97 and 0.93 respectively. Structural reliability was assessed by comparing the consistency of the data structure produced by scores of two diverse populations: students and low back pain patients. A confirmatory structural analysis revealed a correlation between the structure of the two data sets of .83, indicating good structural reliability across groups.

Validity data has also been reported for the IBI (Turkat & Pettegrew, 1983). Predictive validity appears to be good when assessing students. The IBI significantly predicted the frequency of ambulatory medical utilization, bed disability days, and tendency to seek and receive medication from physicians. Convergent validity has been demonstrated by the ability of the IBI to significantly discriminate between those diabetic neuropathy patients identified a priori by their medical staff as high or low in illness behavior. Additionally, the IBI correlated significantly with concurrent measures of diabetes symptoms,
reduction in usual activities, number of days in bed due to illness, a
disability and (medical) utilization index, and scores on the McGill
Pain Questionnaire (pain in the lower extremities is a frequent
concomitant to diabetic neuropathy).

Familial Illness Behavior Inventory (IBI-F). A review of the
studies which assess the presence or absence of a familial illness
behavior model reveals no established methodology for obtaining this
data. The most common approach is one of asking the patients one or
more questions concerning one or both parents and their tendency to (1)
avoid responsibilities, chores, and obligations when ill, (2) gain
special attention, favor, or other special treatment when ill, or (3)
complain of pain (or illness).

For the present study a familial version of the Illness Behavior
Inventory was constructed by inspection from the questions on the IBI
(see Appendix B). Eleven questions were chosen based upon the
appropriateness of the question when asked from an observer's point of
view. In other words, the question, "I avoid certain aspects of my job
when I'm ill" is an example of an item that was felt to be too difficult
to assess by observation, while "I see doctors often" reflects a more
readily observable event and was subsequently translated into the item
"My father saw doctors often". Three sets of the eleven item
questionnaire, one for father (or significant male caretaker), one for
mother (or significant female caretaker), and one for spouse (or
roommate) comprise the complete Family Illness Behavior Inventory. The
answer format is the same as that of the IBI, namely, a six-point Likert
format anchored with the terms "strong agreement" and "strong
disagreement".
Eysenck Personality Inventory, Neuroticism (EPIn). The dimensions of personality assessed by the EPI (Extraversion or "E", and Neuroticism or "N") have been discussed earlier and will not be repeated here. The EPI is a further revision of the Maudsley Personality Inventory (MPI, Knapp, 1962). The EPI was constructed to eliminate the low but significant correlation between E and N as measured by the MPI, reword items to make them more understandable for examinees with low educational level, add a lie scale to detect "faking good" and introduce two equivalent forms (A and B). The manual reports that the parallel forms correlate .75 for E and .80 for N (Eysenck & Eysenck, 1968a).

Correlational data appear to support Eysenck's assertion that N and E are independent factors. In an American sample, correlations between the N and E scales were +0.01 for form A (N=1,003) and -0.11 for form B (N=239). Seven samples of English subjects (total N=1,478) were assessed and no significant correlations were found. Factor analysis has generally supported the two factor structure of the EPI (Walkey & Green, 1981), particularly with regard to the N scale (Howarth, 1976).

Test-retest correlations are good, ranging from .81 to .85 for each scale of each form, and .84 (N) and .88 (E) for both forms combined. Additionally, N scores have been shown to correlate with depression scores (e.g., Beck Depression Inventory, Zung Self-Rating Depression Scale) and, as mentioned earlier, trait anxiety scores (e.g., Taylor Manifest Anxiety Scale) (Bull & Strongman, 1971; Meites et al., 1980). N scores have also been demonstrated to discriminate effectively between normals and psychiatric patients (Knowles & Kreitman, 1965). Verghese and Abraham (1972) also verified this finding and reported that N scores significantly discriminated between normals and neurotics,
normals and schizophrenics, and schizophrenics and neurotics, with the neurotic patient demonstrating the highest N scores and the normals, the lowest. The authors also noted that N scores fell significantly following treatment. Form A was used for all subjects in the present study.

**State-Trait Anxiety Inventory (STAI).** The STAI (Speilberger, Gorsuch, & Lushene, 1970) is a self-report instrument originally designed to assess anxiety in normal adults. This questionnaire contains two forms with a similar format, one in which the examinee is to respond as he "generally" feels ("trait") and one as he feels "right now" ("state"). The "state" form is designed to assess situational, transient anxiety and apprehension, while the "trait" form targets a more stable, characteristic pattern of anxiety proneness. Each form is composed of statements such as "I feel calm", "I am presently worrying over possible misfortunes", and "I feel nervous and restless". The subject is asked to select one of four responses: "not at all", "somewhat", "moderately so", or "very much so". The responses are scored in the direction of anxiety and the total score can be converted into T-scores or percentiles based upon available norms. Not surprisingly, the test-retest reliability for "state" anxiety scores is low (.16 to .54), while that for "trait" anxiety is considerably higher (.73 to .86) (Anastasi, 1976; Green, 1985). Kuder-Richardson reliabilities are high for both test forms (.83 to .92). Additionally, the "trait" anxiety scores correlate highly with the IPAT Anxiety Scale and the Taylor Manifest Anxiety Scale (.75 and .80, respectively).

**McGill Pain Questionnaire (MPQ).** The MPQ (reviewed above) is a self-report instrument comprised of 78 adjective descriptors of pain.
These descriptors address three dimensions of pain: (1) sensory, (2) affective, and (3) evaluative. A fourth "supplementary" category, the miscellaneous dimension, is also assessed. Descriptors in this category include adjectives that did not belong to the central three dimensions (e.g., cool, cold, freezing). The MPQ produces three pain scores. The Pain Rating Index (PRI) is the sum of the rank values for the descriptors chosen by the patient in each of the above dimension classes of pain as well as the total across the entire questionnaire (PRI sensory, PRI affective, PRI evaluative, PRI miscellaneous and PRI Total). The Number of Words Chosen (NWC) is the sum of the descriptors assigned by an individual to his pain. The Present Pain Index (PPI) is the rating of pain at the time of assessment along a 5-point scale from 0 ("No Pain") to 5 ("Excruciating" pain).

Validity for the MPQ has been established through studies assessing the construct validity (McCreary et al., 1981; Prieto et al., 1980; Reading, 1979), and concurrent validity (Dubuisson & Melzack, 1976; Mendelson & Selwood, 1981; Taenzer, 1983). Less work has been published which addresses the reliability of the MPQ, but the data reported suggest that the MPQ has adequate reliability (Graham et al., 1980; Melzack, 1975). The data obtained from this assessment for the present study includes the Pain Rating Index (PRI) and the Present Pain Intensity (PPI).

Visual Analogue Scale of Pain (VAS). The VAS consists of a 100mm line, anchored on the left by the phrase "No Pain" and on the right by the phrase "Severe Pain". The data obtained from this assessment is the distance (in millimeters) from the left hand end point to the patient's indication of the present level of pain. The VAS (reviewed above) is
obviously a quick and easily administered assessment of pain. Despite its brevity, research has indicated that it is highly reliable (with test-retest correlations as high as .99) and at least as valid as the verbal pain scales such as the MPQ (Joyce et al., 1975; Kremer et al., 1981; Onhaus & Adler, 1975; Scott & Huskisson, 1979; Wolff, 1978). In the present study, it provides a single score indicative of the intensity of the postoperative pain experienced at the time of the assessment.

Narcotic Analgesics Requested (ANLG). Postoperative narcotic analgesics were recorded from the Medications Checklist located in the nurses station of the unit on which the patient was staying. Hospital policy requires that all postoperative narcotic medications be accurately recorded as to patient, time, type of medication, dosage administered and route of administration. These medications were converted into morphine equivalents (Drug Facts and Comparisons, 1988) and recorded as a separate score for each day assessed. Pain medications were available following the surgery, and are routinely administered on a "PRN" or "as needed" basis. Patients are encouraged to request these medications if they need them, although their nurse periodically assesses their clinical condition and may offer analgesics even if unsolicited by the patient. Naturally, the patient may also refuse offered medication.

Procedure

Patients presenting for their preoperative assessment who volunteered to participate in the study were given an informed consent form to sign (constructed from mandatory guidelines according to each individual hospital, see Appendix A), followed by the Initial Visit
Information form (demographic data, see Appendix B), the State-Trait Anxiety Inventory (STAI), the Eysenck Personality Inventory (EPI), the Illness Behavior Inventory (IBI), the Familial Illness Behavior Inventory (IBI-F), the Visual Analogue Scale of Pain (VAS), and the McGill Pain Questionnaire (MPQ). Subsequently, on the day of surgery, the admitting nursing staff was responsible for administering the state form of the STAI to the patient just prior to surgery.

Following surgery, pain assessments were performed on two consecutive days, postoperative day 2 and postoperative day 3. These assessments took place between 2 and 5 o'clock in the afternoon whenever possible. The timing for these assessments was structured following data presented by Taenzer (1983). In this study, the author assessed pain in cholecystectomy patients in the morning and afternoon over a six day postoperative period. The results revealed that the average of the pain measures taken in the afternoon of day 2 and day 3 following surgery were the most representative of the entire postoperative period. Thus, the pain scores obtained in the present study on the two postoperative occasions were averaged to provide pain report scores for subsequent analyses.

Postoperative assessments at each visit included the Visual Analogue Scale of Pain (VAS), the McGill Pain Questionnaire, a record of narcotic analgesics (ANLG) administered in the previous 24 hours, and the time of the most recent analgesic intake. Following the final assessment, the patients were thanked for their participation and, if so desired, a mailing address was obtained in order to send a summary of the study findings to the patient.
RESULTS

For ease of reporting, the following abbreviations will be used in the discussion of the study results: (1) preoperative assessments: state anxiety (STAIs0), trait anxiety (STAIt), neuroticism (EPIn), extraversion (EPIe), EPI lie scale (EPIl), Social Illness Behavior (IBIs), Work-related Illness Behavior (IBIw), total Illness Behavior Inventory score (IBIIt), Familial Illness Behavior (IBI-F father, mother, spouse ratings), and state anxiety just prior to surgery (STAIsl); (2) postoperative assessments: Visual Analogue Scale of Pain (VAS), McGill Pain Questionnaire sensory dimension (MPQs), affective dimension (MPQa), evaluative dimension (MPQe), miscellaneous dimension (MPQm), pain rating index total (MPQpritt), present pain intensity (MPQppi) and narcotic analgesic dosage administered in past 24 hours (ANLG).

