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Refereed journals:

1. Seong, H., **Lashley, H.**, Bowers, K., Holmes, S., Fortinsky, R. H., Zhu, S., & Corazzini, K. N. (2022). Resilience in relation to older adults with multimorbidity: A scoping review. *Geriatric Nursing*, 48, 85-93. <https://doi.org/https://doi.org/10.1016/j.gerinurse.2022.08.017>

Other Publications:

Selected abstracts:

1. **Heather Lashley** & Adriane Burgess (2018). A review of the literature: The effect of lactation on cardiovascular outcomes in pre-eclamptic women (Poster presentation). Towson University Undergraduate Student Research Conference, Towson, MD.
2. Seong, H., **Lashley, H.**, Bowers, K., & Corazzini, K. *Resilience in Relation to Multimorbidity in Older Adults: A Scoping Review* [Conference presentation abstract]. The Gerontological Society of America (GSA) 2021 Annual Scientific Meeting, Phoenix, AZ.
3. **Heather Lashley**. Factors Associated with Physical Function in Adults with Fibromyalgia. Poster presentation for American Society for Pain Management Nursing; October, 2024; San Antonio, TX.

Invited presentations:

1. **Heather Lashley**. Resilience and fibromyalgia symptom burden: A scoping review. Oral presentation at Maryland Nurses Association's 119th Annual Convention; October, 2022; Linthicum, MD.

2. **Heather Lashley.** Introduction to Zotero for incoming nursing students.
Oral presentation for University of Maryland School of Nursing; August, 2023; virtual.

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1. Fibromyalgia and chronic pain
2. Symptom management
3. Resilience

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Title	Purpose	Approximate Amount	Duration
Susan G. Dorsey Scholarship	Help to pay fees/school costs	702.00	Awarded 1/23/2023

Title	Purpose	Approximate Amount	Duration
Center for Biology and Behavior Across the Lifespan (BBAL) Facilitation Grant	Incentives for research study	2000.00	Awarded 11/29/2023
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1. Hosted a GNSA information table at orientation in Winter semester 2024
2. Participated in Chancellor's Chat with Dr. Jay Perman on disability services in the University of Maryland System
3. Scored entries for Excellence in Teaching Awards and the Daisy Award in Spring 2024.

ABSTRACT

Title of dissertation: Factors impacting physical function in adults with fibromyalgia

Heather Lashley, Doctor of Philosophy, 2024

Dissertation Directed by: Barbara Resnick, PhD, CRNP, FAAN, FAANP, Professor,
University of Maryland School of Nursing

Resilience has been identified as a potential contributor to improved physical function in individuals with fibromyalgia. However, research remains sparse regarding many physical, psychological, and socio-demographic factors impacting physical function in adults with fibromyalgia and the direct and indirect impact of these variables on resilience and physical function. The purpose of this dissertation is to (1) employ a scoping review to better define the concept of physical function, explore measures that quantify physical function, and identify factors associated with physical function; (2) examine the psychometric properties of the CD-RISC-10 in an adult fibromyalgia population, and (3) test a structural equation model of factors (including age, race, sex, comorbidities, pain intensity, work status, resilience, and depression) that may impact physical function. The scoping review used the Joanna Briggs Institute (JBI) method. A survey was distributed through the Autoimmune Registry to 200 adults with fibromyalgia. Rasch and differential item functioning analyses were used to examine the psychometric properties of the CD-RISC-10. Finally, a structural equation model was constructed to test the relationships between selected factors (age, sex, race, comorbidities, work status, pain intensity, resilience, and depression) and their impact on physical function. The scoping review findings revealed resilience, depression, and multi-

morbidity were associated with physical function. The Rasch analyses found the CD-RISC-10 to be a reliable and valid measure of resilience in a national sample of adults with FM. Finally, a revised structural equation model of the factors associated with physical function supported the significant direct impact of resilience on depression, pain intensity, and physical function. Resilience was also found to impact physical function indirectly through pain intensity. Age and comorbidities were indirectly associated with physical function through resilience. This work provided information about several social, physical, and psychological factors that were associated with physical function. There was additional support for the reliability and validity of the CD-RISC-10 measure. Further research on factors associated with physical function using psychometrically validated measures of resilience ensures more accurate measurement of critical attributes and informs interventions to optimize resilience and promote physical function.

Factors impacting physical function in adults with fibromyalgia

by

Heather Lashley

A dissertation submitted to the Faculty of the Graduate School of the
University of Maryland, Baltimore in partial fulfillment
of the requirements for the degree of
Doctor of Philosophy
2024

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To my mother, who loved me when I couldn't love myself, who forever brightens the corners of my life when my days are darkest, and who reminds me to do the next best thing.

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Chapter 1: Introduction, Background, and Aims/Hypotheses

Fibromyalgia (FM), a chronic pain condition leading to fatigue, disordered sleep, and poor psychological health,¹ affects 10 million people in the United States and 3 to 6% of the global population.² Americans spend between \$12 to \$14 billion annually on the treatment and management of this disorder.³ Persons suffering from FM have been found to have higher comorbidities and pain-related medication use; poorer health status, function, and sleep patterns; lower productivity; and higher health care costs than patients with chronic widespread pain not due to FM.^{3,4} Research indicates psychological resilience, defined as one's ability to rebound from adversity and adapt while retaining self-determination and a positive outlook, may play a role in reducing FM severity, managing symptom burden, and improving physical function in persons with FM.⁵⁻⁹

While some factors associated with resilience and physical function in adults with chronic pain conditions have been identified,¹⁰ an in-depth examination of socioeconomic and psychological factors that directly and indirectly impact resilience and physical function in adults with FM remain to be studied.¹¹ What continues to be unclear in the literature is the nature of the relationship between resilience and physical function and the indirect effects of comorbidities, age, sex, education, and work status on physical function through the moderating effects of resilience, pain intensity, and depressive symptoms. It is critical to understand the direct and indirect impact of these psychological and socioeconomic factors on resilience and physical function in order to optimize clinical outcomes and appropriately individualize therapeutic interventions.

