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MUSIC DISTRACTION TO RELIEVE PAIN IN CHILDREN

BY

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The undersigned certify that they have read, and recommend to the Faculty of Graduate Studies and Research, for acceptance, a thesis entitled "Music Distraction to Relieve Pain in Children" submitted by Susan Fowler-Kerry in partial fulfilment of the requirements for the degree of Master of Nursing.

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ABSTRACT

The need for an injection may precipitate anxiety and anticipation of pain. This common reaction perhaps is the result of early childhood experiences and one that need not develop if steps are taken to reduce the pain of injections during childhood. There are many effective strategies for pain control which have been developed with adult subjects but not assessed for use with children. The purpose of this study was to assess the value of two strategies (suggestion and distraction) in reducing injection pain in children.

The study was conducted in community health clinics in conjunction with ongoing immunization programs. Two hundred children receiving routine diptheria-pertussis-tetanus immunizations were enrolled in the study and randomly assigned to one of the treatment groups. After receiving their experimental treatments from the researcher, the children were asked by the research assistant for their subjective report of pain using a visual analogue scale.

The treatment groups consisted of: (1) distraction alone, (2) distraction with suggestion, (3) suggestion alone, and (4) no distraction or suggestion. The subjects in all four groups wore the headphones. A second control group was added to determine if the headphones presented a novel distracting stimulus with analgesic properties.

A 2 x 2 ANOVA found a significant main effect for distraction. Neither the main effect of suggestion nor the suggestion x distraction interactions were significant. The Headphone Control and the No Headphone Control groups were compared using ANOVA. There was no significant difference in pain response for the two groups. A standard multiple regression determined that having received distraction and the location of clinic attended contributed most to the variance accounted for in the multiple regression. Age was found to be significantly different across clinics. Younger children reported greater pain from injections than older children and were less distracted by music.

The results of this study supported the use of music distraction in the reduction of pain in children receiving injections. The implications of these findings for clinicians and researchers were discussed.

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Music Distraction to Relieve Pain in Children

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The study of pain is not new to scientists. Although much knowledge has been acquired and important technological advances achieved, many individuals still suffer from acute and chronic pain. In a recent review of the pain literature (see Appendix A), it was suggested that children may be among those who have been helped very little by advances in pain research. Most research investigates the adult in pain. Therefore, the present study wishes to explore strategies for reducing pain in children.

Pain is a complex sensory event which is highly individualized (Jacox, 1979; Melzack, 1973; Turk, Meichenbaum & Genest, 1983). The perception of pain is related to physiological and psychological contexts in which pain occurs, (Melzack & Wall, 1965). That is, it depends on the intensity, location and duration of the noxious stimuli and also on many psycho-social and situational factors (Beecher, 1959; Melzack & Wall, 1982). These psycho-social and situational factors, which include age, sex, gender, culture, attitude and past experiences may modify pain by altering its perceived strength or unpleasantness (Zborowski, 1952; Beecher, 1959; Lazarus, 1966; Wolff & Langley, 1968; Melzack & Wall, 1982). Because these factors vary, pain elicited by a constant noxious stimulus will not be perceived in the same way across individuals nor within the same individual across time.

Scientific explorations of pain have led to controversy. One long standing debate concerns which of three theories best explains the mechanisms of pain. Two older theories (Specificity and Pattern) have been combined and extended to produce the third theory (Gate-Control). This latter theory, proposed by Melzack and Wall (1965) is now, generally favoured by researchers. Melzack and Wall (1965) proposed that sensory input passes through the cells of the substantia gelatinosa where a hypothetical gate is located. The gate, which is influenced by activity in small-diameter and large-diameter peripheral nerve fibers, acts by modulating both ascending and descending impulses For example treatment strategies such as hypnosis and distraction are postulated to close the gate on descending impulses while narcotics are responsible for affecting both ascending and descending impulses.

Not all aspects of the Gate-Control theory are accepted especially some physiological assumptions that postulate that the gating activity is modified by the amount of activity in the large-diameter and small-diameter fibers (Wall, 1978). However, the psychological assumptions of this theory have made significant contributions to the understanding of paradoxical pain and the development of creative approaches in pain management (Turk, Meichenbaum & Genest, 1983). Most significantly, the theory has resulted in pain now being regarded as a multidimensional construct (rather than as it was formerly, as a physiological entity only).

Recognition of the multidimensional nature of pain has broadened the approach to pain measurement. The literature describes three basic approaches for the measurement of pain. These are: (1) measurement of autonomic changes, (2) behavioural observations, and (3) subjective reports. Of these the self-report is reliable, valid and most often used with adults (Sternback, Murphy, Timmermans, Greenhout & Akeson, 1974; Bourbonnais, 1981; McGuire, 1984). When children are research subjects, use of self-report for measuring pain may be more difficult because of their level of cognitive development (Beyers, 1984).

Obtaining a meaningful, objective and reliable measure of pain in adult and children subjects is important for many reasons. First, good measures provide an indication of the degree of individual's suffering, which is important in clinical practice. Second, they provide a means for evaluating the efficacy of various treatments. Finally they provide the potential for increasing our knowledge of pain.

Over the past three decades there has been an increased interest in the study of pain in adults. The same trend may only be beginning for children. As mentioned researchers and clinicians now recognize that factors such as age, gender, culture and situational factors affect the adult perception of pain. Unfortunately, the effects of these factors on pain among children are not so well documented. As with adults, pain in children is a complex sensory event. One could expect that, as

children develop, their patterns of pain behaviour and their perceptions of pain change, probably as a consequence of maturation and increasing experience with pain. However, additional research is needed to evaluate all areas of childrens' pain (Eland & Anderson, 1977; McCaffery, 1977; Abu-Saad, 1981; Beyer, De Good, Ashley & Russel, 1983; McGrath, Cunningham, Goodman & Unrah, 1984).

Part of the increased interest in adults' pain has led to the development and testing of the so-called "psychological" treatment approaches. Examples of these strategies include, preparatory information (Johnson & Leventhal, 1974); imagery (Blitz & Dinnerstein; 1971); hypnosis (Hilgard, 1975); relaxation (Knowles, 1981); and distraction (Barber & Cooper, 1972). These strategies have been studied in a more limited way with children. (Wolfner & Visintainer, 1975; Berstein, 1965; LaBaw, Holton, Tewell & Eccles, 1975; Corah, Gale, Pace & Seyrek, 1981).

There are advantages to using psychological treatment strategies since they pose little hazard to the patient. Furthermore, in the clinical setting, nurses using these strategies have the opportunity to exercise judgement independent of the physician-in-charge. On the other hand, disadvantages have been noted for several of the psychological strategies. Some are regarded as impractical in the clinical setting owing to time required for patient preparation (e.g., imagery, biofeedback). Others (e.g., hynposis, biofeedback) require special skills of the clinician. One psychological strategy that does not have

these disadvantages is distraction. It can be recommended as a safe, simple and inexpensive to employ in clinical settings, particularly with children. (Johnson, 1977; Venham, Goldstein, Gaulin-Kremer, Peteros, Cohan & Fairbanks, 1981; Melzack & Wall, 1982; Wentworth-Dolphin, 1983).

Researchers across disciplines have been devising and assessing different distraction strategies for children, including: playing video ping-pong (Cohan, Gale & Illig, 1979); word association tasks (Gardner, Licklider & Weiss, 1960); viewing childrens' television programs (Venham, Goldstein, Gaulin-Kremer, Peteros, Cohen & Fairbanks, 1981); and listening to music (Corah, Gale, Pace & Seyrek, 1981).

Music, as a distraction has been studied predominantly in dentistry. It seems to be a very effective portable and inexpensive distraction strategy to employ with children in the dental operatory (Hewitt, 1967; Corah, Gale, Pace & Seyrek, 1981; Venham, Goldstein, Gaulin-Kremer, Peteros, Cohan & Fairbanks, 1981).

Research evaluating the efficacy of music distraction is often flawed with respect to control of demand characteristics across groups. Few dental studies incorporate a placebo control condition (Melzack, Weisz, & Sprague, 1963; Wardle, 1983) although there are exceptions (see for example Hewitt, 1967). Although the powerful placebo effect of suggestion has been well documented (Beecher, 1959; Melzack & Wall, 1982; Turk, Meichenbaum & Genest, 1983), few dental studies have controlled

for the effect of suggestion (Gardner & Licklider, 1959; Corah, Gale, Illig, 1979). In addition, single or double-blind techniques are infrequently used to control the effects of experimenter bias. This bias may pose a rival to the hypothesis that music is an efficacious distraction for pain if demand characteristics differed systematically across treatment conditions.

