Cultural Variations in Response to Painful Stimuli

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This review updates the literature on cultural differences in response to laboratory-induced pain. Thirteen studies were located, and there was great diversity among the investigations with regard to racial and ethnic groups studied, methods of pain induction, and experimental outcome.

There appear to be no racial/ethnic differences in the ability to *discriminate* painful stimuli. More difficult to assess is cultural variation in the *response* to laboratory-induced pain. Age, sex, experimenter ethnicity and the subjects' working conditions may affect and confound the response to painful stimuli. Given these confounds, there is no consistent experimental evidence to suggest cultural differences in pain response.

Perspectives derived from the social sciences may help future laboratory researchers better delineate cultural variations in the pain response. The difficulties inherent in the translation of pain descriptors across cultural boundaries make pain tolerance, rather than pain threshold, the more relevant transcultural pain measure. Since tremendous cultural heterogeneity can exist within one racial group and since even ethnic groups within a single racial category demonstrate variations in the response to pain, this field might now profitably focus on the study of ethnic group differences. Delineation of ethnic groups for study will require assessment of variations in intra-ethnic acculturation and assimilation which certainly affect group demarcation and may influence pain behavior. Specific guidelines are presented so that future experimental researchers may better operationalize culture in the laboratory setting.

INTRODUCTION

"...how unhappy, how utterly alone, always he suffers the savagery of his illness with no one to care for him..."

Sophocles, *Philoctetes* (1).

"...pain is neither intolerable nor everlasting, if thou bearest in mind that it has its limits, and if thou addest nothing to it in imagination..."

Marcus Aurelius, *Meditations* (2).

Sophocles and Marcus Aurelius eloquently describe two poles in the human response to pain. Differences in pain behaviors have always struck the keen observer, and over the centuries various observers have commented on cultural factors that appear to steer an individual toward pathos or stoicism in response to pain.

Many of these observations have been hearsay or mere stereotyping; however, in recent decades investigators have begun to study this topic carefully (3–14). While many methods have been devised to study pain, two general approaches have been followed. One approach examines pain behavior nonexperimentally in the naturalistic environment (i.e., hospitals or clinics). These observations and measurements of clinical pain have the advantage of immediate clinical relevance and application. The literature on

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cultural variations in clinical pain is extensive (10, 15–28).

The other approach, and that reviewed in this article, studies pain behavior experimentally, in the laboratory. The experimental approach allows for meticulous quantification of both the pain stimulus delivered and the pain response.

Previous reviewers have noted the lack of anthropological sophistication in past laboratory pain research (7, 8, 13). After assessing the current status of the literature, the intent of this review is to suggest ways by which future experimental investigators may better assess and account for complex cultural variables (i.e., *operationalize* culture) in the laboratory setting.

METHODS

Articles were located by MEDLINE, PSYCHLIT, and SOCIOFILE computer-based searches of the medical, psychological, and sociological literature, by correspondence with other researchers and by the checking of bibliographies obtained from the above sources. Thirteen English language articles published in a variety of journals between 1943 and 1989 were located and are discussed in this review.

In reviewing these diverse studies, it is important to note that while the racial and ethnic groups examined, methods of pain delivery, and reported outcomes of these investigations vary considerably, their experimental protocols were quite similar. The standard protocol delineated a particular racial or ethnic population for study, induced painful stimuli through one of a variety of techniques, measured the induced pain, and tabulated individual pain responses, comparing responses between groups. Our analysis of these studies follows this basic structure.

Crucial to the review of cultural variation in the response to painful stimuli are the factors employed to define specific cultural groups. Table 1 summarizes the characteristics of the study populations in terms of: the number of subjects participating in each study, the age, and racial or ethnic makeup of the groups studied, and any additional socioeconomic or demographic data provided by the authors.