Background/Literature Summary

Chronic pain leads to a marked decrease in one's quality of life, reduced productivity, chronic disease exacerbation, and psychiatric disorders.¹² As of 2021, approximately 17 million people in the United States who suffer from chronic pain experienced substantial restrictions in regular day-to-day activities.¹³ The slow but steady damage of chronic pain in the physiological and psychological health of those with FM can result in substantial restrictions that limit daily activities and overall physical function.¹³

Physical function is defined as the ability to perform activities requiring moderate physical effort, including instrumental activities of daily living (IADL's) and performance of household tasks (e.g. carrying groceries, twisting a lightbulb, doing yardwork).¹⁴⁻¹⁶ Physical function differs from physical activity, in that physical function refers to routine activities that are essential to living an independent life, while physical activity is more broadly defined as "any bodily movement produced by skeletal muscles that requires energy expenditure".¹⁷ Physical activity includes movement for the purpose of leisure, transport, or to perform work. Physical activity at moderate and vigorous levels of intensity have been found to improve health.¹⁷ While individuals living with FM are generally able to perform activities of daily living (ADL's), such as eating, toileting, and basic ambulation, physical function is often limited in the FM population.¹⁸

Impact of Psychological Resilience on Physical Function

Research has thus far indicated resilience has a positive effect on overall health and wellbeing in people with FM. One study showed participants categorized as resilient were 25% less likely to die within 10 years when compared to their non-resilient

counterparts.¹¹ Another study examining the relationship between affect, resilience, and fibromyalgia symptom burden revealed statistically significant direct effects of resilience on fibromyalgia symptom burden.⁸ Other researchers found that age, work status, education, depressive symptoms, BMI, and physical activity were statistically significant predictors of physical function.⁹ While resilience did not moderate the relationship between pain and physical function, it did contribute uniquely to the variance in physical function, with higher levels of resilience predicting improved physical function.⁹ A final study examining physical performance and functional ability in older adults with and without FM demonstrated that older adults with FM demonstrated lower levels of perceived functional ability and had more severe physical impairments.¹⁹ Together age, gender, depression, physical activity, and FM status predicted 63% of the variance in perceived functional ability.¹⁹

Impact of Socioeconomic Variables on Resilience and Physical Function

The National Fibromyalgia Association estimates that 75 to 90% of persons with fibromyalgia are women.² However, differences in criteria and methods of diagnosis contribute to greater variance in fibromyalgia prevalence in men and women across research studies.²⁰ For example, in one study, a systematic review of the prevalence of fibromyalgia globally revealed that the prevalence of the disorder is similar between men and women.²¹ Since most research studies in the field focus predominantly on women, much less is known about the experiences of men with fibromyalgia. Because men are more likely to be underdiagnosed, the accuracy of the existing data on disease prevalence, symptomatology, individual and societal costs, and clinical course have been called into question.²²

Racial and ethnic minorities are less likely to be diagnosed with fibromyalgia than their White counterparts. The lower rates of diagnosis of the disorder in minority populations may be due, in part, to racial and ethnic health disparities, medical mistrust, health professional bias, or differences in cultural beliefs or expressions.²³ Limitations of existing studies on resilience and physical function in adults with fibromyalgia include the lack of racial and ethnic diversity represented in the study samples, the lack of clarity on the impact of sex and race on resilience and physical function, and the paucity of research on how socio-demographic variables impact resilience and physical function.

Studies on socio-economic factors relating to fibromyalgia are scant. One longitudinal, prospective study of lifetime socioeconomic circumstances and chronic pain in later adulthood found that having experienced financial hardship across earlier and later adulthood and being a tenant rather than a homeowner in earlier adulthood were associated with an increased risk of chronic widespread pain.²⁴ Another study found that patients with a lower educational level were three times more likely to develop post-operative chronic pain following total knee arthroplasty.²⁵ Increased prevalence of fibromyalgia has been associated with lower education levels and lower socioeconomic status in studies conducted in Ontario, France, Finland, Spain, and Mexico.²⁶

Conceptual Framework

Based on the extant literature, the following conceptual model was developed to describe the relationship between psychological resilience, comorbidities, depressive symptoms, pain intensity, socio-demographic variables, and physical function. The model hypothesizes that comorbidities and selected socio-demographic variables impact physical function both directly and indirectly. The indirect effects of these variables are

moderated by psychological resilience, pain intensity, and depressive symptoms.

Resilience, pain intensity, and depressive symptoms also exert a direct impact on physical function (see Figure 1).