Prior to the presentation of statistical analyses, several important aspects of the data are worthy of note. First, there were periodic violations in the protocol for the timing of the postoperative pain assessments. This was due in large part to the fact that patients were sometimes discharged on postoperative day 3 before assessment time. When the patient was aware of an impending early discharge, assessments were performed earlier in the day. Additionally, several patients refused to be interviewed at the proper time but would allow a later assessment. Interviews were coded as to time of day so that the resulting data set could be analyzed both as a whole and as a subset containing only those subjects whose interviews were conducted on both days (i.e., not discharged early) and within the designated time interval of 2 to 5 p.m. Results indicated that the time of day did not correlate significantly with any of the postoperative pain scores (see
Appendix D, Table D.7). Additionally, the results of the analyses of the "on time" subjects and those of the entire data set were generally equivalent except for a tendency for the IBIs to be less efficacious as a predictor of postoperative pain report in the "on time" data and thus to appear in fewer of the final regression models (see Appendix E, Tables E.4 and E.5). It must be noted, however, that the smaller N available for analysis in the "on time" group renders these analyses less powerful and more prone to Type II error. On the other hand, including pain report data that were taken at times outside of the designated three hour time interval might introduce some interpretive difficulty to the final results. It was felt, however that any additional burden of interpretation would be minimal compared to the loss of power that would occur if the entire data set were not used for analysis. Therefore, subsequent analyses will reflect the data obtained for the entire sample.

Secondly, complete data were not available for all subjects due to patient refusal, early discharge, investigator's illness, and medical staff priority (see Appendix C). The latter case occurred in regard to the STAI given before surgery by the nursing staff who were often faced with insufficient time to administer the questionnaire. Since this happened in quite a few instances (23), each subject was given a code of 1 or 0 if he/she had or had not (respectively) completed the STAI just prior to surgery. This allowed an assessment of the degree to which the missing data were random. No significant correlations emerged between the aforementioned coded variable and the postoperative pain score averages (see Appendix D, Table D.8), indicating that the data are apparently missing in a random way (Cohen & Cohen, 1983).
Missing data were handled by the "pairwise" option (for multiple regression analyses) in the Statistical Package for the Social Sciences (SPSSX, 1988) or were estimated according to a method suggested by Winer (1971, pp. 487-488). The former option allows the regression to be computed from correlations between all available pairs of independent and dependent variables without deleting the entire data record for a subject who has one or more missing data points. The latter was used to estimate postoperative missing data for reasons to be explained below. This method is useful when a measure is administered on several occasions (as are the postoperative pain measures). It should be noted that data were not estimated if a subject was missing both postoperative day 2 and day 3 ratings (which was the case for 11 subjects). According to Winer's formula, the missing data point (for example, postoperative day 2 VAS) is estimated by first computing the mean of the available data points for the measure of interest completed by the subject (e.g., preoperative VAS + postoperative day 3 VAS, divided by 2). To this figure is added the mean of the scores produced by the rest of the subjects corresponding to the missing data point (e.g., the means of all the other subjects' postoperative day 2 VAS). From this sum is subtracted the grand mean of all available data points for the measure across all subjects (e.g., the mean of all available preoperative VAS, postoperative day 2 VAS, and day 3 VAS data points for all subjects). The resulting figure becomes the estimated data point. This strategy was used to estimate missing data for both postoperative days. Of the data obtained on postoperative day 2, two data points each were estimated for the VAS and the MPQ ratings. For postoperative day 3, 12 data points each were estimated for the VAS and the MPQ ratings (except
for the MPQppi which had 13 data points missing) while 4 scores were estimated for postoperative day 3 ANLG. Although no mathematical procedure, however elegant, can truly replace experimentally obtained data, the above procedure was felt necessary in order to permit the calculation of an average postoperative score (from postoperative day 2 and 3 pain scores) for a maximal amount of subjects and to make the most efficient use of the data as a whole.

A correlation matrix was computed between all variables of interest (see below) and inspected. Due to the large number of variables comprising the matrix, only those bivariate correlations with a significance level of $p \leq .01$ will be presented as statistically significant (see Ingelfinger, Mosteller, Thibodeau, & Ware, 1987). Correlations with a significance level of $p \leq .05$ will be presented when appropriate, but can only be considered as "approaching" significance due to the large number of comparisons being made.

Inspection of the correlation matrix was undertaken to assess the relation of the demographic variables to postoperative pain indices (Table 2). For the variables "Race" (black=0, white=1, other=2), "Marital Status" (single=0, married=1, divorced=2, widowed=3), and "Hospital" (BIH=1, BWH=2, MAH=3), multiple regression analysis was required due to dummy coding more than two levels of these variables (Cohen & Cohen, 1983).

The only statistically significant demographic correlate with postoperative pain scores was "Time Since Last Surgery". This variable correlated significantly with VAS ($r=-.42$, $p \leq .005$) and with MPQe ($r=-.40$, $p \leq .005$). "Time Since Last Surgery" also approached significant correlations with MPQs ($r=-.29$, $p \leq .05$), MPQa ($r=-.28$, $p \leq .05$), and
MPQprit (r=-.32, p \leq .05). Other demographic variables approaching significant correlations with postoperative pain scores were noted and are presented in Table 2. Complete data are available in Appendix D, Table D.1. It is important to note that the hospital in which surgery took place (dummy coded, see above) was not significantly correlated with any postoperative pain score.

Table 2

Pearson Correlations Between Subject Demographic Variables and Postoperative Pain Scores

<table>
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<tr>
<th>Pain Score:</th>
<th>VAS</th>
<th>MPQs</th>
<th>MPQa</th>
<th>MPQe</th>
<th>MPQm</th>
<th>MPQprit</th>
<th>MPQppi</th>
<th>ANLG</th>
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<tr>
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<td>-0.29*</td>
<td>-0.28*</td>
<td>-0.40**</td>
<td>-0.32*</td>
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</table>

Note. The number in parentheses is the number of pairs of observations available for analysis.

\text{a} Multiple regression coefficient presented with degrees of freedom in brackets. "Marital Status" coded single=0, married=1, divorced=2, widowed=3.

\text{b} "Time Since Last Surgery" coded <1 yr.=0, 1-2 yrs.=1, >2 yrs.=2.

* p \leq .05
** p \leq .005

Further examination of the correlation matrix revealed some interesting relations between the preoperative psychological variables and illness behavior variables (Table 3). Complete data may be found in Appendix D, Table D.2. The IBI social factor was significantly correlated with all four psychological variables of interest, namely the STAIs0 (r=.33, p \leq .003), the STAIs1 (r=.32, p \leq .01), the STAIT (r=.44, p
and the EPIn ($r=.57$, $p \leq .0001$). The IBI total score also correlated significantly with the STAIIt ($r=.30$, $p \leq .01$) and the EPIn ($r=.45$, $p \leq .0001$) but only approached significance with the STAIis0 and STAIis1. Interestingly, the IBI work factor did not correlate significantly with any of the psychological variables. Additionally, neither the IBI-F mother rating nor father rating correlated with the psychological variables, and the IBI-F spouse/roommate only approached significant correlation with one, that of the STAIis1 ($r=.33$, $p \leq .02$).

### Table 3

Pearson Correlations Between Preoperative Illness Behavior and Psychological Test Scores

<table>
<thead>
<tr>
<th>Illness Behavior:</th>
<th>IBIs</th>
<th>IBIw</th>
<th>IBIt</th>
<th>IBI-F: Father</th>
<th>Mother</th>
<th>Spouse/R</th>
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<tbody>
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<td>.30**</td>
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<td>EPIn</td>
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<td>.45****</td>
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</tbody>
</table>

**Note.** The number in parentheses is the number of pairs of observations available for analysis.

* $p \leq .05$
** $p \leq .01$
*** $p \leq .003$
**** $p \leq .0001$

Correlations between the preoperative illness behavior scores (see Table 4) and the preoperative psychological scores (see Table 5) were also obtained. Complete data can be found in Appendix D, Tables D.3 and D.4, respectively. Not surprisingly, the IBIs and the IBIw were both significantly correlated with the IBIt ($r=.81$, $p \leq .0001$; $r=.82$, $p \leq .0001$ respectively), while also correlating with each other ($r=.34$, $p \leq .001$). The IBIw was significantly correlated with the IBI-F father ($r=.27$, \leq .0001), and the EPIn ($r=.57$, $p \leq .0001$). The IBI total score also correlated significantly with the STAIIt ($r=.30$, $p \leq .01$) and the EPIn ($r=.45$, $p \leq .0001$) but only approached significance with the STAIis0 and STAIis1. Interestingly, the IBI work factor did not correlate significantly with any of the psychological variables. Additionally, neither the IBI-F mother rating nor father rating correlated with the psychological variables, and the IBI-F spouse/roommate only approached significant correlation with one, that of the STAIis1 ($r=.33$, $p \leq .02$).
Correlations between the preoperative psychological variables revealed that the STAIs0 was significantly correlated with the STAIs1 and the STAIt (r=.66, p ≤ .0001; r=.42, p ≤ .0001 respectively), while the STAIs1 and the STAIt correlated to a slightly lesser degree (r=.35, p ≤ .004).

Table 4
Pearson Correlations Between Preoperative Illness Behavior Scores

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<th>IBIs</th>
<th>IBIw</th>
<th>IBIt</th>
<th>IBI-F: Father</th>
<th>IBI-F: Mother</th>
<th>IBI-F: Spouse/R</th>
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<td>.82***</td>
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<td>IBI-F: Father</td>
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<td>.27**</td>
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<td></td>
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</tr>
<tr>
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<td>.24*</td>
<td>.20*</td>
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<td>IBI-F: Spouse/R</td>
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</table>

Note. The number in parentheses is the number of pairs of observations available for analysis.
* p ≤ .05, one-tailed
** p ≤ .001, one-tailed
*** p ≤ .0001, one-tailed

A paired (dependent) sample t-test revealed that STAIs0 (M = 42.1) was significantly different than the STAIs1 (M = 48.7)(t(56)= 4.60, p ≤ .0005). The EPIn correlated with all three anxiety measures: STAIs0 (r=.35, p ≤ .001), STAIs1 (r=.36, p ≤ .003), and STAIt (r=.80, p ≤ .0001). Correlations between the postoperative pain scores revealed that the VAS and the MPQ subscales (MPQs, MPQa, MPQe, MPQm, MPQprit, and MPQppi) were all highly intercorrelated (see Table 6). Complete data are available in Appendix D, Table D.5. Of note is the fact that these self-report pain measures did not correlate significantly with postoperative narcotic analgesic usage (ANLG).
Finally, the correlations between the preoperative (illness behavior and psychological) scores and postoperative pain scores were examined (see Table 7). The STAIs0 correlated significantly only with the postoperative MPQe ($r=.30$, $p \leq .01$) but approached significance with

<table>
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<th>Table 5</th>
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<td>Pearson Correlations Between Preoperative Psychological Test Scores</td>
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<td>STAIso</td>
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**Note.** The number in parentheses is the number of pairs of observations available for analysis.