The methods employed to study the pain response are summarized in Table 2. In particular we have highlighted the method of pain induction, the pain endpoint measured, and variations or comments on the general experimental protocol outlined above. While pain induction techniques are abundant and varied, the pain endpoints measured are relatively constant. All of the studies employ either pain threshold, pain tolerance, or a combination of the two as the pain measure of pain induced. *Pain threshold* is a verbal report of pain by the subject (e.g., "I feel pain"); whereas *pain tolerance* is the level of stimulus at which the subject requests cessation or spontaneously withdraws from the painful stimulus (e.g., "stop") (29, 30). Table 3 summarizes the outcomes of the individual investigations and is divided according to the type of pain endpoint measured. This division is more for organizational purposes, as the significance of measuring pain tolerance versus pain threshold is debatable (29–32). This table summarizes only the influence of race and ethnicity on response to painful stimuli. Other demographic, environmental, and socioeconomic factors found to influence the response to laboratory-induced painful stimuli will be discussed in the text. Comments upon statistical analysis of cultural comparisons are also included in this table.

FINDINGS

We were struck by the diversity of groups studied, methods employed, and results obtained. In particular, reviewing the breakdown of racial and ethnic groups presented in Table 1, it can be seen that no two investigations examined the same combination of cultural groups. The groups studied included Caucasians (Anglos, Italians, Irish, Mediterraneans, and Jews), Blacks, Hispanics, Amerinds (North American Indians and Eskimos), and Asians (Japanese, Chinese, Malaysian, and Nepalese). Subjects were males and females of all ages and social classes.

Likewise, as can be seen from Table 2, painful stimuli were induced through a variety of techniques including: cold pressor, manual and mechanical applied pres-

TABLE 1. Subject Racial, Ethnic, and Demographic Breakdown by Study

Study	*N*	Racial/Ethnic Group	Age	Sex	Other Socioeconomic Variables Addressed
Walsh et al. 1989 (37)	613	446 Anglo-Saxon Americans 133 Hispanic Americans 34 Black Americans	18–87	181M 265F 49M 84F 15M 19F	113 subjects were chronic pain patients
Chapman et al. 1982 (33)	40	20 Native Japanese 10 North Americans of Japanese descent 10 North American Caucasians	18–36	20M 20F	n.r.[a]
Clark and Clark 1980 (34)	11	6 Nepalese Buddhists 5 Occidental Subjects of Jewish or Christian descent	23–42 30–68	n.r.	Nepalese subjects were accustomed to harsh living and working conditions
Knox et al. 1977 (35)	48	24 Native Chinese and Malaysians 24 Non-Asian North Americans	17–25 19–31	n.r.	n.r.
Woodrow et al. 1972 (30)	41,119	34,077 Caucasians 1,649 Asians 5,393 Blacks	All ages except peds.	17,412M 23,707F	Patient level of education recorded
Sternbach and Tursky 1967, 1965 (38, 39)	60	All subjects were North American housewives belonging to one of four ethnic groups: 1. White Protestants of North American descent 2. First generation American Italian Catholics 3. First generation American Irish Catholics 4. First generation American ethnic Jews	n.r.	15F X4	Social class measured by Modified Hollingshead scale. All groups ranked into Hollingshead class III, roughly equivalent to middle class. The difference in scores between Protestants and Jews vs. Irish and Italian was significant at the 0.05 level
Mersky and Spear 1964 (31)	69	38 Caucasian medical students 11 Medical students of African and Asian descent 20 Caucasian student teachers	95% of subjects <30	28M 10F 11M 20M	n.r.

[a] n.r., not recorded.
[b] Details of this study are compiled from the original source (Poser 1963), personal communication with the author (1989), and from Wolff and Langley (1968).

TABLE 1 continued

Study	N	Racial/Ethnic Group	Age	Sex	Other Socioeconomic Variables Addressed
Poser 1963 (40)[b]	88	44 Jewish subjects: 22 Canadian born students and 22 immigrants 44 Roman Catholic subjects: 22 Canadian born students and 22 immigrants	n.r.	n.r.	n.r.
Lambert et al 1960 (41)	80	Equal numbers of American Protestant and American Jewish college females for both experimental trials	18–23	All F	n.r.
Meehan et al. 1954 (42)	95	26 American Indians 37 Alaskian Eskimo 32 Caucasians	12–78 10–70 n.r.	23M 3F 22M 15F 28M 4F	Indian subjects consisted of 16 trappers and fishers, 3 housewives, 2 school children and one retired individual
Chapman and Jones 1944 (36)	200	130 North Americans of Northern European descent 30 "Mediterranean" subjects (including Jews) 25 Blacks from the American South 15 Ukranians residing in America	10–85	n.r.	n.r.
Sherman 1943 (53)	450	260 subjects from the investigators office practice with unspecified organic and functional disorders and unspecified ethnicity 150 Canadian coal miners, of European and Black African descent 40 North American Indians	n.r.	149M 111F All M 27M 13F	n.r.

