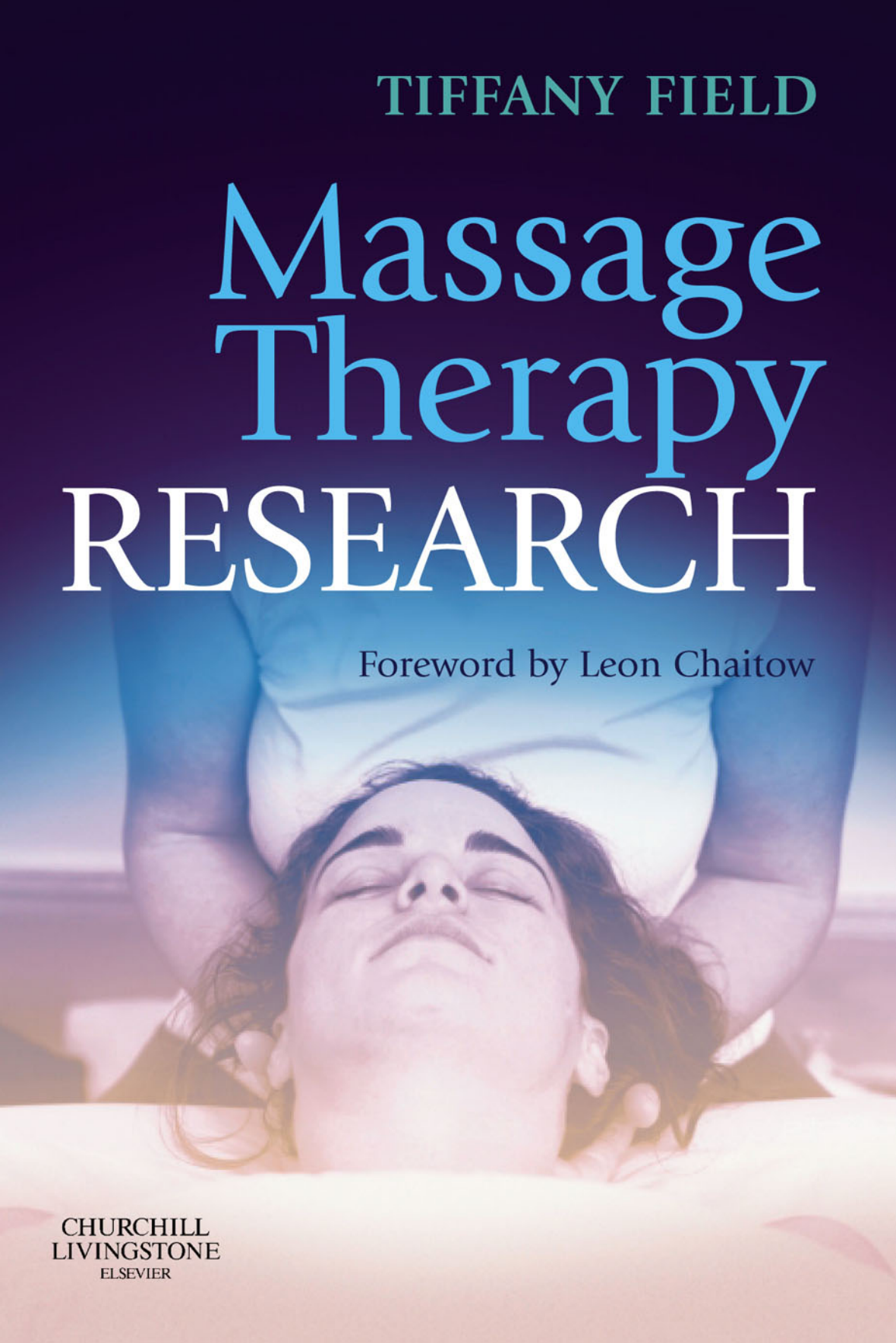




TIFFANY FIELD

Massage Therapy RESEARCH

Foreword by Leon Chaitow

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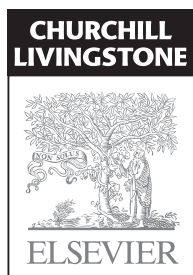
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Foreword

Massage works. Massage eases pain—even in intractable settings. It also reduces psychological distress; modulates the effects of stress; improves sleep, mood and behavior; enhances circulation; encourages improved bowel and breathing function; and raises immunity—among many other benefits. The evidence is now so overwhelming as to the efficacy of massage therapy in these and a host of other diverse settings—from pregnancy to prematurity (and reducing the chances of prematurity), ADHD to autism, stroke to surgery, leukaemia to low back pain—that it is a wonder that government agencies, insurance companies and corporations are not falling over themselves to take advantage of this low-tech, safe, almost universally beneficial therapeutic approach!