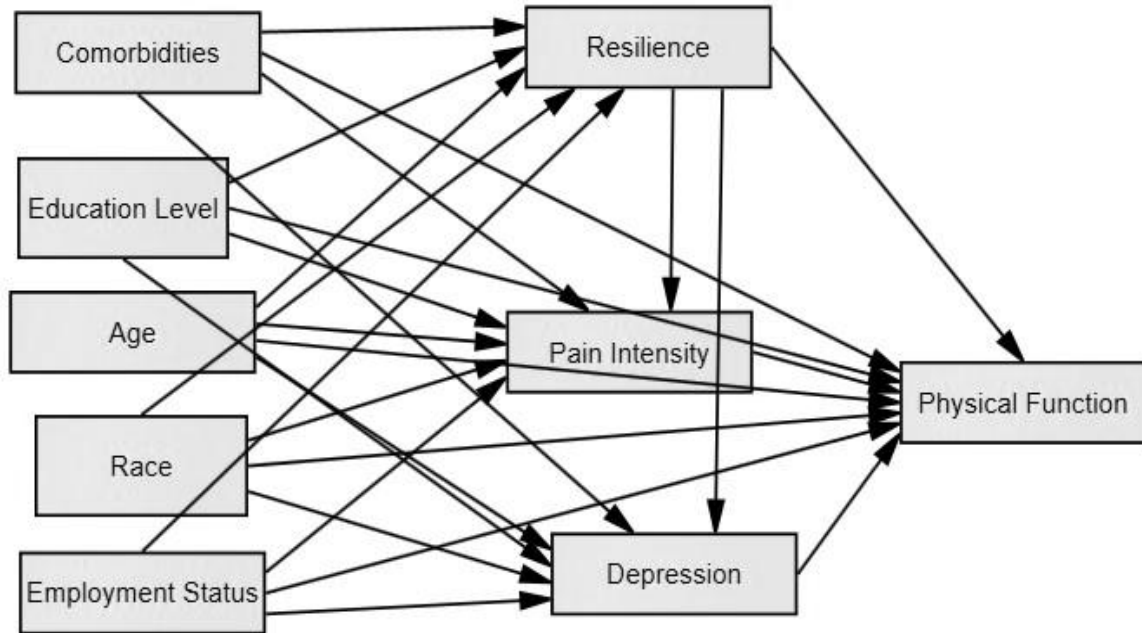


Figure 1: Hypothesized Variable Relationships with Physical Function

Aims/Hypotheses

The long-term goal of this research is to identify factors directly and indirectly influencing resilience and physical function in order to identify targets, develop interventions, and improve physical function in adults with FM. These findings will inform future research as a basis for developing interventions to strengthen resilience and thereby enhance physical function among adults living with FM. In so doing, adults living with FM may be better equipped to manage their symptoms and improve their overall functioning. Therefore, the purpose of this study was to establish a more comprehensive understanding of factors that impact psychological resilience and physical

function among adults with FM. The aims of this study include:

Aim 1/Paper 1: Explore the current literature for factors associated with physical function in adults with fibromyalgia.

Aim 2/Paper2: Assess the reliability and validity of the Connor-Davidson Resilience Scale in adults with fibromyalgia.

Hypothesis 1: Using Rasch measurement model testing there will be evidence of the reliability and validity of the Connor-Davidson Resilience Scale.

Aim 3/Paper 3: Explore the direct impact of psychological resilience, pain intensity, depressive symptoms, comorbidities, age, sex, race, education, and work status and the indirect association of comorbidities, age, sex, race, education, and work status through resilience, pain intensity, and depressive symptoms on physical function among adults with FM.

Hypothesis 1: Higher levels of pain intensity and numbers of depressive symptoms and comorbidities will negatively impact physical function in adults with FM, while psychological resilience will positively impact physical function in adults with FM.

Hypothesis 2: Comorbidities, age, sex, race, education, and work status will indirectly impact physical function through resilience, pain intensity, and depressive symptoms in adults with FM.

Methods

Design

A cross-sectional survey study was conducted to address the aims and hypotheses under investigation, with the approval of the University of Maryland Institutional Review Board. A purposive sampling method was used to recruit participants.

Sample/Setting and Power Estimates

A total of 200 participants were recruited from the Autoimmune Registry Inc., a national 501c3 non-profit organization serving individuals with autoimmune disorders (presently including FM). Inclusion criteria included:(1) being aged 18 or older with a self-reported diagnosis of fibromyalgia; (2) having access to a computer and to complete the online surveys; and (3) being able to read and write in English.

The estimated sample size of 200 participants was based upon the N:q rule for latent variable models. This ratio considers the number of cases (N) to the number of model parameters that require statistical estimates (q). The recommended sample size to parameters ratio is 20:1. If the N:q ratio is less than 10:1, the replicability of the results are called into question. Given this research study measures 10 distinct variables, at least 100 participants were considered an acceptable minimum (10:1 ratio) while 200 participants were considered a desirable sample size (20:1 ratio).²⁷

Measures/Operational Definitions

To address the aims of this study, data was collected on socio-demographic variables (age, sex, race, education, work status), resilience, physical function, comorbidities, pain intensity and depression. Sociodemographic variables were collected and included age, sex, race/ethnicity, education, and work status.

Resilience was measured using the Connor-Davidson Resilience Scale (CD-RISC), a 10-item validated self-report measure that assesses critical attributes of the concept of psychosocial resilience, including adaptability, humor, discouragement in the face of adversity, and other attributes. Participants rate items on a scale from 0 to 4 (not true to true almost all of the time). Scores range from 0 to 40 with higher scores reflecting

greater resilience.⁸ The measure has been found to have good reliability (i.e., internal consistency of 0.92 in one study,⁸ and acceptable construct and criterion validity across multiple populations, disease contexts, and geographic regions.^{8,28–30}

Physical function was measured using the Patient Reported Outcomes Measurement Information System Physical Function (PROMIS-PF) scale. PROMIS is an NIH directed initiative aimed at developing validated instruments to measure a variety of health-related experiences. Item banks are developed using item response theory, yielding a set of comprehensive and calibrated items for measuring the intended domain.³¹ Unlike the concept of disability, physical function measures functions above and below the population mean and reflects a more comprehensive range of abilities. The PF scale is a self-report measure of self-care and selected activities requiring strength, mobility, and endurance.³² The tool has been found to have favorable psychometric properties in diverse populations and contexts, including high internal consistency (0.92–0.96), test-retest reliability (0.92 to 0.95) and acceptable construct, convergent and discriminant validity.^{33–37}