TABLE 2. Methods/Experimental Design

Study	Method of Pain Induction	Pain Measurement Indices	Variations in Experimental Design
Walsh et al. 1989 (37)	Cold pressor	Pain tolerance	1. Ethnic categories redefined as Anglo-Saxon and non-Anglo-Saxon after preliminary tabulation of data 2. Experimenter ethnicity not specified
Chapman et al. 1982 (33)	Dental pulp stimulation	Pain threshold	1. Two different laboratory sites employed for pain induction 2. Translation of pain descriptors required
Clark and Clark 1980 (34)	Transcutaneous electrical stimulation	Pain threshold	1. Secondary correlational study undertaken to determine the effect of harsh environmental conditions on pain threshold 2. Translation of pain descriptors required
Knox et al. 1977 (35)	Cold pressor	Pain threshold and pain tolerance	Translation of Hilgard Pain Report Scale required
Woodrow et al. 1972 (30)	Mechanical pressure applied to the Achilles tendon	Pain tolerance	Numerous experimenters employed of varying ethnicity (Caucasian, black, Asian)
Sternbach and Tursky 1967, 1965 (38, 39)	Transcutaneous electrical stimulation	Pain threshold and pain tolerance	Also measured were changes in autonomic parameters (i.e., heart rate, skin resistance) in response to pain
Mersky and Spear 1964 (31)	Pressure algometry (mechanical pressure applied against a bony surface)	Pain threshold	Two experimenters of unspecified ethnicities
Poser 1963 (40)	Hollander's Technique (Grater sewn to the back of a blood pressure cuff, which is inflated against the skin)	Pain tolerance and pain threshold	Experimenter ethnicity varied between trials
Lambert et al. 1960 (41)	Hollander's technique	Pain tolerance	Groups received verbal, ethnic pain challenge
Meehan et al. 1954 (42)	Radiant heat apparatus focused on dorsal aspect of hand	Pain threshold	1. Three different field sites employed for pain induction 2. Translation of pain descriptors required
Chapman and Jones 1944 (36)	Radiant heat apparatus focused on forehead	Pain threshold and pain tolerance	Variations in skin temperature not adjusted for
Sherman 1943 (53)	Hollander's technique	Pain threshold	No control group for cross-cultural comparisons

sure, radiant heat, and electric shock. Hence, in reviewing these studies one is comparing quite different types of pain (cutaneous, deep tendon, dental pulp, etc.).

Examination of Table 3 reveals that the outcomes of these studies are equally varied. Seven studies demonstrated significant racial and ethnic variation in baseline pain threshold and/or tolerance. Four of these six studies (30, 33–35) examined Asian pain thresholds and tolerance in comparison with Caucasians. In two of these studies (30, 35), Caucasian subjects demonstrated greater stoicism than Asians. One study (34), found six Asians

TABLE 3. Outcomes

Study	Pain Threshold	Pain Tolerance	Combined Tolerance/ Threshold	Comments
Walsh et al 1989 (37)	1. Anglo-Saxon > non-Anglo-Saxon 2. No significant differences between and Hispanics			$p < 0.001$ for Race/Age and Race/Sex covariant interactions
Chapman et al. 1982 (33)	1. N.A. Japanese >[a] N.A. Caucasion 2. N.A. Japanese > Native Japanese 3. N.A. Caucasion > Native Japanese			Combined N.A. Japanese and N.A. Caucasion Tolerance > Native Japanese tolerance at $p < 0.001$
Clark and Clark 1980 (34)	Nepalese > Occidental			1. $p < 0.05$ for racial differences 2. Harsh environment correlated with increased pain threshold
Knox et al. 1977 (35)			Caucasian > Asian	$p < 0.025$
Woodrow et al. 1972 (30)		1. Caucasian > Black 2. Caucasian > Asian 3. Black > Asian		$p < 0.001$ for all racial differences
Sternbach and Tursky 1967, 1965 (38, 39)			1. N.A. Protestant > Ethnic Italians 2. Ethnic Jews > Ethnic Italians	1. $p < 0.01$ for interethnic differences 2. Significant ethnic differences in autonomic parameters demonstrated
Mersky and Spear 1964 (31)	Caucasian =[b] Afro-Asian			$p > 0.05$ for interethnic differences