Much of the credit for the research evidence is due to the untiring efforts of Tiffany Field and her team at the Touch Research Institutes (TRI), Miami School of Medicine. This new book is structured to lead the reader through the evolution of the benefits of massage therapy, from cradle to old age, from dysfunction to serious illness, as well as containing the bonus of a packed 80-page appendix that covers everything from A (aggression) to Y (yoga). This offers an extremely useful package of massage therapy abstracts, under 90 different headings. Many of the studies in this section derive from the Touch Research Institute, but by no means all do, emphasizing the growing interest of researchers world-wide.

Valuable information in the opening chapter describes the methods that have evolved at the TRI to meet the very special needs of research into massage therapy—from the formulation of a research question, through the processes of participant selection, procedures, protocols and finally to the analyses of statistics. In this age of evidence-based medicine this book should be essential reading for researchers into physical medicine, as well as practitioners and therapists within and outside those professions involved in body-work and movement therapy.

In particular it should be read by health care professionals who are not yet aware of the value of massage—as well as by administrators and legislators associated with funding health care.

Leon Chaitow, 2005

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Preface

Massage therapy existed before recorded time but only recently have research data documented its therapeutic effects. Positive outcomes include growth and development in preterm and full-term infants, as well as the treatment of attention deficits like autism and attention deficit hyperactivity disorder (ADHD); affective disturbances including depression, eating disorders and addictions; pain syndromes such as lower back pain and fibromyalgia; muscular problems from cerebral palsy to Parkinson's disease; autoimmune conditions like asthma and diabetes; and immune disorders such as HIV, leukemia and breast cancer. This book is a review of research studies from our laboratory on these conditions. These studies, as well as those from other laboratories that appear in the appendix abstracts, will hopefully help massage therapists and their students and clients to appreciate the benefits of massage, and help them understand the process by which we research those benefits.

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Chapter 1

Massage therapy research methods

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HISTORY OF MASSAGE THERAPY RESEARCH

Hippocrates said in 400B.C. that ‘medicine is the art of rubbing’, a practice that came to be called massage therapy (Fig. 1.1). Published research on massage therapy dates back to the 1930s when human and animal studies were fairly popular. Several of those studies focused on documenting increased blood flow and reduced muscle atrophy associated with massage therapy. Although many of the research questions have remained the same over the years, the measurement technology has improved significantly. Early studies typically featured either single cases or very small samples. The samples were often self-selected clinical patients undergoing treatment for one or another condition. Measurement technology was limited to physiological measures including heart rate, blood pressure and temperature. Improved



Figure 1.1 Touch.

technology for biochemical assays has enabled the testing of more expansive models and the exploration of underlying mechanisms.

The lack of control groups was another methodological problem. Without a control group, the effects of the massage could be due to 'placebo effects', the effects of simply receiving attention from a therapist. Control groups appeared in the literature more recently, but they were non-treatment control groups that could also benefit simply from attention by the therapist. More recently, massage therapy has been compared in studies to other therapies such as relaxation therapy. However, relaxation therapy requires work and concentration, so that the relaxation participants often did not complete the therapy sessions. To solve that problem, sham massage (light touch) groups are now being used as control groups.

FORMULATING THE RESEARCH QUESTION

The first question the readers should ask is whether the question addressed by the research is important and relevant to the field. The research question for most massage therapy studies is whether the therapy is effective and whether it is cost-effective for a particular condition. Interest in research often comes from personal interest, including family or friends having experienced a condition or because it is a common condition seen in therapists' practice, or simply, for the researcher, because the condition is a current funding priority and preliminary 'pilot' research is needed in order to obtain funding in that area. In order to show the effectiveness of the massage therapy the variables measured need to be meaningful. Meaningful variables are called 'gold-standard' variables or important clinical variables for that particular condition. It is then necessary to consider the most effective massage therapy technique for that condition. Also important is the selection of the most

appropriate treatment comparison group and attention control group. To know whether and how these questions have been asked requires first a literature search, typically on the internet.

SEARCHING THE INTERNET FOR ALREADY EXISTING LITERATURE

Medline (www.medline.cos.com) and PsycINFO (www.apa.org/psycinfo) are the best-known literature search programs on the internet for current medical/psychological research, including massage therapy research. Literature from earlier decades can serve as a source of good ideas for replication studies using more sophisticated methods, but as, typically, current publications feature references from the last decade, literature searches are usually confined to the last decade. Another useful source that can be accessed by the general public is PubMed (provided by the National Center for Biotechnology Information) at www.ncbi.nlm.nih.gov.

