POST-STROKE DEPRESSION AND FUNCTIONAL STATUS: A META ANALYSIS

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BY

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To the Dean of Graduate Studies and Research:

I am submitting herewith a dissertation written by Danita Masters Alfred entitled "Post-Stroke Depression and Functional Status: A Meta-Analysis." I have examined this dissertation for form and content and recommend that it be accepted in partial fulfillment of the requirements for the degree of Doctor of Philosophy with a major in Nursing.

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Dean of Graduate Studies and
Research

DEDICATION

This dissertation is dedicated to my nurse colleagues, past, present, and future, whose caring has influenced healing beyond that which can be scientifically explained.

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ABSTRACT

POST-STROKE DEPRESSION AND FUNCTIONAL STATUS:
A META ANALYSIS

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Depression is known to negatively affect functional status and recovery potential for patients with many chronic diseases and for elderly patients. The purpose of this research was to better understand the relationship between depression, functional status, physical rehabilitation, and pharmacologic treatment of depression for post-stroke patients. It was proposed that depression and functional status were related to one another and could be mediated when they operated through the health care system.

A review of the stroke literature completed between 1990 and July 2000 resulted in the identification of 31 subject-studies that examined an association between depression and functional status in the post-stroke patient. Selected characteristics of the subject-studies including design, method, setting, location, quality, time, method of depression assessment, and method of functional status assessment were reviewed.

Meta-analytic methods were used to synthesize the results of the subject-studies. A small to moderate population Effect Size ES*r* of .25 (P = .000, k = 21, N = 2,310) with a Binomial Effect Size Display (BESD) of .37-.63 was found for a homogenous grouping of non-experimental studies examining the relationship between depression and functional status. A moderate to large ES*r* of .43 (P = .000, k = 5, N = 182), with a BESD of .29-.71, was found for a homogeneous grouping of experimental studies examining the relationship between depression and functional status when mediated by physical rehabilitation and pharmacologic treatment for depression. Significant associations between functional status and depression were identified for the prospective cohort studies, the general setting studies, the studies using clinical diagnosis of depression, and the studies using methods other than the Barthel Index for assessment of functional status. Examination of the post-stroke time trajectory revealed significant ESs for the acute time (*r* = .23), the 3-month time (*r* = .25), and the greater than 1 year time (*r* = .35).

Findings support a statistically and clinically significant relationship between depression and functional status, and pharmacologic treatment and physical rehabilitation mediate that relationship. The reciprocal

interaction between depression and functional status is best approached through appropriate and timely treatment of both post-stroke manifestations.

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CHAPTER I

INTRODUCTION

Stroke is the third leading cause of death and the most common disabling disease. In the United States, approximately 600,000 persons suffer a stroke each year. Approximately 3 million Americans are stroke survivors. According to the National Stroke Association (1999), 40% of the stroke survivors suffer from moderate to severe disability, 25% die shortly after the stroke or are admitted to a nursing home for total care, 25% suffer minor disability, while only 10% regain pre-stroke levels of functioning. About one-half of the stroke victims survive for 3 or more years and about one-third survive for 10 years. Of those who survive a stroke, approximately 73% receive some form of rehabilitation (U.S. Department of Health and Human Services [USDHHS], 1995).

Depression is another one of the most common disabling conditions seen by primary care providers. Community studies have found major depression in as many as 10% of the population examined with as many as 20% more of the population having symptoms of depression that do not meet the criteria for major depression. Depressed patients with

heart disease, diabetes, stroke, gastrointestinal disease, and cancer respond slower and less favorably to medical intervention, have poorer survival rates, and less quality of life (D Epiro, 1999). Depression also has been associated with poor functional outcomes, with depression being a precursor to declining functional status as well as the onset of many chronic medical conditions.

The combination of depression and stroke can be a deleterious mix. With functional status already diminished by the stroke, post-stroke depression can result in serious prognostic implications. Gordon and Hibbard (1997) reviewed 10 years of research related to post-stroke depression. Despite recognition of depression as the most common untreated disability secondary to stroke, there is a lack of consensus regarding the cause of the depression, appropriate treatment for depression, and long-term consequences of treatment or failure to treat.

At the time the Agency for Health Research and Quality (AHRQ), formerly the Agency for Health Care Policy and Research, developed the Post-Stroke Rehabilitation Guideline (USDHHS, 1995), there was a scarcity of evidence supporting the benefits of rehabilitation. There was also little outcome evidence supporting the effectiveness of specialized rehabilitation programs, treatment strategies, pharmacologic interventions, or behavioral therapies. Subsequent to the

publication of the guidelines, research related to post-rehabilitation disability in stroke survivors, characteristics of stroke rehabilitation recipients, attributes of stroke rehabilitation facilities, and identification and measurement of critical outcomes began to permeate the literature (Forbes, Duncan, & Zimmerman, 1997; Hoenig et al., 1997; Lee, Baker, Gehlbach, Hosmer, & Reti, 1998).

Five priority research goals were recommended in the AHRQ guideline (USDHHS, 1995), they include:

1. Identification of the characteristics of patients most likely to benefit from rehabilitation.

2. Determination of optimal rehabilitation program for different types of stroke patients.

3. Identification of factors that determine optimal timing, intensity, and duration of rehabilitation.

4. Determination of the effectiveness of specific interventions in reducing impairments or improving function.

5. Development and standardization of standardized tests to monitor post stroke rehabilitation.

Clearly, progress toward these goals has begun; however, many of the findings are disparate, inconclusive, or vague and have not, as yet, influenced nursing practice.

Purpose Statement

Nurses work with stroke patients at the acute, rehabilitation, and chronic stage of the disease. Depression is known to negatively affect functional status and recovery potential for patients with many chronic diseases and for elderly patients. The purpose of this research was to better understand the relationship between post-stroke depression, functional status, and treatment modalities. This will enable nurses to provide more holistic intervention at all stages of stroke recovery.

Problem of the Study

Approximately 65% of the stroke survivors have modifiable disabilities. Two of the most commonly reported sequelae are post-stroke depression and functional status disabilities. Researchers have examined the prevalence of post-stroke depression alone and in combination with functional status, the relevance of location of the stroke lesion to the occurrence and severity of depression and effect on functional status, and the influence of various medications and treatments in mediating depression and functional status.

Despite frequent consideration of both depression and functional status in the post-stroke population, findings relevant to any relationship between the two variables is

inconclusive. Inconsistencies in sampling, design, methodology, instrumentation, and findings limit the use of cumulative conclusions (Gordon & Hibbard, 1997). The problem of the study was to determine what can be said with confidence about the relationships between depression, functional status, and mediating strategies in the post-stroke population.

Rationale for the Study

Meta-Analysis (MA) can be used to pool data on individual patients from smaller or varied studies, thereby increasing statistical power and allowing conclusions about the relationships between depression, functional status, and treatment modalities. Understanding the nature of any association between depression and functional status will enable health care providers to render rehabilitative care that address the whole post-stroke person.

Conceptual Framework

Two conceptual frameworks were considered for instrumental guidance of this research project. Each contributed uniquely to understanding the relationship between post-stroke depression, functional status, and treatment modalities but lacked the integration of concepts in a manner sufficient to guide this research. The conceptual frameworks will be reviewed individually and then

a derived model will be presented that is sufficiently specific and comprehensive to guide this research endeavor.

Huber and Oermann's Model of Outcome Initiative

From the context of quality management in nursing, Huber and Oermann (1999) discussed the relationship between quality and outcomes. Four categories of outcomes are identified: patient/family outcomes, provider outcomes, organizational outcomes, and social/community outcomes. These authors stress the importance of examining outcomes from a balanced and comprehensive approach, recognizing that examining quality from a patient's perspective alone might fail to address the organizational or community perspective. Acknowledging that all of the variables that affect outcomes cannot be examined simultaneously, two conceptualizations for outcome management were elaborated.

The first conceptualization represents a narrow focus on selected outcomes. A simple linear path moving from a selected patient characteristic through a nursing intervention to an outcome was proposed as a method to observe the influence of nursing intervention on the outcome of the selected patient characteristic. The contextual view encompasses the multiple domains actually involved in outcome initiatives. The contextual view presented by Huber and Oermann (1999) recognizes the multifaceted, complex, and

often competing domains present in outcome initiatives. Contextually, outcome initiatives examine the independent and overlapping characteristics of the patient, the provider, the organization, and the community. The characteristics operate through and are influenced by the health care delivery system. Measurements of the patient, provider, organization, and community characteristics are made after they operate through the health care system. The final phase reflects the outcomes of the patient, provider, organization, and community characteristics.

Engel's Biopsychosocial Model

Effective treatment for post-stroke patients requires a model integrating physiologic, behavioral, environmental, and social factors that influence stroke outcomes. The biopsychosocial model (Engel, 1977) a multifactorial approach, is applicable to the rehabilitation needs of post-stroke patients (Swartzman, Gibson, & Armstrong, 1998). Health and illness are balanced by the interplay of organismic, behavioral, and environmental factors (Engel, 1977).

Engel (1977) argued that the biomedical model alone could not account for all aspects of an illness. The biomedical model fails to account for the social, psychological, and behavioral dimensions of the illness.

Although Engel did not specifically define all the concepts of the biopsychosocial model or map the constructs, he did propose that the biopsychosocial model be adopted as a framework for teaching and treatment in the real world of health care.

Derived Model

Drawing from the multifactorial approach of the biopsychosocial model proposed by Engel (1977) and the approach to outcome management by Huber and Oermann (1999), a new derivation specific to the relationship between post-stroke depression, functional status, and mediating strategies is proposed. The derived model, Post-Stroke Depression, Functional Status, and Mediating Strategies is presented in Figure 1. The model begins with two factors of the biopsychosocial model, depression, representing a psychological factor and functional status, representing a biological factor. Two mediating strategies are introduced, pharmacologic treatment for depression and physical rehabilitation for improving functional status. Treatment outcomes are represented by level of improvement in depression and functional status operating through the mediating strategy(ies). Construction of the model, from individual characteristics through the health care system

represented as mediating strategies to the outcomes, follows the paths outlined by Huber and Oermann (1999).

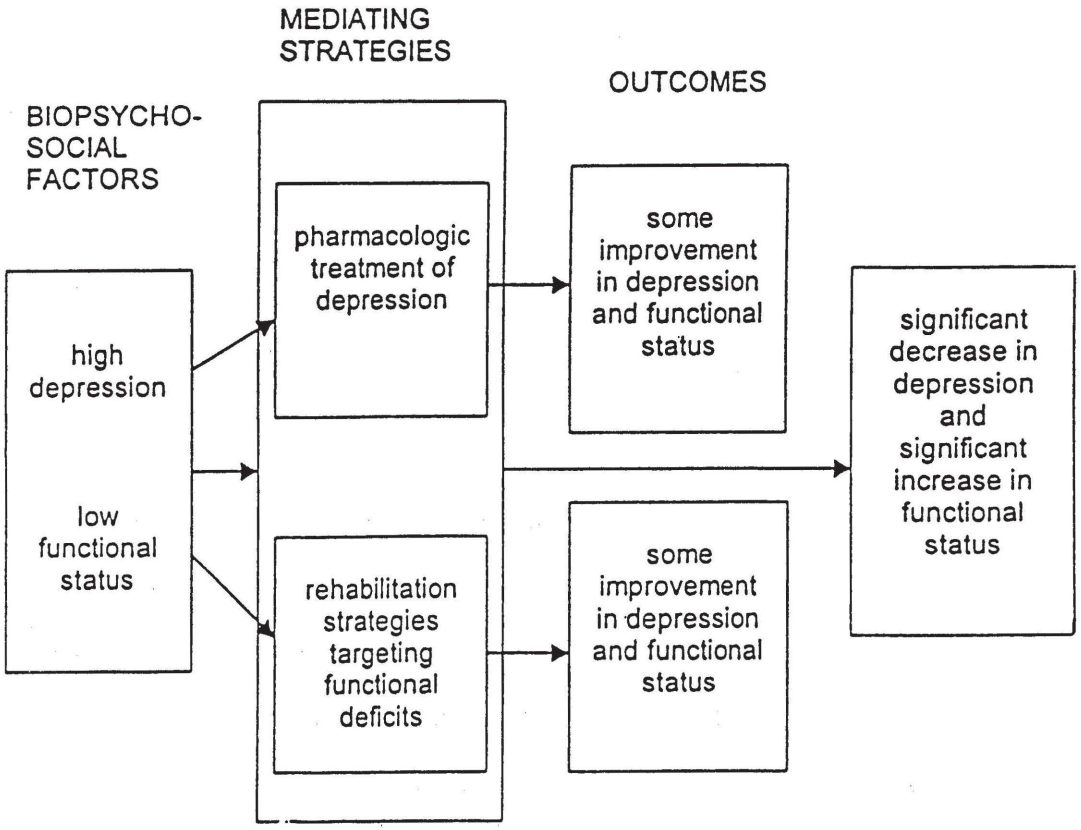

Figure 1. Post-stroke depression, functional status, and mediating strategies.

Assumptions of the model are:

1. Depression and diminished functional status coexist in post-stroke patients.

2. Mediating strategies targeting one of the biopsychosocial factors positively influences the outcome of both factors.

3. Mediating strategies targeting the biopsychosocial factors positively influence the outcome of both factors beyond the level attained when only one factor is targeted.

Hypotheses

The meta-analysis was guided by four directional hypotheses:

1. There is a negative relationship between depression and functional status in the post-stroke patient.

2. Pharmacologic treatment of depression mediates the negative relationship between depression and functional status in the post-stroke patient.

3. Physical rehabilitation mediates the negative relationship between depression and functional status in the post-stroke patient.

4. Pharmacologic treatment of depression and physical rehabilitation together mediate the negative relationship between depression and functional status more than either strategy used alone.

Definition of Terms

Post-stroke depression--is generally defined as "a state of lowered self-esteem, accompanied by feelings of

helplessness and hopelessness that may be evident to others" (Bruckbauer, 1991, p. 34). Robinson, Lipsey, and Price (1985) outlined three types of depression in post-stroke patients: major depression, minor depression or dysthymic depression, and depression manifested by apathy and inappropriate cheerfulness. Operationally defined, post-stroke depression is the clinical diagnosis of dysphoria accompanied by loss of interest in usual activities and/or the clinical impression of dysphoria indicated on a standardized instrument designed to quantify the dysphoric mood state post acute stroke.

Functional status--refers to an ability to perform basic activities of daily living. Most measures of functional status assess an individual's degree of independence in multiple activities including feeding, dressing, grooming, toileting, walking, transferring, and communicating. Functional status is operationally defined as the post-stroke patient's score on a quantitative scale designed to measure a person's dependence/independence in activities of daily living.

Physical rehabilitation--is "a restorative learning process which seeks to hasten and maximize recovery from stroke by treating the disabilities caused by the stroke, and to prepare the stroke survivor to reintegrate as fully as possible into community life" (USDHHS, 1995, p. 2). A

multidisciplinary team including physicians, nurses, physical therapists, speech therapists, occupational therapists, psychologists, and social workers best accomplishes physical rehabilitation. Physical rehabilitation is operationally defined as a restorative process implemented by a multidisciplinary team for the stroke survivor's reintegration into community life.

Pharmacologic treatment of post-stroke depression--is as personal as the treatment of depression in any non-stroke patient. Specific treatment is dependent on age, metabolic state, and manifestation of symptoms. Any drug from the broad category of psychotropic drugs including but not limited to tricyclics, selective serotoninergic reuptake inhibitors, and psychostimulants can be used effectively (Swartzman et al., 1998). Pharmacologic treatment is operationally defined as the use of any psychotropic drug for the expressed purpose of treating post-stroke depression.

Limitations

1. Subject-studies for the MA do not consistently control for pre-stroke depression or functional status.

2. Mediating strategies are not reported in all of the subject-studies and those reporting strategies do not consistently describe the strategies or adhere to a common

protocol. This is especially relevant when examining the mediating strategy, physical rehabilitation.

3. Subject-studies are limited by the publication bias for significant findings, limiting access to studies with non-significant findings.

4. The MA is limited to findings that were reported by authors of subject-studies.

5. Differences in the conceptual and operational definitions measuring depression and functional status may influence the study findings.

Delimitations

1. Subject-studies were limited to research reported in the English language.

2. Only studies completed between 1990 and July 2000 were included.

3. Studies were limited to those that were available to the researcher.

Summary

With stroke effecting over 600,000 Americans annually and leaving 40% of the effected patients with moderate to severe disability, it is easily one of the most commonly encountered health care problems. Depression is also prevalent in both the post-stroke and general population. It has been associated with a slower response to clinical

interventions, poor survival rates, and less quality of life. Despite the recognition of high rates of depression in the post-stroke population, there is a lack of consensus regarding the effects of depression on the post-stroke patient and there is not a standard upon which to base treatment decisions for the depressed post-stroke patient.

Using a derived conceptual model, it was proposed that depression and functional status were related to one another and could be mediated when they operated through the health care system receiving rehabilitation strategies that targeted functional deficits and pharmacologic treatment for depression. The mediating strategies influenced depression and functional status individually and collectively. Four directional hypotheses were used to guide the researcher through the conceptualization. Four critical terms, post-stroke depression, functional status, physical rehabilitation, and pharmacologic were operationally defined.

In the recent past, researchers have addressed the association between depression and functional status in the post-stroke patient. Because of diverse methods, sampling techniques, and measurement instruments, the research findings have been varied. The purpose of this study was to examine previous research for a better understanding of the relationship between depression, functional status, and

mediating strategies in the post-stroke population. Increasing understanding of the nature of such relationships will enable nurses and other health care providers to render more holistic and appropriate post-stroke care.