TABLE 3 continued

Study	Pain Threshold	Pain Tolerance	Combined Tolerance/ Threshold	Comments
Poser 1963 (40)			1. Catholics > Jews with Jewish experimenter 2. Catholics = Jews with Catholic experimenter	1. Jews increase tolerance/threshold with Catholic experimenter 2. Analysis of variance demonstrates ethnicity of subject and experimenter as significant factors
Lambert et al. 1960 (41)	Jews = Protestants			Both Jewish and Protestant groups significantly tolerance with properly worded ethnic pain challenge ($p < 0.03$)
Meehan et al. 1954 (42)	1. Caucasians = American Indians 2. Caucasians = Eskimo 3. Eskimo = American Indians			No p values presented
Chapman and Jones 1944 (36)			1. N.A.[c] of Northern European descent > Blacks 2. N A. of Northern European descent > Mediterraneans	No p values presented
Sherman 1943 (53)	1. Coal Miners > Clinical Population 2. Coal Miners > American Indians 3. American Indians > Clinical Population			No p values presented

[a] X > Y, Indicates Group X displayed significantly greater stoicism in response to painful stimuli than group y.
[b] X = Y, Indicates no significant differences were found between groups.
[c] N.A., North American.

(Nepalese Buddhists) to have a higher pain threshold than five English speaking Occidental subjects of Christian and Jewish background. Chapman et al.'s study (33) demonstrated complex findings, namely that North American Asians had a higher pain threshold than North American Caucasians, but that the latter in turn had higher thresholds than native Japanese.

Two studies demonstrated that North American Caucasians have greater pain tolerance/threshold than North American blacks (30, 36). One study (37) found North American Caucasians to have higher pain tolerance than both North American blacks and North American Hispanics. No significant differences in pain tolerance were observed between black and Hispanic groups.

Four studies found interethnic variation in response to laboratory-induced painful stimuli. Sternbach and Tursky (38, 39) demonstrated significant ethnic differences in pain tolerance and associated autonomic parameters among four Caucasian ethnic groups (Anglo-Americans, Irish American, Jewish American, and Italian-American subjects). The American Protestants and American Jews had significantly higher tolerance than Italian Americans.

Two of these four studies compared the pain response of Jewish and Christian subjects (40, 41). Poser (40) compared pain tolerance and pain threshold while varying experimenter ethnicity and found that Jewish pain tolerance markedly increased with the presence of a Catholic experimenter. Lambert et al. (41), while also varying experimenter ethnicity, delivered an ethnic pain challenge (e.g., members of Group x were told that they can take less pain that Group y) and demonstrated an increase in pain threshold for both Catholic and Jewish groups after this type of verbal pain challenge. These results suggest that culturally determined attitudinal factors may influence pain endpoints in ethnic populations.

Two studies demonstrated no inter-racial/interethnic variation to painful stimuli (33, 42). Thus, in reviewing the above studies there is no consistent data suggesting one particular cultural group is more or less stoic in response to induced pain. Importantly, none of the above studies (33, 34, 38) found intergroup differences in the ability to discriminate painful stimuli, suggesting that any observed cultural variation does not have a neurosensory origin.

DISCUSSION

The conceptual and methodological difficulties inherent in laboratory pain research have been thoroughly reviewed (43–46). Central to this discussion is the relationship of pain tolerance and pain threshold. As noted above, threshold is a verbal report of pain whereas tolerance is a request for cessation or frank withdrawal from the stimulus.