The first step in conducting a literature search is to type the subject area (often referred to as a 'keyword') in the window that appears on the screen. A general topic of interest or a more specific area can be entered with the inclusion of the word 'and'. For instance, to find research on massage therapy, enter 'massage therapy'. However, if your interest is in researching the effects of massage therapy on a certain condition then you would enter 'massage therapy and fibromyalgia', for instance. This would enable you to access information on that particular area. In addition, if you are interested in research that includes massage therapy or fibromyalgia then entering 'massage therapy or fibromyalgia' would give you research articles involving either of those two areas. Once you have entered your particular subject of interest, a listing of citations that include that keyword will be shown. This citation includes the full reference for that research article, including author(s), title of article, journal in which it appears, volume number in which it can be found, page numbers, as well as the year it was published. Along with the reference an abstract is also provided. This is a brief summary of the research article that provides the most pertinent information of the study. If you decide to obtain the full article you now have all the necessary information in order to do so. Full articles for recent years are often available online. Older articles can be obtained from your local university library.

The literature search can be limited to the most current information available, or literature can be obtained from the last few decades. Terms for the condition along with the term massage therapy are likely to yield the most specific information needed. However, it is often good to start with a more global approach of entering the words 'treatment' or 'therapy' and the word for the condition. This general search would yield a greater number of abstracts and more general information about the condition; the hypothesized underlying etiology; gold-standard measures and other measures that have been used in research on other treatments of the condition; and ideas for treatment comparison groups that might serve as an attention control group. The material from the literature search then serves as the background or

introductory section or the first part of most published papers. Most researchers write the first half of the paper before starting the study in order to be clear about the problem being addressed and the methods to study that problem. The literature search can provide background on the incidence of the problem; the symptoms; the etiology or potential etiology; previous treatments (both traditional and complementary); and the effectiveness of those treatments. Once the background and methods sections are drafted, the paper can serve as a proposal that can go to potential collaborators who could facilitate the research.

SELECTING TREATMENT COMPARISONS AND ATTENTION CONTROL GROUPS

In most massage therapy studies over the years, the massage therapy subject or group has been compared to a standard treatment control group, on assessments often made on the first and last days of the treatment period. The problem with this comparison is that the participants might benefit from the massage therapy simply because of the attention from the therapist. Thus, researchers began to use treatment-comparison and/or attention control groups. For example, in much of our early research we used relaxation therapy as a comparison treatment group. Relaxation therapy had been shown to be effective, especially in reducing stress and anxiety, mood states that typically worsened the medical conditions we were studying. Another reason for using relaxation therapy as a comparison group was to show that massage therapy was more effective than relaxation therapy in order to justify the greater expense of the massage therapy treatment. Unfortunately, relaxation therapy was not an optimal treatment comparison group because the participants found that relaxation therapy was hard work and required concentration and self-discipline. Thus, the participants often 'skipped' their sessions and were not compliant or cooperative with the treatment. In addition, relaxation was often too difficult for young children because it required a certain amount of cognitive sophistication along with a reasonable attention span. Thus, we needed to use attention control conditions such as rocking the child, holding the child and playing with toys, or holding and reading to the child.

More recently it was discovered that moderate pressure was necessary for massage therapy to be effective (Diego et al 2004, Field et al 2004). Because of that we have been using light pressure massage therapy as a comparison group. The light pressure group receives exactly the same massage as the moderate pressure group. This allows the subjects to be free of any expectations regarding results of their particular treatment. The participants in each group would expect to receive some benefit from massage whether it was deep pressure (in the case of the real treatment group) or light pressure (in the case of the sham or placebo group). This also allows what is called 'double blinding' or the possibility that the physicians who are providing the standard treatment and the massage therapists who are providing the massage therapy do not necessarily have expectations that light or moderate pressure

massage is going to be more effective. In this way both the participants and the therapists are less biased about their treatment.

SELECTION OF PARTICIPANTS AND ASSIGNMENT TO GROUPS

Groups that are being compared need to be similar in terms of participants' characteristics, including age, gender, ethnicity and socioeconomic status or income. Generally, because all the participants are recruited at the same clinic (e.g. pediatric or adult clinic) and same facility, the age, ethnicity and socioeconomic status are similar across participants. This helps prevent the group comparisons from being affected by variability of ethnicity or socioeconomic status. When participants are randomly assigned, like flipping a coin or drawing straws, the groups are expected to be roughly equivalent on these factors.

Severity of the medical condition is another critical background variable, particularly in medical research. Severity is often highly variable, suggesting the need for careful matching of groups. Participants are randomly assigned to groups by a table of random numbers, much like flipping a coin, or drawing straws, as already mentioned. Randomly assigning participants to groups is expected to yield roughly equivalent groups in terms of background variables. The most effective way to ensure similarity across groups is to match subjects across groups. For example, in studies on prematurely-born babies, the babies are frequently matched on birthweight and gestational age and then randomly assigned to treatment and control groups.