Comorbidities were measured using the Charlson comorbidity index, a weighted index that assesses the number and seriousness of comorbid conditions.³⁸

Pain intensity was measured using the 3-item adaptation of the PROMIS Pain Intensity scale. This three-item scale measures how much an individual is hurting. One study performed with patients diagnosed with osteoarthritis found the PROMIS Pain Intensity scale had excellent test-retest reliability (.83 to .93 for pain intensity depending on whether the format was computer adaptive testing or written short form) and demonstrated known group and ecological validity.³⁷ Additional studies support strong

internal consistency (0.93), sensitivity (74%), specificity (81%), and construct validity.^{35,36}

Depressive symptoms were measured using the 2-item Patient Health Questionnaire (PHQ-2). This tool is a shortened version of the PHQ-9, a validated, widely used scale used to assess for depressive symptoms in clinical practice and research. The PHQ-2 consists of two items that ask whether, over the last two weeks, the participant has experienced little interest or pleasure in doing things and whether the participant is feeling down, depressed, or hopeless.³⁹ Each item is scored from 0 to 3. Total scores range from 0 to 6. A score of 0 indicates the absence of clinical depression. Cut off scores greater than or equal to 3 have demonstrated optimal sensitivity (64%, 84.7%) and specificity (85%, 95.2%) for the detection of clinical depression in prior studies.^{40,41} The instrument also demonstrates strong internal consistency with Cronbach alpha's ranging from 0.767 to 0.83 across several studies.^{39,41,42} The tool has also been found to have good test-retest reliability (0.79 in one study) excellent discriminant validity (AUCs between 0.80 and 0.85, $p < 0.001$ based on ROC curve analyses of the short and long forms prior to and 3-months following treatment), and good convergent validity with similar depression instruments.^{39,41,42}

Data Collection Procedures

Participants were recruited from the Autoimmune Registry Inc., a national registry containing over 800 people with FM. The registry website contained a link to a study information flyer, researcher contact information, and a list of screening questions to determine whether potential participants met criteria for inclusion in the study. Once it was determined that inclusion criteria had been met, the participant received a link to the

electronic informed consent. After obtaining informed consent, the participant could proceed to complete the online survey. Submission of the completed survey automatically triggered a link to the site where they could enter their e-mail to receive a \$10 gift card. The information requested at these links were used to send the gift card and were not connected with the online survey.

Data Analysis Procedures

Reliability and validity of the Connor Davidson Resilience scale was measured using a Rasch analysis and the Winsteps statistical program. The Rasch analysis included item reliability, item mapping and FIT statistics. Item reliability indicated if the sample could correctly locate the items on the latent variable. The item separation index addresses the item hierarchy and a low score suggests that the sample is not large enough to prove the item difficulty hierarchy of the scale. Values of 0.90 or greater are considered acceptable for item reliability.⁴³

The fit of the items to the measure was evaluated based on INFIT and OUTFIT statistics. Fit statistics between 0.4 to 1.6 indicate a good fit of the item to the measurement model.⁴⁴ Fit statistics are based on the mean-square calculation which involves dividing the chi-square statistic by degrees of freedom. Values greater than 1.6 (underfit) indicate unexplained variance in the data and values of less than .4 (overfit) indicate that the responses are too predictable, and the item is not adding anything. Having a good fit of the item to the measurement model means that the item contributes to the concept being tested. OUTFIT statistics are considered less important than INFIT statistics as they are more sensitive to unexpected observations on items that are very easy or very hard. Item mapping was done to determine how well the items spread across

the full range of the concept of resilience. When the mean item measure is close to the mean person measure on the map, there is support for validity of the measure. This assures that the difficulty of the items provide a good match overall with the ability of the participants.⁴⁵

With regard to model testing, the dependent variable in this study is physical function. Data was analyzed using the Statistical Package for the Social Sciences (SPSS) software program version 29. Descriptive statistics including means, proportions, and ranges were used to describe the sample. To test the hypothesis that pain intensity, depressive symptoms, and resilience positively impact physical function, structural equation modeling (SEM) was used to assess direct impacts of these predictor variables on physical function using the Amos statistical program.⁴⁶ SEM is a multivariate approach that combines multiple regression and factor analysis to estimate a series of interrelated relationships among multiple variables which are hypothesized a priori.⁴⁷

The process of developing and testing the measurement model in this study allows for the assessment of whether observed variables relating to physical function are indeed good indicators of function. The sample covariance matrix was used as input and a maximum likelihood solution employed. Model fit was estimated based on chi square divided by degrees of freedom (χ^2/df), the root mean square error of approximation (RMSEA), and comparative fit index (CFI). The larger the probability associated with χ^2/df , the better the fit of the model to the data. A ratio of 3.0 is considered to be a good fit.^{48,49} A RMSEA value of $< .10$ is considered good, and <0.06 is very good.⁵⁰ The CFI evaluates model fit relative to the null model. The results range between 0 and 1 with numbers closer to 1 indicative of better model fit.⁴⁷

Summary of Manuscripts

This dissertation sought to clarify the meaning of physical function, identify ways to measure physical function, and explore factors associated with physical function among adults living with FM. Manuscript #1 describes a scoping review of thirteen studies associated with physical function among adults with fibromyalgia. The review identified a variety of measures of physical activity/functional ability but only a few measures of true physical function. Several factors were noted to be associated with physical function directly or indirectly, including resilience, depression, and multi-morbidity. This scoping review laid a foundation for the development of future research contributing to the advancement of the understanding of factors associated with physical function among adults living with FM.