Even with the methodological weaknesses, dental research has suggested that music is efficacious with children. Well-controlled research, however, should be undertaken to determine the value of music distraction in other clinical settings and for other pain conditions. The present study was undertaken with this goal in mind. Music, as a distraction strategy, was studied in children receiving regular pre-school diptheria-pertussis-tetanus immunizations (DPT).

Because the subjects in this study are children, several important factors relevant to children should be discussed. Age has been identified in the literature as a factor influencing the perception of pain. The majority of studies evaluating pain as a function of age have used small samples with adult subjects, and in those studies where children were included in the sample they were older children (Schludermann & Zubek, 1962; Haslam, 1969; Woodrow, Friedmann, Siegelaub & Collen, 1972). Therefore, the effect of age on pain in children is uncertain.

As age is related to the level of cognitive development, using young subjects introduces potential measurement problems.

Nevertheless, several researchers have reported that visual analogue scales have been used successfully to measure childrens' subjective report of pain (Abu-Saad & Holzemer, 1981; Eland, 1981; Beyers, 1984). These scales can easily be adapted for different levels of cognitive development that children possess.

There do not appear to be studies evaluating gender differences on pain perception among children. The effects of gender on pain are worthy of study, particularly since males and females are treated differently even shortly after birth (Fein, 1978; Yussen & Santrock, 1978). This may result in differential responses to pain for boys and girls. For example boys may be encouraged not to cry during painful procedures

Finally, an important factor known to influence the perception of pain is the "powerful placebo" described by Beecher (1955). The effect of suggestion has become recognized as a significant factor in all aspects of pain research (Beecher, 1955; Melzack, (1961); Melzack & Wall, 1965; Turk, Meichenbaum & Genest, 1985). Yet, the effect of suggestion on children in pain is not documented.

The present investigation intends to study the effect of music distraction upon children receiving a short, painful stimulus from an injection. It is hypothesized that music distraction will reduce the pain of injections. This investigation will also describe the relationship of suggestion, gender and age upon pain response. Specific hypotheses will be presented following a description of the procedure.

Method

Subjects. One hundred male and 100 female subjects participated in this study. These volunteer subjects were among those who attended clinics located in the Stony Plain, Lac St. Anne and Sturgeon Health Regions.

The criteria for subject selection included:

- aged 4 1/2 to 6 1/2 years;
- no history of chronic diseases;
- only routine immunization injections experienced in the past;
- spoke English, as did parents or legal guardians;
- child willing to participate in the study;
- parent or guardian willing to give consent (See Appendix B for consent form).

At the clinics, the health chart for each potential subject was reviewed to ascertain that the first three criteria were met. Satisfying the other two criteria was determined from contact with parents and children. Subjects satisfying the criteria were randomly assigned to experimental groups with the restriction that equal numbers of boys and girls be in each group.

Materials. Music distraction was delivered through headphones that covered the entire outer ear. The music was chosen for its uniqueness and for having sounds of children laughing and singing along with a male vocalist (Neil Diamond, "I am the Lion").

In this study pain was measured by self-report using a 4-point visual analogue scale (Figure 1). The scale consisted of four identical boxes of a neutral colour. The far right box represented maximum pain and the far left box represented no pain.

Procedure. At each clinic, Experimenter I greeted potential subjects and parents or legal guardians. The study was explained to the parent or legal guardian in the absence of the child and group assignment was not revealed. Before the study and in the presence of the parents, subjects were introduced to the pain measurement scale. This was done to assess comprehension of the concept of pain by looking for variation in response to three different stimuli. Three vignettes were presented that asked the child to report how much pain might result from falling in the snow, scraping their knees and being bitten by a mosquito. The vignettes can be found in Appendix B.

After the preparation session, Experimenter I then randomly assigned the subject to group (thus there was a partial blind for Experimenter I). The group assignment was not shown to immunization nurse, parent or child (thus there was a double-blind for parent, subject and nurse). The nurse then prepared and positioned the subject for the immunization injection. Experimenter I then proceeded with the designated intervention and indicated to the nurse by a nod that the injection could be administered.

Immediately following the assigned intervention, Experimenter II asked the subject for a self-report of pain resulting from the injection. Experimenter II was blind to the treatment assignment. Parents were present during the procedure but they had been asked not to prompt the child. Parents did not have any face-to-face contact with the child during the intervention and the final assessment.

Experimenter I returned and asked several open ended questions of the subject to assess degree of attentiveness. The questions were:

1. do you remember being told anything;
2. did you wear headphones;
3. did you hear anything;
4. what did you hear; and
5. did you like what you heard?

Five interventions assessed in this study resulted from combinations of suggestion and music distractions Two control groups were used consisting of headphones and no headphones.

The five groups included:

1. Distraction Only Group - Headphones were placed over the subject's ears and music was delivered at a set volume.

2. Combined Group - The following suggestion was given to the subject: "Before I put these headphones over your ears I am going to do something to help you when you have your needle." Then the subject was treated identically to the Distraction Only Group.

3. Suggestion Only Group - The same suggestion used for the Combined Group was given to the subject. Headphones were then placed over the subject's ears but no music was played as the equipment was not turned on.

4. Headphone Control Group - The headphones were placed over the subject's ears but no suggestion and no music distraction were administered.

5. No Headphone Control Group - Headphones were not placed over the subject's ears and no suggestion or music distraction were administered.

Design. This study employed a 2 x 2 Factorial design (distraction x suggestion). A music distracting stimulus was either present or absent and suggestion was either present or absent. Subjects in groups one through four wore headphones. A fifth group (No Headphones Control Group) was included to assess for novelty effects from headphones. The dependant measure was reported pain from immunization injection.

Hypotheses.

1. Subjects receiving the music distraction will report less pain than those subjects who do not receive music distraction (main effect of distraction).

2. Subjects receiving suggestion will report less pain than those who do not receive suggestion (main effect of suggestion).

3. Subjects who receive combined suggestion and music distraction will report less pain than those subjects from other

groups who did not receive this combination.

4. Subjects in the Headphone Control Group will report less pain than subjects in the No Headphone Control Group.

5. Because age range was restricted, pain response will have a low correlation with age.

6. Boys will report less pain than girls.

Results

The data analyses are presented as follows: (1) characteristics of the sample, (2) effects of distraction and suggestion, and (3) factors affecting pain response.

Characteristics of the Sample

The sample consisted of 100 males and 100 females, who attended regional Albertan health clinics located in Stony Plain, Spruce Grove and St. Albert. These clinics, located in "bedroom boroughs" near metropolitan Edmonton. Table 1 describes the characteristics of subjects across clinics. The data included in this table is as follows: mean age of subjects, gender responses to each vignette, response to the injections, the subject's family birth order, time of day the injection was administered, had the subject received a Measles, Mumps and Rubella (MMR) immunization in the past month, and group assignment.

Analysis of Variance was used to compare clinics for subject ages. Age differed significantly across clinics (Table 2: ANOVA; $F = 52.72$, $df = 2, 197$, $p \leq 0.05$). Post-hoc comparisons (Duncan and Modified LSD $p = 0.05$) demonstrated that subjects at the St. Albert clinic were significantly younger than at the

other two clinics. The mean age of the St. Albert subjects was 61.31 months (Standard deviation, 5.84) compared to 68.53 months (Standard deviation, 2.95) at Stony Plain and 68.03 months (Standard deviation, 3.54) at Spruce Grove.

Although random assignment of subjects was used, a Chi-square analysis was used to confirm treatment assignments did not differ significantly as a function of clinic. Because of the small number of subjects at one clinic and as age was not significantly different for two clinics, Spruce Grove and Stony Plain were collapsed for the purpose of the Chi-square analysis. No significant difference in group assignment across clinics was found for Spruce Grove and Stony Plain compared to St. Albert.

A Chi-square analysis also determined that there was no significant difference in gender across clinics.

Effects of Distraction and Suggestion

A standard multiple regression was performed to determine what variables contributed significantly to the prediction of pain. Variables included in the analysis were: subject's birthorder, time of day injection was administered, whether the subjects had previous Measles, Mumps and Rubella immunization (MMR), pain rating given for three vignettes, gender, clinic attended, age and treatment assignment. The amount of variance accounted for was 19% (Table 3). Having received distraction and the location of the clinic attended contributed most to the variance accounted for in the multiple regression analysis.