A less precise way is to use a random stratification procedure, assigning participants to different cells on a grid. For example, if there are two birthweight conditions (low birthweight and very low birthweight) and two gestational age conditions (short gestation and very short gestation), four cells would result (a cell for very short gestation and very low birthweight babies, a cell for very short gestation and low birthweight babies, a cell for short gestation and very low birthweight babies, and a cell for short gestation and low birthweight babies). A grid for these four cells would be prepared and subjects would then be randomly assigned to the 'cells' (the four groups) on this grid. Equal numbers of participants would be assigned to each of the four cells by the end of the study.

Determining the size of the sample involves several considerations. A power analysis is first conducted to determine what sample size is required to have enough statistical power for effects to be shown in the data analysis. Power can be determined by taking the difference between two group means (averages) from a previous study on a similar topic and dividing that difference by the larger of the two standard deviations for the same means. (The standard deviation reflects group variability.)

Even when the sample size is determined by a power analysis, other considerations such as economic constraints can keep the sample size to a minimum. One way to remain economical is by conducting data analyses as the group size is increased. For example, after recruiting 10 participants per

group, data analyses can be conducted to determine whether the groups are significantly different on the key variables. If the groups are tending to differ statistically on those variables, then the absence of significant differences between groups may mean that the sample is too small and more participants need to be added. Researchers usually consider five participants per variable as a minimum sample for statistical analysis reasons.

SELECTING VARIABLES

The 'gold-standard' clinical variable, or the criterion for clinical improvement in any condition, is typically considered the most important variable. For example, in diabetes the 'gold-standard' variable is typically glucose level, and in asthma the 'gold-standard' variable is usually peak air flow. Clinical gold-standard measures are usually determined by collaborating physicians, based on already-existing research literature. Sometimes more than one clinical gold-standard measure is included.

Stress variables are a second important set of variables, because stress usually worsens clinical conditions. Self-report stress measures, such as the State Anxiety Index and the Profile of Mood State measures (to be elaborated later), are often used to assess stress. In addition, physiological measures, such as heart rate or blood pressure, and chemical measures, such as stress hormones (e.g. salivary cortisol), are good confirmatory measures for self-reported stress.

Treatment research usually involves assessment of the immediate effects of the therapy session, and the longer-term effects are assessed at the end of the treatment period. Follow-up assessments are sometimes conducted at 1 or 2 months after the end of the therapy period. The immediate effects of therapy can be measured by self-reports on the participant's anxiety level and mood state, and saliva samples are sometimes taken for a measure of stress hormone (the most common one being cortisol). Heart rate and blood pressure are common physiological measures of stress. Other measures are unique to the condition. For example, in the pain condition of juvenile rheumatoid arthritis, the response to a dolorimeter might be measured, the dolorimeter being a pressure gauge that determines the threshold beyond which the participant can no longer tolerate the pressure of the rod-like dolorimeter. In burn wound healing, the participant registers itching on a temperature gauge of itchiness immediately following the treatment. Longer-term measures are the gold standards or criteria for the effectiveness of the therapy. Those effects are indexed by clinical measures such as the number of back-pain-free days, number of migraine-free days, glucose levels, or pulmonary measures taken in children with asthma. Often clinical improvement is accompanied by decreases in depression and urinary stress hormones (e.g. cortisol and norepinephrine).

Sleep/wake behavior observations are also invaluable indicators of treatment and clinical changes. However, observers need to be trained to conduct live observations or to code videotapes of the behaviors if they have been

videotaped, by checking off behaviors on paper grids, for example, every 10 seconds or on laptop computers second-by-second. Then at least two individuals need to observe and code behavior simultaneously to determine interobserver agreement (interobserver reliability). The standard for interobserver reliability is 90%, that is the two observers coded the behaviors similarly 90% of the total time sample units across usually one-third of the observations. Significant practice time is required to achieve this level of interobserver reliability. Interobserver reliability is calculated using a 'kappa coefficient', which is a statistical calculation that corrects disagreements that might happen by chance. Monitoring behavioral, physiological and biochemical measures simultaneously increases the robustness of the study. Self-report measures are usually taken on pencil and paper forms.

Heart rate and blood pressure are easily-recorded physiological assessments. More sophisticated measures such as vagal tone (derived from the respiratory sinus arrhythmia of heart rate) are more difficult to collect because of the technical equipment and labor-intensive data reduction required. Biochemical assays are rarely included in massage therapy studies because saliva and urine assays are expensive. For example, saliva cortisol assays cost approximately US\$25.00 per sample. In most studies pre- and post-therapy saliva samples are taken on the first and last days of the study to total approximately US\$100.00 per person.

Gold-standard clinical measures are typically performed by a physician, for example, pulmonary measures in children with asthma and the dolorimeter with patients with pain syndrome, such as those with fibromyalgia. Similar measures can sometimes be taken by the patient to corroborate the physician's assessment, for example, the peak air flow meter measuring pulmonary function by children with asthma and pain-rating scales by patients with fibromyalgia. When children are the participants in studies it is sometimes important to measure parental stress and mood state to determine whether the child's clinical course is affecting the parents and whether parental stress, in turn, may be affecting the child's clinical course.