CHAPTER II

REVIEW OF LITERATURE

Health care and medical literature relating to the pathophysiology, epidemiology, and treatment of stroke and post-stroke patients is voluminous. All of this literature, though contributing to the current status of stroke and stroke rehabilitation care and treatment, was effectively considered by the AHRQ prior to the publication of the Stroke Rehabilitation Guideline (USDHHS, 1995). With that understanding, this review of literature focuses on the literature that subsequently contributes to the growing body of stroke rehabilitation knowledge and relates to the study variables, post-stroke depression, functional status, and mediating strategies.

Post-Stroke Depression

The following summary reflects a brief review of the stroke literature examining the incidence, prevalence, and sequelae of depression in post-stroke patients. Swartzman et al. (1998) found rates ranging from 18% to 60% of the post-stroke patients suffering from depression. They attributed this variation to diverse measurement approaches, sampling times, and study populations. Summarizing the

various study findings, they reported about 40% of the acute stroke patients suffered from depression, from 40% to 60% of the stroke rehabilitation patients suffered from depression, and 16% to 23% of the population based, chronic stroke patients, suffered from depression.

It is still undecided whether post-stroke depression is a direct result of brain damage as some authors have suggested (Astrom, 1996; Herrmann, Bartels, Schumacher, & Wallesch, 1995; Robinson & Price, 1982), an emotional reaction to the stroke disability as described by patients who write about their stroke (Birkett, 1998), situational stress and loss encountered by many stroke patients (Swartzman et al., 1998) or a combination of those factors. As recently as 1991, Bruckbauer noted that acceptance of depression as an inevitable grief reaction possibly explained the lack of attention to post-stroke depression as part of the post-stroke treatment plan.

Association between Location of Stroke Lesion and Depression

No discussion of post-stroke depression would be complete without at least a cursory review of the research related to the anatomical correlates of post-stroke depression. Robinson and Price (1982) and Robinson, Kubos, Starr, Rao, and Price (1984) were the first to document an investigation into the relationship between the location of

the stroke lesion and depression. The initial study linked depression to lesions of the left hemisphere of the brain. This first study by Robinson et al. (1982) examined a relatively young cohort of mostly black males. In this cohort, lesions of the left anterior hemisphere were associated with greater frequency and severity of depression. A subsequent study by Robinson et al. (1984) found that severity of depression was greater for patients with left hemispheric lesions than for patients with lesions located elsewhere. Continued investigations, including work by Robinson et al. into the correlation between lesion location and depression have had diverse results.

Sinyor et al. (1986) and Whitney, Burns, Frederic, and Lowery (1991) found no association between lesion location and frequency or severity of depression in the post stroke patient. Herrmann et al. (1995) examined 104 post-stroke patients within 2 months of an acute stroke. They identified no significant differences in the occurrence of depression for patients with left hemispheric versus right hemispheric lesions. Only nine of the studied patients had symptoms consistent with major depressive disorder and each of those patients had lesions of the left hemisphere that were in close proximity to the basal ganglia. Anderson, Vestergaard, Ingemann-Nielsen, and Lauritzen (1995), however, found no

association between major depression and lesion location in a cohort of 285 post-stroke patients.

More recent research by Robinson and colleagues has demonstrated a greater frequency of left hemispheric lesions in patients with no history of depression (Morris, Robinson, Raphael, Samuels, & Molloy, 1992). Astrom (1996) found that patients who had post-stroke depression with and without generalized anxiety were more likely to have a lesion of the left hemisphere while patients with pure generalized anxiety disorder were more likely to have lesions of the right hemisphere. Despite the inconclusive state of research related to anatomical location of stroke lesions and the presence and severity of depression, evidence does point to a physiologic source for some if not all of the depressive symptoms experienced by the post-stroke patient.

Measures of Depression

Measurement of depression has been one of the major hindrances to synthesis of study findings related to depression in the post-stroke patient. Depression is often dichotomized as either present or absent based on the DSM criteria for major and dysthymic depression. Bruckbauer (1991) described the differences between the two forms of depression and the relevant DSM criteria. Major depression is characterized as a dysphoric mood with loss of interest

in all usual activities. At least four of the symptoms identified in the DSM IV criteria (APA, 1994) must accompany the dysphoria and be present for a minimum of 2 weeks, for a diagnosis of major depression: (a) fatigue or loss of energy; (b) feelings of worthlessness, self-reproach, or inappropriate guilt; (c) impaired thinking or concentration; (d) poor appetite/weight loss or increased appetite/weight gain; (e) suicidal ideation or morbid thoughts; (f) loss of libido; (g) sleep disturbance, either insomnia or hypersomnia; and (h) changes in psychomotor activity, either agitation or retardation.

Bruckbauer (1991) further characterized dysthymic depression as having a long-term, chronic nature lacking in physical symptoms. The DSM IV (APA, 1994) criteria for this type of depression includes: (a) less severe dysthymia with a duration greater than 2 years; (b) short periods free from depression that do not last longer than a few months; (c) depressed mood or loss of interest; (d) at least three of the following symptoms: insomnia or hypersomnia, tiredness or low energy, low self-esteem, reduced capacity to work, poor concentration, social withdrawal, loss of interest, irritability, inability to respond with pleasure, less inclination to talk, pessimism, tearfulness, or morbid thoughts.

Robinson et al. (1985) described one other form of depression that was commonly noted in the post-stroke patient. This form of depression is often masked by indifference, apathy, and inappropriate cheerfulness and is often undetected in the post-stroke patient.

In addition to the use of the DSM criteria for diagnosis of major and dysthymic depression, many depression rating scales have been used to identify and quantify depression in the post-stroke patient. Table 1 summarizes depression rating scales commonly used with the post-stroke patient. Information for the table was aggregated from the AHRQ (1995) review of preferred instruments for assessment of stroke patients, Swartzman et al.'s (1998) selection of depression measures used with stroke patients, and Herrmann et al. (1998) assessment of depressive symptoms.

Table 1

Commonly Used Depression Scales

Instrument	Description	Items	Comments
Beck Depression Inventory (BDI)	Self-administered Scale from 0 = symptom absent to 3 = symptom severe	13 original 21 revised	Useful for detecting possible depression in nonpsychiatric population
Hamilton Depression Rating Scale (HDRS)	Interviewer administered Scale from 0 = none to 4 = extreme	17 24 25	Multiple versions of scale impede comparison Quantifies severity of depression.
Zung Self-Rating Depression Scale (Zung)	Self-administered	20	N/A
Geriatric Depression Scale (GDS)	Self-administered Dichotomized yes/no responses	30 15 short form	Good discrimination in an elderly population
Montgomery and Asburg Depression Rating Scale (MADRS)	Observer rated	20 items	Measures severity of depression
Center for Epidemiological Studies Depression Scale (CES-D)	Self-report measures frequency or duration (from 0-3) of symptoms during the previous week	20 items	High reliability and validity when administered by a research nurse

Functional Status

Unlike depression, the etiology of post-stroke functional deficits is known to be caused by damage to the brain. Functional status disabilities include problems with mobility, basic activities of daily living, instrumental

activities of daily living, and communication (USDHHS, 1995). The combination of deficits and degree of functional disability is related to the location of the stroke lesion (Hayn & Fisher, 1997). Functional disabilities are highest in the immediate aftermath of the stroke, 1 to 3 weeks. Wade and Hewer (1987) reported that only 27% of the patients they studied could walk independently 1-week post stroke, but 85% were able to walk independently after 6 months. Improving functional status is the primary goal of post-stroke rehabilitation.

Measures of Functional Status

Functional assessments are essential tools in determining the degree of functional status disability and the amount of assistance required by the post-stroke patient (Hayn & Fisher, 1997). Most assessments are converted to scale form and include activity domain scores and total scores. The activity domain scores help rehabilitation specialists identify deficits and plan care. The total scores indicate the overall functional status and are used to anticipate length of rehabilitation stay and discharge destination (Brosseau, Potvin, Philippe, & Boulanger, 1996). Functional status is one of, if not the most commonly reported outcome measure for post-stroke patients. Health care providers typically measure recovery in terms of terms

of functional status (Astrom, 1996; King, 1996; Swartzman et al., 1998).

The Barthel Index and the Functional Independence Measure (FIM) are the most commonly used activity of daily living (ADL) scales. These scales have been used and tested widely in rehabilitation for validity, reliability and sensitivity. The most obvious flaw of these measures is the potential for a ceiling effect in patients who have higher levels of functioning (USDHHS, 1995). Strengths and weaknesses of both measures will be briefly addressed in the literature review followed by a summary of commonly used functional status measures (see Table 2.). Information for the table was aggregated from the AHRQ (USDHHS, 1995) review of preferred instruments for assessment of post stroke patients, Herrmann et al. (1998) assessment of functional outcome, and Lofgren, Gustafson, and Nyberg (1999) review of post-stroke assessment instruments.

Table 2

Commonly Used Functional Status Measures

Instrument	Description	Items	Comments
Barthel Index (BI)	Observer rated. Scale 0 = maximum dependence 100 = independent	10 items scored 0-20 or 0-100	Low sensitivity for high level functioning. Widely accepted by clinicians and researchers
Functional Independence Measure (FIM)	Observer rated. Subscales include: self-care, motility and cognition, higher scores reflect greater independence	18 items scored 18-126	When compared to BI, was found to be more sensitive
Oxford Handicap Scale (OHS) AKA Rankin Disability Scale	Observer rated; Measure of impairment; 0 = no symptoms, 5 = severe handicap, totally disabled		Possible low specificity
Fugl-Meyer Scale (FMS)	Observer rated; Motor function; Postural stability; Sensory function; Range of motion	Scores for each side are summed	Considered too complex and time consuming by many. Extensively evaluated
KATZ criteria	Observer rated A-G A = independence G = total dependence	6 items	

The Barthel Index

Mahoney and Barthel published the Barthel Index for general use in 1965; it is the most widely used measure of functional status in the United States. The Barthel Index is standardized and available for public use. It focuses on ADLs and measures feeding, transfer from bed to wheelchair,

transfer from wheelchair to bed, getting on and off the toilet, ascending and descending stairs, dressing, and controlling bowel and bladder. ADL tasks are scored by the amount of time the patient takes to perform the task and the amount of assistance a patient requires when performing the task. Test-retest reliability for the measure is 0.89 and it is useful for patients with cognitive and communication deficits (Jacelon, 1986).

The Barthel Index has been used to predict post-stroke outcomes (Baldridge, 1993). The Barthel Index score effectively predicted those who were able to live at home and those who needed nursing home or attendant care. Post-stroke patients identified as more likely to discharge home scored greater than 40 on the Barthel Index. Scores of 60 and greater were seen as pivotal for complete independence in ADLs. The most frequently cited problem with use of the Barthel Index is the ceiling effect for higher functioning patients.

The Functional Independence Measure

A second frequently used functional status measure is the Functional Independence Measure (FIM). The FIM was developed by a task force for the uniform data system; it is standardized and in the public domain (State University of New York, 1987). ADL, communication, and cognitive status

are assessed using a 7-point scale that ranges from 1 = total dependence, to 7 = total independence. It is a discipline free measure that assesses disabilities without regard to underlying pathology. It has an interrater reliability of .95 (Byrnes & Powers, 1989).

Black, Soltis, and Bartlett (1999) found the FIM to accurately predict discharge location for post-stroke patients. A discharge FIM score of 80 or greater was highly predictive of discharge home. The sensitivity for predicting discharge to home for patients with a FIM score of 80 or greater was 94%. The specificity for predicting a discharge destination other than home for patients with a discharge FIM score below 80 was 65%.

Association of Depression and Functional Status in the Post-stroke Patient

Schubert, Taylor, Lee, Mentari, and Tamaklo (1992) did an extensive review of research studies examining the relationship between depression and functional status. Of the 11 studies supporting a relationship between depression and functional status, five focused on post-stroke patients. Six studies reviewed by Schubert et al. did not support a relationship between functional status and depression, four of these studies focused on the post-stroke patient.

Mediating Strategies

Physical Rehabilitation

In the early 1990s the AHRQ began the process of sifting through the research and professional literature related to the efficacy of stroke rehabilitation. Although there was a preponderance of literature, much of it was observational or based on expert opinion, lacking in scientific rigor and producing inconsistent or inconclusive results. By setting the Stroke Rehabilitation Guideline in motion, the AHRQ either created a surge of scientific research related to post-stroke rehabilitation or caused researchers to approach the study of stroke rehabilitation with greater scientific rigor. When the Stroke Rehabilitation Guideline was published in 1995, nearly 73% of the post-stroke patients covered by Medicare received some form of stroke rehabilitation. This occurred in spite of the scarcity of conclusive evidence regarding the benefits of stroke rehabilitation. It was not until after the guideline was published that there was conclusive evidence that specialized inpatient stroke rehabilitation decreased mortality and improved outcomes for post-stroke patients. The following summary reflects a brief review of studies supporting the improved outcomes, particularly improved functional outcomes related to impatient post-stroke rehabilitation.

In a prospective epidemiologic study, Jorgensen et al. (1995a) examined the outcomes of 1,197 post-stroke patients over time. Initial stroke severity was assessed using the Scandinavian Neurological Stroke Scale and the Barthel Index. Stroke severity was very severe for 19% of the subjects, severe for 14% of the subjects, moderate for 26% of the subjects, and mild for 41% of the subjects. Twenty-one percent of the subjects died during their hospital or rehabilitation stay, 15% were discharged to nursing homes, and 64% were discharged home. Forty-six percent of those who completed rehabilitation had no disability in activities of daily living, 26% were mildly disabled, 8% were moderately disabled, and 20% were severely disabled. Approximately half of the subjects initially classified as very severe or severe improved to severe or moderate levels of disability. All surviving subjects improved in functional status.

Following the same patients, Jorgensen et al. (1995b) examined the time trajectory for recovery of neurological and functional status. Eighty percent of the patients had reached their best ADL functioning within 6 weeks of stroke onset; ranging from 3 weeks for patients with initially mild disability to 11.5 weeks for patients with initially severe or very severe disability. Neurological recovery preceded functional recovery by an average of 2 weeks. Ninety-five percent of all functional recovery was complete by 3 months;

even the most severely disabled did not experience recovery after 5 months. In conclusion, they noted that the time course for functional recovery based on the patient's initial stroke severity could be used to plan the duration of rehabilitation.

Kalra and Eade (1995) compared outcomes for severely disabled stroke patients treated in the general hospital environment with the outcomes for those treated in a specialized stroke rehabilitation unit. In a randomized study of 34 patients treated in a stroke rehabilitation unit and 37 patients treated in the general hospital environment, the severely disabled stroke patients treated in the stroke rehabilitation unit had significantly better outcomes than patients treated in the general hospital. Mortality, discharge destination, length of stay and functional status were the outcomes measured. The patients treated at the stroke rehabilitation unit had less mortality, 21% versus 46% for the patients treated at the general hospital ($\underline{P} < .05$). Forty-seven percent of those treated in the rehabilitation unit were discharged home while 19% of those treated in the general hospital were discharged home ($\underline{P} < .01$). The median length of stay for the patients in the stroke rehabilitation unit was 43 days compared with 59 days for the patients treated in the general hospital ($\underline{P} < .05$).

A collaborative effort between stroke trialists resulted in meta-analysis of data from 19 randomized trials comparing organized inpatient stroke rehabilitation care with other post-stroke care (Stroke Unit Trialists Collaboration, 1997). The goal of the meta-analysis was clarification of the way inpatient post-stroke rehabilitation impacted the reduction in case fatalities and post-rehabilitation institutionalization. Inpatient stroke rehabilitation reduced the odds of death across all causes (odds ratio 1.41, $\underline{P} < .01$), but reduction was most markedly distinct for deaths attributed to immobility such as urinary sepsis, venous thrombosis, and pressure ulcers (3.8% of the patients in the inpatient group compared to 6.3% in the control group). The increase in patients who returned home after inpatient rehabilitation, as opposed to an institution was attributed to improvement in physical functioning. Inpatient stroke rehabilitation also improved functional independence for all levels of stroke severity but the improvements were not statistically significant.

Ronning and Guldvog (1998) concluded that inpatient stroke rehabilitation reduced mortality and improved functional status. In a controlled trial, 251 post-stroke patients were randomly assigned to the inpatient rehabilitation group or the community care group. Thirty-one percent of the community group did not receive any organized

rehabilitation. The group receiving inpatient rehabilitation were less likely to be dead or dependent in ADL (< 75 Barthel Index score) at discharge, 23% when compared to the community group, 38% (P = .01). When measured at 7 months post-stroke, 12.6% of the inpatient rehabilitation group and 25% of the community group remained dependent in ADLs (P = .07). Patients scoring < 50 on the Barthel Index and who received inpatient rehabilitation had better outcomes; fewer became dependent in ADLs, than their community counterparts (P = .005).

Treatment for Depression

Recognition of the prevalence of post-stroke depression has begun to impact practice. Most of the research related to treatment in the depressed post-stroke patient has been limited to pharmacologic agents. Even that research is limited, but it is increasing. Many practitioners are somewhat hesitant to use psychotropic drugs in an elderly population such as is more common in the post-stroke population. Both the indications and side effects of psychotropic drugs make them a category to be more closely scrutinized than many other drug categories. In the post stroke population, the practitioner must consider the effects of polypharmacy and patient comorbidities as well as the potential to undermine physical functioning (Gordon &

Hibbard, 1997). However, with careful supervision pharmacologic treatment with antidepressant therapy can be as effective in the post-stroke depressed patient as it is in the depressed patient who is neurologically intact (Vogel, 1995).

Three categories of antidepressants are most commonly used for treatment of depression in the post-stroke patient. Table 3 reflects the most commonly used antidepressants by category as well as a fourth category of drugs, central nervous system (CNS) stimulants, that have also been used to effectively treat post-stroke depression (Hinkle, 1998).