Table 1

Characteristics of Sample by Clinic

	Clinic		
	Stony Plain	Spruce Grove	St. Albert
Mean Age (in months)	68.53	68.03	61.31
Standard Deviation	2.95	3.54	5.84
Subjects	19	117	64
Male	7	60	33
Female	12	57	31
Vignette Mean Pain Response			
#1 (falling on snow)	.225	.170	.000
#2 (falling on sidewalk)	1.70	2.93	2.76
#3 (mosquito bite)	.566	.915	.894
Mean Injection Pain Response	1.05	1.35	1.95
Standard Deviation	1.18	1.12	1.06
Frequency of Birthorders			
First born	7	91	27
Second born	6	19	30
Third born	3	6	7
Fourth born	2	1	0
Fifth born	1	0	0
Time of Day Injection Administered			
A.M.	16	80	51
P.M.	3	37	13
Frequency of MMR Immunization			
Had	1	8	11
Did not have	18	109	53
Frequency of Group Assignment			
Distraction Only	6	19	15
Suggestion Only Combined	3	23	14
Distraction and Suggestion	3	23	14
Headphone Control	4	22	14
No Headphone Control	3	30	7

Table 2

Age by Clinic

Source	Degrees of Freedom	Mean Square	F	p
Between Groups	2	1005.34	52.72	.000
Error	197	19.07		
TOTAL	199			

Group	n	Mean Age	Standard Deviation	Standard Error
Stony Plain	19	68.53	2.95	0.68
Spruce Grove	117	68.03	3.54	0.33
St. Albert	64	61.31	5.84	0.73
TOTAL	200	65.93	5.38	0.38

Table 3

Regression Coefficients Relating Demographic Variables to Pain Response

Variable	Standardized Regression Coefficient	t	p
Birthorder	-.0628	-.595	.55
Distraction with Suggestion	-.9659	-3.954	.0001
Gender	.1647	1.072	.28
Clinic 2	-.4517	-2.095	.04
MMR	-.0498	-.189	.85
Time of Day	-.3114	-1.890	.06
Headphone Control	-.4427	-1.830	.07
Clinic 1	-.8087	-2.532	.01
Age	-.0158	-.888	.38
Distraction	-.6952	-2.786	.01

$R^2 = .19$

A 2 x 2 ANOVA compared the four groups receiving combinations of distraction and suggestion. A significant main effect was found for distraction. Pain responses were significantly lower when distraction was used compared to no distraction (Table 4: ANOVA; $F = 3.95$, $df = 1$, $p \leq 0.05$). Neither the main effect of suggestion nor the suggestion x distraction interaction were significant.

All subjects who received distraction (Distraction Only and Combined groups) were analyzed separately to determine whether clinic, gender or age predicted successful distraction. Subjects were grouped according to pain response into successful (pain scale response = 0 or 1) or unsuccessful (pain response = 2 or 3). Age was significantly different for the two "success" groups (Table 5: ANOVA; $F = 3.50$, $df = 1, 78$, $p \leq 0.06$). Subjects in the successful group, on the average, were older than subjects in the unsuccessful group.

Chi-square analysis found no significant relationship between distraction success group and gender. However clinic was related to success of distraction (Table 6: $\chi^2 = 6.86$, df, 2, $p \leq 0.05$). The Stony Plain clinic had a greater than expected rate of success with distraction and the St. Albert clinic had a less than expected rate of success.

Because of the potential effect of age on pain response, a 2 x 2 analysis of covariance was performed with age as the covariate. The main effect of distraction was again significant but neither the main effect of suggestion nor the suggestion x distraction

Table 4

Effect of Distraction and Suggestion on Pain

Source	Degrees of Freedom	Mean Square	F	p
Distraction	1	4.90	3.95	.049
Suggestion	1	0.40	0.32	
Distraction x Suggestion	1	1.25	0.99	
Error	156	1.24		
TOTAL	159	1.26		

Group	Mean Pain Response	Standard Deviation	n
Combined Distraction and Suggestion	1.07	1.02	40
Distraction Only	1.35	1.14	40
Suggestion Only	1.60	1.13	40
Headphone Control	1.60	1.15	40
No Headphone Control	1.95	1.13	40

Table 5

The Effect of Age on the Success of Distraction

Source	Degrees of Freedom	Mean Square	F	p
Between Groups	1	103.88	3.50	.06
Error	78	29.71		
TOTAL	79			

Group	Mean Age	Standard Deviation	n
Successful	66.69	5.23	49
Low/unsuccessful	64.35	5.79	31

Table 6

Success of Distraction

Clinic	Successful	Not Successful	Total
Stony Plain	9*	0	9
	5.5**	3.5	
Spruce Grove	25	17	42
	25.7	16.3	
St. Albert	15	14	29
	17.8	11.2	
Total	49	31	80

chi-square = 6.86, df = 2, $p \leq 0.05$

* Actual frequency

** Expected frequency

Table 7

Effect of Distraction and Suggestion on Pain with Age as the Covariate

Source	Degrees of Freedom	Mean Square	F	p
Covariate				
Age	1	10.52	8.92	
Main Effects				
Distribution	1	5.15	4.73	.038
Suggestion	1	0.40	0.34	
Interaction	1	1.15	0.98	
Error	155	1.78		
TOTAL	159	1.26		

Table 8

Frequency of Pain Response Choice by Vignette

Vignette	No Pain	Some Pain	More Pain	Worst Pain	N
1 (falling in snow)	164	34	2	0	200
2 (falling on sidewalk)	2	10	73	115	200
3 (mosquito bite)	67	101	32	0	200

Table 9

Clinic by Pain

Source	Degrees of Freedom	Mean Square	F	p
Between Clinics	2	9.76	7.99	.0005
Error	197	1.22		
TOTAL	199			

Mean Pain Responses

Clinic	Mean	Standard Deviation	n
Stony Plain	1.05	1.18	19
Spruce Grove	1.33	1.11	117
St. Albert	1.95	1.06	64

interaction were significant (Table 7: ANOVA; $F = 4.37$, $df = 1, 194$, $p \leq 0.05$).

The Headphone control and the No Headphone control groups were compared using ANOVA. Results demonstrated that pain responses were not significantly different for the two control groups.

Factors Affecting Pain Response

Clinic. Since the multiple regression indicated that the location of clinic attended contributed to the pain response, the relationship of clinic and pain was further examined. Pain responses differed significantly across clinics (Table 9: ANOVA; $F = 7.99$, $df = 2, 197$, $p \leq 0.05$). Post-hoc comparisons (Duncan, Modified LSD, $p = 0.05$) demonstrated that the pain responses of subjects attending St. Albert were significantly higher than subjects attending the other two clinics.

Pain Rating in Response to Vignettes. The results of first order correlations, between pain response and vignettes were as follows:

Vignette 1 - (falling in snow) r = .005

Vignette 2 - (falling on sidewalk) r = -.051

Vignette 3 - (mosquito bite) r = .081

These results demonstrate that the presentation of vignettes prior the subject's injection did not significantly affect the final pain response. Table 8 reveals the frequency of pain response choice by vignette.

Gender. A 2 x 2 x 2 ANOVA (gender x distraction x suggestion) was conducted for pain response. There was no main

effect of gender nor suggestion, but distraction was significant. Two-way and three-way interactions were not found to be significant. By including gender in the analysis of treatment effects, the sample size for each cell was reduced from 40 to 20. This had the effect of reducing the power, thereby increasing the risk of a Type I error. In short, it may be erroneous to fail to reject the null hypothesis. Only by increasing the sample size, would there be certainty that gender had no effect.

Discussion

The purpose of the present study was to evaluate the effectiveness of music distraction for children receiving immunization injections. The results supported the hypothesis that music distraction reduces reported pain. Further analysis revealed that success of distraction was related to age of the children and clinic attended. The finding that younger subjects were distracted less by the music than the older subjects was surprising particularly since researchers have assumed that young children are distractable (Eland & Anderson, 1977; Jacox, 1977; Hester, 1979; Whaley & Wong, 1983). However as children become fore fearful they may become less distracted. Nevertheless, observations made during the study supported the use of distraction as an acceptable treatment for children. For example, several parents whose children were in either the Distraction or Combination groups, commented that they had never seen their children so relaxed during an injection. In addition, several subjects in the pilot study, who were back at the clinics

to receive their MMR injections, requested the music because they felt that it helped reduce injection pain. Finally, it was observed that there seemed to be a long latency to startle with subjects in the distraction or combination groups. These observations provide some degree support for music being an effective distraction strategy. The finding that clinic was related to success of distraction was surprising. The sample collected from one clinic (the one which was significantly different from the others) was small (19 subjects, 9 assigned to the distraction only or combined group). Therefore, the finding that clinic is related to success of distraction may be spurious (due to the small sample size).

In this study, the effect of suggestion (a placebo) did not significantly reduce reported pain from injections. However the combined distraction and suggestion group had the lowest mean pain scores (although not significantly different from the Distraction only group) thus hinting at some added benefit from suggestion.