THERAPY AND RESEARCH PROCEDURES

Treatment and research procedures need to be carefully considered and designed prior to the beginning of the study. Researchers write the background and the methods of their study in advance of their research so that the institution's review board can review any concerns they may have about protecting the rights of human subjects.

One of the most important aspects of the research procedure is that the participants and the observers should not know the hypotheses of the study and the participant's group assignment, as the participants and observers could be biased by these factors. Including several observers in the study can also help prevent bias, although the training of several observers and practice sessions to achieve interobserver reliability are costly.

The therapy protocol also requires careful thought. The description of the therapy needs to be extremely detailed to cover many muscle groups and different parts of the body to be effective. Cost considerations include the length of the session. This is relevant for both the cost of the study and the cost of transporting the treatment once it is determined to be effective. Most people cannot afford more than one 30-minute session by a professional massage therapist per week. Training a 'significant other' in the procedure is more cost-effective, although even that person is not likely to conduct massages more than a couple of times a week at 20–30 minutes per session. The research can be less expensive when using volunteer massage therapists. The therapists appreciate the research experience, particularly when it involves children, who they are rarely able to see otherwise. Participants are also more likely to continue their treatment if the procedure has proven cost-effective. For these reasons we have limited the therapy sessions in our studies to 20-minute sessions once or twice per week. We also train significant others to conduct the massage following the end of the study. They are given demonstrations on themselves and on the research participants and they are then given a video for home review of the procedure.

For massage studies with children, we teach the parents to be the therapists. The massage becomes part of the bedtime ritual that helps not only the children but the parents as well. We have documented that the therapist benefits from providing the massage in the same way that the recipient benefits (Field et al 1998a). Massage therapy by parents, of course, is a very cost-effective procedure and one that not only helps the child's clinical condition but also helps make the parent feel empowered as part of the treatment process and helps the parent's and child's relationship.

SELECTION OF COLLABORATORS

It is necessary for massage therapists wanting to conduct research to find research collaborators. Usually research collaborators can be found at universities or hospitals. The research protocol needs to be approved by an institutional review board in a research institution. Medical collaborators are important for identifying important clinical measures (gold standards) for the condition being studied. They can also refer patients for participation in research and can administer the clinical measures. Finally, they are helpful in terms of publications and grant proposals because they add credibility for reviewers of publications and grants. Scientist collaborators are also helpful. For example, neuroscientists can conduct assays of biochemical measures or interpret physiological data, e.g. electroencephalograms (EEGs). Statisticians and PhD researchers can assist with designing the methods and conducting the statistical analyses for the project. If the collaborating researcher is not a PhD-trained researcher, the team will need at least a statistician collaborator. Massage therapist collaborators are, of course, needed (particularly if the researcher is not a massage therapist), for the design of the massage therapy procedure to be used and to help identify measures that can directly assess

the effects of that massage therapy procedure. Volunteer massage therapists are critical for the therapy itself or for demonstration of the therapy if the parents or significant others are going to be the therapists.

RESEARCH PROTOCOLS FOR SPECIFIC CONDITIONS

In the next section, specific research protocols are reviewed as examples. These include research on prenatal and postnatal growth and development, attention deficit hyperactivity disorder (ADHD), psychiatric conditions and addictions, pain syndromes, autoimmune conditions including asthma, dermatitis and diabetes, and immune conditions including HIV and breast cancer.

Growth and development studies

Pregnancy massage

Prematurity is a costly problem that would best be prevented. Stress and depression of the mother may contribute to prematurity. In some studies, for example, the cortisol levels (representative of stress) of the pregnant woman at 28 weeks' gestation predicted premature delivery with a reliability of 0.98 (Wadwha et al 1998). The prematurely-born babies had significantly higher cortisol levels than those who were not born prematurely. In another study conducted by our group, the mothers' prenatal catecholamines (norepinephrine) and stress hormones (cortisol) during the last trimester of gestation were later mimicked by their newborns (Lundy et al 1998). This finding concurs with data showing that at least 40% of the mother's cortisol crosses the placenta (Glover et al 1999). Another study from our laboratory suggests that fetuses of depressed versus non-depressed mothers were also more active from the fifth to the seventh gestational month (Dieter et al 2001), which may be a result of increased stress hormone levels. These data highlight the importance of interventions during pregnancy that can reduce stress and depression. In a recent study we provided pregnancy massage twice a week over the last trimester of pregnancy (Field et al 1998b). Perinatal complications were reduced, and most importantly, prematurity was reduced. In a more recent study we explored the effects of pregnancy massage specifically on depressed mothers (Field et al 2004). The massage reduced not only depression and anxiety but also the neurotransmitters and hormones associated with depression and anxiety (norepinephrine and cortisol). Serotonin, the antidepressant neurotransmitter, was increased. Again, reduced prematurity was the most important effect.