* $p \leq .01$, one-tailed
** $p \leq .001$, one-tailed
*** $p \leq .0001$, one-tailed

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<tr>
<td>MPQprit</td>
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<tr>
<td>MPQppi</td>
</tr>
<tr>
<td>**</td>
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</table>
| $p \leq .002$, one-tailed
| $p \leq .0001$, one-tailed

the MPQppi ($r=.29$, $p \leq .05$). The STAIsl correlated significantly with several pain scores, namely VAS ($r=.35$, $p \leq .01$), MPQa ($r=.46$, $p \leq .001$),
MPQe \( (r=.51, p \leq .001) \), MPQprit \( (r=.34, p \leq .01) \), and MPQppi \( (r=.43, p \leq .001) \), while approaching significance with the MPQs \( (r=.28, p \leq .05) \).

The IBIs correlated significantly with the postoperative VAS \( (r=.33, p \leq .01) \), the MPQe \( (r=.39, p \leq .001) \), and the MPQprit \( (r=.30, p \leq .01) \), while approaching significance with the MPQs \( (r=.26, p \leq .05) \), MPQa \( (r=.26, p \leq .05) \), and MPQppi \( (r=.25, p \leq .05) \). Not surprisingly, the IBIt also

**Table 7**

<table>
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</table>

**Note.** The number in parentheses is the number of pairs of observations available for analysis.

* \( p \leq .05 \)

** \( p \leq .01 \)

*** \( p \leq .001 \)

correlated significantly with the VAS \( (r=.34, p \leq .01) \) and the MPQe \( (r=.39, p \leq .001) \), but only approached significance with the MPQs \( (r=.25, \)
of the familial illness behavior measures, only the IBI-F (mother rating) correlated significantly with postoperative pain, namely the MPQa ($r = .33$, $p \leq .01$). For complete data see Appendix D, Table D.8.

Before examining the data via multiple regression analyses, several aspects of the data set were noted. First, although preoperative pain scores were obtained as a control for tendency to report pain, it was observed that patients reported little, if any pain prior to surgery. In fact, no significant correlations emerged between any of the preoperative and postoperative pain scores (see Appendix D, Table D.6). Furthermore, when the preoperative pain scores were included along with the other preoperative predictors (STAI, EPI, IBI, and IBI-F) as independent variables upon which postoperative pain scores were regressed, the results were comparable to that produced by the other preoperative predictors alone. Therefore, the preoperative pain scores were not included in any further analyses. Additionally, at each postoperative assessment, the time of the most recent analgesic dose was recorded so that a variable, "time since last dose", could be used as a control for analgesic effect upon the postoperative pain measures. However, "time since last dose", like the preoperative pain scores above, was not significantly correlated with any of the postoperative pain report indices and therefore was not included in further analyses (see Appendix D, Table D.7).

Examination of postoperative pain score data was undertaken via a backward elimination multiple regression approach. This procedure begins with a regression equation calculated with all the independent
variables of interest entered. Each partial regression coefficient is tested for significance as if it were the last variable to enter the equation. The variable with the least significant contribution to the equation is removed if it is not significant at a pre-determined level ($p \leq 0.1$ in the present study) and the process continues. This procedure has the advantage of entering all variables first so that the full model may be inspected before the final model is generated (Draper & Smith, 1981). Additionally, "stepwise" procedures such as the one utilized herein, if interpreted carefully, can provide a satisfactory strategy for obtaining the simplest and most efficient model for predictive research (see Cohen & Cohen, 1983; Dowdy & Wearden, 1983; Draper & Smith, 1981).

Due to the extensive amount of data analyzed in the present study and to the consequent redundancy of reporting the regression models for each dependent variable, not all regressions will be presented and discussed in the body of this paper. All analyses are presented, however, in Appendix E. Of the eight postoperative pain scores obtained (VAS, MPQs, MPQa, MPQe, MPQm, MPQprit, MPQppi, and ANLG), four pain scores were selected for presentation and discussion (VAS, MPQs, MPQa, and MPQprit). This selection was based upon several factors. First, the four selected pain scores are generally representative of the complete data as a whole (see Appendix E, Tables E.1 and E.2). Secondly, the four selected variables are those most commonly presented in the relevant literature. In the case of the VAS, this results from its simplicity and adequate psychometric properties (see review above). In the case of the MPQs, MPQa, and MPQprit, the appeal lies in the interpretability of the sensory dimension, affective dimension, and
total pain score (respectively) (Melzack, 1975). In addition, the MPQe was not selected because, aside from being composed of only one item on the MPQ, it purports to measure pain intensity, a measurement redundant with that of the VAS. The MPQm ("miscellaneous" dimension) was not selected because of difficulty in interpretation (see Melzack 1975, 1984). The MPQppi was not included due to the statistical drawbacks of the numeric and adjective rating scales (reviewed above). Finally, the amount of postoperative narcotic analgesics administered (ANLG) is not presented per se, but for a different reason. The only significant predictor of ANLG in any of the final regression models obtained (see Appendix E, Table E.2) was that of the EPI lie scale when both behavioral and psychological predictors were entered ($R^2=0.07. df=1,78, P \leq.02$). These results, though not presented in the following tables, are significant in their own right and will be discussed in a later section.

Table 8

Multiple Regression Analysis (Backward Elimination):
Illness Behavior Predictors of Selected Postoperative Pain Scores

<table>
<thead>
<tr>
<th>Pain Measure</th>
<th>Predictor</th>
<th>Beta</th>
<th>t</th>
<th>sig t</th>
<th>Mult R</th>
<th>Mult $R^2$</th>
<th>df</th>
<th>F</th>
<th>P value</th>
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<td>.03</td>
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<td>4.86</td>
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<td>.14</td>
<td>2.65</td>
<td>5.19</td>
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</table>

Note. Beta = Standardized Regression Coefficient.
When postoperative pain scores were regressed upon the illness behavior measures (IBIs, IBIw, IBI-F father, IBI-F mother, and IBI-F spouse ratings), some very interesting results emerged (Table 8). The Illness Behavior Inventory social factor (IBIs) was the sole significant predictor of the postoperative Visual Analogue Scale ($R^2=.11, p \leq .006$) and the MPQ sensory dimension ($R^2=.07, p \leq .03$). The IBI-F mother rating together with the IBIs significantly predicted both the postoperative MPQ affective dimension ($R^2=.16, p \leq .003$) and the MPQ pain rating index total ($R^2=.14, p \leq .008$).

Next, the postoperative pain scores were regressed upon both preoperative illness behavior measures and psychological measures (STAIs0, STAIs1, STAIT, EPIe, EPIn, and EPI1). The results (Table 9) revealed that the STAIs1 (the state anxiety measure taken just prior to surgery) was the sole significant predictor of the postoperative MPQ.

### Table 9

<table>
<thead>
<tr>
<th>Pain Measure</th>
<th>Predictor</th>
<th>Beta</th>
<th>t</th>
<th>sig t</th>
<th>df</th>
<th>F</th>
<th>P value</th>
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</table>

Note. Beta = Standardized Regression Coefficient.
pain rating index total \( (R^2=.12, p < .01) \). The STAIsl joined together with the IBIs to significantly predict the postoperative VAS \( (R^2=.17, p < .008) \) and with the IBI-F mother rating to significantly predict the MPQ affective dimension \( (R^2=.30, p < .0001) \). The IBIs was the only significant predictor of the MPQ sensory dimension \( (R^2=.07, p < .03) \).

Testing for the significance of the unique variance in pain score accounted for by the illness behavior measures with the STAIsl variable already in the equation, it can be seen in Table 9 that the IBI-F mother rating contributed a significant amount of unique variance to the regression model for the MPQa \( (p < .02) \). Additionally, the IBIs approached a significant contribution of unique variance in the prediction of the VAS \( (p < .08) \).

Finally, since the only demographic variable that consistently correlated with postoperative pain measures was the time since the

| Table 10 |

Multiple Regression Analysis (Backward Elimination): Illness Behavior, Psychological, and "Last Surgery" Predictors of Selected Postoperative Pain Scores

<table>
<thead>
<tr>
<th>Pain Measure</th>
<th>Predictor</th>
<th>Beta</th>
<th>t</th>
<th>sig t</th>
<th>Mult R</th>
<th>Mult R^2</th>
<th>df</th>
<th>F</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>VAS</td>
<td>Last Surg</td>
<td>-.37</td>
<td>-2.57</td>
<td>.01</td>
<td>.51</td>
<td>.26</td>
<td>2</td>
<td>3.66</td>
<td>.005</td>
</tr>
<tr>
<td></td>
<td>STAIsl</td>
<td>.29</td>
<td>1.97</td>
<td>.06</td>
<td>.51</td>
<td>.26</td>
<td>2</td>
<td>6.28</td>
<td>.005</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>MPOs</td>
<td>Last Surg</td>
<td>-.29</td>
<td>-2.06</td>
<td>.05</td>
<td>.29</td>
<td>.09</td>
<td>1</td>
<td>4.24</td>
<td>.05</td>
</tr>
<tr>
<td></td>
<td>STAIsl</td>
<td>.43</td>
<td>3.65</td>
<td>.0006</td>
<td>.51</td>
<td>.30</td>
<td>2</td>
<td>10.62</td>
<td>.0001</td>
</tr>
<tr>
<td></td>
<td>IBI-F mother</td>
<td>.29</td>
<td>2.48</td>
<td>.02</td>
<td>.55</td>
<td>.30</td>
<td>2</td>
<td>4.24</td>
<td>.05</td>
</tr>
<tr>
<td>MPOprit</td>
<td>STAIsl</td>
<td>.30</td>
<td>1.96</td>
<td>.06</td>
<td>.43</td>
<td>.19</td>
<td>2</td>
<td>4.17</td>
<td>.02</td>
</tr>
<tr>
<td></td>
<td>Last Surg</td>
<td>-.27</td>
<td>-1.76</td>
<td>.09</td>
<td>.43</td>
<td>.19</td>
<td>2</td>
<td>4.17</td>
<td>.02</td>
</tr>
</tbody>
</table>

Note. Beta = Standardized Regression Coefficient.
patient's last surgery (in those who had experienced a prior operation), this variable (Last Surg) was entered along with the psychological and illness behavior predictors as an independent variable in a multiple regression analysis of the postoperative pain scores (Table 10). The results indicated that Last Surg emerged as the only significant predictor of the postoperative MPQs ($R^2 = 0.09, p < 0.05$). Additionally, Last Surg combined with the STAIsl to significantly predict the VAS and the MPQprit ($R^2 = 0.26, p < 0.005$ and $R^2 = 0.19, p < 0.02$ respectively).