There may be several reasons why suggestion did not produce a significant result. First data collected to determine the degree of attentiveness of subjects to the interventions revealed that 67 of a possible 80 subjects receiving suggestion and the combination of suggestion with distraction remembered the researcher telling them something prior to their injection. Interestingly, 32 subjects said that the researcher was going to do something so the injection would not hurt.. The remaining 35

subjects responded with the suggestion statement verbatim. Although 67 subjects said they heard the suggestion, the manner in which the statement was presented by the researcher may not have been strong enough. Second, the literature evaluating the efficacy of imagery and hypnosis reports that the success of these two strategies depends largely on the positive rapport established between the patient and clinician (Stacher, Schuster, Bauer, Lahuda & Schultz, 1975). In this study, the subjects did not know the researcher prior to their injection, therefore the development of a good rapport was difficult. The subjects may not have trusted the researcher enough to respond positively to the placebo. Finally, it is possible that young children do not respond to suggestion at all.

Because the researcher was not certain how wearing headphones would affect the subjects, a second control group (no headphone control) was added to the design of this study. From talking to the subjects, children in this age group were certainly afamilar with wearing headphones. The result which demonstrated that there was no novelty effect from wearing headphones was therefore not surprising.

This study observed that the younger the child the more pain reported from injections. This is an important finding considering the many myths about the inability of very young children to perceive or remember past painful experiences (Eland & Anderson, 1977; McBride, 1977; Beyers, 1984). This study shows the inaccuracy of this belief.

Another interesting finding was that reported pain varied across clinics. Variation in pain can mainly be attributed to the significant differences in ages by clinic. Subjects attending the St. Albert clinic were significantly younger than at the other two clinics. Variation in pain can also be attributed to procedural and environmental differences in the clinics.

Stony Plain and Spruce Grove were physically smaller clinics than St. Albert. The children were in those clinics only to be given immunizations. The clinics were never very congested with clients. By contrast there was much more activity at the St. Albert clinic. The high noise level at this clinic may have had the effect of increasing the child's level of anxiety which would also increase the amount of pain experienced (Wolfner & Visintainer, 1975; Melzack & Wall, 1982).

Another difference was that the nurses at Stony Plain and Spruce Grove were often acquainted with the subject or parent prior to the immunization whereas the same was not observed at St. Albert. Prior exposure of the child to the nurses (perhaps under less threatening circumstances), may have reduced the child's level of anxiety. For example, less crying behaviour, which is an indicator of effects of anxiety on pain, was observed during the immunizations at Stony Plain and Spruce Grove clinics as compared to St. Albert.

The gender of subjects was balanced in the design of this study because research had not investigated gender differences

with young children. Young girls may be given more freedom to cry during painful procedures by their parents than young boys. The results of this study suggest that young children do not yet respond to this social bias since gender differences did not significantly affect the final pain responses. In addition, there were no gender differences observed associated with crying.

Interestingly, some nurses in the study reported using crying and other behaviours as indicators of pain. Several children exhibited behaviors that some nurses believed to be indicative of pain and then reported little or no pain from the injection. When confronted with this inconsistancy between their perception of the child's pain and the child's final pain response, they assumed that the child did not understand the pain measurement scale.

The reports of pain given by children in response to the third vignette about mosquito bites caused several nurses to question the often used strategy of telling children that an injection will "only hurt like a mosquito bite". Another concern was the use of the vignettes prior to the injection. They felt these vignettes would affect the final pain responses. The purpose of the vignettes was to determine whether the subjects understood the pain measurement scale. Also they served as a means of eliminating subjects who displayed a response bias. The result of the first order correlations demonstrated that the response to the vignettes did not significantly affect the pain response to the injection.

The descriptive data collected revealed several variables such as the latency to startle, crying behavior, nurse's perceptions of the child's pain etc., which may be included as dependant measures in future studies. In summary the results of this study provide health care professionals with empirical data to improve the quality of patient care.

Recommendations for Future Studies

Due to the lack of research in the area of children's pain there is a need for further studies. Research is needed to dispel the myths about children and pain and to provide empirical data for improving clinical practice. As a result of this study several specific recommendations for future research can be made.

1. The success of music distraction has been established in one clinical setting with one noxious stimulus. Therefore studies in different settings with a variety of noxious stimuli such as lumbar punctures, veni-punctures, pre-operative injections are necessary to establish the value of music distraction in reducing pain.

2. Because younger subjects in this study had less successful responses to distraction than older subjects, further studies are needed to determine whether this finding is true with all distraction strategies and other pain relieving techniques.

3. Due to the lack of research on the influence of placebos with children, studies should be encouraged in this area.

4. Since younger children in this study reported more overall pain, research is needed to detail the relationship between age and pain in children.

Implications for Nursing Practice

The goals of a professional nurse are to provide quality care and comfort to patients. To meet these nursing goals requires clinically based research. As a result of this study there are several implications for improving nursing practice which will be discussed. Before proceeding, it is necessary to recognize that although several hypotheses failed to be supported by this study, these findings also make a significant contribution to the existing body of knowledge about children and pain. Secondly, the results of this study have implications not only for nurses but for all health care professionals, such as laboratory technicians, phlebotomists, child life workers, physicians, etc. who care for children.

This study provides evidence that a safe, simple and effective strategy exists which reduces injection pain. Therefore health care professionals in a variety of clinical settings should be encouraged to utilize this strategy whenever possible.

Because the results of this study revealed that younger children reported more pain from injections than older children there are several recommendations which will be made for improving practice. First, nurses should become more sensitive to the special needs of their younger patients. This can be

achieved by talking to children in language they understand, maintaining a non-threatening environment prior to and during a procedure such as an injection, and allowing the child some choice. For example in what location do you want your injection. Secondly, since some Community Health Clinics start their pre-school immunizations with children aged 4 1/2 years, possibly in view of the results of this study these clinics could re-consider their policy and start with screening programs with children aged 5 years and older. Thirdly, although it is probably more convenient to have mass immunization programs restricting the numbers being screened thereby reducing the noise level in these clinics may have positive effects on patients.

Due to range of responses obtained from the last vignette, the pain from a mosquito bite should never be related to the pain of an injection. Suggesting that the pain of a mosquito bite is similar to that of an injection may have the effect of setting children up to perceive more pain than previously anticipated.

In conclusion, because the majority of nursing text books offer little or nothing on the subject of pain, nursing curricula ought to be revised to include courses on pain. The results of this study could be used in courses dealing with the care of children.

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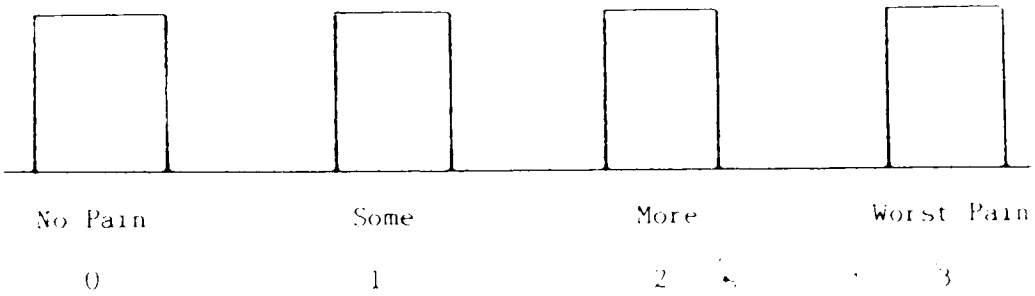

Note. Boxes were white on a grey background.

Figure 1. Pain Measurement Scale

Appendix A

Synopsis of Pain Literature

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Pain is a universal experience that can be intense or mild, chronic or acute, disabling or annoying. The potential that pain has for creating profound physical and mental effects explains our ongoing search to define, explain and control pain. Yet in spite of the research generated by the phenomenon of pain, many people continue to suffer from and/or become incapacitated by pain.

This paper reviews the pain literature in order to develop an overview of pain interventions and an understanding of the dilemmas of pain. Topics covered in this review include history of pain intervention, theories of pain mechanisms, factors influencing pain, measurement of pain and treatment strategies.

History of Pain Interventions

Alleviating pain is not a recent concern. For example, in the Book of Genesis, on Babylonian clay tablets, in the Egyptian papyri which dates back to 1550 B.C., on tablets from Mycenae, and on Persian records carved in leather are found references to pain and the methods thought to alleviate it (Dallenback, 1939; Merskey, 1980; Turk, Meichenbaum & Genest, 1983).