Reliable and valid instruments are essential to adequately measure the critical attributes of resilience and to help inform optimal interventions that support the ability of adults with fibromyalgia to overcome adversity. Manuscript #2 examined the reliability and validity of the Connor-Davidson Resilience Scale in a sample of adults with fibromyalgia. This study found the CD-RISC-10 to be a reliable and valid scale for assessing resilience in adults with fibromyalgia. There was sufficient evidence to support the reliability of the CD-RISC-10 based on item separation index and item reliability estimates provided through Rasch analysis. Furthermore, there was evidence to support the validity of the CD-RISC-10 based on construct validity and hypothesis testing. All of the items fit the model based on adequate INFIT and OUTFIT statistics. Further examination of this scale is recommended for other groups experiencing chronic pain and in other fibromyalgia communities.

Manuscript #3 explored the direct impact of psychological resilience, pain intensity, depressive symptoms, comorbidities, age, sex, race, education, and work status and the indirect association of comorbidities, age, sex, race, education, and work status through resilience, pain intensity, and depressive symptoms on physical function among adults with FM. Resilience, pain intensity, age, and comorbidities were found to directly impact physical function in adults with FM. Age and comorbidities were also indirectly associated with physical function through the mediating impact of resilience. Depression was the only variable to have neither a direct nor indirect impact on physical function but was included due to its strong relationship with resilience.

Conclusion

The slow but steady progression of chronic pain wearing on the physiological and psychological health of those with FM can result in substantial restrictions that limit daily activities and overall physical function. While some factors associated with resilience and physical function in adults with chronic pain conditions have been identified, an in-depth examination of factors that directly and indirectly impact resilience and physical function in adults with FM has not been widely studied.

This study sought to ascertain what is known about factors associated with physical function in adults with FM and how these factors work together to impact physical function. The study also sought to add to the existing knowledge base on the reliability and validity of a standardized resilience scale which has been used extensively in the literature to measure the concept of psychological resilience in populations with chronic pain conditions. Finally, the study sought to promote a more comprehensive understanding of the role of resilience in improving physical function and promoting

positive reintegration. By better understanding the factors that impact resilience and physical function, the development of interventions can be more individualized and implemented in concert with bio-physiological interventions to foster optimal resilience patterns. This knowledge may help to inform the development of nursing interventions to promote resilience in this population, enhance positive coping, and improve quality of life.

Chapter 2: Physical Function in Adults with Fibromyalgia: A Scoping Review

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Abstract:

Background: Fibromyalgia (FM) is a widespread chronic pain condition that impacts 10 million people in the United States and an estimated 3 to 6% of the global population. Chronic pain leads to a marked decrease in one's quality of life, reduced productivity, chronic disease exacerbation, and psychiatric disorders. The negative impact of chronic pain on the physical and psychological health of individuals with fibromyalgia can result in substantial restrictions that limit daily activities and overall physical function.

Purpose: The purpose of this scoping review was to synthesize applicable literature on physical function among adults living with FM, to elucidate gaps in the literature, and to recommend directions for future research related to physical function among those living with FM.

Methods: The Joanna Briggs Institute (JBI) scoping review methodology was used to identify and synthesize studies. The screening process was conducted using a Preferred Reporting Items for Scoping Reviews and Meta-Analyses (PRISMA-ScR) chart. The resulting 13 papers were comprehensively reviewed and demographic data was collated. Data was extracted and synthesized to form a matrix for comparison to more easily

interpret major themes.

Results: Prior studies demonstrate that physical function scales are often subsumed into health-related quality of life or general function measures. The lack of a distinct measure of physical function made it difficult to compare and contrast research findings and to ensure all aspects of the concept were adequately measured. Multiple studies supported the relationship between resilience and functional adaptation among individuals with FM. Resilience was identified as a protective factor that promoted adaptation and reduced FM severity. Other factors noted to be associated with physical function included depression and multi-morbidity.

Conclusions: The purpose of this study was to describe the meaning of physical function, identify ways to measure physical function, and explore factors associated with physical function among adults living with FM. This scoping review lays a foundation for the development of future research contributing to the advancement of the understanding of factors associated with physical function among adults living with FM.

Introduction

Fibromyalgia (FM) is a widespread chronic pain condition that impacts 10 million people in the United States and an estimated 3 to 6% of the global population.² While chronic pain is a central symptom of this condition, individuals with FM more frequently experience reduced physical function which is defined as the ability to perform activities requiring moderate physical effort, including instrumental activities of daily living (IADLs) and performance of household tasks (e.g., carrying groceries, twisting a lightbulb, doing yardwork).¹⁴⁻¹⁶ Physical function differs from physical activity, in that physical function refers to routine activities that are essential to living an independent life, whereas physical activity is more broadly defined as “any bodily movement produced by skeletal muscles that requires energy expenditure”.¹⁷ In addition, these individuals experience sleep disturbances, headaches, fatigue, anxiety, and depression, and report a greater number of comorbid or associated conditions than individuals with other chronic pain conditions.^{3,51}

Chronic pain leads to a marked decrease in one’s quality of life, reduced productivity, chronic disease exacerbation, and psychiatric disorders.¹² As of 2021, approximately 17 million people in the United States who suffer from chronic pain experienced substantial restrictions in regular day-to-day activities.¹³ The slow but steady damage of chronic pain in the physiological and psychological health of those with FM can result in substantial restrictions that limit daily activities and overall physical function.¹³

Although individuals living with FM are generally able to perform activities of daily living (ADL’s), such as eating, toileting, and basic ambulation, physical function is

often limited in the FM population.¹⁸ Despite these limitations, little is known about the factors impacting physical function in adults with FM. Therefore, the purpose of this scoping review was to synthesize applicable literature on physical function among adults living with FM, to elucidate gaps in the literature, and to recommend directions for future research related to physical function among those living with FM. Specific research questions guiding this work included:

1. What is the definition of physical function for individuals with FM?
2. What measures of physical function for adults with FM are currently available in the literature?
3. What factors are associated with physical function in adults with FM?