Table 3

Drugs Commonly Used to Treat Post-stroke Depression

Category	Drug
Tricyclic Antidepressants	Imipramine Desipramine Nortriptyline Amitriptyline
Tetracyclic Antidepressants	Maprotiline
Selective Serotonin Reuptake Inhibitors (SSRI)	Fluoxetine Trazodone (similar)
CNS Stimulants	Dexedrine Methylphenidate

Finklestein et al. (1987) were some of the first to examine pharmacologic treatment of depression in the

post-stroke patient. In a retrospective review of 60 post-stroke patients who were evaluated for major depression, 42 were treated with anti-depressant drugs and 18 were not. Overall, there was no greater decrease in depression for the treated versus non-treated patients; however, a sub-group of 40% of the treated patients showed substantial improvement in depression when compared to the untreated group. Only three of the untreated patients improved at a level equal to that of the sub-group. Subsequent randomized clinical trials (RCT) have attempted to determine which drugs and categories of drugs are most likely to positively influence depression and functional status in post-stroke patients.

Most of the RCTs have focused on the comparison of tricyclic antidepressants and selective serotonin reuptake inhibitors. Dam et al. (1996) examined 46 severely disabled post-stroke rehabilitation patients for improvement in depression and function after treatment with fluoxetine, maprotiline, or a placebo. The group treated with fluoxetine had a greater number of patients with good functional outcomes compared to the group who received maprotiline or placebo. Miyai and Reding (1998) reported similar results in a study of 24 post-stroke rehabilitation patients treated with trazodone, fluoxetine, or desipramine. All patients showed significant improvement in depression, but the

trazodone and fluoxetine treated patients showed significantly greater improvements in functioning ($p < 0.02$) than those treated with desipramine.

Gonzalez-Torrecillas, Mendlewicz, and Lobo (1995) also compared the two categories of drugs studying the effects of fluoxetine and nortriptyline on the treatment of depression in a large cohort of post-stroke rehabilitation patients. Twenty-six depressed patients were treated with fluoxetine, 11 depressed patients were treated with nortriptyline and 11 patients were not treated. The three treatment groups were compared to 82 nondepressed patients for improvement in depression and functional status after 6 weeks of treatment.

Both groups of treated depressed patients, when compared to the nontreated depressed patients improved significantly in both functional status ($F = 3.92$, $df = 6$, $p = .004$) and depression ($F = 9.12$, $df = 12$, $p < .001$). The sub-group of treated depressed patients reached levels of recovery similar to the nondepressed group. In the most recent RCT comparing the two categories of antidepressants, Robinson et al. (2000) found recovery of function and improved depression was greater for depressed post-stroke rehabilitation patients treated with nortriptyline than it was for patients treated with fluoxetine.

One other category of psychotropic drug has been examined for efficacy in treating the depressed post-stroke

patient. Grade, Redford, Chrostowski, Toussaint, and Blackwell (1998) studied 21 post-stroke rehabilitation patients. Patients were randomly assigned to the group receiving methylphenidate, a CNS stimulant or a placebo. The group receiving methylphenidate had greater improvement in mood (F = 5.714, df = 1,18, p = .028) and function (F = 5.374, df = 1,18, p =.032) than the group receiving a placebo.

Summary

The review of literature is a survey of the latest research related to post-stroke depression, with its anatomical and functional correlates; methods of assessment and measurement of depression and functional status; and the efficacy of strategies to mediate post-stroke depression and functional disabilities. At present, there is still a lack of conclusive evidence regarding the correlation between the anatomical location of the stroke lesion and the incidence and severity of post-stroke depression. There does, however, appear to be some relationship between location of the lesion and the occurrence of depression, even though conclusions regarding the influence of specific sites cannot be drawn.

With increasing awareness of post-stroke depression, more clinicians are assessing patients for dysphoric mood,

either by clinical diagnosis or by use of one of the many standardized measures of depression. The multiplicity of methods to measure depression is one of the problems in cumulating study findings and drawing summary conclusions regarding depression in the post-stroke population.

The relationship between post-stroke depression and functional status has been the topic of considerable study. Researchers have found both large negative associations between post-stroke depression and functional status and no significant associations between the two variables. Like the assessment of depression, cumulating findings from studies of a relationship between functional status and depression has been hampered by the variety of functional status instruments available and employed to measure functional status.

Recent publications have pointed to the efficacy of specialized inpatient post-stroke rehabilitation for mediating outcomes, which particularly demonstrates improving functional status in the post-stroke patient. A second mediating strategy, pharmacologic treatment for post-stroke depression, is beginning to receive considerable research attention. The tricyclic antidepressants and the selective serotonin reuptake inhibitors are being aggressively investigated for the treatment of stroke related depression particularly in the rehabilitation setting.

At present, only the efficacy of inpatient rehabilitation for the post-stroke patient has been adequately addressed. Other variables related to the status and the treatment of the post-stroke patient, such as the relationship between depression and functional status as well as the effect of rehabilitation and pharmacologic treatment on depression and functional status, have not been clearly determined. The purpose of this research study is to determine what can be said with confidence regarding the relationships between post-stroke depression, functional status, and the mediating strategies of physical rehabilitation and pharmacologic treatment.

CHAPTER III

PROCEDURE FOR COLLECTION AND TREATMENT OF DATA

The study utilized a retrospective, non-experimental, meta-analytic design. Meta-analysis (MA), a quantitative approach to research synthesis involving analysis of the analyses, is both the design and the approach to data analysis used for this study.

Domain of Research

The consequences commonly attributed to stroke represents the domain of research. Specifically, the focus was on depression and functional disability, two of the most frequently identified outcomes of stroke.

Population and Sample

The population for this MA was comprised of all completed research measuring depression and functional status for post-stroke patients. Eligible studies were identified through a series of steps: computer-aided search mechanisms, review of published study reference lists, and letters to primary author's requesting their assistance in locating non-published or missed but applicable studies.

Sample selection was limited to studies completed between 1990 and July 2000. The sample was further limited to studies reporting an association between depression and functional status that allowed calculation of an effect size (ES*r*).

Protection of Human Subjects

The research study involved the collection and study of existing data that were available to the public and recorded so that individual human subjects could not be identified. An application for Level I (Exempt) Status was reviewed by a committee of the Institutional Review Board of Texas Woman's University and was determined to be exempt from further review (see Appendix A).

Instruments

The researcher developed a coding sheet adapted from recommendations by Jones (1994). The coding sheet included subject-study identification number, study design, country of study, setting of study, assessment(s) of depression, assessment(s) of functional status, statistical test(s), time(s), sample size(s), P Value, Zp, ES*r*, Fisher's Z*r*, and the quality indicator. The coding sheet and entries were formatted for SPSS version 10.0 (see Appendix B).

Determination of subject-study quality was guided by the "Quality of Study Instrument" and guide proposed by

Smith (1993). A letter of permission to use and copy the instrument and guide was obtained (see Appendix C). The researcher reviewed and rated each study according to the criteria proposed by Smith.

Data Collection

All subject-studies meeting the sample criteria were included whether or not findings were significant. The method for study identification outlined above was adhered to stringently. The coding sheet was used to extract applicable data from each subject-study. Extraction and coding of data were done by the researcher. Most studies utilized cross-sectional or prospective cohort research methods. Depression was determined by clinical diagnosis according to the DSM criteria in use at the time of the study and/or quantified by either a self-report or observer-rated standardized depression scale. Functional status was quantified by an observer-rated standardized functional assessment. Pearson's r was calculated to determine the correlation between the two outcome variables, level of depression and functional status. In some studies, level of depression or its presence/absence was used as grouping variable to examine the outcome, functional status. Finally, randomized clinical trials were also included that examined the efficacy of the pharmacologic treatment of

depression on the outcomes of functional status and/or depression.

Treatment of the Data

The meta-analytic approach allowed the researcher to synthesize findings from studies asking common research questions but relying on disparate operational definitions, research methods, and/or sampling techniques. Glass, McGaw, and Smith (1981) provided the theoretical direction for this quantitative synthesis while Hunter and Schmidt (1990), Rosenthal, Rosnow, and Rubin (2000), and Wolf (1986) provided the technical direction for application of the statistical procedures.

META Version 5.3 (Schwarzer, 1989) is a computer program for meta-analysis that is distributed under the User Supported Concept which allows use, copy, and distribution of the software as long as it is done for free. The META program was used to transform subject-study summary statistics to ESr and to calculate the statistics for the meta-analysis.

Theoretical Considerations

Glass et al. (1981) discussed three fundamental characteristics of the MA. First MA is quantitative, relying on numeric processes to organize large quantities of study data that are otherwise incomprehensible. In their former

state, as numerous individual studies, it was primarily the lack of parallel numbers that prevented integration. In the MA the numbers were used to reunite the data so that cumulative conclusions could be drawn.

Second, MA does not prejudge the quality of research. In some methods for synthesizing study data such as the narrative review, a priori judgment of a study's quality is employed. Glass et al. (1981) criticized the exclusion of studies that were plagued by methodological weaknesses, citing that there is a lack of evidence to support the assumption that those weaknesses influence study findings, namely effect size. All studies that met the inclusion criteria were included in the MA and findings of quality were treated as any other empirical findings by using meta-analytic methods.

The third characteristic of MA is related to the general nature of the conclusions being sought. Typically, research seeks definitive answers to specific questions of causation or relationship. The specificity of the research makes it difficult to compare findings in a more general context. The sole purpose of MA is to allow generalizations that identify important differences between studies while ignoring features that make no difference, such as methods of assessment or research design. The MA then becomes a tool that aligns the scientist and the practitioner.

Technical Considerations

In many ways, meta-analytic and inferential statistics are similar. In contrast, however, the meta-analysis requires conversion of the original summary statistics from the various subject-studies into a common metric (Wolf, 1986). As a unit free metric, the effect size reflects the degree to which a phenomenon is manifest in the population (Cohen, 1988). The effect size becomes the quantitative basis for drawing summary conclusions about the characteristics and population of interest (Beard et al., 1997).

Transforming the various summary statistics reported in the individual studies requires application of one or more algorithms. Rosenthal et al. (2000) advocated the use of Pearson product-moment correlation coefficients to measure effect size (ES), because they are more easily calculated than other statistics, are generally applicable, and are easily interpreted.

Meta-analytic procedures were used to convert the findings of each study into a common metric that allowed consideration of the cumulative study outcomes as well as outcomes of subsets of the studies (example, time series). The methods proposed by Hunter and Schmidt (1990) were followed for this MA. Each study contributed a single ES*r* that was either equal to the Pearson's product-moment

correlation coefficient *r* if the specific subject-study was calculated from one of the various summary statistics such as *t*, X^2, *F*, or *P* values. The META program provided a "utilities" option that included common transformations. Summary statistics reported in the subject-studies were transformed to ES*r* by the META program using formulas for algorithms found in many statistics books (Mullen & Rosenthal, 1985; Rosenthal, 1985; Rosenthal et al., 2000). Nonsignificant *P* values that had no corresponding summary statistics were set at 0.50. Studies that did not report a correlation or summary statistic were excluded from the MA.

Each study contributed only one ES except when logical aggregations of subsets of data could be made (example, time series). When more than one association between the variables was reported or when more than one instrument was used to measure a variable, the associations were converted to standardized *Z* scores and averaged to form a single ES (Rosenthal et al., 2000). Also, studies reporting on a single data base were aggregated to form one study so that the risk posed by one study contributing multiple ES could be avoided (Wolf, 1986).

Both the unweighted and weighted population ES were calculated. The weighted population ES is the most respected summary statistic because it reflects the influence of the sample size (Hunter & Schmidt, 1990). The weighted *r* is

calculated by transforming each r value into a Fisher's z, multiplying the Fisher's z by the sample size, summing the values in a group of studies, and then dividing the sum by the square root of the sum of the squared weights. The weighted z is then back transformed into r. An ES is significant if its 95% confidence interval (CI) does not include 0 or if the P value associated with the Z statistic is < 0.05. META, Version 5.3 (Schwarzer, 1989) was used to calculate the unweighted and weighted ESr values and the 95% CI around the values.

Reliability and Validity Considerations

Wolf (1986) addresses three reliability issues in MA. The first involves the consistency with which two independent researchers might locate the same studies for MA. Strict adherence to the outlined criteria for study location and inclusion increased the reliability of the MA.

The second reliability issue relates to the reliability of coding features. Only one individual, the researcher, participated in the coding. Coding for all studies followed a three-step process. First the researcher reviewed each study for measurement of study variables and inclusion of necessary summary statistics. Studies that did not meet all inclusion requirements were excluded at that time. The second step involved extraction of critical data from each

study as well as entry of data into the specified data-base. The third step involved review of each study according to Smith's (1993) guidelines for quality.

The third issue of reliability involves accuracy of required calculations, particularly algebraic transformations. Use of the META program was a significant deterrent to mathematical errors. The program, although still DOS based, is one of the most widely used and accepted programs for calculation of the necessary meta-analytic statistics. It has been repeatedly evaluated by mathematicians and statisticians for both reliability and validity of reports (Schwarzer, 1989).

Issues of validity were also raised by Wolf (1986). The concerns of external and construct validity relate back to the third characteristic of MA discussed by Glass et al. (1981). The inclusion of studies using diverse methods, populations, and definitions of the variables and how it is measured is both a strength and weakness of the MA. To strengthen external and construct validity, study coding characteristics were examined for potential mediating effects. Logical aggregates of the subject-studies guided the examination for mediating effects. Two tools were used to assist in the examination of the studies for mediating effects. Cluster analysis was recommended by Hedges and Olkin (1985). The ES of each study was rank-ordered and

compared to critical values at the .01, .05, and .10 levels of significance. The clusters helped to identify studies that were more homogenous. Finally, a stem-and-leaf display was used to visualize the distribution of each individual study effect size for outliers that can influence homogeneity (Schwarzer, 1989).

Additionally, tests for homogeneity of effect size allowed the researcher to conclude whether or not a subject-study(ies) was influencing the effect size. Heterogeneity of effect size is indicative of a study(ies) that might need to be excluded from the MA. Exclusions of such subject-study(ies) increased the validity of the overall MA. The META 5.3 calculated the three indicators of homogeneity recommended by Hunter and Schmidt (1990):

1. Residual standard deviation, which should be less than one-fourth of the population effect size.

2. The percentage of observed variance that can be accounted for by sampling error, which should be at least 75%.

3. A chi-square test of homogeneity, which should not be significant.

The final MA was limited to logically derived homogenous aggregates of the data. Scientific inquiry rigor was further increased through calculation of the fail-safe-N. Calculating the fail-safe-N was necessary to identify the

number of studies with nonsignificant effect sizes that was required to convert a significant effect size to a nonsignificant one. A large fail-safe-N is desirable and indicates the stability of the significance to additional studies in instances where there are a number of nonsignificant file drawer studies that were not available for examination (Beard et al., 1997).

Hypothesis Testing and Clinical Significance

The population effect size for all subject-studies and the specified data aggregates indicated by the hypotheses were compared for determination of significance. Following Hunter and Schmidt's (1990) recommendation, a population ES is considered significant if its 95% CI does not include 0 or if the p value associated with the Z statistic is $< .05$.

Rosenthal et al. (2000) recommended that the Binomial Effect Size Display (BESD) be used to estimate clinical significance rather than the more commonly references r^2, explained variance. The BESD is based on a point-biserial r represented as 2 x 2 contingency table with rows corresponding to a dichotomized independent variable (e.g., treatment vs. placebo) and columns that correspond to a dichotomized outcome variable (e.g., improved vs. not improved). Clinical significance can be estimated by comparing the success rate of subjects who improved with

treatment to the success rate of subjects who improved without treatment.

Summary

All studies of depression and functional status of the post-stroke patient reported between 1990 and July 2000 were considered for inclusion. All studies meeting the inclusion criteria were systematically reviewed for coding characteristics and indicators of study quality.

The MA primarily employed the strategies recommended by Hunter and Schmidt (1990) for calculating the individual unweighted and weighted population effect sizes used to draw summary conclusions and answer the hypotheses. META, Version 5.3 (Schwarzer, 1989) was employed to calculate the ESr values and the 95% CI around the values.

Scientific inquiry rigor was facilitated through calculation of the fail-safe-N and examination of the studies for homogeneity of ES. Three tests for homogeneity of effect size were calculated for the overall ES and the ES for each of the logical aggregates: the residual standard deviation, the percentage of observed variance accounted for by sampling error, and a chi-square test of homogeneity.

Only homogenous aggregates of the data were used for hypothesis testing. An effect size was considered significant if its 95% CI does not include 0 and if the p

value associated with the Z statistic is < .05 (Hunter & Schmidt, 1990). The BESD was used to estimate clinical significance of the effect size (Rosenthal et al., 2000).

CHAPTER IV

ANALYSIS OF DATA

The purpose of this study was to examine the relationships between depression, functional status, and mediating strategies in the post-stroke population. Four hypotheses guided the study:

1. There is a negative relationship between depression and functional status in the post-stroke patient.

2. Pharmacologic treatment of depression mediates the negative relationship between depression and functional status in the post-stroke patient.

3. Physical rehabilitation mediates the negative relationship between depression and functional status in the post-stroke patient.

4. Pharmacologic treatment of depression and physical rehabilitation together mediate the negative relationship between depression and functional status more than either strategy used alone.

This chapter includes a description of the sample of subject-studies included in the meta-analysis and addresses findings regarding the hypotheses. Additional findings are also presented.

Description of the Sample

The sample of subject-studies included in the meta-analysis were drawn from the population of all studies examining a relationship between functional status and depression in the post-stroke patient that were completed between 1990 and July 2000. A three-step process was used to identify potential subject-studies: a computerized search of electronic data-bases, a review of published study reference lists, and letters to the primary authors requesting assistance in locating any unpublished or missed but applicable subject-studies. Forty-five studies examining functional status and depression in the post-stroke patient which were completed between 1990 and July 2000 were identified. Of those 45 studies, 26 studies reported some measure of association between functional status and depression that allowed calculation of an ES*r*. Five of the 45 studies were randomized clinical trials (RCT) that examined the relationship between functional status and depression when mediated by physical rehabilitation and pharmacologic treatment of post-stroke depression. A total of 31 subject-studies was included in the meta-analyses. Selected characteristics of the subject-studies, including design and method, setting, location, quality, and time were reviewed. Additionally, the methods used to assess functional status and depression were examined.