A brief historical review will be presented to demonstrate how views about the mechanisms of pain influence the strategies used to treat pain. The earliest view was that demons were responsible for pain and disease. When primitive man could not

relieve his pain, the head of the family, usually the woman was summoned. Women, due to their maternal instincts, were considered qualified to drive away demons (Crue, 1970). These healers would conduct ritual acts, utter spells and give magic potions to pain sufferers in an attempt to exorcise the demons of pain. Gradually the functions of the healing mother were taken over by the medicine man who was considered to be the anti-demon. The rituals performed by the medicine men frequently involved wrestling with and beating the patient to drive out the demons (Dallenback, 1939).

Eventually pain became attributed to punishment inflicted by the deity. The medicine man was replaced by the pagan priest who employed natural remedies as well as prayers at the shrine of the deities in Babylonia, Egypt, ancient Greece and Rome (Merskey, 1980). Charms and sacrifices were also used to appease the Gods. With the coming of Christianity, these pagan rites disappeared. Later, pain was relieved by prayer and the laying on of hands by the clergy. However pain in some instances was also considered to be a punishment for sins and a trial for the saint (Merskey, 1980).

In addition to prayers, the clergy of the Middle Ages also used natural remedies, primarily plants, for the relief of pain (Dallenback, 1939, Shapiro, 1963). Many of these plants were fortuitously found to have analgesic properties. Knowledge of the value of plants in pain relief probably was passed down from primitive man to the medicine man, the pagan priest and clergy.

finally, the use of drugs was passed on to the physician.

More recent literature contains many examples of ingenious and desperate attempts to alleviate pain such as purging, blistering, bleeding, poisoning, leeching and sweating (Merskey, 1980; Turk, Meichenbaum & Genest, 1983). Although considered crude by our modern standards and having little physiological basis, some of these primitive treatment strategies such as trephining, roman baths and ritual acts had some limited success (Melzack & Wall, 1982).

Trephining, for example was used to relieve headache and strange behaviour considered to be caused by the presence of demons. That the headache subsided was due less to the release of demons than the reduction of intracranial pressure. In other cases, a reduction of pain after this treatment, may be attributed to a placebo effect as described by Beecher (1955).

The discovery of general anaesthesia in 1846, was a significant milestone in the alleviation of surgical pain. Before anaesthesia, the surgeon had no time to operate cautiously; and the best surgeon was the fastest surgeon (Dallenback, 1939).

Prior to the discovery of anesthesia, other methods had to be used to control the patient and/or the pain. For example, the simplest method was to strike the patients, knocking them unconscious. A common practice in the battlefield was to place ice around a limb before amputating it (Dallenback, 1939). Another technique noted in records dating back to 2500 B.C., involves applying pressure over nerves to produce numbness (Turk,

Meichenbaum & Genest, 1983). In addition, Aristotle described the effect of pressure over the carotid arteries to produce insensibility so that operations could be performed (Mersky, 1980).

The use of drugs derived from plants to produce analgesia can be traced back to primitive cultures. Considered to be as old as agriculture, alcohol was the first analgesic known to man (Dallenback, 1939). Early records also describe the pain-relieving effects of such plants as the poppy, hemp and henbane (Turk, Meichenbaum & Genest, 1983).

Drugs continue to be used today in the treatment of pain. Interestingly the majority of prescriptions written for pain relief come from the aspirin and opium family of compounds (Melzack & Wall, 1982). Acetysalicylic acid was first introduced as an antipyretic, it was only later that its analgesic properties were discovered, while opium by the middle of the sixteenth century was well established as an analgesic (Turk, Meichenbaum & Genest, 1983).

Although drugs have been used quite successfully in the treatment of pain (Melzack & Wall, 1982; Turk, Meichenbaum & Genest, 1983), some chronic pain patients cannot be managed solely with drugs. These patients frequently become candidates for surgical interventions in the management of their pain. As discussed previously surgical interventions in the treatment of pain are not a recent development. However with the technological advances which have occurred these surgical

interventions in addition to becoming more refined are much safer to perform.

Recent literature indicates that a number of surgeons are currently developing and testing the effectiveness of devices which electrically stimulate nerves rather than surgically destroy them (Wall, 1980; Melzack, 1983; Turk, Meichenbaum & Genest, 1983). Should these devices, which can be either surgically implanted or left on the skin surface, prove successful another alternate strategy can be offered to patients for the treatment of their pain.

With the development of the Gate-Control theory in 1965 new treatment strategies have emerged to modulate sensory input such as biofeedback and prepatory information. In addition this theory provided a scientific explanation for some older forms of treatment thereby making them more acceptable. Examples of these older forms of treatment include relaxation, imagery, counter-irritation and distraction.

Pain Theories

The development of theories of pain have influenced the strategies employed to alleviate pain. Melzack and Wall (1982) have provided us with thorough reviews of pain theories. Actually, they describe two old but popularly held theories (Specificity and Pattern) and develop a third (Gate-Control). This section describes the three theories.

Specificity Theory

According to Melzack and Wall (1982), the Specificity theory was the earliest of the scientific theories for pain. The theory holds that specific cutaneous pain receptors channel impulses directly to the brain along specific pain fibers and pathways. It also maintains that the area affected by the stimulus is directly related to the amount of pain experienced.

The clinical implication of this theory is that pain can be eliminated by removing the noxious stimulus or by blocking the pathway to the brain through surgical techniques such as cordotomies, cortical lesions, nerve blocks or drugs with local pharmacological action (White & Sweet, 1969).

The analgesic technqiues which resulted from this theory ignored the psychological component of the pain experience. Consequently, these techniques did not always meet with the anticipated level of success (Melzack & Wall, 1965; 1982). Nonetheless many of these techniques remain prominent among the strategies used today by the medical profession to relieve pain (Nathan, 1963; Loeser, 1972; Mitchell, 1973; Melzack & Wall, 1982).

There are two major limitations to this theory. First, the theory does not recognize that the amount and quality of perceived pain is influenced by a number of psychological variables such as early experiences (Melzack & Scott, 1957); cultural attitudes (Zborowski, 1952; Wolff & Langley, 1968); and the expectation of pain (Wolfner & Visintainer, 1975). Second, the Specificity theory cannot explain persistence of pain in patients whose pain

tracts have been blocked or severed nor paradoxical disorders such as phantom limb, causalgia and neuralgia (Melzack & Wall, 1982). Consequently, people suffering from such unexplained pain have been treated as if they were suffering from thought disorders.

Nurses may be no more sophisticated in managing pain than physicians. Although advocating a holistic approach to patient care, nurses treat patients in pain as though adhering to the Specificity theory. This contradiction between what is professed and what is practiced is substantiated by a lack of nursing research on analgesic strategies with psychological bases. The lack of research may be attributed to the traditional role of the nurse as the helpmate of the physician or to the fact that nurses' education has been guided by the medical model where the Specificity theory has been dominant.

Pattern Theory

The Pattern theory is a group of theories which emerged to provide a physiological explanation for clinical pain syndromes of neuralgia, causalgia and phantom limb that could not be accounted for by the Specificity theory. It is based on the concept of stimulus intensity and central summation proposed by Goldschnieder in 1894 (Melzack & Wall, 1982). In its simplest interpretation, the Pattern theory proposes that the pattern of nerve impulses that elicit pain are produced by the summation of sensory input within the spinal cord (Melzack & Wall, 1982). Thus pain is experienced when the total output of cells located in the dorsal

horn of the spinal cord exceed a critical level (Melzack & Wall, 1965).

Although the Pattern theory explained paradoxical disorders, it had a major limitation. Like the Specificity theory, the Pattern theory did not recognize the impact of psychological variables in the pain experience. The Pattern theory has never received the same support from researchers and clinicians that has been accorded the Specificity theory, primarily because it did not lead to the development of any new techniques to reduce or alleviate pain. Nevertheless, like the Specificity theory, its contribution has been valuable in unlocking the mystery of pain.

Gate-Control Theory

Building on concepts advanced by the Specificty and Pattern theories, Melzack and Wall (1965) developed the Gate-Control theory. This theory postulates that activity in the large fibers modulates afferent activity in the small fibers (the "pain fibers"). This modulation process is controlled by inhibitory cells located in the substantia gelatinosa of the dorsal horn (Melzack & Wall, 1965; Iggo, 1974; Wall, 1980). These cells are also described as the central mechanism and as a result of their modulating effect, pain can be increased or decreased. Thus, psychological influences over pain can be explained by this mechanism.