**DISCUSSION**

The results presented above indicate that self-reported illness behavior and self-report of familial illness behavior do indeed predict postoperative pain report. Specifically, of the illness behavior measures, the Social Illness factor of the Illness Behavior Inventory emerged as the sole significant predictor of 2 (VAS, MPQs) postoperative pain indices and, combined with the Familial Illness Behavior Inventory mother rating, significantly predicted two others (MPQA, MPQprit). These measures predicted up to 16% of the total variance in postoperative pain scores, a modest but significant finding. Taken together, these data suggest that patients with a history of responding to illness and pain with higher levels of observable illness behaviors, particularly those of a social nature (e.g., talking excessively with others about their illness) are more likely to report higher levels of postoperative pain. To a lesser degree, a higher pain report could be expected from those that report high illness behavior in their mother. These are significant results in that they render support for a behaviorally based prediction of postoperative pain. In other words, the identification of those patients at risk for higher (or lower)
levels of postoperative pain might be accomplished by focusing on the patient's past behavioral response to pain or illness as well as that of the patient's developmental role models (namely, the mother). In the present study, this was accomplished via responses to the Illness Behavior Inventory, which asks questions regarding specific behaviors (e.g., "I see doctors often", "I stay in bed when I feel ill") as opposed to psychological measures such as the State Trait Anxiety Inventory which were derived to assess feeling states (e.g., "I feel calm", "I feel secure", "I feel confused").

Although various measures of anxiety have been shown to reliably predict postoperative pain (and indeed, in the present study, one measure of anxiety was an impressive predictor, see below), authors reporting these data seldom present a hypothesis of the mechanism(s) mediating the relation between preoperative anxiety and pain following surgery (Johnston & Carpenter, 1980). In contrast, the present study utilized a behavioral formulation of pain report to assert that a history of high levels of illness behavior and familial modeling of illness behavior should predict a patient's pain (illness) behavior following surgical trauma. This hypothesis was generally supported. The existence of a genetic or otherwise physiologic predisposition to a lower pain tolerance cannot be ruled out (Edwards, et al, 1985), yet need not be for the same conclusions to be drawn. Hence, self-report of past illness behavior (regardless of the presence or absence of physiologic influence), as well as familial illness behavior (regardless of physiologic influence) predict future illness behavior in elective cholecystectomy patients.
It is interesting that the reported illness behavior of the mother alone emerged as a significant predictor of postoperative pain, as opposed to that of the father or spouse. Perhaps mothers are more available to children as both a role model for response to illness as well as a reinforcer of a level of illness behavior consistent with their own. Fathers may be less available to influence the child's developmental acquisition of behavioral response to illness, perhaps resulting in the tendency of the child to follow patterns set by the mother. These are only hypotheses, however, which require further investigation. Interpretation of these results is made difficult by the fact that the sample in the present study contains a majority of females. Research with a larger comparison group of males would clearly be necessary to more accurately assess the impact of parental modelling on both sexes.

When the psychological predictors of interest (STAIs0, STAIs1, STAIT, and EPIn) were entered along with the illness behavior predictors, the state anxiety measure taken just prior to surgery (STAIs1) emerged as a reliable predictor of postoperative pain. The STAIs1 was the only significant predictor of the postoperative MPQ pain rating index total. Additionally, the STAIs1 with the IBIs significantly predicted the postoperative VAS and, with the IBI-F mother rating significantly predicted the MPQa. The IBIs emerged as the sole significant predictor of the MPQs. It is not surprising to see state anxiety emerge as a significant predictor of postoperative pain scores, particularly given the review of the literature presented above. In fact, these data were quite consistent with those of Taenzer et al. (1986) and others. What is more notable is the fact that two of the
illness behavior measures (IBIs and IBI-F mother rating) appeared in several of the final regression equations whereas the neuroticism score (EPIn), the trait anxiety score (STAIt), and the state anxiety score taken prior to the day of surgery (STAIs0) did not. It could be argued that the latter measure might not represent a patient's anxiety level concerning surgery as well as the same measure taken just prior to surgery (STAIs1) and might therefore be a less potent predictor of postoperative pain scores. This indeed proved to be the case in the current study. Nonetheless, the other two psychological measures are both "trait" measures which should be expected to remain relatively stable over time. These measures, shown by some researchers to be consistent predictors of postoperative pain report, did not contribute significantly to the predictive ability of the STAIs1 (state anxiety just prior to surgery) whereas the illness behavior scores did.

Of the two pain scores predicted significantly by more than one preoperative measure, analysis revealed that the illness behavior measures contributed a significant (in the case of the postoperative MPQa) or near significant (postoperative VAS) amount of variance in postoperative pain scores beyond that contributed by the state anxiety measure alone. These results are encouraging and suggest that the behavioral framework within which the present study was designed may hold promise as a viable theoretical approach to the prediction of postoperative pain (and perhaps other types of acute pain as well).

One of the illness behavior measures employed herein was the Familial Illness Behavior Inventory. Further work is certainly needed in this area of assessment, as no consistent methodology has been used in the pertinent literature. The familial illness behavior ratings
employed in the present study were derived from the self-report illness behavior measure (IBI) itself as discussed above. Further work must be done on these measures to establish their psychometric properties and refine their ability to adequately assess the extent of familial illness behavior.

Together, the anxiety plus illness behavior measures accounted for up to 30% of the variance in postoperative pain report (see Table 9). Illness behavior scores (IBIs, IBI-F mother rating) are apparently valuable predictors, not just in their own right, but in conjunction with state anxiety score (STAI), a psychological measure previously established as a reliable predictor of postoperative pain.

Another interesting finding is the comparative efficacy of the two state anxiety measures, one taken at the preoperative visit (STAIs0) and the other just prior to surgery (STAIsl). Although the overwhelming majority of studies obtaining preoperative anxiety measures assessed that variable the day before surgery or earlier, one recent study by Johnston (1980) examined patterns of state anxiety (STAI) over several preoperative assessments including just prior to surgery in four samples of surgery patients. Her data consistently show no significant difference in preoperative anxiety levels up to six days before the operation. The present results were not consistent with this report (paired samples t-test revealed that the two assessments were significantly different with anxiety just prior to surgery higher than that taken at the preoperative assessment). Unfortunately, her statistical analyses did not include anxiety measures taken the morning of surgery, data she was not able to obtain on all subjects. Examination of the mean scores presented for the subjects who were
administered the questionnaire revealed lower average anxiety on the day of surgery than 1-2 days before. The discrepancy with the present study may stem, at least in part, from the heterogenous nature of Johnston's surgical samples (1 orthopedic, 2 gynecological, and 1 "wide range" of surgeries). It may also reflect a biased sample since many patients did not complete the anxiety measure on the day of surgery. In the present study, the state anxiety scores obtained just prior to surgery consistently predicted postoperative pain report better than that obtained several days earlier. In light of this result, the importance of the anxiety measure taken just prior to surgery should be noted by investigators in future studies of this nature.

Next, examination of the relation of the illness behavior scores to the psychological scores shed further light on these two important types of variables and their role in the prediction of postoperative pain. Inspection of the correlation matrix revealed significant correlations between the anxiety measures (STAIs0, STAIs1, STAIt) and both the IBIs and IBIt (see Table 3). Of note is the fact that every psychological variable of concern to the present study was correlated significantly with the IBI Social Illness Behavior factor, yet none of them correlated with the IBI Work-related Illness Behavior factor. Clearly, state anxiety and social illness behavior have something in common. Perhaps both variables belong to a response class of behaviors elicited by illness or threat of illness. This hypothesis would be supported by earlier reports (Fey & Fordyce, 1983; Keefe, 1982; and Poulsen, Hansen, Langemark, Olesen, & Bech, 1987) describing increased anxiety in chronic pain patients (patients who frequently exhibit high levels of pain behaviors) and, to a lesser extent, by data presented above regarding
lowered pain threshold and tolerance in anxious subjects (Bobey & Davidson, 1970; Bowers, 1970) as well as higher pain complaint levels observed in anxious psychiatric patients (Merskey, 1965a, 1965b). These data may also support the hypothesis that patients prone to state anxiety in illness situations may somehow acquire more illness behavior, or that state anxiety potentiates or exacerbates illness behavior. It is also possible that illness behavior precipitates anxiety in illness situations as well. Future research should focus on these issues in an effort to better understand the relation between illness behavior and state anxiety in the prediction of postoperative pain.

Having dealt with the major hypotheses of the present study, a few additional findings are worthy of note. First, it was surprising to find that none of the regression equations produced a significant prediction of the narcotic analgesics administered following surgery. Also, there was apparently no significant relation between pain report and receipt of narcotic analgesics (see Table 6). These findings imply one of several possibilities. Perhaps the self-report assessments were influenced by the recency of the last analgesic administration, resulting in a confounded assessment. Though this is possible, no significant correlations emerged between the "time since last analgesic dose" and any of the postoperative pain scores as one might expect were there an influence of analgesia upon pain report. Another explanation might be that the patients were medicated to the point of feeling little pain, resulting in small or nonsignificant correlations between the pain they did report and their analgesic usage. This, too, is unlikely given the wide range of pain scores reported by the subjects.
A truly feasible explanation is likely to be more complicated. Several factors may be involved. First, some patients are probably undermedicated, a problem frequently cited (Bonica, 1983; Cohen, 1983) and thought to result at least in part from the well-founded apprehension concerning the risk of fatal respiratory depression (Catling, Pinto, Jordan & Jones, 1980). These patients may report feeling more constant, unrelieved pain though they may be getting the maximum analgesic dose their physician is willing to prescribe (i.e., moderately high analgesia, high pain report). A second group of patients, for whatever reason, may be unwilling to take medication freely (this was observed anecdotally in patients who "didn't like taking a lot of medicine"). This group of patients would tolerate a higher pain level than others in order to avoid excessive medication (i.e., low analgesia, high pain report). A third group of patients may have adequate pain relief within the medication regime prescribed. Some of these patients will have pain controlled completely, but only with the maximum dose of analgesia (i.e., high analgesia, low pain report) while others will simply have little pain and require little analgesia (i.e., low analgesia, low pain report). When pain and analgesia are considered in this way, it is not surprising that no consistent pattern emerges in the relation between pain report and analgesic usage. It should be noted that the data presented in this study are consistent with that of several researchers who have also found only weak correlations between pain report and analgesic requirement following surgery (Feinmann, Ong, Harvey & Harris, 1987; Taenzer, 1983).

This is an area worthy of further investigation. Although some investigators report significant correlations between preoperative
variables and postoperative analgesic requirement (Lim et al. 1983; Taenzer et al. 1986) others have not (Bruegel, 1971; Scott et al. 1983). Perhaps this discrepancy results, at least in part, from the lack of a consistent relation between pain report measures and analgesic requirement as just discussed. Further research should address this relation and the role these variables should play in studies of postoperative pain.