Much debate persists as to how pain tolerance and threshold relate to one another and which, if either, is a better measure of laboratory-induced painful stimuli. While Gelfand (47) suggested that there is little relation between pain threshold and pain tolerance, Clark and Bindra (48) demonstrated a high correlation between the two measures. Harris and Rollman (32) compared pain threshold and tolerance levels using three different methods of pain induction: cold pressor, electrical stimulation, and cutaneous pressure. Multitrait-multimethod

analysis of subject response applied across the various stressors demonstrated that while related, threshold and tolerance measures may elucidate different aspects of the pain experience. These results support Wolff's conclusion that pain threshold is more loaded towards physiological or sensory variables as opposed to psychological variables, while the reverse was true of pain tolerance (29).

As for the question of which measure is more appropriate for cross-cultural studies, recent developments in other areas of cross-cultural pain research may provide an answer. Linguistic analysis of the semantics of pain across cultures indicates the complexity of the translation of English language pain descriptors (49–52). A number of the investigations included in this review have required the translation of pain descriptors from English, in order to compare intergroup pain thresholds (33–35, 42). Unfortunately, it appears that many of these translations were performed in a haphazard, informal manner, thus reducing the reliability of any intergroup pain threshold data stemming from these studies. Because of these semantic and methodological difficulties, it seems that pain tolerance, requiring a simple request for cessation of the stimulus or the observed withdrawal of the experimental subject, is a more useful cross-cultural measure than pain threshold. Wolff (7) has suggested utilization of a nonverbal, graphic method of pain measurement such as the Visual Analogue Scale, if pain threshold must be measured cross-culturally. However, even here, the anchor points of such a scale are by necessity grounded in language.

Furthermore, reliance upon language and linguistic analysis alone may cloud the underlying cultural meaning of pain. Beyond language, pain behavior may mean something disparate in different societies depending on cultural beliefs. Sargent's ethnographic work among the Bariba of West Africa (26) demonstrates this point. The Bariba present a scant vocabulary for the expression of pain, yet stoicism and pain endurance are tremendously important tacit determinants of honor and shame in Bariba culture. Whether experiencing pain from wounds incurred during battle, or the pain of circumcision, Bariba males are encouraged to demonstrate extreme stoicism rather than suffer public dishonor. Likewise, ideal behavior for a Bariba woman in labor is to endure birth pains silently, calling for help only when assistance is needed in severing the umbilical cord. Clearly, these observable cultural nuances surrounding the response to pain defy attempts at verbal quantification.

There are of course, a number of other variables besides racial and ethnic group which significantly influence pain tolerance and threshold. Four studies (30, 31, 37, 53) found that sex affected the response to painful stimuli: there was greater stoicism in men than women. While earlier reviews of the literature suggested no clear trends with regard to sex differences in pain response (54), more recent work suggests that men may consistently demonstrate greater stoicism than women (37, 55, 56).

Three studies (30, 36, 37) examined the influence of age on response to painful stimulus. Woodrow et al. (30) report decreasing stoicism with increasing age when measuring deep tendon pain. Likewise, Walsh et al. (37) noted decreasing tolerance in males to cold pressor with increasing age. On the other hand, Chapman and Jones (36) report increasing stoicism with age in response to cutaneous

pain induced by radiant heat stimulation. The current literature on the relationship between pain response and age shows no clear trends (57).

Two studies (34, 53) demonstrated that living and working environments influence the pain response. Both studies examined the response to pain in individuals who were accustomed to harsh living and working conditions (Nepalese Sherpas and Canadian Coal Miners). The investigations demonstrated greater stoicism in these groups when compared with other segments of the population.

It is interesting to note that while two of the studies (30, 33) mentioned the possibility that race and/or sex of the experimenter may have accounted for unexpected findings, only one study (40), purposefully manipulated experimenter ethnicity. The literature on experimental effects of experimenter ethnicity includes few psychophysiological studies (58). Nevertheless some evidence suggests that the ethnicity of the experimenter may significantly impact certain parameters such as heart rate (59) and galvanic skin potentials (58, 60).

Furthermore, only one investigator (40), systematically employed statistical analysis to assess sociocultural and demographic factors that may have significantly influenced the variance in response to pain. He found ethnic origin of the experimental subject and ethnic origin of the investigator to be significant factors in the response to painful stimuli. It appears then that a major limitation of these studies is the failure to consider factors besides subject racial and ethnic group, such as ethnicity of experimenter and the subjects' exposure to harsh environmental conditions that could influence the response to laboratory-induced painful stimuli.