Although there is some evidence for the anatomical assumption of large and small-fiber interactions in the dorsal horn (Wall,

1978; Wall, 1980), the major criticisms against the Gate-Control theory have been related to its hypothetical neurophysiological mechanism (Wall, 1978). Conceptually, however this theory remains strong due to its clinical predictions. As well, the Gate-Control theory, in its recognition of psychological variables in the experience of pain has resulted in the development of a number of new pain relief strategies such as bio-feedback, preparatory information which are effective alternatives and supplements to pharmacology and surgery in the treatment of pain (Johnson & Leventhal, 1974; Cox, Freudlich, Meyer, 1975; Clum, Luscomb & Scott, 1981; Ahles, Blanchard & Leventhal, 1983).

Factors Influencing Pain

The experience of pain is recognized as a complex phenomenon which is mediated by the interaction of a variety of physiological, psychological and sociocultural factors. Most researchers and clinicians have accepted these factors as major determinants of pain (Zborowski, 1952; Beecher, 1959; Lazarus, 1966; Wolff & Langley, 1968; Melzack & Wall, 1982).

Beecher's (1956) description of seriously wounded soldiers who were without pain, underscored the importance of all the dimensions of pain. As a result of Beecher's work subsequent research has been conducted to determine how factors such as age, gender, culture, anxiety, and the individual having some control over the situation affect the experience of pain.

Age

Researchers are uncertain about the influence of age on pain because evidence has not supported a relationship between the two. For example, using a saline injection to induce pain, Wolff and Jarvik (1964) reported that men were able to tolerate more pain with increasing age. Women were found to tolerate less pain with age. Clark and Mehl (1971) reported that older subjects had difficulty discriminating between the sensation of heat and pain induced by radiant heat on their forarms. Although the majority of research studies on the influence of age on pain support the position that adults tolerate more pain with increasing age (Schudermann & Zubek, 1962; Haslam, 1969; Woodrow, Friedman, Seigelaub & Collen, 1972), this position is not conclusive.

Few studies have been conducted with child subjects evaluating the effects of age on pain. In studies where children were used, they were often grouped with older subjects (Schludermann & Zubek, 1962; Halsam, 1969; Woodrow, Friedman, Siegelaub & Collen, 1972) thereby limiting the results.

Gender

Some studies have indicated differences in pain tolerance between male and female subjects (Petrie, 1960; Wolff & Jarvick, 1964; Woodrow, Friedman, Siegelaub & Collen, 1972). A limitation of these studies is small sample sizes. As well, no attempt appears to have been made to make the groups comparable with respect to racial origin, socio-economic status and other variables which may affect the pain experience. The reported

findings of these studies may be attributed more to social learning rather than entirely to gender.

No study seems to have been done which has as its main objective the determination of gender differences for children in pain. Evidence indicates that emotionally expressive behaviour, including pain behaviour is socially-learned. Therefore, additional studies are needed to confirm whether gender differences affect children's responses to pain.

Culture

Considerable research is available describing ethnocultural differences on pain expression (Zborowski, 1952; Zola, 1966; Wolff & Langley, 1968; Woodrow, Friedman, Siegelaub, & Collen, 1972). The results of these studies reveal that cultural traits predispose subjects to tolerate different levels of pain. For example, the Irish and Eastern Europeans have been found to tolerate more pain than Italians and Jews. Yet, like gender, cultural differences likely affect children's pain experiences, but due to a lack of research there are no data available describing when these factors or how these factors affect young children.

Anxiety

The relationship between anxiety and pain has been documented in the literature (Hodges & Spielberger, 1966; Staub & Kellet, 1972; Wolfer & Visintainer, 1975; Melzack & Wall, 1982). The tendency to define a situation prior to experiencing it modifies the response to the actual situation (Wolfer & Visintainer, 1975;

Melzack & Wall, 1982). Therefore modifying anxiety associated with the experience of pain is considered an important theoretical basis for a number of pain relieving strategies. Decreasing an individual's anxiety about a situation will in turn reduce pain experience (Melzack & Wall, 1982).

Control

Allowing a subject to have some control over the painful situation is an extension of the anxiety reduction strategy (Lazarus, 1966). It has been suggested that a lack of control increases anxiety which results in increased pain (Bowers, 1968; Staub, Tursky & Schwartz, 1971). Adult subjects, given control over the intensity and timing of shocks tolerated higher levels of shock as compared to the no-control subjects (Staub, Tursky & Schwartz, 1971). This has been confirmed with clinical research (Keeri-Szanto, 1979) Post-surgical adult patients who were permitted to control the administration of their own narcotic medication reported less pain and required fewer narcotics than control group subjects.

Although control and anxiety have been shown to affect the experience of pain with adults, there remains little research available evaluating the effect of these factors with child subjects.

Other Factors

In addition to those factors mentioned there are certainly other factors affecting the experience of pain. These include psychiatric disease states (Malmo & Shagass, 1949; Malmo, Shagass

& Davis, 1951), socio-economic status (Hollingshead & Redlich, 1958) and family size (Gonda, 1962). Because there are only a few studies evaluating the effects of these factors on the pain experience, the results are not conclusive and additional studies are required.

The literature has established that physiological, psychological and sociocultural factors influence the experience of pain. This knowledge has led to the development of improved pain relieving strategies. Therefore in evaluating the efficacy of any pain relieving strategy one must acknowledge the complex phenomena of pain.

Pain Measurement

There are three basic approaches for the measurement of experimental and clinical pain. These are: (1) measuring autonomic changes, (2) observing behaviour, (3) asking for subjective reports.

The literature evaluating clinical pain relief strategies describes the need for all pain measures to address and satisfy the criteria of reliability and validity (Woodeforde & Merskey, 1972; Sternback, Murphy, Timmermanns, Greenhoot & Akeson, 1974; Harris & Rollman, 1983; McGuire, 1984). Measurement techniques for pain are briefly reviewed in this section.

Measuring Autonomic Changes

Autonomic responses are often measured by heart-rate, respiratory rate, galvanic skin response and pupil size. Using these measures to infer pain is not without problems (Abu-Saad &,

Holzemer, 1981; Jeans, 1983). For example, fear, anxiety and anger result in arousal states similar to those caused by pain (Johnson, 1977). Therefore studies using autonomic responses as the dependent measure of pain show weak construct validity. Many researchers agree that a more reliable and valid measure of pain is achieved with observations of voluntary behaviour rather than involuntary responses (Woodforde & Merskey, 1972; Wolff, 1980; Reading, 1983; McGuire, 1984).

Behavioural Observations

The underlying premise in using behaviour as a measure of pain, is that pain is expressed through non-verbal behaviours (Abu-Saad & Holzemer, 1981; Jeans, 1983; McGrath, Cunningham, Goodman & Unrah, 1984; McGrath, Johnson, Goodman & Schillinger, 1984). These include paralinguistic vocalization, locomotor activity and changes in facial expressions.

Most studies measuring pain with behavioural observations have been conducted with children used as subjects. This measurement method may be chosen when children's developmental levels limit their ability to report pain. One behavior which has been measured is crying (Abu-Saad & Holzemer, 1981; McGrath, Cunningham, Goodman & Unrah, 1984). Although in research, the presence or absence of crying has been measured using tape recorders and stopwatches, it is also a guide under less controlled conditions for parents and clinicians in detecting pain in young children.

Another means of measuring pain is to have experienced raters estimate the amount of pain the child has by using rating scales which have categories for crying, pain vocalizations, distortion of the face and muscle rigidity (Katz, Kellerman & Seigel, 1980; McGrath, Johnson, Goodman & Schillinger, 1984). However this measurement method has limitations, due to the introduction of systematic bias. As in all forms of social judgement, a decision about pain is subject to errors of recognition (Abu-Saad & Holzemer, 1981; McGrath, Johnson, Goodman & Schillinger, 1984). Behaviour can be misinterpreted by the perceiver as a result of cultural influences on pain response (Zborowski, 1959; Wolff & Langley, 1968).

Self-Reports

Due to the subjective nature of the pain experience, self-reports are the most common measures of pain for both children and adults (Ohnhaus & Adler, 1975; Downie, Leatham, Rhind, Wright, Branco & Anderson, 1978; Hester, 1979; Reading, 1980; Dixon & Bird, 1981; Beyer, 1984). Visual analogue scales have been widely used as a subjective rating scale in clinical trials directed at establishing the efficacy of some treatment strategies (Sternback, Murphy, Timmermans, Greenhoot & Akeson, 1979; Ohnhaus & Adler, 1975; Downie, Lentham, Rhind, Wright, Bronco & Anderson, 1978; Reading, 1980). This scale is used frequently because of its sensitivity, simplicity, reproducibility and universality (Huskisson, 1974; Reading, 1980).