Methods

The Joanna Briggs Institute (JBI) scoping review methodology⁵² was used to identify and synthesize studies. This methodology is comprised of seven steps: 1) defining the topic under review; 2) developing a protocol; 3) applying the PCC (population/concept/context) framework; 4) conducting the systematic search(es); 5) screening resulting studies to determine if they meet eligibility criteria; 6) extracting data from the resulting studies; and 7) summarizing and reporting the evidence.⁵²

Search strategy

The researchers selected PubMed, Embase, CINAHL, and PsycINFO as databases that would most likely contain studies related to physical function and FM. The literature search encompassed adults with FM (population) and the concept of physical function. Setting was generalized to include community, hospital, and other settings. Each database search was tailored to the individual databases using standardized terms to describe

article content, such as Medical Subject Headings (MeSH) and Emtree terms, for physical function and FM. Search terms were developed based on variations of the following key phrases: physical function, instrumental activities of daily living, fibromyalgia, and chronic pain.

Study selection

Studies were included in the final synthesis if they: 1) had samples of adults 18 years of age and older with FM; 2) measured physical function and/or IADL's; 3) were published 2016 or later; 4) were qualitative, quantitative, and/or mixed methodologies; 6) were full-text; published; peer-reviewed; and (5) were in English. Non-research literature (i.e. books and letters), non-peer reviewed/unpublished studies, and non-English articles were all excluded from the search.

Data extraction and synthesis

The researchers independently performed the screening process to review articles. Following this process, the results from the database were exported to Zotero (Corporation for Digital Scholarship. (2024). Zotero (6.0.36) [Software]. <https://www.zotero.org/>). Discrepancies between the reviewers as to whether to include or exclude any article were resolved through regular communication between two authors and a third independent reviewer. The screening process was conducted using a Preferred Reporting Items for Scoping Reviews and Meta-Analyses (PRISMA-ScR) chart (Figure 2). The resulting 13 papers were comprehensively reviewed and demographic data was collated in Table 1. Data was extracted and synthesized to form a matrix for comparison (Table 2 and Table 3) to more easily interpret major themes and details.