Design and Method

Twenty-six of the subject-studies were non-experimental research. Twelve of the studies were cross-sectional and 14 were cohort studies using prospective or longitudinal methods. The five randomized clinical trials were the only experimental studies included in the meta-analysis.

Setting

The samples for 16 of the subject-studies were drawn from a general population of post-stroke patients. The samples for 14 of the subject-studies were drawn from post-stroke rehabilitation programs. The sample for one subject-study was drawn from post-stroke patients residing in a nursing home.

Location

The subject-studies were conducted in 11 countries representing four continents, Asia, Australia, Europe, and North America. Table 4 provides information regarding the number and percentage of studies conducted in the representative countries.

Table 4

Location of Subject-studies by Country

Country	Frequency	Percent
Australia	4	12.9
Belgium	1	3.2
Canada	2	6.5
China	2	6.5
Denmark	1	3.2
England	2	6.5
Finland	2	6.5
Italy	3	9.7
Netherlands	1	3.2
Sweden	2	6.5
United States	11	35.5
Total	31	100.0

Quality

A review of each subject-study for quality was conducted. Smith's (1993) "Quality of Study Instrument" and guide was used to accomplish the review. The range of scores on the instrument was from a low of 1.24 to a high of 1.90 with a mean of 1.54. The possible maximum was 2. The studies were divided into two non-experimental groups, the prospective cohort studies and the cross-sectional studies. There was minimal difference in the mean or range of those

two study groups. The experimental studies, randomized clinical trials (RCT), were compared with the two groups of non-experimental studies. The mean is higher for the RCTs and the range is much smaller. See box plot, Figure 2, for comparison of the three groups.

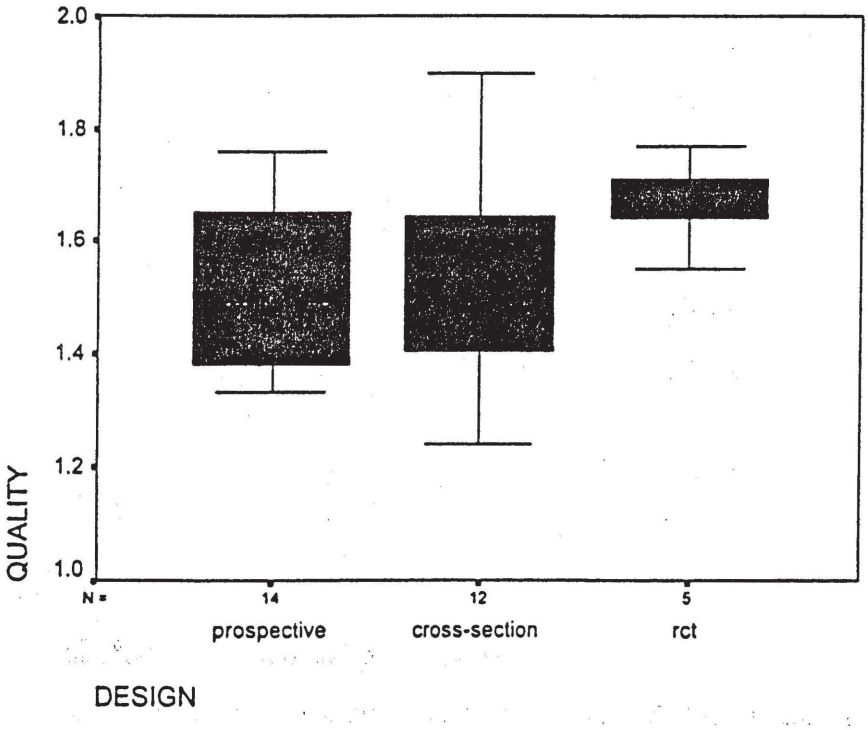

Figure 2. Box plot of quality of study by design.

Time

Functional status and depression in post-stroke patients were examined across a time continuum from the acute phase, immediately post-stroke, up to 5 years after the stroke. Data for the meta-analysis were grouped into six time delimited categories: acute, 3 months or rehabilitation discharge, 6 months, 1 year, greater than 1 year, or mixed times. Table 5 depicts the number and percent of measures reported for each of the time delimiting categories.

Table 5

Time of Subject-study Measures

Time	Frequency	Percent
Acute	9	20.0
3 months	12	26.7
6 months	6	13.3
1 year	5	11.1
> 1 year	7	15.6
Mixed	6	13.3
Total	45	100.0

Assessment of Functional Status

Twelve different instruments were used to assess functional status in the 31 subject-studies. Ten of the instruments were described by the authors as valid and

reliable tools for assessment of functional status. Two of the instruments reported in the subject-studies were constructed by the researcher(s) for the purpose of measuring functional status in that study sample and reliability and validity were not addressed. Several of the studies used more than one method to assess functional status. The Barthel Index (BI) was the most frequently used assessment of functional status and was cited in 16 of the subject-studies. The Functional Independence Measure (FIM) was the second most frequently used assessment and was cited in six of the subject-studies. Table 6 lists the assessment instruments and the frequency and percentage of use in the meta-analysis.

Table 6

Functional Status Assessment Instruments

Functional Assessment Instrument	Frequency	Percentage
Barthel Index (BI)	16	41.0
Functional Independence Measure (FIM)	6	15.4
Fugl-Meyer Scale (FMS)	3	7.7
Katz Activities of Daily Living Index (KATZ)	3	7.7
Australian Activities of Daily Living Scale (AADL)	2	5.1

(table continues)

Functional Assessment Instrument	Frequency	Percentage
Oxford Handicap Scale (OHS)	2	5.1
Karnofsky Performance Status Scale (KPSS)	2	5.1
Researcher Developed (other)	2	5.1
Crichton Geriatric Rating Scale (CGRS)	1	2.6
Johns Hopkins Functioning Inventory (JHFI)	1	2.6
Northwestern University Disability Scale (NUDS)	1	2.6
Total	39	100.0%

Assessment of Depression

The presence and/or absence of depression was assessed in subject-studies using a variety of methods. The most commonly used method was clinical diagnosis, which was frequently, but not always, specified as consistent with the DSM criteria in place at the time of the study. In the subject-studies, researchers also used scaled instruments designed to assess the presence, absence, or severity of depression. Nine different depression scales were used in the subject-studies; some exclusively identified and measured post-stroke depression and others were used in conjunction with clinical diagnosis of depression. Table 7

depicts the various methods used to assess depression and the frequency and percentage of use in the meta-analysis.

Table 7

Depression Assessment Methods

Method of Depression Assessment	Frequency	Percentage
Clinical Diagnosis (Diagnosis)	11	33.4
Hamilton Depression Rating Scale (HDRS)	7	17.9
Zung Self-Rating Depression Scale (Zung)	4	10.3
Beck Depression Inventory (Beck)	4	10.3
Montgomery Asberg Depression Rating Scale (MADRS)	3	7.7
Geriatric Depression Scale (GDS)	2	5.1
Philadelphia Geriatric Center Morale Scale (PGCMS)	1	2.6
Hospital Anxiety & Depression Scale (HADS)	1	2.6
Visual Analogue Dysphoria Scale (VADS)	1	2.6
Center for Epidemiological Studies Depression Scale (CES-D)	1	2.6
Generalized Anxiety Disorder with Depression (GAD)	1	2.6
Combined Scales (other)	1	2.6
Total	37	100.0%

Findings

As stated previously, 31 studies met the criteria for inclusion. The studies were divided into two major groups, non-experimental and experimental, with several logical aggregates within each major group. The non-experimental studies comprised the largest group of studies. The meta-analyses of this group and logical subsets were used to answer the first three hypotheses. The second major group of studies included the experimental studies as well as logical subsets within this major group. Meta-analyses from the second group of studies were used to answer the fourth hypothesis. The meta-analysis of each major group and the logical subsets within each group will be discussed generally first and then with regard to the four hypotheses.

General Meta-analysis

Table 8 provides a description of each subject-study in the meta-analysis. The complete reference for each of the subject-studies is listed in Appendix D. The non-experimental studies were assigned an identification number, 1 through 26. When two studies examined the same database, the data for meta-analysis was aggregated and both studies were assigned the same number but differentiated as study A or study B. The experimental studies were referenced by an alphabetical character, A through E, for

identification. Information in Table 8 also includes the method(s) used to assess depression and functional status in each subject-study. The abbreviations used in Table 8 correspond to those provided for functional status assessment in Table 6 and depression assessment in Table 7. The statistical test(s) used to calculate the ES*r* for each subject-study is provided with the corresponding variables. The overall N and the ES*r* for each study are provided. When a subject-study reported more than one association between variables or when more than one method was used to assess a variable, the associations were converted to standardized *Z* scores and averaged to form a single ES*r*. See the coding sheet, Appendix E for a complete list of all associations contributing to the overall ES*r* for each subject-study.

Table 8

Description of Subject-studies

Study (ref)	Depression Assessment	Functional Assessment	N	Statistical Test(s)	ESr
Herrmann et al. (1A) Singh et al. (1B)	Zung MADRS Combination	FIM OHS	131	Pearson correlations: Zung & FIM MADRS & FIM Zung & OHS MADRS & OHS Combination & FIM @ 3 months & 1 year	.34
Clark & Smith (2)	Zung	AADL	94	Pearson correlations: Zung & AADL @ 3months, 6 months, & 1 year	.11
Clark & Smith (3)	Zung	AADL	60	Pearson correlations: Zung & AADL @ 3months, 6 months, & 1 year	.14
Ingles et al. (4)	GDS	BI OHS	88	Regression analysis: BI predicts GDS OHS predicts GDS cross-sectional	.13
van de Weg et al. (5)	Diagnosis	FIM	85	t test: IV: diagnosis; DV: FIM @ acute & 6 months	.25
Paolucci et al. (6)	Diagnosis	BI	470	Regression analysis: diagnosis predicts BI @ acute	.08

Study (ref)	Depression Assessment	Functional Assessment	N	Statistical Test(s)	ESr
Pohjasvaara et al. (7)	Diagnoses: Depression Major Depression Pure Stroke Depression	BI	277	*t* test: IV depression diagnosis; DV: BI cross-sectional	.16
Kauhanen et al. (8)	Diagnosis	BI	97	Kruskal Wallis: IV diagnosis; DV: BI @ 3 months & 1 year	.32
Lofgren et al. (9)	PGCMS	FMS KATZ	47	Spearman correlations: PGCMS & FMS PGCMS & KATZ cross-sectional	.29
Evans & Whitney (10)	Beck	BI	48	*t* test: IV: depression (Beck) DV: BI @ acute & 6 months	.24
Zalewski et al. (11)	Diagnosis	FIM	207	*t* test: IV: diagnosis DV: FIM @ acute & 3 months	-.15
Wilkinson et al. (12)	HADS	BI	96	Spearman correlations: HADS & BI cross-sectional	.56
Fuh et al. (13)	GDS	ADL scale (other)	45	Spearman correlation: GDS & ADL scale cross-sectional	.40

Study (ref)	Depression Assessment	Functional Assessment	N	Statistical Test(s)	ESr
Morris et al. (14)	MADRS	BI	88	Pearson correlation: MADRS & BI cross-sectional	.11
Sharpe et al. (15)	Diagnosis	BI	60	Chi-Square: Diagnosis & BI cross-sectional	.43
Loong et al. (16A) Ng et al. (16B)	Diagnosis	BI	52	Kendall's tau-*b*: Diagnosis & BI @ acute & 6 months	.43
Schwartz et al. (17)	HDRS	CGRS	91	Pearson correlation: HDRS & CGRS	.41
Parikh et al. (18)	Diagnosis	JHFI	63	*t* test: IV: diagnosis DV: JHFI @ acute & greater than 1 year	.22
van Rooijen et al. (19)	Beck	Scale - self-care & mobility (other)	52	Pearson correlations: Beck & self-care Beck & mobility cross-sectional	.22
Anderson et al. (20)	HDRS	BI	191	Mann Whitney *U*: IV: Depression DV: BI @acute & 3 months	.05
Angeleri et al. (21)	Beck	NUDS	180	Regression analysis: Beck predicts NUDS cross-sectional	.40

Study (ref)	Depression Assessment	Functional Assessment	N	Statistical Test(s)	ESr
Stern & Bachman (22)	VADS	BI	52	Pearson correlation: VADS & BI cross-sectional	.02
Morris et al. (23)	Diagnosis	KPSS & BI	42	*t* test: IV: Diagnosis DV: KPSS & BI 3 months & greater than 1 year	.29
Ramasubbu et al. (24)	CES-D	BI	626	Regression analysis: CES-D predicts BI *t* test: IV: depression (CES-D) DV: BI cross-sectional	.23
Schubert et al. (25)	Diagnosis	BI	15	Chi-Square: Diagnosis & BI @ acute	.40
Astrom et al. 26 (A) & Astrom (26B)	Diagnosis & GAD	KATZ	63	Fisher's Exact Test of Associations: Diagnosis & KATZ GAD & KATZ @acute, 3 months, 1 year, & greater than 1 year	.19

Study (ref)	Depression Assessment	Functional Assessment	N	Statistical Test(s)	ESr
Dam et al. (A)	HDRS	BI	46	Mann-Whitney *U*: DV: Placebo, Maprotiline, or Fluoxetine IV: BI Cluster analysis: DV: Placebo or Maprotiline & Fluoxetine IV: BI RCT	.29
Grade et al. (B)	HDRS & Zung	FIM FMS	19	ANCOVA: DV: Methylphenidate or Placebo IV: HDRS, Zung, FIM, FMS RCT	.48
Miyai & Reding (C)	HDRS	FIM FMS	24	Repeated measure ANOVA: DV: pre and post (Desipramine, Trazodone, Fluoxetine) IV: HDRS, FIM, FMS RCT	.70
Gonzalez-Torrecillas et al. (D)	HDRS, MADRS & Beck	BI & KPSS	48	ANOVA: DV: Fluoxetine & Nortriptyline or nontreated IV: HDRS, MADRS, Beck, BI & KPSS RCT	.39

Study (ref)	Depression Assessment	Functional Assessment	N	Statistical Test(s)	ESr
Robinson et al. (E)	HDRS	FIM	45	Repeated measure ANOVA DV: pre & post (Fluoxetine, Nortriptyline, or placebo) IV: HDRS & FIM RCT	.45

Dealing efficiently with the positive and negative associations between depression and functional status with the diversity of measurement instruments became problematic. For the purpose of assigning valence to each ES*r*, an association was assigned a positive value if it indicated that the higher levels of depression were associated with lower functioning or lower levels of depression were associated with higher functioning. An ES*r* was assigned a negative value if it indicated that higher levels of depression were associated with higher functioning or lower levels of depression were associated with lower functioning. This method was most manageable as only one subject-study required a negative valence; it reported an association between higher levels of depression and higher functioning (Table 8, study number 11).

Table 9 is a summary report of the meta-analyses. Data are presented for the non-experimental subject-studies as well as the logical subsets within that group and for the experimental subject-studies with the corresponding logical subsets within that group. The summary report for each meta-analysis includes the following:

1. Study grouping,
2. Number of studies included,
3. Population N,

4. Level of significance and Z value for the weighted population ES*r*,

5. Weighted population ES*r*, associated 95% confidence interval (CI), and binomial effect size display (BESD),

6. Unweighted population ES*r* and associated 95% CI,

7. Tests for homogeneity of inter-study effect size variance, heterogeneous results are reported, and

8. Fail-safe-N at .05 level of significance.

Table 9

Summary of Meta-Analyses

Study Groupings	k	N	Weighted P & Z	Weighted ES*r* & CI BESD	Unweighted ES*r* & CI	Tests of Homogeneity	Fail-Safe-N
				Non-experimental Subject-studies			
1. All studies	26	3326	p .000, Z 11.474	*r* = .20, .05 - .45 .40 - .60	*r* = .24, .18-.30	heterogeneous RSD = .13, %OV = 30.41, x^2 = 85.5 p = .000	76
2. All except 6,11,12, 20, 22	21	2310	p .000, Z 12.36	*r* = .25, .18 - .33 .37 - .63	*r* = .27, .23-.32	homogeneous	85
3. Cohort studies except 6,11,20	11	756	p .000, Z 7.21	*r* = .26, .26 - .26 .37 - .63	*r* = .27, .21-.32	homogeneous	46
4. Cross-sectional except 12, 22	10	1554	p .000, Z 10.03	*r* = .25, .12 - .38 .37 - .63	*r* = .28, .21-.35	heterogeneous RSD = .06, %OV = 56.66, x^2 = 17.65 p = .040	40
5.General setting except 12, 20, 22	13	1773	p .000, Z 11.05	*r* = .26, .19 - .32 .37 - .63	*r* = .28, .23 -.33	homogeneous	54

Study Groupings	k	N	Weighted P & Z	Weighted ESr & CI BESD	Unweighted ESr & CI	Tests of Homogeneity	Fail-Safe-N
6. Rehab except 6, 11	7	485	p .000, Z 5.3	r =.24, .10 - .37 .38 - .62	r = .26, .16 -.37	heterogeneous RSD = .07, %OV = 72.68, x^2 = 9.63 p = .141	26
7. Pre-rehab includes 5,11, 16	3	344	p .171 Z .95	r = .05 -.41 - .52 .47 - .53	r = .20 -.09 - .50	heterogeneous RSD = .24, %OV = 13.33, x^2 = 22.51 p = .000	0
8. Post-rehab includes 5,11,16	3	344	p .373 Z .32	r = .02 -.35 - .39 .49 - .51	r = .14 -.10 - .39	heterogeneous RSD = .19, %OV = 19.44, x^2 = 15.43 p = .000	-2
9. Acute except 6, 11	7	965	p .000, Z 7.26	r = .23, .15 - .32 .38 - .62	r = .26, .15 -.37	homogeneous	25
10. 3-months except 11	6	550	p .000, Z 5.98	r = .25, .25 -.25 .37 - .63	r = .24, .17 -31	homogeneous	24
11. 6-months	6	430	p .000, Z 4.83	r = .23, .09 -.37 .38 - .62	r = .22, .11 -.33	heterogeneous RSD = .07, %OV = 70.48, x^2 = 8.51 p = .130	22