Labor massage

To continue the stress reduction achieved in pregnancy we taught significant others to perform labor massage (Field et al 1998b). In that study we were

able to reduce labor pain by having the significant other give the massage for the first 15 minutes of every hour of labor. The massage led to shorter labors, less need for labor medication, shorter hospitalization and less postpartum depression.

Preterm growth and development

Approximately 10% of infants in the US are born prematurely at less than 37 weeks' gestation. Those infants are hospitalized in neonatal intensive care units (NICUs) for sometimes 2–5 months, experiencing stresses of the nursery including loud sounds and bright lights. When the newborn is no longer considered to be medically unstable, the primary agenda for the infant is to gain enough weight to be discharged. It is at this time that we have introduced 'preemie massage'. The massage protocol included three 15-minute massages a day for a 10-day period which led to a 47% greater weight gain (Field et al 1986). In our most recent study we were able to establish the same weight gain over a 5-day period (Dieter et al 2003) and thus we are now using the more cost-effective 5-day treatment period. We are also working to teach the parents to continue the massage following discharge.

In addition to weight gain, we documented that we could save US\$4.7 billion in hospital costs if we were to provide 10 days of massage to the approximately 470 000 infants born prematurely in the US each year (saving US\$10 000 in hospital costs per infant) due to their being discharged on average 6 days earlier. The cost savings would be even greater today because of increased NICU costs. We also observed sleep/wake behaviors and conducted newborn behavior assessments with these infants (see Appendix, p. 21 for the sleep/wake behavior codes and the list of behaviors). Recording 45-minute sleep/wake sessions, we were able to document that indeterminate sleep (a sleep state that is very difficult to code because it is disorganized and does not look like deep sleep or active sleep) was a problem for preterm infants, a problem that was diminished by the massage therapy. Also, the massaged babies were more responsive on the newborn assessments. Follow-up assessments showed that these infants still had a weight and developmental advantage at 8 months post-discharge (Scafidi et al 1993). Perhaps because their newborn behavior was more responsive, the infants' interactions with their parents were better and thus, they were able to eventually show better growth and development.

We later added growth hormone (IGF1) and oxytocin to our set of measures. These variables are considered important for growth and have been shown to increase with additional stimulation in rats, for example (Uvnas-Moberg 1993). We added these variables in order to explore the underlying mechanism for the massage therapy/weight-gain relationship. In an earlier study we speculated that the underlying mechanism for increased weight gain in the massaged preterm babies was that following massage the activity of the vagus nerve was increased. As a result more food absorption hormones

were being released for more efficient food absorption, that being the function of the vegetative branch of the vagus nerve. Vagal activity was measured from heart rate recordings and was shown to increase, and insulin (a food absorption hormone) in plasma samples increased. Other possible underlying mechanisms include an increase in gastric motility (also stimulated by the vegetative branch of the vagus nerve), which could also contribute to more efficient food absorption.

The additional measures of IGF1 and oxytocin may further inform us as to underlying mechanisms. If underlying mechanisms are known, medical professionals are more likely to adopt massage therapy as a routine treatment on neonatal intensive care units. Functional magnetic resonance imaging (MRI) methods are being used by some researchers to show that significant brain development accompanies massage therapy, particularly the development of the hippocampus (the brain region that involves memory functions). In the rat, which often serves as a model for human growth and brain development, increased dendritic arborization (branching) occurs in the hippocampal region following moderate-pressure rubbing (Schanberg & Field 1987). In this study, the experimenter used a paintbrush to simulate the mother's moderate-pressure tongue licking. The tongue-licking pressure lowered levels of cortisol, which is noted to kill brain cells. Brain cells were saved, and as adults, the rats performed maze tests as well as they had in their youth.

Unfortunately, the use of functional MRI and growth measures (IGF1 and oxytocin) are extremely expensive in the human. For example, IGF1 growth hormone assays cannot be done until dozens of samples are collected because of the expense involved in assaying a few samples at a time. Functional MRI equipment and the technical expertise that is needed to read the functional MRI scans are extremely expensive. Although brain scans and growth hormones are compelling data, the clinical measure, in this case weight gain, is typically the easiest and least expensive variable.