Figure 2: PRISMA-ScR Diagram

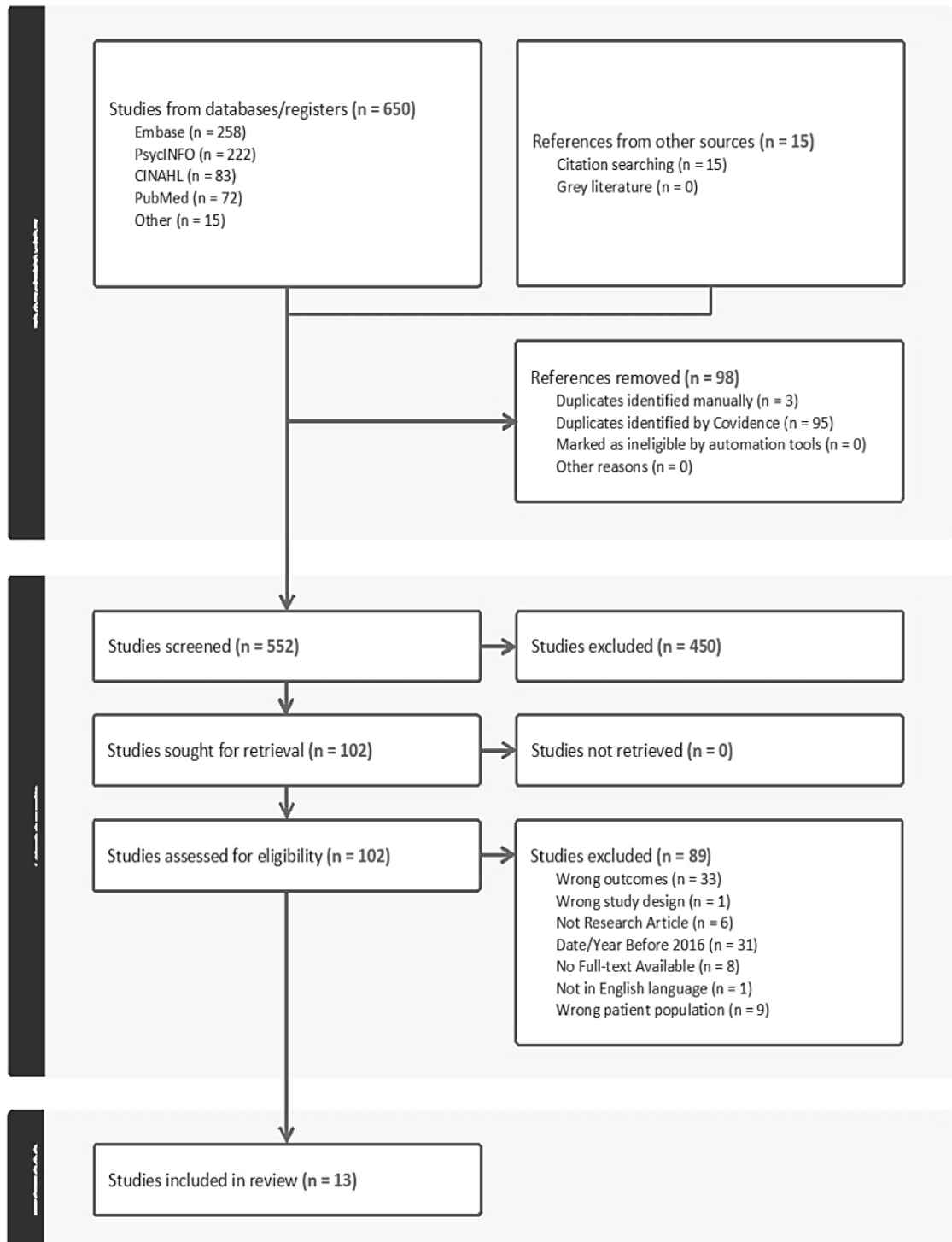


Table 1: Characteristics of Studies Included in the Scoping Review (n=13)

Characteristics		N	%
Age of Sample	18+	3	23.1
	30+	1	7.6
	40+	3	23.1
	50+	3	23.1
	Not Reported	3	23.1
Location of Study	United States	2	15.4
	Spain	5	38.6
	Israel	2	15.4
	Denmark	2	15.4
	Germany	1	7.6
	Turkey	1	7.6
Study Design	Quantitative	13	100
Year of Publication	2016-2017	6	46.2
	2018-2019	3	23.1
	2020-2021	3	23.1
	2022-2023	1	7.6
Sample Size	25-125	5	38.6
	126-225	2	15.4
	226-325	2	15.4
	326-425	1	7.6
	426-525	2	15.4
	526-625	1	7.6

Table 2: Summary of Instruments Utilized in the Scoping Review Studies

Instruments Measuring Physical Function	Author/Year	Description of Instruments
Short Form 36 (SF-36) Health Survey	Perez de-Heredia-Torres et al., 2016; Montoro et al., 2022; Bartley et al., 2018; Argaman et al., 2021; Estevez-Lopez et al., 2017	SF-36 Health Survey – used to assess health related quality of life. Includes 36 items grouped in 8 sections, one section being physical function. Scores range from 0 to 100 with higher scores indicating better health status.
Variant: Short Form 12v2 (SF 12v2)	Schaefer et al., 2016	SF 12v2 measures general health status in 8 areas, one of which is physical functioning. Each domain scored from 0 to 100 with higher scores indicating improved health status.
Variant: Short Form Health Survey (SF-12)	Braun et al., 2020	SF-12 short version of the SF-36 questionnaire to assess quality of life. Physical function measured as part of the physical component summary subscale.
Functional Independence Measure (FIM)	Perez de-Heredia-Torres et al., 2016	An 18-item instrument measuring level of functional independence in ADLs (cognitive and motor performance). Scores range from 1 to 7 with higher scores indicating higher levels of functional independence.
Fibromyalgia Impact Questionnaire (FIQ)	Perez de-Heredia-Torres et al., 2016; Montoro et al., 2022; Von Bulow et al., 2016; Braun et al., 2020; Argaman et al., 2021; Ozen et al., 2019	FIQ self-administered 10-item questionnaire evaluating physical and work related impairment, pain, fatigue, stiffness, depression, and anxiety. Scores range from 0 to 100 with higher scores indicating increased functional capacity. Internal consistency (Cronbach alpha) of overall FIQ - 0.82. FIQ – used to assess disability. Consists of 10 subscales including a physical function subscale.
Variant: FIQ-Revised	Schaefer, et al., 2016; Estevez-Lopez et al., 2017	A 21-item scale measuring function and overall impact of FM. Each item scored from 0 to 10 with overall scores ranging from 0 to 100. Higher scores indicate a greater impact from FM.
Canadian Occupational Performance Measure (COPM)	Perez de-Heredia-Torres et al., 2016	COPM – Measures self-perception of occupational performance (self-care, productivity and leisure). Activities that are difficult to perform are prioritized and rated in importance on a scale from 1 to 10 (1 – not important; 10 –very important). The top 5 activities are then rated in terms of quality of performance (very poor to very good performance) and satisfaction with performance (non-satisfactory to very satisfactory). Takes approximately 30 minutes to complete and easy to administer.

Table 2: Summary of Instruments Utilized in the Scoping Review Studies (continued)

Instruments Measuring Physical Function	Author/Year	Description of Instruments
Pain Self-Efficacy Scale	Rasmussen et al., 2016	10-item instrument measuring ability to manage selected ADL tasks and life situations known to be problematic for persons living with chronic pain. Persons rate their ability to perform activity despite pain on a 7-point scale (0="not at all confident" to 6="complete confidence"). Total scores range from 0 to 60 with higher scores indicating greater self-efficacy. Study confirmed high internal consistency (coefficient alpha = 0.88 and test-retest reliability = 0.93). Confirmatory factor analysis demonstrated a good model fit.
Work Productivity and Activity Impairment Questionnaire: Specific Health Problem V2.0	Schaefer, et al., 2016	Measures effects of health problem on hours worked and productivity.
International Fitness Scale (IFS)	Estevez-Lopez et al., 2017; Pulido-Martos et al., 2020	Measures speed, agility, muscle strength, flexibility, and cardiorespiratory fitness on a subjective level.
Senior Fitness Battery (SFB)	Estevez-Lopez et al., 2017; Pulido-Martos et al., 2020	Measures objective fitness by having participants attempt to stand from seated chair, arm curl, and walk for 6 minutes.
Accelerometer	Alvarez-Gallardo et al., 2019	Accelerometer worn on the hip for 9 days during 24-hour period except during water activities.
Assessment of Motor Process Skills (AMPS)	Von Bulow et al., 2016	Standardized observation-based instrument measuring ADL ability. Rater evaluates each of the 36 ADL skill items on a four-point ordinal scale for ease, efficiency, safety, and independence.
Chronic Pain Self-Efficacy Scale	Estevez-Lopez et al., 2017	This scale assesses the individual's perception of their ability to manage pain, to cope, and to function physically.
Visual Analogue Scale	Levy et al, 2016	10-cm scale with one end representing no pain, fatigue or functional disability, and the other end representing the worst possible pain, fatigue, or functional disability.