Another shortcoming of these studies is the selection of "race" as the major factor in the delineation of comparison groups (7, 8). Chapman and Jones (36) and Sternbach and Tursky (38) demonstrated that the laboratory pain responses of various ethnic groups *within* a single racial category (Caucasian) may vary significantly. Wolff (7, 8) anecdotally reports increased stoicism to experimental pain among North American black males when compared with West African blacks; pain responses of West Indian blacks tended to fall between the North American and African groups. There is also a plethora of data suggesting significant ethnic variation in response to clinical pain (15–17, 21, 24, 26). Yet despite this evidence, six of the investigations reviewed failed to specify Caucasian ethnicities (39, 31, 34–36, 42).

Anderson (59) has discussed the importance of further dividing the racial category "Black American" into specific subcultural groups to properly assess sociocultural factors in the study of essential hypertension. This argument applies as well to the study of cultural variation in laboratory-induced pain. "Race" may be an obsolete marker for the delineation of study populations. Instead ethnic groups, with common origins, a shared sense of identity and collective standards for behavior (61), may be the more appropriate units of comparison in cross-cultural pain research.

Evidence from studies of clinical pain suggest that levels of subject assimilation and acculturation strongly influence intra-ethnic variation in the experience of clinical pain (10). First and second generation immigrants are more likely to retain idiosyncratic beliefs and behaviors that may influence the response to painful stimuli. In contrast, later, more assimi-

lated generations are less likely to retain these behaviorally significant aspects of ethnicity, while continuing with more superficial, or what Harwood (61) labels "ideologic" ethnic traits (e.g., the occasional use of idiomatic phrases from an ancestral language during fluent English conversation). Among the reviewed investigations, only Sternbach and Tursky (38, 39) made an attempt to thoroughly delineate levels of acculturation and assimilation in experimental subjects of different ethnic groups. Prior to the onset of investigation, ethnic American Protestant, Irish American, Italian American, and Jewish American subjects were questioned with regard to their generational status (i.e., first generation, second generation etc.) familial origin, and social class. In future investigations, if ethnic groups are to be the units of study in laboratory pain research, intraethnic differences in acculturation and assimilation will need to be thoroughly delineated before the initiation of investigation.

Current cross-cultural psychiatry encourages the integration of a social science perspective into biomedical research and practice (62). Anthropologists have started to examine the clinical experience of pain in their ethnographies (26). While investigators researching cultural influences on clinical pain (10) and pain semantics across cultures (50–52) have begun to incorporate these perspectives, researchers investigating cultural variations in laboratory-induced pain have not.

CONCLUSION

The response to painful stimuli ranges from pathos to stoicism. The diversity of response has occasioned comments from a variety of scholars including anthropologists, medical clinicians, and laboratory researchers.

Because anthropological and clinical study is so demanding and still difficult to quantify and control, it was only natural for investigators to attempt to model pain behavior in the laboratory where the variables can be better regulated. Unfortunately as this review reveals, the laboratory model has remained ill-developed. These studies lavished attention on the pain stimulus while ignoring the social psychology of the laboratory. The social scientist can potentially bring to the laboratory milieu the awareness that subject and experimenter outlooks and preconceptions can potentially prejudice the collection and interpretation of psychophysiologic data.

There is no evidence suggesting that the neurophysiologic detection of pain (i.e., pain threshold) varies across cultural boundaries. On the other hand, pain tolerance reflects the behavioral aspects of pain that are profoundly influenced by culture. It may be that some populations are more stoic, but evidence for this proposition will remain unconvincing until laboratory testing considers the following questions that are so likely to mediate the expression of pain and influence the outcome of individual investigations:

1. What are the patients' expectation of the research and the researcher?
2. What are the patients' understanding of the research in particular or for that matter the tradition of research?
3. Is the crucial contrast between groups A and B or is the described pain behavior a function of differences in social class, sex, or acculturation?
4. How do individuals in the ethnic groups being studied describe pain? How will laboratory attempts to assess pain response account for intergroup differ-

ences in verbal description and nonverbal expression of pain?

5. How will the groups under study be delineated? Will the investigation assess both intergroup and intragroup differences?

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