Attention and attention disorders

Stimulation of the vagus is critical for attention. Vagal activity and EEG patterns are reliable indicators of attention; slower heart rate and increased vagal activity accompany attention. The sinus arrhythmia of heart rate is controlled by the vagus, so heart rate recordings can be easily converted to vagal activity by a computer program. EEG requires sophisticated equipment and technical expertise for reducing the data. EEG patterns that accompany attentiveness include increased beta and theta waves. This EEG pattern of heightened alertness/attentiveness was noted in a recent study following 15-minute chair massages in participants' offices (Field et al 1997a). The EEG alertness/attentiveness pattern following the massage sessions was accompanied by improved performance on mathematical computations, including being able to perform them in less time with greater accuracy. Enhanced perform-

ance has also been documented for infants (Cigales et al 1997). That study showed superior performance on habituation tasks by infants following massage. These are primitive learning tasks involving learning that a repeated stimulus, such as the repeated sound of a bell, becomes irrelevant because it does not signal anything else happening. The infant stops responding to the stimulus and then responds to a novel stimulus, suggesting that the old stimulus was learned. We also showed in a study on preschool children that they were able to perform IQ scale items including pegs and block design tasks in less time and more accurately following a brief massage (Hart et al 1998).

Children with attention disorders

Children with attention disorders such as autism (Field et al 1997b) and ADHD (Field et al 1998c) are also able to perform better and stay on task for longer periods following massage therapy. After two sessions per week by a massage therapist these children were able to stay on task longer and relate more to their teachers (Field et al 1997b). In a more recent study the children's parents were used as the therapists (Escalona et al 2001). That study showed that the children not only spent more time being attentive and on-task in the classroom, but they also showed fewer sleep problems. Sleep problems are prevalent in children with autism. The sleep diaries kept by the parents on the onset of sleep, duration of sleep and number of sleep-wakings were a critical measure. To the parents' surprise, sleep problems decreased over this brief period.

Parents of children with autism are often biased toward seeing any signs of improvement. Thus, converging measures are particularly important. In some studies we have recorded night-time sleep by time-lapse video. With time-lapse video 8 hours of sleep, for example, can be coded in 1 hour. The taped movements look like Charlie Chaplin moving about, so they are easy to record for a measure of activity. Activity is only seen in active sleep (versus deep sleep). Night-wakings and moving out of the bed are coded as wakeful activity. Actometers (activity monitors) are more precise measures of sleep, they are less intrusive and they require less subject compliance. The actometer is a converted Timex watch (with the spring removed) such that every time a participant moves an arm, the time hand on the watch moves. The clock time elapsed on the watch from night-time to daytime is a measure of activity that has occurred during night-time sleep. This becomes the total time in active sleep or non-deep sleep. Actometers are easy to use with all age groups.

Similar measures have been used with children and adolescents with ADHD (Field et al 1998c). The most meaningful measures for this group are those taken in the classroom, where the children show their worst problems. In studies on ADHD teacher and parent rating scales were used (the Conners scale because it is shorter than the Child Behavior Checklist, a similar measure used by parents and teachers). Parents' and teachers' ratings often

correlate. Some behaviors are difficult for parents to rate, for example, on-task behavior in the classroom, and some are difficult for teachers to rate, for example, sleep behavior. Teachers' and parents' ratings have been criticized because they are thought to be subjective. However, they have recently been highly correlated with independent observer ratings, so they are now less subject to criticism.

Attentiveness would ideally be recorded by some kind of device that could be mounted on the head to record eye movements and free field recordings of heart rate that would not be affected by movement. However, when sophisticated devices are used, their readings are often similar to (correlated with) behavior ratings. For example, EEG sleep recordings are highly correlated with activity watch (actometer) readings of sleep activity as well as time-lapse video recordings of activity.

Psychiatric conditions

Psychiatric conditions such as depression or eating disorders and post-traumatic stress disorder (PTSD) can also be improved by massage therapy. Because these are typically accompanied by depressed mood and anxiety, we include self-reports on depression and anxiety in our studies. These include:

1. The Profile of Mood States (McNair et al 1971), which taps depressed mood state, anxiety, and anger.
2. The Center for Epidemiological Studies on Depression Scale (CESD; Radloff 1977) or the Beck Depression Inventory (Beck et al 1961), both of which measure depressive symptoms. The CESD seems to be more sensitive (detects more individuals with depressive symptoms) and is more user-friendly or simpler. Younger and less educated people are more able to complete this instrument.
3. The State Anxiety Inventory (Spielberger et al 1970) (which also has a children's version called the State Anxiety Inventory for Children [STAIC]), assesses state anxiety (current, short-term anxiety) and trait anxiety (approximating a personality trait). The State-Trait Anger Expression Inventory (STAXI), designed by the same psychologist, measures anger. These 20-item, five-point scales are easy to complete and have good properties including good test-retest reliability (meaning that completing the scale on two occasions usually yields similar ratings).

For an assessment of psychiatric conditions we also use converging measures of behavior including the symptoms that are reported on the self-report scales, for example, depressed affect, anxious and angry behavior. For behavior observations we designed the Behavior Observation Scale. Following a brief behavior observation the behaviors are rated on a five-point scale. Both mood scales are completed by the participant, and the behavior observations are made before and after the massage therapy session.