Another interesting group of results was that of the demographic variables. Based upon the review of the literature, it was anticipated that sex would correlate significantly with some of the pain indices, though surprisingly, this was not the case. This absence of significance for the variable of sex is difficult to reconcile except for the fact that most of the present sample were female which may have served to obscure any differences that may have emerged in a sample equally divided according to gender. It is of note that the variable "time since last surgery" or Last Surg was significantly (negatively) correlated with 2 of the 8 postoperative pain scores and approached significance with others. When entered along with the psychological and illness behavior predictors, Last Surg contributed significantly to the prediction of the postoperative VAS and the MPQs. This would suggest that the more recent the patient's last surgery, the higher his or her postoperative pain report is likely to be. Perhaps this is simply due to an increased sensitivity to painful stimuli. Alternatively, patients with more recent surgeries may recall more vividly their pain experience and may be more likely to describe noxious stimuli as painful. The effectiveness of "Last Surg" as a predictor may also be a function of education (about the process and experience of surgery). Scott et al.
(1983) found that, among their subjects who had experienced a previous surgery, the degree of surgery information (assessed via questionnaire) was a significant predictor of several postoperative pain scores, indicating that the more they knew about surgery, the more pain they tended to report. Perhaps the amount of accurate information about surgery that a patient possessed reflected the recency of that patient's last surgery (not assessed by Scott et al.). These hypotheses should be explored in future research in an attempt to delineate the most efficacious predictor variable(s). For instance, if information about surgery is a function of (i.e., highly correlated with) "time since last surgery", then the latter variable would clearly be preferable as a predictor of postoperative pain (in terms of ease of assessment) in patients with one or more previous surgeries.

In summary, the present study is unique in that it assessed the influence of past illness behavior and familial models of illness behavior (both via self-report instruments) upon postoperative pain report. Additionally, state anxiety was measured both several days before surgery and again just prior to the procedure itself, a strategy not typically employed by other reported studies of this nature. The results indicated a significant role of past illness behavior in the prediction of pain report following cholecystectomy. Though never assessed before by previous investigators, these data lend support for a behaviorally based assessment of postoperative pain report probability. This model asserts that a patient's prior pattern of behavior in response to illness along with that modeled by his significant others, will predict, via stable behavior patterns, the patient's response to the "illness" of surgical trauma. It is important to note that this
pattern of behavioral response to illness or pain may be mediated by genetic or physiologic predisposition in at least some patients. The model proposed, however, can be applied efficiently even if this is the case since it proposes no specific physiologic determinants of illness or pain behavior, instead, relying only upon the past behavioral response as the predictor of future behavioral response. Whether or not that behavior is biological predisposed is irrelevant.

When both illness behavior scores and psychological test scores were entered into the regression equation, the state anxiety taken just before surgery (STAI-sl) emerged as the only psychological test score to consistently predict pain, along with two illness behavior measures (IBIs, IBI-F mother rating). As mentioned above, future research efforts should focus on the relation between state anxiety and illness behavior. Anxiety may predispose patients to the acquisition of illness behaviors, or may potentiate illness behavior (although less intuitive, illness behavior may precipitate anxiety as well). Conversely, anxiety may, in itself, be an illness behavior. If the latter is true, perhaps assessment strategies could be developed to measure "anxious behavior in response to illness" in terms of objective, discrete behaviors or questions about those behaviors (as the IBI attempts to do). The relevant measures might also be further refined, shortened, or combined into one instrument in order to efficiently identify those "at risk" behaviorally for higher levels of postoperative pain. Finally, these assessments should be amenable to administration and interpretation by nonpsychological health personnel (e.g., nurses) to keep the expense (both in time and money) of the assessment at a minimum.
Since it appears that there exists a behavioral component to many patients' response to the pain and trauma of surgery, future research should also focus on the generation and evaluation of behavioral interventions to assist in the pain management of surgery patients. This might consist of medication masking, staff education regarding social attention and reinforcement, or patient education in stress management techniques. Indeed, Fordyce has recently reported the results (Fordyce, 1988; Fordyce, Brockway, Bergman, & Spengler, 1986) from a controlled study implementing behavioral strategies typically employed with chronic pain patients in the treatment of a group of acute pain (recent back injury) patients. The patients receiving behavioral intervention showed less long term impairment and tended to return more reliably to pre-injury levels of functioning by follow-up than patients treated with a more standard medical approach. Perhaps the assessment of prior illness behavior can identify a subgroup of surgery and other acute pain patients that benefit significantly from these sorts of interventions.

Surgery is a stressful procedure, both physically and psychologically. Controlling the risks and managing the discomforts of surgery are the goals of health care providers today. Predicting accurately (and efficiently) which patients are likely to report more pain is the first step in the process of better postoperative pain management, whether pharmacological, behavioral, educational, etc. Perhaps the data presented in this study will contribute in a meaningful way to that ultimate goal.
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APPENDIX A: INFORMED CONSENT FORMS

Figure A.1: Informed Consent for Beth Israel Hospital

BETH ISRAEL HOSPITAL, BOSTON
HARVARD MEDICAL SCHOOL

INFORMED CONSENT

Part 1 of 2.

SUBJECT'S NAME:_____________________________________________________

TITLE OF RESEARCH PROTOCOL: Prediction of Postoperative Pain in Surgery Patients

PRINCIPAL INVESTIGATOR'S NAME: Lee Tyner

RESEARCH PROTOCOL #: 87-04-08-617

1. PURPOSE OF STUDY:

This study is designed to investigate the degree and amount of pain that surgery patients may experience after their operation.

2. PROCEDURE:

Participation in this study involves the completion of several questionnaires designed to produce information about personality variables, illness history, and degree of comfort during the surgery experience. Your medical chart will also be reviewed for information concerning your medications.

3. RISKS AND DISCOMFORTS:

Subjects are occasionally concerned about who will have access to the information they disclose in the questionnaires. This information will be available only to the investigators in the research project and will be completely confidential.

4. BENEFITS:

Although there will be no direct benefit to the individual participant, the results of this study will provide information that may increase further the ability of health care providers to identify the most appropriate treatment for postoperative pain in surgery patients.

5. CONFIDENTIALITY:

The information obtained in this study will be identified by a subject code number. After the data is collected on an individual, their name will not be associated with that information in any way. In addition, only the investigators in this research project will have access to that data. All information will be treated with strict confidentiality.
INFORMED CONSENT FORM

RESEARCH PROTOCOL # 87-04-08-617

I have fully explained to the Subject, _________________, the nature and purpose of the procedures described above and such risks as are involved in its performance. I have asked the Subject if any questions have arisen regarding the procedures and have answered these questions to the best of my ability.

Investigator's Signature

I have been fully informed about the above procedure, with its possible benefits, risks and consequences. I recognize that I am free to ask any questions. I understand that participation in this study is voluntary and I am free to withdraw from this study at any time without affecting my care or my relationship to Beth Israel Hospital.

I will receive a copy of this consent form. Beth Israel Hospital maintains an "Institutional Assurance of Compliance:, a document which explains how the hospital provides for protection of human subjects, a copy of which is available on request.

In the event physical injury occurs to me resulting from the research procedures, medical treatment will be available, if appropriate, at Beth Israel Hospital. However, no special arrangements have been made for compensation or for payment for treatment solely because of my participation in this research study.

I hereby agree to become a subject in this investigation.

Subject's Signature or Subject's Legal Representative when appropriate

I have witnessed the explanation made by the Investigator and heard the responses to questions. I have no conflicting interest in the activity proposed.

Witness

For any questions regarding the rights of a research subject, or information regarding treatment of research-related injuries, please contact: Mrs. Joan Pinck, Director, Office of Research Administration and Policy, 735-4585.
Figure A.2: Informed Consent for Brigham and Women's Hospital

BRIGHAM AND WOMEN'S HOSPITAL
RESEARCH CONSENT FORM

DATE PREPARED: 6/22/87
PROJECT TITLE: Prediction of Postoperative Pain in Surgery
SIGNED BY: Keith A. Marcotte
SECRETARY, HUMAN RESEARCH COMMITTEE

PRINCIPAL INVESTIGATOR AND CO-INVESTIGATOR(S)
John A. Mannick, M.D. PROTOCOL NUMBER: 87-2229-1
L. Lee Tynes, M.S.

EXPIRATION DATE: 7/7/88

1. PURPOSE

We would like permission to enroll you as a participant in a research study. The purpose of this study is to assess your past experience with illness, some very basic personality variables, and your level of comfort before and after surgery.

2. PROCEDURE

The study will involve you answering several questionnaires before surgery and on two occasions thereafter. The preoperative questionnaires will take about 30 to 45 minutes to complete, while the postoperative ones will require about 15 minutes of your time. The questionnaires will ask you a variety of questions concerning your own personality "style", how you react to other people and to life events, and, what you and your family's experience with illness has been like. Additionally, your medication usage while in the hospital will be recorded from your chart.

3. RISKS AND DISCOMFORTS

There is little potential discomfort that may result from participation other than the inconvenience of answering the questionnaires.

4. BENEFITS

There will likely be no benefit to you as a subject for participation in this study. However, the information obtained in the study will hopefully provide helpful information for health care providers attempting to best serve their patients.
THE FOLLOWING PARAGRAPHS CONTAIN INFORMATION ON WHICH, IN THE OPINION OF
THE HUMAN RESEARCH COMMITTEE OF THE BRIGHAM AND WOMEN'S HOSPITAL,
GENERALLY APPLIES TO PERSONS INVOLVED IN A RESEARCH STUDY AND ARE
REQUIRED ON ALL CONSENT FORMS.

5. In the event that at any time during the course of this project, you
feel you have not been adequately informed as to the risks, benefits,
alternative procedures, or your rights as a research subject, or feel
under excessive duress to continue this treatment against your wishes,
the Executive Secretary of the Human Research Committee or
representative is available to speak with you at 732-5740.

6. Confidential information contained in your medical record may not be
furnished to anyone unaffiliated with the Brigham and Women's Hospital
without your written consent, except as required by law or regulation.

7. A signed copy of this consent form will be made available to you.

8. You are free to withdraw your consent and to discontinue
participation in this project at any time, and such discontinuance will
not affect your regular treatments or medical care in any way. Additionally, you may refuse to answer any or all of the questions asked
of you during the course of the study without affecting your regular
treatment or medical care in any way.

I have fully explained the procedures, identifying those which are
investigational, and have explained their purpose. I have asked whether
or not any questions have arisen regarding the procedures and have
answered these questions to the best of my ability.

_________________________  ____________________________
Date                          Responsible Investigator

I have been fully informed as to the procedures to be followed,
including those which are investigational, and have been given a
description of the attendant discomforts, risks and benefits to be
expected and the appropriate alternate procedures. In signing this
consent form, I agree to this method of treatment and I understand that
I am free to withdraw my consent and have this study discontinued at any
time. I understand also that if I have any questions at any time, they
will be answered.

_________________________  ____________________________
Date                          Patient
Figure A.3: Informed Consent for Mount Auburn Hospital

MOUNT AUBURN HOSPITAL
INFORMED CONSENT FORM

Subject's Name:__________________________________

Title of Research Project: Prediction of Postoperative Pain in Surgery Patients

Principal Investigator: L. Lee Tynes, M.S.