Study Groupings	k	N	Weighted P & Z	Weighted ESr & CI BESD	Unweighted ESr & CI	Tests of Homogeneity	Fail-Safe-N
12. 1-year	5	438	p .000, Z 4.47	r = .21, .07 -.35 .39 - .61	r = .20, .10 -.31	heterogeneous RSD = .07, %OV = 66.90, x^2 = 7.47 p = .113	16
13. > 1-year except 12	5	393	p .000, Z 7.22	r = .35, .35 - .35 .32 - .68	r = .32, .25 -.40	homogeneous	30
14. Mixed times	5	660	p .001 Z 3.03	r = .12, .12 - .12 .44 - .56	r = .12, .05 -.18	homogeneous	7
15. Depress diagnosis except 6, 11	9	767	p .000, Z 6.88	r = .24, .24 - .24 .38 - .62	r = .29, .22 -.36	homogeneous	35
16. Depress by scale except 12, 20, 22	12	1549	p .000, Z 10.16	r = .25, .15 - .36 .37 - 63	r = .25, .19-.32	heterogeneous RSD = .05, %OV = 70.40, x^2 = 17.04 p = .107	49
17. Function by BI except 6, 12, 20, 22	10	1400	p .000, Z 8.09	r = .21, .10 - .32 .39 - .61	r = .24, .15 -.33	heterogeneous RSD = .06, %OV = 67.68, x^2 = 14.78 p = .10	33

Study Groupings	k	N	Weighted P & Z	Weighted ES*r* & CI BESD	Unweighted ES*r* & CI	Tests of Homogeneity	Fail-Safe-N
18. Function by other scales except 11	13	1048	p .000, Z 9.78	*r* = .30, .23 - .36 .35 - .65	*r* = .28, .23 -.34	homogeneous	64
Experimental Subject-studies							
19. RCT function & depress	5	182	p.000 Z 6.06	r=.43 .45-.45 .27-.73	r=.46, .34-.58	homogeneous	38
20. RCT depress	5	187	p.000 Z 6.47	r=.45 .45-.45 .27-.73	r=.47, .36-.58	homogeneous	40
21. RCT function	4	129	p.000 Z 5.27	r=.44 .44-.44 .28-.72	r=.49, .35-.63	homogeneous	31

Note. RSD = Residual Standard Deviation; %OV = Percent Observed Variance.

Non-Experimental Subject-studies

The non-experimental subject-studies were heterogeneous by all three tests of inter-study ES variance (Table 9, line 1). Two tools, cluster analysis and stem-and-leaf-display were used to examine the non-experimental studies for potential mediating effects. Cluster analysis was used to rank the ES of each study and compare it to critical values at the .01, .05, and .10 levels of significance. All studies formed one cluster at the .01 level of significance. Three clusters formed at the .05 and .10 levels of significance. Cluster 1, contained only one study, number 12 with an ES*r* = .56, *n* = 96. Cluster 3, contained only one study, number 11 with an ES*r* = -.15, *n* = 207. The middle, Cluster 2, contained the remaining 24 non-experimental studies (*n* = 3,023). Removal of subject-studies 11 and 12 from the meta-analysis still resulted in heterogeneous results.

A stem-and-leaf-display for the 26 effect sizes in the meta-analysis was examined for mediating effects (see Figure 3). The display allows identification of outliers among the subject-studies. After review of the stem-and-leaf-display, outliers were removed and the meta-analysis of non-experimental studies was homogenous by all three tests of inter-study ES variance (Table 9, line 2).

```
-.9 I
-.8 I
-.7 I
-.6 I
-.5 I
-.4 I
-.3 I
-.2 I
-.1 I 5
-.0 I
+.0 I 258
+.1 I 113469
+.2 I 2234599
+.3 I 24
+.4 I 001133
+.5 I 6
+.6 I
+.7 I
+.8 I
+.9 I
```

Figure 3. Stem-and-leaf display for 26 effect sizes.

Attempts were made to identify some factor that was common to the outliers that might logically account for the mediating influence of the ES. The outliers were varied in study design, setting, time, and quality. The only common factor was their extreme positions on the stem-and-leaf-display. All subsequent analyses of the non-experimental subject-studies involved examination for the influence of the outliers if study subsets were not homogenous. Only homogeneous aggregates of the data were used for testing Hypotheses One, Two, and Three.

Experimental Subject-studies

The meta-analysis for the overall group of experimental studies was homogeneous as were the meta-analyses of the subsets. Table 9 lines 19, 20, and 21 represent the meta-analyses of experimental subject-studies. Information from the experimental studies was used to answer hypothesis number four.

Hypothesis 1

The first hypothesis states that there is a negative relationship between depression and functional status in the post-stroke patient. Hypothesis One was supported by the meta-analysis of the homogenous subset (k = 21, N = 2310) of non-experimental subject-studies represented in Table 10. The weighted ESr =.25 (CI, .18 - .33) reflects a small to moderate effect size that is significant (p = .000). In addition, the fail-safe-N for the meta-analysis was 85 for a critical r of .05.

Table 10

Meta-Analysis of Homogeneous Subset of Non-Experimental Studies

Study groupings	k	N	Weighted P & Z	Weighted ES*r* & CI BESD	Unweighted ES*r* & CI	Tests of homogeneity	Fail-safe-N @ .05
All except 6, 11, 12, 20, 22	21	2310	p .000, Z 12.36	*r* = .25, .18-.33 .37-.63	*r* = .27, .23-.32	homogeneous	85

Hypothesis 2

The second hypothesis stated that pharmacologic treatment of depression mediates the negative relationship between depression and functional status in the post-stroke patient. Subject-studies did not provide the specific data required to test Hypothesis Two. When examined in context with the previously described conceptual model, the purpose of hypothesis two was to examine the relationship between depression and functional status when depression was treated pharmacologically without the influence of rehabilitation. This required examination of studies drawn from the general post-stroke population as opposed to those drawn specifically from the population known to have received physical rehabilitation.

Only four studies from the general population addressed pharmacologic treatment of depression and only one provided any measure of association between depression and functional status. In study number 7, 39% of the depressed patients were treated with antidepressants. In study number 18, of 25 patients with clinical diagnosis of depression, only 2 received anti-depressants. Only 3.22% of the 180 post-stroke patients included in study number 21 took antidepressant medication. Seventeen percent of the patients suffered severe depression. Study number 23 reported the only association between depression and functional status for

patients treated with antidepressant medications. Two of the 49 patients studied received mianserin, an antidepressant. The average functional gain for the treated patients was 67% over baseline compared with 23% gain for depressed patients as well as 48% gain for the non-depressed patients.

Hypothesis 3

The third hypothesis stated that physical rehabilitation mediates the negative relationship between depression and functional status in the post-stroke patient. The meta-analyses did not support the hypothesis. Only three of the studies from the rehabilitation setting (5, 11, and 16) associated pre-rehabilitation functional status and depression. Study number 11 was the only subject-study reporting an association between depression and higher functioning. It was assigned a negative valence and identified as an outlier on both the cluster analysis and the stem-and-leaf-display. Heterogeneity of inter-study effect size variance precluded further analysis of the data (see Table 11).

Table 11

Meta-Analyses of Pre and Post Rehabilitation Studies

Study Groupings	k	N	Weighted P & Z	Weighted ESr & CI BESD	Unweighted ESr & CI	Tests of homogeneity	Fail-safe-N @ .05
Pre-rehab includes 5,11, 16	3	344	p .171 Z .95	r = .05 -.41 - .52 .47 - .53	r = .20 -.09 - .50	heterogeneous RSD = .24, %OV = 13.33, x^2 = 22.51 p = .000	0
Post-rehab includes 5,11,16	3	344	p .373 Z .32	r = .02 -.35 - .39 .49 - .51	r = .14 -.10 - .39	heterogeneous RSD = .19, %OV = 19.44, x^2 = 15.43 p = .000	-2

Hypothesis 4

The fourth hypothesis stated that pharmacologic treatment of depression and physical rehabilitation together mediate the negative relationship between depression and functional status more than either strategy used alone. The moderate to large effect size (.43) supported Hypothesis Four of the experimental subject-studies (see Table 12). The randomized clinical trials (see Table 8, subject-studies A-E) examined the mediating effects of various pharmacologic preparations for treatment of depression in conjunction with physical rehabilitation on the association between depression and functional status. The inter-study ES variance was homogeneous ($\underline{k}$ = 5, $\underline{N}$ = 182), the weighted ES*r* was .43 (95% CI = .43-.43) and significant at $\underline{P}$ = .000. The fail-safe-N was 38 for a critical *r* of .05.

Table 12

Meta-Analyses of Experimental Studies

Study Groupings	k	N	Weighted P & Z	Weighted ESr & CI BESD	Unweighted ESr & CI	Tests of homogeneity	Fail-safe-N @ .05
RCT function & depress	5	182	p .000, Z 6.06	*r* = .43, .43 - .43 .29 - .71	*r* = .46, .34-.58	homogeneous	38
RCT depress	5	187	p .000, Z 6.47	*r* = .45, .45 -.45 .27 - .73	*r* = .47, .36 -.58	homogeneous	40
RCT function	4	129	p .000, Z 5.27	*r* = .44, .44 -.44 .28 - .72	*r* = .49, .35 -.63	homogeneous	31

Additional Findings

Logical subsets of the non-experimental studies were examined for further information related to the association between depression and functional status. The first logical aggregation involved examination by research methodology. Fourteen studies were prospective cohort studies. Homogeneity ($\underline{k}$ = 11, $\underline{N}$ = 756) of inter-study ES variance was attained when the outliers were removed (see Table 13). The ES*r* of .26 (95% CI .26-.26) was significant ($\underline{P}$ = .000) and small to moderate. The fail-safe-N was 46 for a critical *r* of .05. The cross-sectional subset remained heterogeneous even after removal of outliers (see Table 13).

Table 13

Meta-Analysis by Research Method: Prospective Cohort and Cross-sectional Studies

Study Groupings	k	N	Weighted P & Z	Weighted ESr & CI BESD	Unweighted ESr & CI	Tests of homogeneity	Fail-safe-N @ .05
Cohort studies except 6,11,20	11	756	p .000, Z 7.21	r = .26, .26 - .26 .37 - .63	r = .27, .21-.32	homogeneous	46
Cross-sectional except 12, 22	10	1554	p .000, Z 10.03	r = .25, .12 - .38 .37 - .63	r = .28, .21-.35	heterogeneous RSD = .06, %OV = 56.66, x^2 = 17.65 p = .040	40

The next logical aggregation involved examination by setting; subjects were either drawn from a general population such as a stroke data bank or from a rehabilitation population. The aggregate of subject-studies from the general setting were homogeneous ($\underline{k}$ = 13, $\underline{N}$ = 1773) after removal of outliers (see Table 14). A small to moderate population ES is reflected in by the ES*r* of .26 (95% CI .19-.32) and significant at $\underline{P}$ = .000. The fail-safe-$\underline{N}$ for critical *r* of .05 is 54. Subject-studies drawn from the rehabilitation setting were still heterogeneous after removal of the outliers (see Table 14).

Table 14

Meta-Analysis by Setting: General and Rehabilitation

Study Groupings	k	N	Weighted P & Z	Weighted ESr & CI BESD	Unweighted ESr & CI	Tests of homogeneity	Fail-safe-N @ .05
General setting except 12, 20, 22	13	1773	p .000, Z 11.05	*r* = .26, .19 - .32 .37 - .63	*r* = .28, .23 -.33	homogeneous	54
Rehab except 6, 11	7	485	p .000, Z 5.3	*r* =.24, .10 - .37 .38 - .62	*r* = .26, .16 -.37	heterogeneous RSD = .07, %OV = 72.68, x^2 = 9.63 p = .141	26

One of the most interesting aggregations involves examination by time (see Table 15). Homogeneous subsets were formed for the acute time frame ($\underline{k}$ = 7, $\underline{N}$ = 965), 3 months or rehabilitation discharge ($\underline{k}$ = 6, $\underline{N}$ = 550), greater than 1 year ($\underline{k}$ = 5, $\underline{N}$ = 393), and mixed times ($\underline{k}$ = 5, $\underline{N}$ = 660). The 6 month and 1 year subsets were not homogenous by two of three tests for inter-study ES variance; the chi-square test was not significant. Figure 4 represents the population ESr and corresponding CI for each time delineated subset. The 6-month and 1-year aggregates are included; even they are not homogeneous.

Table 15

Meta-Analysis by Time: Acute, Three Months, Six Months, One Year, Greater than One Year, and Mixed

Study Groupings	k	N	Weighted P & Z	Weighted ES*r* & CI BESD	Unweighted ES*r* & CI	Tests of homogeneity	Fail-safe-N @ .05
Acute except 6, 11	7	965	p .000, Z 7.26	*r* = .23, .15 - .32 .38 - .62	*r* = .26, .15 -.37	homogeneous	25
3-months except 11	6	550	p .000, Z 5.98	*r* = .25, .25 -.25 .37 - .63	*r* = .24, .17 -31	homogeneous	24
6-months	6	430	p .000, Z 4.83	*r* = .23, .09 -.37 .38 - .62	*r* = .22, .11 -.33	heterogeneous RSD = .07, %OV = 70.48, x^2 = 8.51 p = .130	22
1-year	5	438	p .000, Z 4.47	*r* = .21, .07 -.35 .39 - .61	*r* = .20, .10 -.31	heterogeneous RSD = .07, %OV = 66.90, x^2 = 7.47 p = .113	16
> 1-year except 12	5	393	p .000, Z 7.22	*r* = .35, .35 - .35 .32 - .68	*r* = .32, .25 -.40	homogeneous	30
Mixed times	5	660	p .001 Z 3.03	*r* = .12, .12 - .12 .44 - .56	*r* = .12, .05 -.18	homogeneous	7

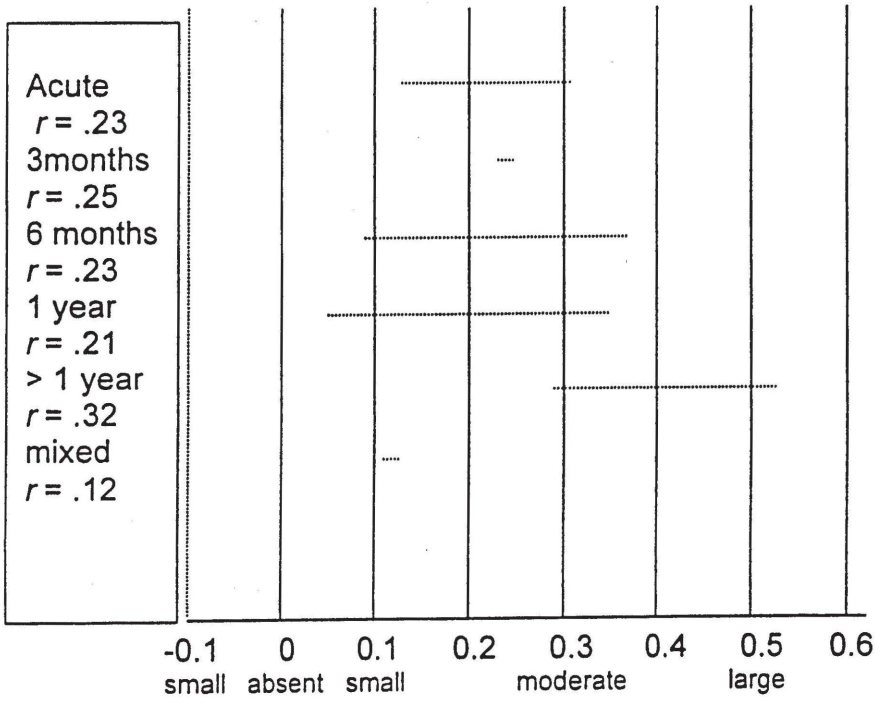

Figure 4. Effect size and 95% confidence intervals for aggregations by time.

Another interesting approach to aggregation of subject-studies was the method used to assess depression. Two subsets were formed, assessment of depression by clinical diagnosis or depression assessment by scale. A homogeneous subset of studies based on clinical diagnosis of depression is represented in Table 16. Nine studies were aggregated with a population N of 767 and a significant ES*r* = .24 (95% CI .24-.24). The fail-safe-N for a critical *r* of .05 was 35. Even after removal of three of the outliers, the aggregate of studies based on assessment of depression by scale was not homogeneous (see Table 16).

Table 16

Meta-Analysis by Depression Assessment

Study Groupings	k	N	Weighted P & Z	Weighted ESr & CI BESD	Unweighted ESr & CI	Tests of homogeneity	Fail-safe-N @ .05
Depress diagnosis except 6, 11	9	767	p .000, Z 6.88	*r* = .24, .24 - .24 .38 - .62	*r* = .29, .22 -.36	homogeneous	35
Depress by scale except 12, 20, 22	12	1549	p .000, Z 10.16	*r* = .25, .15 - .36 .37 - .63	*r* = .25, .19-.32	heterogeneous RSD = .05, %OV = 70.40, x^2 = 17.04 p = .107	49

The final aggregations involved examination of studies by assessment of function. The BI was the most commonly used assessment of function. The authors of 14 studies relied on the BI to assess functional status. Even after removal of four outliers a homogeneous subset could not be obtained (see Table 17). Functional status assessments by any instrument except the BI were included in the next aggregate. Removal of one outlier from the subset resulted in a homogeneous group of 13 studies with a population N of 1,048 (see Table 17). The aggregate had a moderate ES and a significant ES*r* of .30 (95% CI = .23-.36). The fail-safe-N for critical *r* of .05 was 64.