Although the explanation for using the scale must be translated, the scale is really independent of language. The scale used in the measurement of adult pain can be understood and managed by children aged five and over (Scott, Ansell, Huskisson, 1977; Abu-Saad & Holzemer, 1981; Ohnhaus & Adler, 1975; Reading, 1980; Dixon & Bird, 1981; Harris & Rollman, 1983). However, despite the successful record of visual analogue scales, very few studies have utilized this measurement strategy with children (Scott, Ansell & Huskisson, 1977; Abu-Saad, 1981; Bever, 1984).

The visual analogue scales can easily be adapted for different levels of cognitive ability. For example, young children between the ages of two through five have difficulty integrating two abstract concepts such as amount of pain and objects of increasing size meant to represent increasing amounts of pain (LeFrancois, 1982). Therefore developing a visual analogue scale with just one abstract concept would be suited to this group of subjects.

Researchers have had to devise many creative visual analogue scales to obtain subjective reports of pain from children. Eland (1981) developed a color scale originally designed by Stewart (1977). Using this stategy, children were asked to rank-order colors according to their prior pain experiences. Following a new painful experience each child was asked to select a color which represented their pain, thus providing a rating based on a personalized pain rating scale.

using four white poker chips. Hester (1979) asked children to indicate how many "pieces of hurt" they felt. However due to the concrete nature of this task, only children four years and older were able to use this strategy. Bevers (1984) developed another rating scale called the "Oucher" for children three to twelve years old. The poster format of this instrument consists of a numerical scale (0-100) for those who can count. For those who cannot, six photographs of a child's face representing different levels of pain are substituted for the numbers.

Although each of the visual analogue scales mentioned above have been used in research, none have been used extensively with large samples. In addition, each of these scales has an apparent problem with response bias (Woodforde & Merskey, 1972; Wolff, 1980). For example there are no checks to determine whether children are picking their favorite colour, number, or picture instead of rating their pain experience. It also does not appear that the researchers have attempted to detect response bias. These checks could take the form of a series of questions to confirm that subjects are understanding the concept of pain. The measurement of pain is difficult in both child and adult subjects. Without an accurate measure it is difficult to determine the efficacy of treatment interventions.

Treatment Strategies

The relief of pain has traditionally been a goal of nursing and medicine. There has been much research evaluating the efficacy of various treatment strategies. Although the

strategies are often classified as either physiological or psychological. In truth, interventions are often a combination of physiology and psychology.

Physiological Interventions

The specificity theory, though inadequately accounting for known pain phenomena, resulted in the development of many physiologically-based treatment strategies. Examples of physiological treatment strategies include nerve blocks, surgical or chemical destruction of spinal nerves, cordotomies and local anaesthetics. These strategies are directed at interrupting the nerve pathway by surgically cutting the nerve, destroying it with chemical substances or blocking it with local analgesia (Nathan, 1963; Ballantine, Cassidy, Flanagan & Marno, 1967; Loeser, 1972).

The indication for destroying a nerve pathway is intractable or chronic pain. Local and regional blocks are also used for intractable or chronic pain. These interventions are similarly used in treating acute pain such as obstetrical, post-operative and multiple trauma pain (Loeser, 1972).

The success of physiological strategies varies considerably, due in part to the patients selected. For example, the terminally-ill may die before long-term effects can be evaluated and others may suffer side-effects such as such as limb numbness, paraplegia, loss of anal and urethral sphincter control.

Despite the potential risks involved in these physiological interventions, they often remain the only recourse for some patients. Nursing has a role in the management and care of these

patients, but the decision to carry out these interventions is not directly within the traditional domain of the nurse.

Psychological Interventions

Strategies considered to be psychological in nature have in common the alteration of cognitive, affective and/or evaluative aspects of pain. Psychological strategies are important because nurses can initiate them independent of the physician. An additional benefit is that these strategies provide an alternative to invasive medical interventions such as surgery and drugs. Examples of psychological strategies include; preparatory information, imagery, hypnosis, relaxation and distraction. These strategies overlap considerably and are hypothesized to use a central mechanism which closes the gate, thereby blocking the transmission of pain impulses.(Melzack & Wall, 1982). The gate is closed by either reducing anxiety, distracting attention or a combination of the two.

Anxiety Reducing Strategies. Preparatory information is an example of a frequently used strategy to reduce a patient's anxiety about medical procedures. Generally preparatory information strategies consist of sensory and/or procedural information (Johnson & Leventhal, 1974; Wolfner & Visintainer, 1975; Johnson, Kirchoff & Endress, 1975; Peterson & Shigetomi, 1981). Sensory information involves explaining to the patient what different sensations they will experience; while procedural information involves telling the patient only what will happen during the procedure.

A consistent finding with adult subjects is that instruction alone or combined sensory and procedural instruction is more effective in reducing anxiety and pain than procedural information alone (Johnson & Leventhal, 1974; Langer, Janis & Wolfer, 1977; Wernick, Jaremko & Taylor, 1981). Similar results have been reported in studies with child subjects who were experiencing removal of orthopedic casts (Johnson, Kirchhoff & Endress, 1977) and injections (Hedberg & Schlong, 1973).

Although the results of preparatory information have been generally positive, other researchers such as Shipley et al. (1979) have documented that subjects who characteristically cope with threatening situations by seeking out information, benefit significantly from the combination of sensory and procedural instruction. However those subjects who cope with threatening situations with denial do not show any significant treatment effect from sensory-procedural instruction.

In light of these findings and the reported efficacy of patient preparation programs, future studies should examine interaction of treatments and subject coping strategies for both children and adults. This type of research would assist with identifying subjects who could not benefit from preparatory interventions.

Distracting strategies. Examples of psychological strategies which distract attention from the painful situation will be discussed under the following headings: imagery, hypnosis, relaxation and distraction.

1. Imagery

Use of imagery to relieve pain recognizes the role of attention in the perception of pain. When patients with pain utilize imagery successfully, they redirect their attention away from noxious stimuli by imagining something more pleasant, thereby achieving a state of relaxation. Because the effectiveness of imagery is reported to be enhanced when preceded by relaxation, both are frequently used simultaneously (Blitz & Dinnerstein, 1971).

The literature describes numerous examples of imagery techniques with both child and adult subjects, but no studies have demonstrated that any one of these techniques is better at reducing pain. Rather the efficacy of imagery has been reported to depend upon the manner in which the therapist presents the technique to the patient and the amount of patient involvement. These findings certainly imply that the success of imagery may be due in part to a placebo effect (Beecher, 1959), which is influenced by the expectancies of the therapist (Stacher, Schuster, Bauer, Lahoda & Schultz, 1975). Because suggestion influences the pain experience, all studies evaluating pain relief strategies must incoporate techniques to control experimenter expectancies. However, since it was not clear in the majority of these studies whether adequate control techniques were built into the designs, significant results may be due in part to rival hypotheses.

In conclusion, the effectiveness of imagery in reducing pain depends in large part upon the patient's ability to concentrate on images. Thus the patient who has a vivid imagination would be expected to benefit the most from imagery. The major weakness of imagery is the time commitment required to teach and rehearse this strategy with patients making it cost-ineffective and not practical in all clinical situations.

2. Hypnosis

Hypnosis is described as a learned state of selective concentration together with a strong suggestion (Finer, 1974). Although the mechanisms of hypnosis remain debatable, there are two features of hypnosis which are important in understanding its psychological contributions to pain control. First the literature has documented that not all people can be hypnotized (Barber, 1963; Spanos, Horton & Chaves, 1975). Approximately one third of the population will respond to hypnosis (Barber, 1963). A second feature is that the therapist must establish a good rapport with the patient and present a convincing rationale for the use of hypnosis. Both features suggest that individuals who are susceptible to hypnosis respond to the demand characteristics of the therapist.

While hypnosis appears to be a successful and interesting psychological strategy with adults (Barber, 1963; Hilgard, 1975) and children (Berstein, 1965; Gardner, 1974; LaBaw, Holton, Tewell & Eccles, 1975), the procedure has limitations. As with placebos, the repeated use of hypnosis makes it less effective

over time (Melzack & Wall, 1982). Hypnosis like imagery requires considerable time for training both the subject and the hypnotist, but since only one third of the population is able to reach deep hypnotic states, this strategy like imagery does not appear practical in the majority of clinical situations.

3. Relaxation

Although there is no single definition of relaxation, it is usually described as mental and physical freedom from tension. A variety of techniques designed to achieve a state of relaxation are discussed in the literature (Flaherty & Fitzpatrick, 1978; Reeves & Shapiro, 1982; Clum, Luscomb & Scott, 1982).