I. PURPOSE

You are being asked to participate in a research project. This project involves the completion of various paper-and-pencil questionnaires that inquire about your experience as a surgery patient. The questions will ask you about your past experience with illness or pain, your level of pain or discomfort (if any) during the surgery experience, and will ask other questions about your general personality attributes. All of this information will be compiled in an effort to better understand the experience of surgery from a patient's perspective and will hopefully contribute data to aid health care providers in serving patients even better.

II. DURATION

The study will span four days and will be completed before you are discharged from the hospital.

III. PROCEDURE

You will be asked to fill out several questionnaires before you actually have surgery. This will be done at your preoperative visit to the hospital and will take 20-25 minutes. Also, you will fill in a short form the morning of surgery. On two occasions after surgery (postoperative day 2 and 3), you will be asked to fill in some brief pain ratings, which take about 10 minutes. Additionally, your postoperative medications will be recorded from your chart.

IV. RISKS

The only foreseeable risk might be that of breach of confidentiality; however, following data collection, all information obtained in this study will be identified by a number code and will be treated with strict confidentiality.

V. BENEFITS

There will likely be no benefit to you as a patient for participation in this study. Hopefully, as mentioned above, the information obtained by this project will be helpful to future surgery patients.
Mount Auburn Hospital has an Institutional Review Board that reviews all studies conducted at the hospital that involve human subjects. The Committee is responsible for assessing that the risks (if any) to the subject will be outweighed by the possible benefit to the subject and/or the importance of the information to be gained. The Committee also tries to be sure that the rights and welfare of each person will be adequately protected and that informed consent will be obtained by adequate and appropriate means. In the event that you should be injured in the course of this study, you will be provided with necessary care. However, this statement does not mean that either such care or hospitalization, if necessary, will be free of charge. Furthermore, Mount Auburn Hospital cannot provide you with compensation as the result of any injuries. Every subject is free to contact a representative of the Human Studies Committee by calling 492-3500 extension 4676.

I have fully described to ___________________________ the nature and purpose of the study described above and such risks as are involved. I have asked if there are any questions about this study and have answered these questions to the best of my ability. I have explained what alternative treatments or procedures are available. I have also provided the name and telephone number of a person to contact in the event of a research related injury.

Investigator Date

Isaac Mehrez, M.D. 492-3500 x5150
Name and number of person to contact in the event of emergency.

I am satisfied that any questions I have had have been fully answered as of this time. I agree to voluntarily participate in this study with the understanding that I may withdraw for any reason, and that this will in no way prejudice my medical care. I have read the above description and understand the circumstances of my participation in this study. I also understand that a signed copy of this consent form will be given to me. I know that I may contact the IRB office to ask any further questions regarding my rights as a research subject.

Signature of Subject or Legal Representative Date

Signature of Witness
APPENDIX B: PREOPERATIVE ASSESSMENTS

Figure B.1: Initial Visit Information

Please fill out this basic information sheet to the best of your ability.

REMEMBER, WHAT YOU WRITE ON THIS SHEET IS STRICTLY CONFIDENTIAL AND NO ONE EXCEPT MEMBERS OF THE RESEARCH TEAM WILL HAVE ACCESS TO IT.

1. Patient Initials __ __ __

2. Date of Birth __/__/__  Sex  Race__

3. Highest Educational Level ____________________

4. Marital Status (S, M, D, W) _________________

5. Number of previous surgeries requiring hospitalization________

   Date of most recent surgery __/__/__

6. Have you ever experienced head trauma or brain damage that required hospitalization? __________

7. Apart from your gallbladder problem, do you have any other medical conditions?

   (Please list)________________________________________________

   __________________________________________________________

   __________________________________________________________

8. Have you ever been diagnosed with cancer or a malignancy?________

   If so, when? __/__/__

9. Have you ever suffered from a mental illness requiring hospitalization? ______

10. Have you ever received inpatient treatment for alcohol or substance abuse? __________

11. Is English your first (native) language? __________
When you feel ill (including pain), we each communicate about feeling ill in different ways. The purpose of this questionnaire is to get your impression of how you communicated with others about feeling ill.

Some questions will be hard to answer but please try to answer as best you can. Certain terms such as work, chores, or job are used in this questionnaire. Housework, attending school, doing homework, etc. are considered similar to work, chores, or job.

Some of the questions will seem quite similar. However, each question has a slightly different focus. Try to answer each question as if it were the only question being asked. Don’t spend too much time on any one question. All answers will be kept strictly confidential.

CIRCLE THE RESPONSE WHICH BEST REFLECTS YOUR FEELINGS WITH THE STATEMENT

The following scale is used for your response to each item.

YES = strong agreement with statement
Yes = moderate agreement with statement
yes = slight agreement with statement
no = slight disagreement with statement
No = moderate disagreement with statement
NO = strong disagreement with statement
<table>
<thead>
<tr>
<th>1. I see doctors often.</th>
<th>YES</th>
<th>Yes</th>
<th>yes</th>
<th>no</th>
<th>No</th>
<th>NO</th>
</tr>
</thead>
<tbody>
<tr>
<td>2. When ill, I have to stop work completely.</td>
<td>YES</td>
<td>Yes</td>
<td>yes</td>
<td>no</td>
<td>No</td>
<td>NO</td>
</tr>
<tr>
<td>3. I stay in bed when I feel ill.</td>
<td>YES</td>
<td>Yes</td>
<td>yes</td>
<td>no</td>
<td>No</td>
<td>NO</td>
</tr>
<tr>
<td>4. I work fewer hours when I'm ill.</td>
<td>YES</td>
<td>Yes</td>
<td>yes</td>
<td>no</td>
<td>No</td>
<td>NO</td>
</tr>
<tr>
<td>5. I do fewer chores around the house when I'm ill.</td>
<td>YES</td>
<td>Yes</td>
<td>yes</td>
<td>no</td>
<td>No</td>
<td>NO</td>
</tr>
<tr>
<td>6. I seek help from others when I'm ill.</td>
<td>YES</td>
<td>Yes</td>
<td>yes</td>
<td>no</td>
<td>No</td>
<td>NO</td>
</tr>
<tr>
<td>7. When ill, I work slower.</td>
<td>YES</td>
<td>Yes</td>
<td>yes</td>
<td>no</td>
<td>No</td>
<td>NO</td>
</tr>
<tr>
<td>8. I leave work early when I'm ill.</td>
<td>YES</td>
<td>Yes</td>
<td>yes</td>
<td>no</td>
<td>No</td>
<td>NO</td>
</tr>
<tr>
<td>9. I complain about being ill when I feel ill.</td>
<td>YES</td>
<td>Yes</td>
<td>yes</td>
<td>no</td>
<td>No</td>
<td>NO</td>
</tr>
<tr>
<td>10. I avoid certain aspects of my job when I'm ill.</td>
<td>YES</td>
<td>Yes</td>
<td>yes</td>
<td>no</td>
<td>No</td>
<td>NO</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td></td>
</tr>
<tr>
<td>11. I take rest periods when I'm ill.</td>
<td>YES</td>
<td>Yes</td>
<td>yes</td>
<td>no</td>
<td>No</td>
<td>NO</td>
</tr>
<tr>
<td>12. Most people who know me are aware that I take medication.</td>
<td>YES</td>
<td>Yes</td>
<td>yes</td>
<td>no</td>
<td>No</td>
<td>NO</td>
</tr>
<tr>
<td>13. Even if I don't feel ill at certain times, I find that I talk about my illness anyway.</td>
<td>YES</td>
<td>Yes</td>
<td>yes</td>
<td>no</td>
<td>No</td>
<td>NO</td>
</tr>
<tr>
<td>14. Others often behave towards me as if I'm ill.</td>
<td>YES</td>
<td>Yes</td>
<td>yes</td>
<td>no</td>
<td>No</td>
<td>NO</td>
</tr>
<tr>
<td>15. Although I very seldom bring up the topic of my illness, I frequently find myself involved in conversation about my illness with others.</td>
<td>YES</td>
<td>Yes</td>
<td>yes</td>
<td>no</td>
<td>No</td>
<td>NO</td>
</tr>
<tr>
<td>16. Others seem to act as if I am more ill than I really am.</td>
<td>YES</td>
<td>Yes</td>
<td>yes</td>
<td>no</td>
<td>No</td>
<td>NO</td>
</tr>
<tr>
<td>17. My illness or aspects of it is a frequent topic of conversation.</td>
<td>YES</td>
<td>Yes</td>
<td>yes</td>
<td>no</td>
<td>No</td>
<td>NO</td>
</tr>
<tr>
<td>18. When I'm ill people can tell by the way I act.</td>
<td>YES</td>
<td>Yes</td>
<td>yes</td>
<td>no</td>
<td>No</td>
<td>NO</td>
</tr>
<tr>
<td>19. Often I act more ill than I really am.</td>
<td>YES</td>
<td>Yes</td>
<td>yes</td>
<td>no</td>
<td>No</td>
<td>NO</td>
</tr>
<tr>
<td>20. I have large medical bills.</td>
<td>YES</td>
<td>Yes</td>
<td>yes</td>
<td>no</td>
<td>No</td>
<td>NO</td>
</tr>
</tbody>
</table>
The purpose of this questionnaire is to get your impression of how your loved ones communicated with others about feeling ill. Below, you will find three sets of questions. One set refers to your father, one to your mother, and one to your current spouse or roommate. In some cases, one or both of your parents may have been absent from the home. If this is true in your case, please indicate in the proper blank at the beginning of the section and answer the questions in terms of the guardian(s) or person(s) who raised you (for instance, "Grandmother" instead of "Mother"). If there was only one parent or guardian in the home as you grew up, you may leave the other set of questions blank.

CIRCLE THE RESPONSE WHICH BEST REFLECTS YOUR FEELINGS WITH THE STATEMENT

The following scale is used for your response to each item:

YES = **strong** agreement with statement
Yes = moderate agreement with statement
yes = slight agreement with statement
no = slight disagreement with statement
No = moderate disagreement with statement
NO = **strong** disagreement with statement
I: Circle the response below that best describes your father. If your father was absent, please indicate your primary male caretaker (e.g., "Uncle", "Stepfather", "Guardian", etc.) in the blank at the end of this sentence and answer the questions accordingly.