Table 17

Meta-Analysis by Functional Status Assessment

Study Groupings	k	N	Weighted P & Z	Weighted ESr & CI BESD	Unweighted ESr & CI	Tests of homogeneity	Fail-safe-N @ .05
Function by BI except 6, 12, 20, 22	10	1400	p .000, Z 8.09	*r* = .21, .10 - .32 .39 - .61	*r* = .24, .15 -.33	heterogeneous RSD = .06, %OV = 67.68, x^2 = 14.78 p = .10	33
Function by other scales except 11	13	1048	p .000, Z 9.78	*r* = .30, .23 - .36 .35 - .65	*r* = .28, .23 -.34	homogeneous	64

Summary of Findings

This chapter described the sample of subject-studies and results of the meta-analyses testing the four hypotheses. A further exploration of the subject-study data resulted in additional findings. The final sample included 31 subject-studies, 26 non-experimental and 5 experimental.

Data from the meta-analyses supported the first hypothesis that a negative relationship exists between depression and functional status in the post-stroke patient. A small to moderate population ES was found for a homogenous grouping of 21 subject-studies.

Hypothesis Two, examining the mediating effect of pharmacologic treatment of post-stroke depression, could not be examined quantitatively due to the lack of data reported in the subject-studies. Data for Hypothesis Three, related to examination of the mediating effects of physical rehabilitation, were limited to contributions from three subject-studies. The data were heterogeneous; therefore, could not be used to test the hypothesis.

Hypothesis Four stated that the mediating effect of pharmacologic treatment, the use of psychotropic drugs targeting depressive symptoms, and physical rehabilitation for low functional status occurring together would be greater than either mediator by itself. The moderate to

large ES*r* in the meta-analysis of experimental subject-studies supported the hypothesis.

Additional meta-analyses revealed relationships between depression and functional status by research method, by setting, by time, and by assessment method. Significant population effect sizes were found for the prospective cohort studies, the general setting, the studies using clinical diagnosis of depression, and the studies using methods other than the BI for assessment of functional status. Time post-stroke was examined; significant ESs were identified during the acute time, the 3-month time, greater than 1-year time, and for mixed times.

CHAPTER V

SUMMARY OF THE STUDY

This final chapter will serve two purposes. The first purpose is a review of the study and discussion findings. The second purpose is to establish the relevance of the study findings related to the current and future practice of nursing and other healthcare professions.

In the recent past, researchers have studied the association between depression and functional status in the post-stroke patient. Because of diverse methods, sampling techniques, and measurement instruments, comparison of the research findings as printed are impossible. The purpose of this study was to examine previous research for a better understanding of the relationship between depression, functional status, and mediating strategies in the post-stroke population.

Using a derived conceptual model, it was proposed that depression and functional status were related to one another and negative outcomes could be mediated by operating through the health care system. Health care strategies included rehabilitation targeting functional deficits and pharmacologic treatment targeting depression. The mediating

strategies influenced depression and functional status individually and collectively. Four directional hypotheses were used to guide the researcher through the conceptualization.

1. There is a negative relationship between depression and functional status in the post-stroke patient.

2. Pharmacologic treatment of depression mediates the negative relationship between depression and functional status in the post-stroke patient.

3. Physical rehabilitation mediates the negative relationship between depression and functional status in the post-stroke patient.

4. Pharmacologic treatment of depression and physical rehabilitation together mediate the negative relationship between depression and functional status more than either strategy used alone.

In this study a retrospective, non-experimental, meta-analytic design was utilized. The meta-analysis (MA) primarily employed the strategies recommended by Hunter and Schmidt (1990) for calculating the individual unweighted and weighted population effect sizes which were used to draw summary conclusions and to test the hypotheses. A population ES was considered significant if its 95% CI did not include 0 and if the P value associated with the Z statistic was

< .05. META, Version 5.3 (Schwarzer, 1989) was used to calculate the ESr values and the 95% CI around the values.

The population for the MA was comprised of all research measuring depression and functional status in post-stroke patients completed between 1990 and July 2000. Forty-five studies examining functional status and depression in the post-stroke patient and completed between 1990 and July 2000 were identified. Of those 45 studies, 26 non-experimental studies reported some measure of association between functional status and depression that allowed calculation of an ESr. Five of the 45 studies were randomized clinical trials (RCTs) that examined the relationship between functional status and depression which were mediated by physical rehabilitation and pharmacologic treatment of post-stroke depression. A total of 31 subject-studies were included in the meta-analyses. The sample of subject-studies was described in terms of research design and methodology, location and setting of the study, quality of the study, time post-stroke, as well as methods used to assess depression and functional status.

Data from the meta-analyses supported the first hypothesis that a negative relationship exists between depression and functional status in the post-stroke patient. A small to moderate population ES was found for a homogenous grouping of 21 subject-studies.

Hypothesis Two, examination of the mediating effect of pharmacologic treatment of post-stroke depression, could not be investigated quantitatively due to the lack of data reported in the subject-studies. Data for Hypothesis Three, examination of the mediating effects of physical rehabilitation, were limited to contributions from three subject-studies. The data were heterogeneous; therefore, they could not be used to test the hypothesis.

Hypothesis Four stated that the mediating effect of pharmacologic treatment for depression and physical rehabilitation for low functional status together would be greater than either mediator by itself. The moderate to large ESr in the meta-analysis of experimental subject-studies supported the hypothesis.

Additional meta-analyses of the relationship between depression and functional status examined subject-studies representing diverse research methods, general and rehabilitation settings, time post-stroke, as well as various methods of assessing depression and functional status. Significant population effect sizes were found for the prospective cohort studies, the general setting studies, the clinical diagnosis depression studies, and studies with methods other than the Barthel Index (BI) used to assess functional status. Time post-stroke was examined with

significant ESs identified during the acute phase, at 3 months, greater than 1 year, and for mixed times.

Discussion of Findings

Research relevant to the care and treatment of the post-stroke patient has been the focus of much attention during the last decade. Despite frequent reports of both depression and functional status in the post-stroke patient, findings relevant to the relationship between the two variables is inconclusive. Inconsistencies in sampling, in design, in methodology, in instrumentation, and in findings limit the use of cumulative conclusions (Gordon & Hibbard, 1997). This study focused on what could be said with confidence about the relationships between depression, functional status, and mediating strategies in the post-stroke population.

Two primary conclusions can be drawn from the MA. First that there is a significant negative relationship between depression and functional status in the post-stroke patient population. Second, physical rehabilitation and pharmacologic treatment of depression significantly mediate that negative relationship. In addition, there are times in the post-stroke trajectory that the negative association between depression and functional status is more critical. The remainder of the meta-analytic findings are more

methodological than clinical but can benefit the future study of depression and function in the post-stroke population.

Relationship Between Depression and Functional Status

Past research regarding the relationship between depression and functional status has produced various although not necessarily spurious or contradictory results. The mere nature of research with human beings presents the opportunity for such diverse approaches that consistent findings are an enigma. Meta-analytic research is a respected method for unifying the disparate results of such research. The MA of non-experimental subject-studies supported the hypothesis that a negative relationship exists between depression and functional status in the post-stroke patient. The MA considered all available non-experimental research to come to this conclusion.

One of the most impressive findings from the Sunnybrook Stroke Study (Herrmann et al., 1998) was the significance of the negative relationship between depression and activities of daily living. The relationships were measured at 3 months and 1 year, the negative correlations ranged from .31 at 3 months to .28 at 1 year. Kauhanen et al. (1999) reported similar results at 3 months and 1 year. In another longitudinal study of 85 patients assessed at the acute

stage and 6 months post-stroke, van de Weg, Kuik, and Lankhorst (1999) reported similar findings, depressed patients had significantly lower functioning at both assessments than the non-depressed patients.

Contrary findings were reported by Zalewski, Keller, Bowers, Miske, and Gradman (1994). Pre- and post-rehabilitation scores on the FIM were higher for depressed patients than for non-depressed patients. The authors offered several plausible explanations for this difference. First, there was the potential for omitting the cognitively impaired from the study because of the difficulty assessing depression. Second, there was the potential to exclude patients with the most severely impaired functioning from rehabilitation. In a study of 52 post-stroke patients residing in long-term care facilities, van Rooijen, Gingher, Gordon, and Mann (1990) found no relationship between depression and functional status regardless of time elapse from stroke.

This brief examination of diverse findings indicates the extreme importance and timeliness of meta-analysis to synthesize and draw conclusions regarding the true nature of depression and functional status in the post-stroke patient. One can readily see the relationship between depression and with the functional status via the Pearson correlation ES*r* .25 understanding that depression explains 6% of the

variance seen in functional status. However, how information affects clinical practice is somewhat more difficult to envision. The Binomial Effect Size Display (BESD) is the best method for translating the ES into information that is meaningful to clinical practice (Rosenthal et al., 2000). The BESD answers the question: How does implementation of certain treatments influence the success rate? Therefore, the best parameter for gauging clinical significance is the BESD. The meta-analysis suggests that treatment of depression in the post-stroke population could increase the proportion of post-stroke patients with higher levels of functioning from 37% to 63%. This finding alone makes all of the work required for meta-analysis worthwhile because of the important clinical significance for the large number of people who experience a stroke.

Mediating Effects of Pharmacologic Treatment and Rehabilitation

Failure of the meta-analytic findings to support the third hypothesis related to the exclusive effect of physical rehabilitation on the association between depression and functional status in no way diminishes the known effectiveness of physical rehabilitation on functional status. It only prevents the immediate understanding of the influence of physical rehabilitation without the covariant influence of psychotropic drug therapy on post-stroke

depression. Based on the studies included in the meta-analysis, it is most likely that there is essentially very little pharmacologic treatment of post-stroke depression in any setting excluding clinical trials. As was stated earlier, recent research has supported the efficacy of specialized post-stroke rehabilitation for mediating outcomes, particularly improving functional status (Jorgensen et al., 1995a, 1995b; Kalra & Eade, 1995; Ronning & Guldvog, 1998).

A very interesting side note to the meta-analysis of experimental studies is the significance of the setting where all of the randomized clinical trials (RCTs) occurred which evaluated the effectiveness of pharmacologic agents for the treatment of post-stroke depression. Without exception, even those RCTs that did not examine functional status, all took place in the rehabilitation setting. This side note provides some insight into the lack of subject-studies available to answer Hypothesis Two. The lack of pharmacologic treatment for a large number of depressed stroke patients and the limited number of clinical trials outside the rehabilitation setting is evident. Clearly, depression occurs throughout the post-stroke trajectory. Post-stroke patients need more support than just during the immediate aftermath of the insult.

In this meta-analysis there were no attempts to isolate the influence of any particular psychotropic drug or category of drug used in the treatment of post-stroke depression. Drugs used in studies which contributed to the meta-analysis were from all categories of antidepressants and methylphenidate, a central nervous system (CNS) stimulant. Considered together, all drugs used to treat depression in the post-stroke patient positively influenced both depression and functional status. Support for the positive effect was noted by the moderate to large ES which is apparent in the ESr of .43. However, the BESD (.29-.71) is the most significant parameter for relating the MA to clinical practice. Treating depressed post-stroke patients could potentially increase those patients with higher functioning from 29% to 71%.

Dam et al. (1996) found that patients treated with fluoxetine as an adjunct to physical therapy yielded a significantly larger number of patients with good functional recovery compared to maprotiline or placebo treated patients. Both the fluoxetine and maprotiline significantly decreased patients' level of depression. In a similar study, Miyai and Reding (1998) found higher functional improvements in the groups treated with fluoxetine and trazodone rather than in the group treated with desipramine. Depression,

however, improved significantly with pharmacologic treatment regardless of the choice of drug.

Methylphenidate, a CNS stimulant was studied by Grade et al. (1998). The findings indicated significant improvement in both depression and functioning for post-stroke patients treated with methylphenidate. Grade et al. attributed the effectiveness of methylphenidate to the overlapping CNS mechanisms of recovery for depression and motor functioning.

Despite the recent increase in clinical trials examining the efficacy of pharmacologic treatment of post-stroke depression, drug therapy is limited in the post-stroke population. Perhaps the frequently encountered side effects associated with psychotropic drug use in healthy adults have prevented wide spread drug therapy use in this more fragile population. However, the positive response of patients treated in the clinical trials was so remarkable that it is clearly an option for the depressed post-stroke patient that should not be totally ignored.

Almost without exception, every subject-study included in the MA recommended that clinicians seriously consider the prevalence or impact of depression on the overall recovery of the post-stroke patient. From the Sunnybrook Stroke Study, Herrmann et al. (1998) concluded that diagnosis and treatment of depression are essential elements for an

optimal recovery. Clark and Smith (1998) concluded that early recognition and treatment of depression is essential to optimal social and functional recovery in the post-stroke patient. Other authors identified the under-reporting of post-stroke depression and the importance of investigating treatment options (Kauhanen et al., 1999; Paollucci et al., 1999; Pohjasvaara et al., 1998; van de Weg et al., 1999).

Influence of Time on Post-stroke Depression and Functional Status

The meta-analyses of subject-studies reporting data taken at different times post-stroke is an interesting component to study in itself. At the 3-month time post-stroke, the relationship between depression and functional status is at its highest point until measured at some time greater than 1 year. There is a very slight but steady decline in the relationship between the variable during each interval between the 3-month time and greater than 1 year period in the trajectory. The ESr for the acute post-stroke period is .23, it is .25 at 3 months, .23 at 6 months, and .20 at 1 year. The dramatic increase in the ESr (.35) for times greater than 1 year might seem spurious were it not for individual studies repeatedly identifying a similar pattern. In the subject-study with the highest ESr (.56), investigators studied post-stroke patients who had an average of 4.9 years since the acute stroke (Wilkinson et

al., 1997). Sharpe et al. (1994) studied patients 3 to 5 years post-stroke. In a multivariate analysis, they found that functional impairment was the factor most strongly associated with post-stroke depression. In an investigation correlating depression at the acute stage with functional status at a point more than a year after the stroke, Morris, Raphael, and Robinson (1992) found that 20% of the depressed patients deteriorated in functional status compared to 0% of the non-depressed patients. Parikh et al. (1990) reported similar findings in patients at 2 years post-stroke also noting poor functional status even in patients whose depression had improved.

The time trajectory for post-stroke patients brings up important new questions. How much of an influence does acute post-stroke depression have on long-term functional improvement in the post-stroke patient? Would effective treatment of post-stroke depression at the acute stage, minimize long-term functional status deficits?

Methodological Findings

Issues related to trends affecting research can also be evaluated through meta-analytic techniques. When comparing the meta-analyses of prospective cohort and cross-sectional studies, it is not surprising that the prospective cohort studies were homogenous while the cross-sectional studies

were heterogeneous. Although time-consuming and expensive, prospective cohort studies generally exert greater research control than cross-sectional studies. The fact that both types of studies have a similar ES*r* value (prospective cohort = .26, cross-sectional = .25) to each other and to the overall MA of non-experimental studies (.25) supports the validity of MA as a viable technique for research synthesis. What is surprising, is the lack of homogeneity found in subject-studies from the rehabilitation setting when compared to a homogeneous subset from the general setting. There is no apparent explanation for this finding since one would expect greater control in the rehabilitation setting.

Assessment of depression by clinical diagnosis was homogeneous where assessment of depression by scale was heterogeneous. Heterogeneous results by scale is not surprising since nine different scales were used some of which were self-report. The ESs for depression by clinical diagnosis and depression by scale were very similar (.24 and .25, respectively), supporting the overall similarity of results by either method. This is contrary to a recent MA examining the relationship between depression and glycemic control. Lustman et al. (2000) found the ES was much greater in studies that assessed depression using criteria-based diagnoses as opposed to scaled assessments.

The final methodological issue is related to the meta-analyses of subject-studies relying on the BI compared with those using any other functional assessment instrument. The ES was markedly higher for studies using methods other than the BI. The ESr for the subset of studies using the BI was .21 and the ESr for the subset of studies using other assessment instruments was .30. Additionally, the MA for the subset of studies using the BI was heterogeneous and the subset of studies using other assessment instruments was homogeneous. Those findings contrast the fact that the BI was selected for 16 to the 3 subject-studies. This may be related to the well-documented ceiling effect of the BI. Although the ceiling effect is identified as a potential problem by many researchers, the BI is still the most widely used instrument for assessing functional status. Evans and Whitney (1998) stated that although other functional assessments with greater accuracy are now available for use, the BI was still considered a reliable indicator of functional ability and they used the BI to measure functional status in the study they authored.

Ebersole and Hess (2001) reported that health care providers frequently expressed difficulty scoring the BI outside the rehabilitation setting. However, they noted that the BI provided data to determine the type of support that is needed in activities of daily living and served in the

rehabilitation setting as a method of tracking improvement in a patient's ability to perform activities of daily living.

Wilkinson et al. (1997) compared the BI with other measures of functional status. The rank correlation coefficients reported by Wilkinson et al. included the BI with the Nottingham health profile, physical mobility dimension $\underline{r}$ = .84; with the London handicap scale $\underline{r}$ = .73; and with the short form 36, physical functioning dimension $\underline{r}$ = .81. They concluded that the BI was still justified as the standard outcome measure for post-stroke patients. Baldridge (1993) stated that although the BI effectively predicted discharge status for post-stroke patients, there was a problem with the ceiling effect for higher functioning patients.

The ceiling effect of the BI may be reflected in the lower association between depression and functional status in that subset of studies. Most of the subject-studies focused on community dwelling post-stroke patients. Consequently the BI may not capture the higher functioning of the community dwelling patient.