Relaxation techniques have been effective in relieving tension headaches (Cox, Freudlich & Meyer, 1975; Blanchard, Theobald, Williamson, Silver & Brown, 1978) and post-operative pain (Copp, 1974). In addition many childbirth education classes teach pregnant women a form of relaxation (Lamaze, 1970; Davenport, Slack & Boylan, 1974; Cogan, Henneborn & Klopfer, 1976). However, since relaxation techniques may be used in combination with other strategies, it is not known how much relaxation alone contributes to the relief of labour pain.

There is a need to evaluate the effectiveness of relaxation, particularly where children are the subjects. As in studies assessing imagery and hypnosis, the literature indicates that before relaxation techniques can be taught, the clinician must establish a good rapport with the patient (Flaherty & Fitzpatrick, 1978; Knowles, 1981; Turner & Chapman, 1982; Clum,

1982). Thus relaxation has the same limitation as hypnosis and imagery.

4. Distraction

As mentioned previously, all the psychological strategies discussed thus far involve some form of distraction. This is not surprising particularly since the literature has supported the proposition that if attention is focused on a painful stimulus, pain will be perceived more intensely (Melzack & Wall, 1965, 1982).

Individuals often devise their own distraction strategies by directing their attention to games, books, radio and watching television in an attempt to reduce their pain. For example, a young child's interest in play post-operatively may not represent an absence of pain, rather play may be an attempt at using distraction to reduce or eliminate pain.

Because the literature reveals that certain individuals are known to enter aversive situations with their own distraction strategies, it is reasonable to assume that in research studies some subjects assigned to the no-treatment control groups may actually be using their own distraction strategy. On the other hand, a number of studies have provided evidence which demonstrated that some subjects in the treatment groups failed to use the distraction strategies provided to them by the researcher (Barber & Cooper, 1972; Scott & Barber, 1977; Avia & Kanfer, 1980). The point is this; it is often not clear whether subjects adhere to the prescribed treatment. Therefore researchers should

devise and incorporate checks into their studies to determine whether the control subjects actually were "untreated" and whether the treatment subjects used the assigned strategy.

Research conducted in both laboratory and clinical settings provides support for the effectiveness of distraction as a pain relief strategy (Barber & Cooper, 1972; Clum, Luscomb & Scott, 1981; Corah, Gale, Pace & Seyrek, 1981; Ahles, Blanchard & Leventhol, 1983; Farthing, Venturio & Brown, 1984). Moreover distraction has been recommended as an effective strategy for patients of any age who are experiencing pain that gradually increases (Melzack, Weisz & Sprague, 1963; Melzack & Wall, 1982). Examples of successful distraction strategies discussed in the literature include; counter-irritation, which also has a physiological explanation (Melzack, Guite & Gonshoir, 1980), white noise (Barber & Cooper, 1972), cognitive tasks (Gardner, Licklider & Weiss, 1960; Girodo & Wood, 1979) and music (Corah, Gale, Pace & Seyrek, 1981; Rozzano, 1981).

By far the majority of research about distraction comes from the disciplines of psychology and dentistry. Psychological studies are frequently conducted in laboratory settings (Barber & Cooper, 1972; McCaul & Haugtvedt, 1982; Fathing, Venturino & Brown, 1984). Dental distraction studies conducted in clinical settings have been prompted by a concern about long term effects of children's fear of dentists. The result of these studies demonstrate that children respond well to distraction strategies by reporting less pain. Of all the distraction strategies

dentists evaluated, music was reported to be the most effective and simplest strategy to use with children in the dental operatory.

The weakness with dental studies generally is their failure to incorporate placebo control groups to assess subject expectancies (Gardner & Licklider, 1959; Corah, Gale & Illig, 1979; Wardle, 1983). Single or double-blind techniques to minimize or eliminate experimenter bias are infrequently used or reported (Gardner, 1959; Howitt, 1967; Corah, Gale & Illig, 1979; Corah, Gale, Pace & Seyrek, 1981; Venham, Goldstein, Gaulin-Kremer, Peteros, Cohan & Fairbanks, 1981). Consequently few of these studies are sensitive enough to infer with any measure of confidence that distraction reduces pain. Rather, the reported success of distraction in these studies may be the result of distraction, placebo effects or other rival hypotheses. Therefore future controlled studies are needed to evaluate music distraction.

Conclusion and Suggestions for Future Study

From a historical review, the need to define, explain and ultimately to control pain is not a recent concern. Yet despite the rapid advances which have occured over the past decades many questions about pain remain unanswered as evidenced by the many who continue to suffer and/or become disabled from pain. To date the majority of research in the study of pain has been conducted by the disciplines of medicine and psychology. Nursing, although involved in the care of patients in pain, has not been active in

this area of research.

Perhaps the most significant contribution to the study of pain has been the development of the Gate-Control Theory by Melzack and Wall in 1965. Not without limitations, the Gate-Control Theory has done much to increase awareness that pain is a multidimensional phenomena. In addition this theory has introduced a variety of new treatment strategies (biofeedback, imagery, preparatory information) while validating many forms of old folk medicine (acupuncture, massage, hypnosis).

Despite the advances in the treatment of pain the study of children with pain has not been adequately researched. Consequently many health care professionals are guided in the care of children in pain more by myths than by empirical facts. The excuse most frequently cited for this lack of research is the problem of pain measurement with children. However sufficient evidence exists demonstrating that reliable and valid subjective responses of pain can be elicited from children. The most frequent and successfully used technique to evoke this subjective response from children is visual analogue scales.

The profession of dentistry has been concerned about the long-term effects of children's fears of dentists. To reduce this fear, which is often caused by painful procedures such as injections, dentists have devised and assessed a variety of distraction strategies. Unfortunately other health care disciplines, like nursing, have not been equally interested in evaluating the efficacy of strategies such as distraction in the

clinical setting.

Because the long-term effects of pain on young children have not been identified, and since myths frequently continue to influence the care of children in pain, there is a need for additional research in this area. Nurses ought to be actively involved in this research because of their roles on the health care team. As well, strategies, such as distraction allow nurses to practice independent of the physicians.

In summary, the literature reveals that there has been a tremendous surge of interest in the study of pain over the past several decades. Numerous pain clinics have been opened, national and international pain societies have been formed, as well a journal dealing exclusively with pain is published. Yet, the most common symptom responsible for people to seek out health care services remains the least understood. Because nurses tend to have the most contact with the patient in pain, they are in a unique position to make significant contribution in evaluating pain relief strategies.

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Appendix B

Consent Form

Study: Music Distraction to Relieve Pain in Children

Investigator: Susan Fowler-Kerry
Faculty of Nursing
University of Alberta
Phone: 432-6251

This study is an investigation of the effectiveness of music distraction and/or suggestion to reduce pain from needles. The needle is the one given during your child's immunization at this health clinic.

1. No needles other than the one scheduled will be given.
2. You may withdraw you child from this study at any time with no consequences.
3. Your child also has the right to withdraw from this study at any time without consequences.
4. The information gathered in this study will be confidential and anonymous.
5. Your child may be in a control group where he/she may not receive music distraction and/or suggestion.

I give consent for my child to participate in the study titled "Music Distraction to Relieve Pain in Children".

_____ _____
(Signature of Parent/Guardian) (Date)

_____
(Witness)

Appendix C

VIGNETTES

VIGNETTE 1

Now (calling the child by first name) you are outside playing in the snow. You notice a big pile of fluffy, white snow so you jump in it. How much do you think it would hurt to jump in the snow? Point to the box which shows how much it would hurt (holding up the pain measurement scale).

VIGNETTE 2

Now (calling the child by first name) you are outside in the summer-time playing and running and all of a sudden you trip and fall down on the sidewalk scrapping your hands and knees really hard. How much do you think this would hurt? Point to the box which shows how much it would hurt (holding up the pain measurement scale).

VIGNETTE 3

Now (calling the child by first name) it's summer-time and you have been outside playing. At bedtime you notice a mosquito bite right here (point to the posterior aspect of the child's right hand). How much do you think this mosquito bite would hurt? Point to the box which shows how much it would hurt (holding up the pain measurement scale).

Appendix D

University of Alberta | Inter-departmental Correspondence

to: Susan Fowler-Kerry, MN Candidate
Faculty of Nursing

date: February 26, 1985

our file:

from: Jannetta MacPhail, Dean
Faculty of Nursing

your file:

subject: Ethics Review of your proposal: "Music Distraction to Relieve Pain in Children"

This is to advise you that your research proposal, "Music Distraction to Relieve Pain in Children", has been approved for ethical clearance by the Ad Hoc Ethics Review Committee. You may proceed with the research and submission of your grant proposal for funding.

JM:jm

Jannetta MacPhail

Jannetta MacPhail, Ph.D., F.A.A.N.

cc: Dr. S. Stinson, Associate Dean
Graduate Education & Research Development