____________________was my primary male caretaker.

<table>
<thead>
<tr>
<th>Strong disagreement</th>
<th>Moderate disagreement</th>
<th>Slight disagreement</th>
<th>Slight agreement</th>
<th>Moderate agreement</th>
<th>Strong agreement</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

1. My father saw doctors often. YES Yes yes no No NO
2. When ill, my father had to stop work completely. YES Yes yes no No NO
3. My father stayed in bed when feeling ill. YES Yes yes no No NO
4. My father did fewer chores around the house when ill. YES Yes yes no No NO
5. My father sought help from others when ill. YES Yes yes no No NO
6. My father complained about being ill when he was feeling ill. YES Yes yes no No NO
7. Most people who knew my father were aware that he took medication. YES Yes yes no No NO
8. Others often behaved toward my father as if he was ill. YES Yes yes no No NO
9. Others seem to act as if my father was more ill than he really was. YES Yes yes no No NO
10. My father's illness or aspects of it was a frequent topic of conversation. YES Yes yes no No NO
11. When my father was ill people could tell by the way he acted. YES Yes yes no No NO
II: Circle the response below that best describes your mother. If your mother was absent, please indicate your primary female caretaker (e.g., "Aunt", "Stepmother", "Guardian", etc.) in the blank at the end of this sentence and answer the questions accordingly.

__________________________ was my primary female caretaker.

<table>
<thead>
<tr>
<th>Question</th>
<th>Yes</th>
<th>Yes</th>
<th>yes</th>
<th>no</th>
<th>No</th>
<th>NO</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. My mother saw doctors often.</td>
<td>YES</td>
<td>Yes</td>
<td>yes</td>
<td>no</td>
<td>No</td>
<td>NO</td>
</tr>
<tr>
<td>2. When ill, My mother had to stop work completely.</td>
<td>YES</td>
<td>Yes</td>
<td>yes</td>
<td>no</td>
<td>No</td>
<td>NO</td>
</tr>
<tr>
<td>3. My mother stayed in bed when feeling ill.</td>
<td>YES</td>
<td>Yes</td>
<td>yes</td>
<td>no</td>
<td>No</td>
<td>NO</td>
</tr>
<tr>
<td>4. My mother did fewer chores around the house when ill.</td>
<td>YES</td>
<td>Yes</td>
<td>yes</td>
<td>no</td>
<td>No</td>
<td>NO</td>
</tr>
<tr>
<td>5. My mother sought help from others when ill.</td>
<td>YES</td>
<td>Yes</td>
<td>yes</td>
<td>no</td>
<td>No</td>
<td>NO</td>
</tr>
<tr>
<td>6. My mother complained about being ill when she was feeling ill.</td>
<td>YES</td>
<td>Yes</td>
<td>yes</td>
<td>no</td>
<td>No</td>
<td>NO</td>
</tr>
<tr>
<td>7. Most people who knew my mother were aware that she took medication.</td>
<td>YES</td>
<td>Yes</td>
<td>yes</td>
<td>no</td>
<td>No</td>
<td>NO</td>
</tr>
<tr>
<td>8. Others often behaved toward my mother as if she was ill.</td>
<td>YES</td>
<td>Yes</td>
<td>yes</td>
<td>no</td>
<td>No</td>
<td>NO</td>
</tr>
<tr>
<td>9. Others seem to act as if my mother was more ill than she really was.</td>
<td>YES</td>
<td>Yes</td>
<td>yes</td>
<td>no</td>
<td>No</td>
<td>NO</td>
</tr>
<tr>
<td>10. My mother's illness or aspects of it was a frequent topic of conversation.</td>
<td>YES</td>
<td>Yes</td>
<td>yes</td>
<td>no</td>
<td>No</td>
<td>NO</td>
</tr>
<tr>
<td>11. When my mother was ill people could tell by the way she acted.</td>
<td>YES</td>
<td>Yes</td>
<td>yes</td>
<td>no</td>
<td>No</td>
<td>NO</td>
</tr>
</tbody>
</table>
III: Circle the response below that best describes your current spouse or roommate. If you are divorced or widowed and have no current roommate, please check "Ex-spouse" below and answer the questions accordingly. If you have never married and have no current roommate, you may leave this set of questions blank.

(Check One)  
____ Current Spouse  
____ Ex-spouse  
____ Roommate

<table>
<thead>
<tr>
<th>Strong disagreement------:</th>
<th>Moderate disagreement------:</th>
<th>Slight disagreement------:</th>
<th>Slight agreement------:</th>
<th>Moderate agreement------:</th>
<th>Strong agreement------:</th>
</tr>
</thead>
</table>

1. My spouse (roommate) sees doctors often.  
2. When ill, my spouse stops work completely.  
3. My spouse stays in bed when feeling ill.  
4. My spouse does fewer chores around the house when ill.  
5. My spouse seeks help from others when ill.  
6. My spouse complains about being ill when (s)he is feeling ill.  
7. Most people who know my spouse are aware that (s)he takes medication.  
8. Others often behave toward my spouse as if (s)he is ill.  
9. Others seem to act as if my spouse is more ill than (s)he really is.  
10. My spouse's illness or aspects of it is a frequent topic of conversation.  
11. When my spouse is ill people can tell by the way (s)he acts.
### APPENDIX C: DATA FREQUENCIES

#### Table C.1: Frequencies of Data Collected Preoperatively

<table>
<thead>
<tr>
<th>Variable</th>
<th>Abbreviation</th>
<th>N=</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of days between initial assessment and surgery</td>
<td>Preop Days</td>
<td>80</td>
</tr>
<tr>
<td>Hospital</td>
<td>Hospital</td>
<td>80</td>
</tr>
<tr>
<td>Surgeon</td>
<td>Surgeon</td>
<td>80</td>
</tr>
<tr>
<td>Age</td>
<td>Age</td>
<td>80</td>
</tr>
<tr>
<td>Sex</td>
<td>Sex</td>
<td>80</td>
</tr>
<tr>
<td>Race</td>
<td>Race</td>
<td>76</td>
</tr>
<tr>
<td>Educational level</td>
<td>Education</td>
<td>71</td>
</tr>
<tr>
<td>Marital Status</td>
<td>Mar Stat</td>
<td>80</td>
</tr>
<tr>
<td>Number of prior surgeries</td>
<td>Previous Surgeries</td>
<td>78</td>
</tr>
<tr>
<td>Time since last surgery</td>
<td>Last Surg</td>
<td>55</td>
</tr>
<tr>
<td>English as native language</td>
<td>English</td>
<td>80</td>
</tr>
<tr>
<td>Preop State Anxiety (STAI)</td>
<td>STAI_s0</td>
<td>80</td>
</tr>
<tr>
<td>Trait Anxiety (STAI)</td>
<td>STAI_t</td>
<td>80</td>
</tr>
<tr>
<td>Extraversion (EPI)</td>
<td>EPI_e</td>
<td>80</td>
</tr>
<tr>
<td>Neuroticism (EPI)</td>
<td>EPI_n</td>
<td>80</td>
</tr>
<tr>
<td>Lying (EPI)</td>
<td>EPI_l</td>
<td>80</td>
</tr>
<tr>
<td>Illness Behavior Inventory</td>
<td>IBIt</td>
<td>80</td>
</tr>
<tr>
<td>Social Illness Behavior</td>
<td>IBIs</td>
<td>80</td>
</tr>
<tr>
<td>Work-related Illness Behavior</td>
<td>IBIw</td>
<td>80</td>
</tr>
<tr>
<td>Familial Illness Behavior - father</td>
<td>IBI-F father</td>
<td>75</td>
</tr>
<tr>
<td>Familial Illness Behavior - mother</td>
<td>IBI-F mother</td>
<td>79</td>
</tr>
<tr>
<td>Familial Illness Behavior - spouse or roommate</td>
<td>IBI-F spouse/r</td>
<td>70</td>
</tr>
<tr>
<td>Preop Visual Analogue Scale of pain</td>
<td>VAS</td>
<td>80</td>
</tr>
<tr>
<td>Preop McGill Pain Questionnaire</td>
<td>MPQs</td>
<td>80</td>
</tr>
<tr>
<td>sensory dimension</td>
<td>MPQa</td>
<td>80</td>
</tr>
<tr>
<td>affective dimension</td>
<td>MPQe</td>
<td>80</td>
</tr>
<tr>
<td>evaluative dimension</td>
<td>MPQm</td>
<td>80</td>
</tr>
<tr>
<td>miscellaneous dimension</td>
<td>MPQprit</td>
<td>80</td>
</tr>
<tr>
<td>pain rating index total</td>
<td>MPQppi</td>
<td>80</td>
</tr>
<tr>
<td>present pain intensity</td>
<td></td>
<td></td>
</tr>
<tr>
<td>State Anxiety just before surgery (STAI)</td>
<td>STAI_s1</td>
<td>57</td>
</tr>
</tbody>
</table>
Table C.2: Frequencies of Data Collected Postoperatively

<table>
<thead>
<tr>
<th>Variable</th>
<th>Postoperative:</th>
<th>Day2 N</th>
<th>Day3 N</th>
<th>&quot;On Time&quot;a N</th>
</tr>
</thead>
<tbody>
<tr>
<td>Postop Visual Analogue Scale of pain (VAS)</td>
<td></td>
<td>67</td>
<td>57</td>
<td>34</td>
</tr>
<tr>
<td>Postop McGill Pain Questionnaire</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>sensory dimension (MPQs)</td>
<td></td>
<td>67</td>
<td>57</td>
<td>34</td>
</tr>
<tr>
<td>affective dimension (MPQa)</td>
<td></td>
<td>67</td>
<td>57</td>
<td>34</td>
</tr>
<tr>
<td>evaluative dimension (MPQe)</td>
<td></td>
<td>67</td>
<td>57</td>
<td>34</td>
</tr>
<tr>
<td>miscellaneous dimension (MPQm)</td>
<td></td>
<td>67</td>
<td>57</td>
<td>34</td>
</tr>
<tr>
<td>pain rating index total (MPQprit)</td>
<td></td>
<td>67</td>
<td>57</td>
<td>34</td>
</tr>
<tr>
<td>present pain intensity (MPQppi)</td>
<td></td>
<td>67</td>
<td>56</td>
<td>34</td>
</tr>
<tr>
<td>Postop narcotic analgesics (ANLG)</td>
<td></td>
<td>80</td>
<td>76</td>
<td>39</td>
</tr>
</tbody>
</table>

a"On Time" N refers to the number of subjects who received both a postoperative day 2 and day 3 assessment, both within the protocol guidelines of 2-5 p.m. Not included in this number are those who were discharged early or who received one or both assessments outside the 2-5 p.m. schedule.
### Table D.1: Demographic Correlations With Postoperative Pain Scores