Theoretical Considerations

This study was guided by a derived model, specific to the relationship between post-stroke depression, functional status, and mediating strategies. The derived model, Post-Stroke Depression, Functional Status, and Mediating Strategies was originally presented in Chapter I, Figure 1. Figure 5 reflects the influence of the mediating strategies on depression and functional status as indicated by the meta-analyses. The BESD at the first outcome level reflects the proportion of the post-stroke population whose functional status or depression would improve as a result of at lease one mediating strategy. The BESD at the second outcome level reflects the proportion of the post-stroke population whose functional status and depression would improve as a result of both mediating strategies.

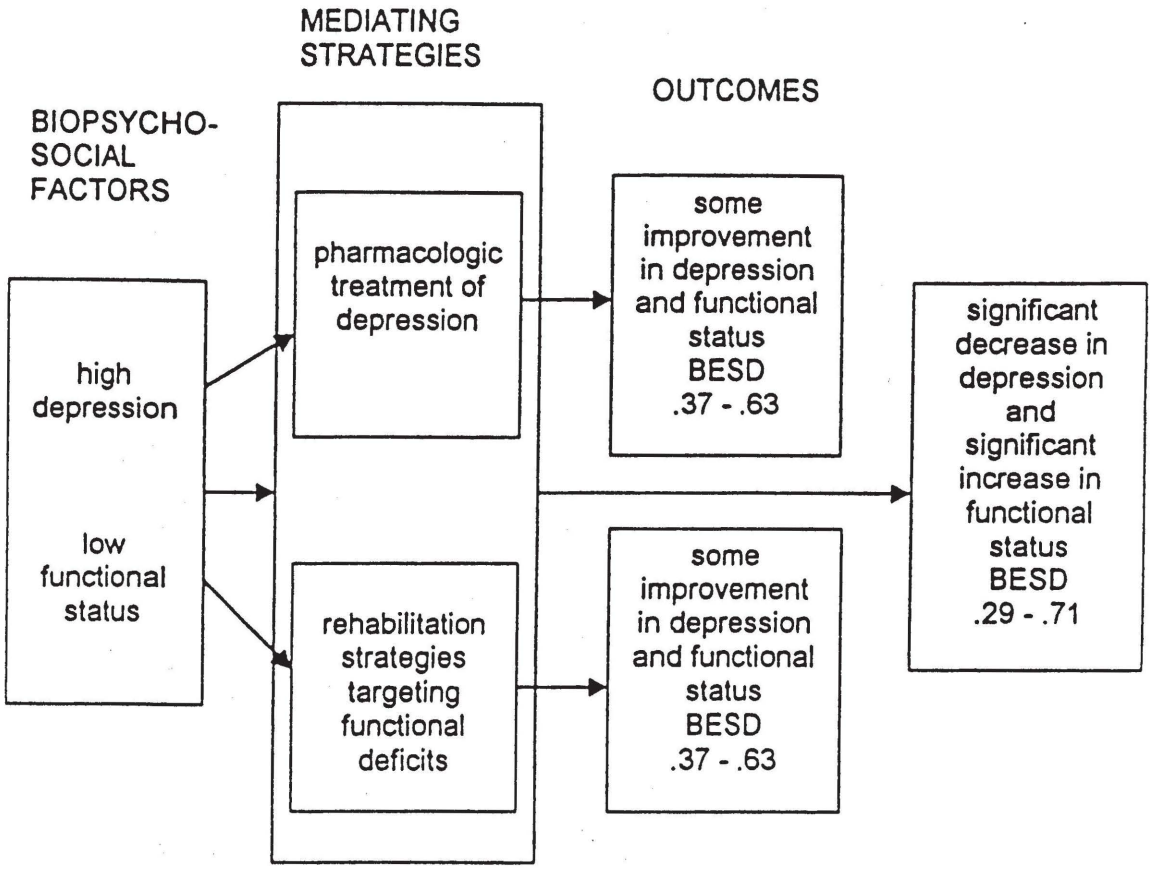

Figure 5. Post-stroke depression, functional status, and mediating strategies.

The mind and body cannot be separated. In a criticism of medicine for attempting to separate the biological or physical side of illness from the psychosocial issues that influence it, Engel (1977) called medicine to embrace a biopsychosocial approach. For explanation, Engel considered diabetes a somatic disease and schizophrenia a mental disease. The biochemical nature of diabetes does not sufficiently explain why some diabetics assume the sick role

and others adapt and function as though healthy. Likewise, psychosocial parameters do not adequately explain the manifestation of schizophrenia. For many healthcare providers, a stroke is a biologic event and the treatment has been purely targeted at the physical attributes of the stroke.

A holistic approach targeting all biopsychosocial factors is required to effect positive outcomes in the post-stroke patient. Holistic approaches to health and illness care are not new to nursing; however, nursing has not always had sufficient knowledge or voice to influence patient care practices that require medical intervention. Knowledge related to the prevalence and severity of post-stroke depression and its relationship to functional status will enable the nurse to provide timely, theory-based interventions that will substantively affect patient outcome even when practice requires medical collaboration.

Nurses are uniquely positioned and qualified to both assess and treat or recommend treatment strategies targeting the negative outcomes associated with a stroke. The nurse, of all the health care providers, probably has the most consistent contact with the post-stroke patient throughout the time trajectory. It is essential that nurses recognize depressive symptoms and instigate services to treat the post-stroke patient for the depression. The meta-analysis

provides substantive evidence that treatment of depression increases the potential for more successful post-stroke functional and mood status outcomes.

Limitations of the Study

Publication bias is the primary limitation to the generalizability of this MA. Although significant efforts were made to locate file drawer studies, those studies with non-significant results that might not have been published, only two were located. Both of those studies were dissertations and neither met the inclusion criteria regarding a reported association between depression and functional status that would allow calculation of an ES*r*. The fail-safe-N of the primary MA was 85; although this is relatively high it does not totally eliminate the possibility of some publication bias. Many of the studies examined for the MA had primary goals other than measuring the association between depression and functional status in the post-stroke patient. This practice may have diminished the likelihood of publication bias to some extent.

Recommendations for Future Research

Findings from the meta-analyses and review of contributing research suggest the following areas for future research related to depression and functional status in the post-stroke patient.

1. Through meta-analysis, synthesize the findings of all recent RCT which examine the efficacy of psychotropic drugs for treatment of post-stroke depression, not limiting inclusion to those that also measure functional status. Further, attempt to isolate those drugs or categories of drugs that have the greatest influence on post-stroke depression and functional status.

2. Include community dwelling post-stroke patients in RCT which examine the efficacy of psychotropic drugs for treatment of post-stroke depression.

3. Examine the impact of early treatment of post-stroke depression on the long-term functional status of depressed patients.

4. Study the BI scores of higher functioning post-stroke patients for the influence of the ceiling effect.

Conclusions and Implications

Clearly, the two primary meta-analyses of this study provide sufficient justification for healthcare providers to incorporate assessments for depression into the routine care of post-stroke patients across time. Although use of psychotropic drugs in an elderly or fragile population is not without risk, the benefits of successful treatment will certainly make the extra efforts worth while.

While the results of this study clearly point to the under recognition and treatment of post-stroke depression, the emphasis on assessment of depression and subsequent treatment should not be interpreted as suggestive of a causal or even directional relationship. The findings support the existence of a relationship between depression and functional status, and support treatment with psychotropic drugs to mediate that relationship. Assessment and treatment of depression has been identified as the missing link in the association between depression and functional status. Clearly, assessment of physical functioning and focused rehabilitation has proved advantageous to recovery in the post-stroke patient. The reciprocal interaction between depression and functional status can be best approached more effectively through appropriate and timely treatment of both post-stroke manifestations.

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APPENDIX A

IRB Letter of Exempt Status and Graduate School Permission Letter

TEXAS WOMAN'S
UNIVERSITY
DENTON/DALLAS/HOUSTON

THE GRADUATE SCHOOL
P.O. Box 425649
Denton, TX 76204-5649
Phone: 940/898-3400
Fax: 940/898-3412

August 18, 2000

Ms. Danita Alfred
288 South Bay Dr.
Bullard, TX 75757

Dear Ms. Alfred:

I have received and approved the prospectus entitled **"Post-Stroke Depression and Functional Status: A Metaanalysis"** for your *Dissertation* research project.

Best wishes to you in the research and writing of your project.

Sincerely yours,

Leslie M Thompson

Leslie M. Thompson
Associate Vice President for Research and
Dean of the Graduate School

LMT/sgm

cc Dr. Margaret Beard, Nursing
Dr. Carolyn Gunning, Nursing

TEXAS WOMAN'S
UNIVERSITY
DENTON/DALLAS/HOUSTON

HUMAN SUBJECTS
REVIEW COMMITTEE
P.O. Box 425619
Denton, TX 76204-5619
Phone: 940/898-3377
Fax: 940/898-3416

July 27, 2000

Ms. Danita Alfred
288 South Bay Drive
Bullard, TX 75757

Dear Ms. Alfred:

Re: Post-Stroke Depression and Functional Status: A Metaanalysis

The above referenced study has been reviewed by a committee of the Institutional Review Board (IRB) and was determined to be exempt from further TWU IRB review.

If applicable, agency approval letters obtained should be submitted to the IRB upon receipt prior to any data collection at that agency. Because you do not utilize a signed consent form for your study, the filing of signatures of subjects with the IRB is not required.

Another review by the IRB is required if your project changes. If you have any questions, please feel free to call the Institutional Review Board at the phone number listed above.

Sincerely,

Dr. Linda Rubin, Chair
Institutional Review Board - Denton

cc. Dr. Carolyn Gunning, College of Nursing
Dr. Margaret Beard, College of Nursing
Graduate School

APPENDIX B

Coding Sheet

	study#	quality	location	design	setting	depscale	funscale
1	1.00	1.65	Canada	prospect	genera	Zung	FIM
2	1.00	1.65	Canada	prospect	genera	MADRS	FIM
3	1.00	1.65	Canada	prospect	genera	other	FIM
4	1.00	1.65	Canada	prospect	genera	Zung	Oxford H
5	1.00	1.65	Canada	prospect	genera	MADRS	Oxford H
6	1.00	1.65	Canada	prospect	genera	Avg of S	avg. scal
7	1.00	1.65	Canada	prospect	genera	Zung	FIM
8	1.00	1.65	Canada	prospect	genera	MADRS	FIM
9	1.00	1.65	Canada	prospect	genera	other	FIM
10	1.00	1.65	Canada	prospect	genera	Zung	Oxford H
11	1.00	1.65	Canada	prospect	genera	MADRS	Oxford H
12	1.00	1.65	Canada	prospect	genera	Avg of S	avg. scal
13	1.00	1.65	Canada	prospect	genera	Avg of S	avg. scal
14	2.00	1.48	Australia	prospect	rehab	Zung	AADL
15	2.00	1.48	Australia	prospect	rehab	Zung	AADL
16	2.00	1.48	Australia	prospect	rehab	Zung	AADL
17	2.00	1.48	Australia	prospect	rehab	Zung	AADL
18	3.00	1.76	Australia	prospect	rehab	Zung	AADL
19	3.00	1.76	Australia	prospect	rehab	Zung	AADL
20	3.00	1.76	Australia	prospect	rehab	Zung	AADL
21	3.00	1.76	Australia	prospect	rehab	Zung	AADL
22	4.00	1.38	Canada	cross-se	genera	GDS	Oxford H
23	4.00	1.38	Canada	cross-se	genera	GDS	Barthel
24	4.00	1.38	Canada	cross-se	genera	GDS	avg. scal
25	5.00	1.48	Netherla	prospect	rehab	Diagnosi	FIM
26	5.00	1.48	Netherla	prospect	rehab	Diagnosi	FIM
27	5.00	1.48	Netherla	prospect	rehab	Diagnosi	FIM
28	6.00	1.62	Italy	prospect	rehab	Diagnosi	Barthel
29	7.00	1.48	Finland	cross-se	genera	Diagnosi	Barthel
30	7.00	1.48	Finland	cross-se	genera	Major D	Barthel
31	7.00	1.48	Finland	cross-se	genera	Pure Str	Barthel
32	7.00	1.48	Finland	cross-se	genera	Avg of S	Barthel
33	8.00	1.48	Finland	prospect	genera	Diagnosi	Barthel
34	8.00	1.48	Finland	prospect	genera	Diagnosi	Barthel
35	8.00	1.48	Finland	prospect	genera	Diagnosi	Barthel
36	9.00	1.67	Sweden	cross-se	genera	PGCMS	B-F-Mey
37	9.00	1.67	Sweden	cross-se	genera	PGCMS	KATZ
38	9.00	1.67	Sweden	cross-se	genera	PGCMS	avg. scal

	stats	time	subjects	p_value	z_of_p	esr	fisherzr
1	Pearson	3 mos or	150.00	.00005	3.89	.31	.32
2	Pearson	3 mos or	150.00	.00005	3.89	.35	.37
3	Pearson	3 mos or	81.00	<.00025	3.48	.38	.40
4	Pearson	3 mos or	150.00	.00005	3.89	.41	.44
5	Pearson	3 mos or	150.00	.00005	3.89	.40	.42
6	.	3 mos or	136.20	.00007	3.81	.37	.39
7	Pearson	1 year	136.00	.00299	2.75	.26	.27
8	Pearson	1 year	136.00	.001	3.09	.27	.28
9	Pearson	1 year	81.00	<.001	3.09	.36	.38
10	Pearson	1 year	136.00	.00005	3.89	.36	.38
11	Pearson	1 year	136.00	.0005	3.29	.29	.30
12	.	1 year	125.00	.0006	3.22	.30	.31
13	.	average	130.60	.0002	3.52	.34	.35
14	Pearson	3 mos or	94.00	<.05	1.65	.17	.17
15	Pearson	6 mos	94.00	<.05	1.65	.17	.17
16	Pearson	1 year	94.00	NS	.00	.00	.00
17	.	average	94.00	.1363	1.10	.11	.11
18	Pearson	3 mos or	60.00	<.05	1.65	.21	.22
19	Pearson	6 mos	60.00	NS	.00	.00	.00
20	Pearson	1 year	60.00	<.05	1.65	.21	.22
21	.	average	60.00	0.1363	1.10	.14	.14
22	regressi	mixed	88.00	<.025	1.96	.26	.27
23	regressi	mixed	88.00	NS	.00	.00	.00
24	.	mixed	88.00	.1635	.98	.13	.14
25	t-test	acute	85.00	.00499	2.58	.28	.29
26	t-test	6 mos	85.00	.02499	1.96	.21	.22
27	.	average	85.00	.012	2.27	.25	.25
28	regressi	acute	470.00	<.05	1.65	.08	.08
29	t-test	mixed	277.00	.0381	1.77	.11	.11
30	t-test	mixed	277.00	.0040	2.65	.16	.16
31	t-test	mixed	277.00	<.0000	3.72	.22	.23
32	.	mixed	277.00	.0032	2.72	.16	.17
33	Kruskal	3 mos or	101.00	.0015	2.97	.31	.32
34	Kruskal	1 year	92.00	.0005	3.29	.34	.36
35	.	average	96.50	.00087	3.13	.32	.34
36	Spearm	greater t	47.00	.0081	2.40	.38	.40
37	Spearm	greater t	47.00	.1	1.29	.19	.19
38	.	greater t	47.00	.0325	1.85	.29	.30

	study#	quality	location	design	setting	depscale	funscale
39	10.00	1.71	United S	prospect	genera	Beck	Barthel
40	10.00	1.71	United S	prospect	genera	Beck	Barthel
41	10.00	1.71	United S	prospect	genera	Beck	Barthel
42	11.00	1.38	United S	prospect	rehab	Diagnosi	FIM
43	11.00	1.38	United S	prospect	rehab	Diagnosi	FIM
44	11.00	1.38	United S	prospect	rehab	Diagnosi	FIM
45	12.00	1.67	England	cross-se	genera	Hosp. A	Barthel
46	13.00	1.48	China	cross-se	genera	GDS	Other
47	14.00	1.29	Australia	cross-se	rehab	MADRS	Barthel
48	15.00	1.43	England	cross-se	genera	Diagnosi	Barthel
49	16.00	1.33	China	prospect	rehab	Diagnosi	Barthel
50	16.00	1.33	China	prospect	rehab	Diagnosi	Barthel
51	16.00	1.33	China	prospect	rehab	Diagnosi	Barthel
52	17.00	1.43	United S	cross-se	rehab	HDRS	Crichton
53	18.00	1.33	United S	prospect	genera	Diagnosi	John Ho
54	18.00	1.33	United S	prospect	genera	Diagnosi	John Ho
55	18.00	1.33	United S	prospect	genera	Diagnosi	John Ho
56	19.00	1.62	United S	cross-se	nursing	Beck	Other
57	19.00	1.62	United S	cross-se	nursing	Beck	Other
58	19.00	1.62	United S	cross-se	nursing	Beck	avg. scal
59	20.00	1.43	Denmar	prospect	genera	HDRS	Barthel
60	21.00	1.24	Italy	cross-se	genera	Beck	NUDS A
61	22.00	1.57	United S	cross-se	genera	Visual A	Barthel
62	23.00	1.38	Australia	prospect	genera	Diagnosi	Karnofsk
63	23.00	1.38	Australia	prospect	genera	Diagnosi	Barthel
64	23.00	1.38	Australia	prospect	genera	Diagnosi	avg. scal
65	24.00	1.90	United S	cross-se	genera	CES-D	Barthel
66	24.00	1.90	United S	cross-se	genera	CES-D	Barthel
67	24.00	1.90	United S	cross-se	genera	CES-D	Barthel
68	25.00	1.67	United S	prospect	rehab	Diagnosi	Barthel
69	26.00	1.43	Sweden	prospect	genera	Diagnosi	KATZ
70	26.00	1.43	Sweden	prospect	genera	Diagnosi	KATZ
71	26.00	1.43	Sweden	prospect	genera	GAD	KATZ
72	26.00	1.43	Sweden	prospect	genera	Avg of S	KATZ
73	26.00	1.43	Sweden	prospect	genera	Diagnosi	KATZ
74	26.00	1.43	Sweden	prospect	genera	GAD	KATZ
75	26.00	1.43	Sweden	prospect	genera	Avg of S	KATZ
76	26.00	1.43	Sweden	prospect	genera	Diagnosi	KATZ