A third set of measures typically collected for individuals with psychiatric conditions are saliva (for an assay of the stress hormone cortisol) before and after the first and last massage therapy session. Urine is collected for assays of the stress neurotransmitters (norepinephrine and epinephrine), the body's natural antidepressants (dopamine, serotonin), and cortisol, at the beginning of the first and last sessions of the treatment period. The saliva measure of cortisol is taken as an index of the immediate reduction of stress following the therapy session, and the urine assays are made to assess the longer-term effects of massage therapy over the course of the study.

The above, self-help, behavior observations, and biochemical samples have been included in our studies on depressed children, depressed adolescents and depressed mothers, as well as studies conducted on patients with eating disorders (anorexia, bulimia) to assess the longer-term effects of massage therapy. Depression, eating disorders and addictions are considered to have an underlying depression base. This suggests the use of depression measures across studies. Other measures that were unique to the different studies included:

1. Time-lapse videotaped sleep during a child and adolescent psychiatry study as well as nurses' ratings of the children's and adolescents' behavior on the the psychiatric unit.
2. The Eating Disorders Inventory (Garner et al 1983) for an eating disorder study.
3. The number of cravings and cigarettes smoked for a smoking cessation study.
4. EEG for depressed adult studies. Relative right frontal EEG is typically noted in depressed individuals during the expression or reception of negative emotions. The right frontal area of the brain is involved in processing negative emotions. Less right frontal EEG activation is noted following massage therapy.
5. For children with PTSD (following Hurricane Andrew), the children drew themselves using magic markers to assess the change in depression. The drawings are scored on seven factors including: (1) small figure on page; (2) use of dark colors; (3) missing facial features; (4) sad face; (5) distorted figure; (6) displaced body parts; and (7) agitated lines. The drawings of depressed children often have very few facial features, distorted body parts and a small figure on the page.

Pain syndromes

A number of pain syndromes have shown benefit from massage therapy, including migraine headaches, lower back pain, premenstrual syndrome, and pain from burns, fibromyalgia and juvenile rheumatoid arthritis. In these conditions we have used self-report scales on pain including the McGill pain questionnaire, the pain intensity scale and a visual analog scale such as a ruler with ratings along its scale or a thermometer with ratings in the case of adults

or a series of sad to happy faces in the case of children's ratings of pain. In addition to children's selection of faces that match their feelings, we often ask the children's parents and physician to rate the pain they think the child is experiencing. We also use measures unique to the different syndromes. So, for example, for migraine headaches, participants are asked to keep a diary on their headache-free days.

For lower back pain we assessed range of motion and the patients' ability to touch their toes. For burn subjects higher pain thresholds were noted following the massage therapy sessions. Their reactions to debridement (skin brushing) were assessed to determine their pain threshold. For fibromyalgia we used a dolorimeter (a rod that exerts pressure until the patient winces, representing the pain threshold). For juvenile rheumatoid arthritis, we asked parents to assess their child's ability to continue activities of daily living.

Because pain syndromes are often accompanied by anxiety, and anxiety in turn exacerbates pain syndromes, we also use anxiety scales (State Anxiety Inventory) to assess the pre- and post- massage therapy session anxiety levels. In addition, we use saliva cortisol as a secondary measure of anxiety/stress levels pre- and post-massage therapy sessions. Sleep is disturbed in pain syndromes either because of the pain or because sleep disturbances contribute to the pain (the direction of this relationship is not certain). Thus, we have used sleep recordings (sleep diaries or actometers). More recently we have noticed that sleep improved following massage therapy in pain syndromes, and pain was also reduced. Pain syndromes are often accompanied by insufficient deep or restorative sleep. Reduced deep sleep is accompanied by increased levels of substance P which causes pain. In a recent study on fibromyalgia we noted reduced substance P in saliva samples, improved sleep and decreased pain following a 1-month massage therapy treatment period.

Autoimmune disorders

Stress hormones such as cortisol are known to interact with and to affect autoimmune and immune conditions. Thus, cortisol is measured in saliva before and after massage therapy sessions and in urine at the beginning and end of the study period. In autoimmune diseases in children (including asthma, dermatitis, and diabetes), parents were used as the massage therapists. We knew that the parents would also likely benefit from the therapy because we had noted improvement in elderly volunteer massage therapists who massaged infants. The volunteers became less depressed, and their cortisol levels decreased (Field et al 1998a). We also know that parents' stress levels affect their children's stress levels, which may in turn affect their autoimmune condition. Thus, we also use self-report measures to assess stress in parents. The other measures of the autoimmune conditions are unique to the condition.

In the case of diabetes, self-report measures are completed by the parents on the child's glucose regulation, insulin and food regulation and exercise. In addition, glucose levels are measured by the children and their parents using