<table>
<thead>
<tr>
<th>Variable</th>
<th>VAS</th>
<th>MPQs</th>
<th>MPQa</th>
<th>MPQe</th>
<th>MPQm</th>
<th>MPQprit</th>
<th>MPQpp</th>
<th>ANLG</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>-0.13</td>
<td>-0.25*</td>
<td>-0.09</td>
<td>-0.08</td>
<td>-0.07</td>
<td>-0.20</td>
<td>-0.23*</td>
<td>-0.23*</td>
</tr>
<tr>
<td>(69)</td>
<td></td>
<td>(69)</td>
<td>(69)</td>
<td>(69)</td>
<td>(69)</td>
<td>(69)</td>
<td>(69)</td>
<td>(80)</td>
</tr>
<tr>
<td>Sex&lt;sup&gt;a&lt;/sup&gt;</td>
<td>0.05</td>
<td>0.002</td>
<td>-0.04</td>
<td>-0.14</td>
<td>0.04</td>
<td>-0.01</td>
<td>0.06</td>
<td>-0.02</td>
</tr>
<tr>
<td>(69)</td>
<td></td>
<td>(69)</td>
<td>(69)</td>
<td>(69)</td>
<td>(69)</td>
<td>(69)</td>
<td>(69)</td>
<td>(80)</td>
</tr>
<tr>
<td>Race&lt;sup&gt;b&lt;/sup&gt;</td>
<td>0.06</td>
<td>0.03</td>
<td>0.04</td>
<td>0.10</td>
<td>0.04</td>
<td>0.05</td>
<td>0.06</td>
<td>0.008</td>
</tr>
<tr>
<td>[2,66]</td>
<td></td>
<td>[2,66]</td>
<td>[2,66]</td>
<td>[2,66]</td>
<td>[2,66]</td>
<td>[2,66]</td>
<td>[2,66]</td>
<td>[2,77]</td>
</tr>
<tr>
<td>Marital Status&lt;sup&gt;c&lt;/sup&gt;</td>
<td>0.06</td>
<td>0.08</td>
<td>0.05</td>
<td>0.09</td>
<td>0.05</td>
<td>0.08</td>
<td>0.06</td>
<td>0.10*</td>
</tr>
<tr>
<td>[3,65]</td>
<td></td>
<td>[3,65]</td>
<td>[3,65]</td>
<td>[3,65]</td>
<td>[3,65]</td>
<td>[3,65]</td>
<td>[3,65]</td>
<td>[3,76]</td>
</tr>
<tr>
<td>Education (yrs.)</td>
<td>0.09</td>
<td>0.006</td>
<td>0.16</td>
<td>0.08</td>
<td>0.20</td>
<td>0.08</td>
<td>0.26*</td>
<td>0.11</td>
</tr>
<tr>
<td>(61)</td>
<td></td>
<td>(61)</td>
<td>(61)</td>
<td>(61)</td>
<td>(61)</td>
<td>(61)</td>
<td>(61)</td>
<td>(71)</td>
</tr>
<tr>
<td>English&lt;sup&gt;d&lt;/sup&gt;</td>
<td>-0.13</td>
<td>0.07</td>
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<td>-0.06</td>
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<td>-0.28*</td>
<td>-0.40**</td>
<td>-0.16</td>
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<td>0.05</td>
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<td>[2,66]</td>
<td>[2,66]</td>
<td>[2,66]</td>
<td>[2,77]</td>
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</tbody>
</table>

**Note.** For the variables "Race", "Marital Status", and "Hospital", multiple regression analysis was required due to dummy coding more than two levels of the variable, thus multiple regression coefficients are presented in these rows. The numbers in brackets are the degrees of freedom for the multiple regression model. The number in parentheses is the number of observations available for analysis in the bivariate correlations.

<sup>a</sup>Sex was coded male=0, female=1.
<sup>b</sup>Race coded Black=0, White=1, Other=2.
<sup>c</sup>Marital Status coded single=0, married=1, divorced=2, widowed=3.
<sup>d</sup>English coded yes=1 (if native language), no=0.
<sup>e</sup>Time Since Last Surgery coded <1 year=0, 1-2 yrs.=1, >2 yrs.=2.
<sup>f</sup>Hospital coded Beth Israel=1, Brigham and Women's=2, Mount Auburn=2.

*p ≤ .05

**p ≤ .01
Table D.2: Pearson Correlations Between Preoperative Illness Behavior and Psychological Test Scores

<table>
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<th>STAIt</th>
<th>EPIn</th>
<th>EPIe</th>
<th>EPI1</th>
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<td>-.04</td>
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<td>(80)</td>
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<td>.32**</td>
<td>.44***</td>
<td>.57***</td>
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<tr>
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<td>.17</td>
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<td>-.04</td>
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<td>(80)</td>
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<td>IBI-F (spouse)</td>
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</table>

Note. The number in parentheses is the number of pairs of observations available for analysis.

* \( p \leq .05 \\
** \( p \leq .01 \\
*** \( p \leq .001 \)
### Table D.3: Pearson Correlations Between Preoperative Illness Behavior Scores

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<th>IBIw</th>
<th>IBIt</th>
<th>IBI-F: Father</th>
<th>Mother</th>
<th>Spouse/R</th>
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<td>IBI-F: Father</td>
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<td>Mother</td>
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<td>.24*</td>
<td>.20*</td>
<td>.07</td>
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<td>(79)</td>
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<tr>
<td>Spouse/R</td>
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</table>

**Note.** The number in parentheses is the number of pairs of observations available for analysis.

* p ≤ .05, one-tailed
** p ≤ .01, one-tailed
*** p ≤ .0001, one-tailed
Table D.4: Pearson Correlations Between Preoperative Psychological Test Scores

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<td>EPIe</td>
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Note. The number in parentheses is the number of pairs of observations available for analysis.

**p \leq 0.01, one-tailed
***p \leq 0.001, one-tailed
Table D.5: Pearson Correlations Between Postoperative Pain Scores

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<th>MPQs</th>
<th>MPQa</th>
<th>MPQe</th>
<th>MPQm</th>
<th>MPQprit</th>
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<td>.65***</td>
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</tr>
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Note. N=69.

*P ≤ .05, one-tailed
**P ≤ .01, one-tailed
***P ≤ .001, one-tailed
### Table D.6: Pearson Correlations Between Preoperative and Postoperative Pain Scores

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<td>-.02</td>
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**Note.** The number in parentheses is the number of pairs of observations available for analysis.

*p ≤ .05, one-tailed

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<td>(67)</td>
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</table>

Note. The number in parentheses is the number of pairs of observations available for analysis. "Time of Day" and "Time Since Last Dose" are presented separately for postoperative day2 and day3 since averaging the two time scores and correlating them with pain score averages would introduce difficulty into the interpretation of results.

a"Time of Day" coded Before 12:00=0, 12:00-12:59=1, 1:00-1:59=2, 2:00-5:00=3, 5:01-6:00=4, After 6:00=5.

*p ≤ .05
Table D.8: Pearson Correlations Between Preoperative Experimental Variables and Postoperative Pain Scores

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<th>MPQs</th>
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Note. The number in parentheses is the number of pairs of observations available for analysis.

*STAI?* represents a variable coded 1 if the STAI0 was given to the patient before surgery, or 2 if not.

*p ≤ .05  
**p ≤ .01  
***p ≤ .001
APPENDIX E: COMPLETE MULTIPLE REGRESSION ANALYSES

Table E.1: Multiple Regression Analysis (Backward Elimination):
Illness Behavior Predictors of Postoperative Pain Scores

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Note. Beta = Standardized Regression Coefficient.
### Table E.2: Multiple Regression Analysis (Backward Elimination):
Illness Behavior and Psychological Predictors of Postoperative Pain Scores

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**Note.** Beta = Standardized Regression Coefficient.
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Note. Beta = Standardized Regression Coefficient.
Table E.4: Multiple Regression Analysis (Backward Elimination):Illness Behavior Predictors of Postoperative Pain Scoresfor Subjects Whose Postoperative AssessmentsWere Both From 2:00 to 5:00 PM

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Note. Beta = Standardized Regression Coefficient
Table E.5: Multiple Regression Analysis (Backward Elimination): Illness Behavior and Psychological Predictors of Postoperative Pain Scores for Subjects Whose Postoperative Assessments Were Both From 2:00 to 5:00 PM

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Note. Beta = Standardized Regression Coefficient
CURRICULUM VITA

Date: 5/89

Name: Lannis Lee Tynes

Home Address: 818 Main Street Apt. #2
Melrose, MA 02176
(617) 662-6656

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Birthplace: Beaumont, Texas

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1983-1989 Louisiana State University
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Major: Psychology
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Minor: Behavioral Neurology
Received Ph.D., May, 1989

1981-1983 University of Southwestern Louisiana
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Major: Psychology
Received M.S., December, 1983

1976-1980 Baylor University
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Received B.S., December, 1980

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1986-present  Clinical Fellow in Psychology  
          Department of Psychiatry  
          Harvard Medical School, Boston MA

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1982-1983  Graduate Lecturer  
          University of Southwestern Louisiana  
          Department of Psychology

1981-1982  Graduate Teaching Assistant  
          University of Southwestern Louisiana  
          Department of Psychology

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1985-1986  Chief Extern, Psychology Consultation/Liaison Service  
          Family Practice Unit  
          Earl K. Long Memorial Hospital  
          Baton Rouge, LA

1984-1985  Medical Psychology Trainee  
          Family Practice Unit  
          Earl K. Long Memorial Hospital

1984-1985  Medical Psychology Trainee  
          Greater Baton Rouge Kidney Center

1984-1985  Psychological Assistant  
          Greenwell Springs Hospital  
          Greenwell Springs, LA

PROFESSIONAL MEMBERSHIPS

American Psychological Association (Student Affiliate)  
American Pain Society (Student Member)

PRESENTATIONS

Bruce, B.K., Brantley, P.J., Cocke, T.B., Carnrike, C.L.M., Tynes, L.L.,  
hemodialysis patients. Paper presented at the annual meeting of the  
Association for Advancement of Behavior Therapy, Houston, TX.

Ruggiero, L., Brantley, P.J., Mosley, T., Tynes, L.L., & Bruce, B.K.  
(1989). The role of health locus of control and health status as  
mediators of psychological distress in hemodialysis patients. Paper  
presented at the annual meeting of the Society of Behavioral  
Medicine, San Francisco, CA.
INVITED ADDRESSES

"Behavioral Assessment and Treatment of Problem Adolescents". Workshop presented to the Sabine Neches Association for Counseling and Development, March 14-15, 1986, Spindletop Holiday Inn, Beaumont, TX.

PUBLICATIONS


CURRENT RESEARCH

Principal Investigator, multi-site investigation of behavioral predictors of postoperative pain in surgery patients.

Co-investigator, study assessing pertinent medical and psychological variables in patients with treatment-resistant depression.

Co-investigator, double-blind study of sertraline vs. placebo in the treatment of patients with Obsessive-Compulsive Disorder.
DOCTORAL EXAMINATION AND DISSERTATION REPORT

Candidate: Lannis Lee Tynes, Jr.

Major Field: Psychology

Title of Dissertation: Illness Behavior and the Preoperative Prediction of Postoperative Pain in Cholecystectomy Patients

Approved:

[Signatures]

Major Professor and Chairman

Dean of the Graduate School

EXAMINING COMMITTEE:

[Signatures]

Date of Examination:

March 7, 1989