	stats	time	subjects	p_value	z_of_p	esr	fisherzr
39	t-test	acute	48.00	<.025	1.96	.31	.32
40	t-test	6 mos	48.00	<.025	1.96	.18	.18
41	.	average	48.00	<.025	1.96	.24	.25
42	t-test	acute	207.00	.013	2.23	-.15	-.16
43	t-test	3 mos or	207.00	.015	2.17	-.15	-.15
44	.	average	207.00	.014	2.20	-.15	-.15
45	Spearm	greater t	96.00	.0005	3.29	.56	.64
46	Spearm	mixed	45.00	.0035	2.70	.40	.43
47	Pearson	3 mos or	88.00	.032	1.85	.11	.11
48	Chi Squ	greater t	60.00	<.01	2.33	.43	.46
49	Kendalls	acute	52.00	<.025	1.96	.48	.53
50	Kendalls	6 mos	52.00	<.025	1.96	.37	.39
51	.	average	52.00	<.025	1.96	.43	.46
52	Pearson	6 mos	91.00	.0005	3.29	.41	.44
53	t-test	acute	63.00	NS	.00	.05	.05
54	t-test	greater t	63.00	.005	2.58	.38	.40
55	.	average	63.00	.1	1.29	.22	.23
56	Pearson	mixed	52.00	NS	.00	.20	.20
57	Pearson	mixed	52.00	NS	.00	.24	.24
58	.	mixed	52.00	NS	.00	.22	.22
59	Mann W	mixed	191.00	NS	.00	.05	.05
60	regressi	greater t	180.00	<.025	1.96	.41	.43
61	Pearson	mixed	52.00	>.025	.00	.02	.02
62	t-test	greater t	49.00	.0005	3.29	.46	.50
63	t-test	greater t	49.00	.245	.69	.10	.10
64	.	greater t	49.00	.023	2.00	.29	.30
65	t-test	acute	626.00	.00005	3.89	.20	.20
66	regressi	acute	626.00	.00005	3.89	.25	.26
67	Avg of te	acute	626.00	.00005	3.89	.23	.23
68	Chi Squ	acute	15.00	>.025	1.65	.40	.42
69	Fisher's	acute	76.00	NS	.00	.08	.08
70	Fisher's	3 mos or	73.00	.01	2.33	.27	.28
71	Fisher's	3 mos or	70.00	.020	2.05	.25	.25
72	.	3 mos or	71.50	.0142	2.19	.26	.27
73	Fisher's	1 year	68.00	NS	.00	.08	.08
74	Fisher's	1 year	66.00	.019462	2.07	.25	.26
75	.	1 year	67.00	.1508	1.03	.17	.17
76	Fisher's	greater t	57.00	NS	.00	.09	.09

	study#	quality	location	design	setting	depscale	funscale
77	26.00	1.43	Sweden	prospect	genera	Avg of S	KATZ
78	26.00	1.43	Sweden	prospect	genera	GAD	KATZ
79	26.00	1.43	Sweden	prospect	genera	Avg of S	KATZ
80	26.00	1.43	Sweden	prospect	genera	Avg of S	KATZ
81	A	1.71	Italy	clinical tr	rehab	HDRS	Barthel
82	A	1.71	Italy	clinical tr	rehab	HDRS	.
83	A	1.71	Italy	clinical tr	rehab	HDRS	Barthel
84	B	1.64	United S	clinical tr	rehab	HDRS	.
85	B	1.64	United S	clinical tr	rehab	Zung	.
86	B	1.64	United S	clinical tr	rehab	Avg of S	.
87	B	1.64	United S	clinical tr	rehab	.	FIM
88	B	1.64	United S	clinical tr	rehab	.	B-F-Mey
89	B	1.64	United S	clinical tr	rehab	.	avg. scal
90	B	1.64	United S	clinical tr	rehab	Avg of S	avg. scal
91	C	1.68	United S	clinical tr	rehab	.	FIM
92	C	1.68	United S	clinical tr	rehab	.	B-F-Mey
93	C	1.68	United S	clinical tr	rehab	.	avg. scal
94	C	1.68	United S	clinical tr	rehab	HDRS	.
95	C	1.68	United S	clinical tr	rehab	HDRS	avg. scal
96	D	1.55	Belgium	clinical tr	rehab	HDRS	.
97	D	1.55	Belgium	clinical tr	rehab	MADRS	.
98	D	1.55	Belgium	clinical tr	rehab	Beck	.
99	D	1.55	Belgium	clinical tr	rehab	Avg of S	.
100	D	1.55	Belgium	clinical tr	rehab	.	Barthel
101	D	1.55	Belgium	clinical tr	rehab	.	Karnofsk
102	D	1.55	Belgium	clinical tr	rehab	.	avg. scal
103	D	1.55	Belgium	clinical tr	rehab	Avg of S	avg. scal
104	E	1.77	United S	clinical tr	rehab	HDRS	.
105	E	1.77	United S	clinical tr	rehab	.	FIM
106	E	1.77	United S	clinical tr	rehab	HDRS	FIM

	stats	time	subjects	p_value	z_of_p	esr	fisherzr
77	.	.	69.00	.28	.58	.13	.13
78	Fisher's	greater t	57.00	,01050	2.31	.31	.32
79	.	greater t	57.00	.12425	1.15	.20	.20
80	.	average	62.67	.1095	1.23	.19	.20
81	Cluster	3 mos or	46.00	.025	1.96	.29	.30
82	Mann W	3 mos or	46.00	.025	1.96	.29	.30
83	Avg of te	3 mos or	46.00	.025	1.96	.	.
84	ANOVA	3 mos or	21.00	.028	1.91	.49	.54
85	ANOVA	3 mos or	21.00	.0551	1.60	.44	.47
86	.	3 mos or	21.00	.03971	1.75	.46	.50
87	ANOVA	3 mos or	21.00	.032	1.85	.48	.52
88	ANOVA	3 mos or	12.00	.075	1.44	.56	.63
89	.	3 mos or	16.50	.04988	1.65	.51	.56
90	.	3 mos or	18.75	.0448	1.70	.48	.53
91	ANOVA	3 mos or	24.00	.0005	3.29	.67	.81
92	ANOVA	3 mos or	24.00	.0001	3.72	.75	.99
93	.	3 mos or	24.00	.00023	3.51	.71	.89
94	ANOVA	3 mos or	24.00	.0005	3.29	.67	.81
95	.	3 mos or	24.00	.0003	3.43	.70	.87
96	ANOVA	3 mos or	48.00	.0005	3.29	.41	.43
97	ANOVA	3 mos or	48.00	.0005	3.29	.49	.53
98	ANOVA	3 mos or	48.00	.0005	3.29	.37	.39
99	.	3 mos or	48.00	.0005	3.29	.42	.45
100	ANOVA	3 mos or	48.00	.002	2.88	.28	.29
101	ANOVA	3 mos or	48.00	.0005	3.29	.40	.42
102	.	3 mos or	48.00	.001	3.08	.34	.36
103	.	3 mos or	48.00	.00067	3.21	.39	.41
104	ANOVA	3 mos or	40.00	.0005	3.29	.52	.58
105	ANOVA	3 mos or	40.00	.01	2.33	.38	.39
106	.	3 mos or	40.00	.0025	2.81	.45	.48

APPENDIX C

Quality of Study Instrument Guide and Permission

Danita Alfred, M.S., R.N.
288 South Bay Drive
Bullard, Texas 75757

phone 903 825-6160
fax 903 825-6615
email dmfa@aol.com

July 24, 2000

Mary Collette Smith, Ph. D., R.N.
Professor of Graduate Studies – 215 Nursing
School of Nursing
University of Alabama at Birmingham
1701 University Boulevard
Birmingham, Alabama 35294-1210

Dear Dr. Smith:

I am writing to request your permission to use and reproduce the attached adapted Quality of Study Instrument and Guide Sheet. The Quality of Study Instrument will be used as part of my dissertation research Post-Stroke Depression and Functional Status: A Meta-Analysis. This dissertation research is under the guidance of Margaret Beard, Ph.D., R.N., Professor of Nursing at Texas Woman's University, Denton, Texas.

Upon completion of the research, the instrument and scoring guide will be reproduced in the appendix of the dissertation. Proper credit will be given in all presentations and/or publications resulting from the research. Please advise me of the most appropriate citation for credit and if permission should be sought from any other entity.

If permission is granted, please sign your name and date below and return in the enclosed envelope. I appreciate your attention to this detail and look forward to using your instrument in my dissertation research.

Sincerely,

Danita Alfred

Danita Alfred
Doctoral Candidate
Texas Woman's University, College of Nursing

August 7, 2000
Date

Mary Collette Smith
Signature

Quality of Study Instrument – Study Number: _____

				Absent	NA
1.0	**Introduction**				
1.1	Justification for study	2	1	0	___
1.2	Conceptual framework	2	1	0	___
1.3	Statement of problem or purpose	2	1	0	___
1.4	Critical review of research	2	1	0	___
1.5	Methodological issues	2	1	0	___
1.6	Hypotheses or study questions stated	2	1	0	___
1.7	Operational definitions	2	1	0	___

1.0 Sum = _____ 1.0 n = _____ 1.0 Mean _____

				Absent	NA
2.0	**Methodology**				
2.1	Design described	2	1	0	___
2.2	Control of validity threats	2	1	0	___
2.3	Sufficient sample size	2	1	0	___
2.4	Representative sample	2	1	0	___
2.5	Data collection procedures described	2	1	0	___
2.6	Instrument validity described	2	1	0	___
2.7	Instrument reliability described	2	1	0	___

2.0 Sum = _____ 2.0 n = _____ 2.0 Mean _____

				Absent	NA
3.0	**Data analyses and results**				
3.1	Statistical treatment	2	1	0	___
3.2	Data presentation	2	1	0	___
3.3	Results related to problem and/or hypotheses	2	1	0	___
3.4	Findings are substantiated by methods used	2	1	0	___

3.0 Sum = _____ 3.0 n = _____ 3.0 Mean _____

				Absent	NA
4.0	**Conclusions/recommendations**				
4.1	Discussion related to background & significance	2	1	0	___
4.2	Conclusions logically derived from findings/results	2	1	0	___
4.3	Recommendations consistent with findings	2	1	0	___
4.4	Alternate explanations advanced	2	1	0	___

4.0 Sum = _____ 4.0 n = _____ 4.0 Mean_____

Total sum = _____ Total n = _____ Mean _____

Adapted from "Integrative Review and Meta-Analysis of Nursing Research Coding Form: Master," generated from "An Integrative Review of Oncology Nursing Research." funded by the National Institutes of Health, National Center for Nursing, grant number R15 NR02441, Mary Colette Smith, RN, Ph.D., principle investigator.

Quality of Study Instrument

Guide Sheet

Note:
Consider limitations within journal page limits. This form has been designed as a guide for use when coding the quality of each study.

NA = Not applicable is to be used when the listed item is an unnecessary response due to the research design.

1.0 INTRODUCTION

1.1 Justification for study (in abstract or body of paper)
- 2 clear, sufficient elaboration
- 1 mentioned, vague
- 0 not given

1.2 Conceptual or theoretical framework
- 2 identified or described, summarized theoretical or conceptual
- 1 identified only, not described
- 0 not identified

1.3 Statement of problem or purpose (in abstract or body)
- 2 introduced early, clearly stated, does not ramble
  - If problem statement, includes phenomenon of concern and populations to be studied
  - If problem statement, includes goal, variables, population, and setting for study
- 1 vague, rambles, fuzzy global statement, or inferred only
- 0 not identifiable

1.4 Critical review of research
- 2 critical review of research included, summarized polar theories and research findings, gaps, identified
- 1 general review of some literature included
- 0 no review included

1.5 Methodological issues
- 2 methodology is clearly appropriate for research goal, subjects and circumstances
- 1 appropriateness of methodologies are questionable
- 0 not appropriate

1.6 Hypotheses or study questions stated
- 2 all hypotheses or study questions stated clearly, expected relationships stated
- 1 inferred, partial vague
- 0 not identifiable

1.7 Operational definitions (listed or found within narrative)
- 2 all key terms identified, variables defined and methods for quantifying them described
- 1 included some but not all key terms
- 0 not included

2.0 METHODOLOGY

2.1 Design described
- 2 clear enough to replicate, includes a description of the research design, the setting used, procedures, description of sample, methods used to collect data (outlined in consecutive order), and data analysis procedures
- 1 vague description, missing some elements, confusing
- 0 not described

2.2 Control of validity threats (code NA except experimental study)
- 2 methods used to control for biases evident
- 1 sources of bias evident but method to control vague
- 0 no attempt to control for validity threats evident
- NA non-experimental study

Campbell and Stanley indicate that there are two kinds of validity: internal and external. Cook and Campbell have subdivided these into three kinds of validity: internal, external, and construct. Threats to each of these kinds are listed:

A. <u>Internal Validity</u>
1. Statistical conclusion: low statistical power, violation of the assumptions of the statistical tests, "fishing" or error rate, reliability of measurement, reliability of treatment implementation, random heterogeneity of response and random irrelevancies in the experimental setting
2. History - effect due to event between pre and post test that is not treatment; could include maturation, testing
3. Diffusion/imitation of treatment – control group gets information from experimental group
4. Compensatory equalization of treatment – control group tries harder
5. Compensatory rivalry of response of group receiving less desirable treatment
6. Resentful demoralization of group receiving less desirable treatment

B. Construct Validity
   7. Inadequate pre-operational explication of the construct: restricted generalizability across constructs, evaluator apprehension, confounding constructs and levels of constructs
   8. Mono-operational (1 measure) bias or mono-method (1 method of data collection, i.e., only paper and pencil, only observation) bias
   9. Hypothesis guessing within experimental conditions which is similar to experimental group guessing experimental expectations
   10. Treatment interaction/interaction of treatment and testing

C. External Validity
   11. Interaction of selection and treatment, setting and treatment or history and treatment

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2.3 Sufficient sample size
   2 in general greater than or equal to 30 (large enough not to violate statistical assumptions)
   - Consider homogeneity of sample (heterogeneous generally need larger sample
   - Appropriate for type of study (e.g. pilot study) and for treatment of data
   1 in general less than 30
   - Questionable number for type of study or treatment of data
   0 insufficient of insufficient data to determine

2.4 Representative sample
   2 used probability sampling – random sample
   1 used non-probability sampling – convenience sample
   0 insufficient data to determine

2.5 Data collection procedures described
   2 detail sufficient to replicate; procedure clear enough to determine if results can be repeated (the who, what, when, and how)
   1 vague or partial description of procedure
   0 not described

2.6 Instrument validity described (content, predictive, construct)
   2 addresses all 3
   1 addresses 1 or 2
   0 not mentioned
   NA qualitative study

2.7 Instrument reliability described stability, (e.g. test-retest), equivalence, (e.g. two instruments or interrater reliability), homogeneity, (e.g. split halves test).
- 2 addresses all 3
- 1 addresses 1 or 2
- 0 not mentioned
- NA qualitative study

3.0 DATA ANALYSIS AND RESULTS

3.1 Statistical treatment
- 2 analytical procedures are appropriate for the design and appropriate to answer research questions (if no research question or hypothesis stated, then score = 1)
- 1 confusing, limited, question appropriateness, no research question(s) or hypothesis per se
- 0 not specified
- NA qualitative study

3.2 Data presentation
- 2 presented clearly, logically, accurately all statistics of interest included; (such as %'s, t-tests, df, and p values)
- 1 confusing, limited stats and/or inaccuracies (i.e., t-test, but no df)
- 0 inadequate / not presented

3.3 Results related to problem and/or hypotheses or research questions (relates to 1.6)
- 2 addresses problem, research question or hypothesis clearly & adequately (requires 2 on item 1.6 for this score). Exception: qualitative without problem, research question or hypothesis that clearly addresses purpose
- 1 vague or partially addresses problem, research question, hypothesis (and/or purpose of qualitative studies without problem, research question or hypothesis)
- 0 results not presented in relation to problem or hypotheses

3.4 Findings are substantiated by methods used
- 2 substantiated, findings supported by data
- 1 partially substantiated/supported
- 0 not substantiated

4.0 CONCLUSIONS, RECOMMENDATIONS

4.1 Discussion related to background, significance, and conceptual framework
- 2 related to all 3; discussion of all the statistically significant results included
- 1 related to 1 or 2
- 0 not related

4.2 Conclusions logically derived from findings/results
- 2 conclusions logically derived from findings and (must be) related to research questions or hypothesis
- 1 partial or vague, fuzzy, to general, logical but not related to research question or hypothesis
- 0 no attempt to connect conclusions with findings/results or not included

4.3 Recommendations consistent with findings
- 2 relationship between findings and recommendations clearly related to research question or hypothesis and applicability to scientific area of practice
- 1 relationship unclear, illogical; may be clear and logical but not related to research question or hypothesis
- 0 no recommendations included

4.4 Alternate explanations presented
- 2 if other, conclusions can be drawn, author identifies them; if alternate explanations evident, author identifies them for journals
- 1 inferred or vague attempt
- 0 not mentioned

SCORING INSTRUCTIONS

Each item is rated with a zero, one, or two, giving a sum for each of the four categories. The sum of the four categories ranges from a maximum score of 44 to a minimum score 0. An overall mean rating for the quality of the study will be determined by dividing the total score by the number of items in the instrument.

The Quality of Study Guide Sheet comes primarily from an unpublished report funded by the National Institutes for Health, National Center for Nursing Research, Academic Research Enhancement Award, Grant Number R15 NR02441, "Integrative review of Oncology Nursing Research," pages 253-258, Mary Colette Smith, R.N., Ph.D., Principal Investigator.

APPENDIX D

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