Table 3: Description of Evidence Pulled from Scoping Review

Author/Year	Sample	Design	Model	Key Findings	Weight of Evidence (H-M-L)
Perez-de-Heredia-Torres et al., 2016	Nonprobability sample of 20 women with FM from rheumatology department of a university hospital in Spain and 20 healthy women from the general population (matched on age and hand dominance) recruited by newspaper announcement.	Cross sectional, case control study Data collection occurred in computerized designed apartment at the university department of rheumatology to enable observation of participant in conducting everyday activities.	No specific model guiding study. One performance measure (COPM) based on Canadian Occupational Performance Model (not described in article).	Participants with FM exhibited significantly greater disability and reduced quality of life than healthy counterparts.	Medium No theoretical model guiding study.
Montoro et al., 2022	115 women diagnosed with FM. Recruited from the FM Association in Spain.	Cross sectional study design. Data obtained through semi-structured interviews and self-report questionnaires. Participants were examined by a rheumatologist and determined to meet criteria for FM diagnosis.	No model guiding study identified.	Functional capacity was significantly associated with all symptoms except state anxiety. Pain catastrophizing and depression mediated the association between clinical pain and functional capacity.	High Supports depression as a mediating factor in functional capacity.
Schaefer, et al., 2016	472 participants with FM.	Multi-stage observational study. Large scale, geographically diverse Internet based study with multiple stages including administration of online screening questionnaire and on-site physician evaluation of FM diagnosis.	No model reported.	Participants with chronic widespread pain (CWP) and FM had a higher disease burden than participants with CWP but no FM, with the highest disease burden reported by subjects with FM. FM subjects had more comorbidities, higher use of pain-related medications, poorer health status, function and sleep, lower productivity, and higher costs than those without FM.	High Relevant to FM and distinguishes FM from other conditions that produce chronic widespread pain.

Table 3: Description of Evidence Pulled from Scoping Review (continued)

Author and Year	Sample	Design	Model	Key Findings	Weight of Evidence (H-M-L)
Rasmussen et al., 2016	102 patients with chronic widespread pain and diagnosed with FM referred to a rehabilitation clinic in Denmark	The aim of this study was to evaluate the psychometric properties of the Pain Self-Efficacy Questionnaire (PSEQ) in a population of patients with FM in Denmark. The instrument was translated, adapted to a Danish setting, and tested for reliability and validity. Patients were sent a mailed questionnaire to complete. Pre-final version submitted to 8 subjects with focus group interview following.	Bandura's Self-Efficacy Theory	High internal consistency (0.88) and test-retest reliability (0.93) reported. Confirmatory factor analysis revealed a good model fit.	High Supports reliability and validity of the pain self-efficacy scale among a selected population of patients with FM
Pulido-Martos et al., 2020	569 individuals with FM in Southern Spain.	Observational, population based, cross sectional study to test integrated model of FM severity using structural equation modeling. Subjects recruited through local FM associations and through mass media, university websites, e-mail, letter, and phone.	Integrative Model of Fibromyalgia Severity included 8 factors: resilience, catastrophizing, active lifestyle, declarative memory, subjective and objective fitness, psychological distress, physical fatigue.	Identified resilience and physical fitness as additional protective factors of FM severity. Provided evidence of a comprehensive model of FM severity as opposed to isolated associations. High resilience and low catastrophizing associated with low psychological distress and thereby reduced FM severity. Active lifestyle also found to lead to low physical fatigue and thereby reduced FM severity.	High Provides evidence of importance of resilience in reducing psychological distress and FM severity.

Table 3: Description of Evidence Pulled from Scoping Review (continued)

Author and Year	Sample	Design	Model	Key Findings	Weight of Evidence (H-M-L)
Alvarez - Gallardo, et al., 2019	276 women 18-65 years of age with FM in Southern Spain	Cross-sectional study of a geographically representative sample of adults with FM in Southern Spain.	No theoretical framework reported.	Time spent in reproductive labor was associated with higher levels of light physical activity and lower sedentary behavior but not with better physical fitness or cognitive performance. Women in paid labor had higher levels of physical activity, less sedentary behavior, better physical fitness, and better cognitive performance than women who engaged exclusively in reproductive labor.	Medium Found connection between type of work and physical fitness and cognitive performance. Objective measures used to measure physical activity, sedentary behavior, cognitive performance. Men excluded from study.
Bartley et al., 2018	256 FM patients recruited from fliers, FM support groups, and outpatient clinics of the University of Florida	Longitudinal, ecological study using daily diaries to assess day to day variability in pain related symptoms	No theoretical framework reported.	Individuals with greater variability in fatigue and depressed mood exhibited higher levels of pain. FM patients with higher levels of pain unpleasantness, fatigue, and anxiety experienced greater pain intensity.	High Study captures day to day variability in symptom experiences among individuals with FM.
Von Bulow, et al., 2016	230 Women with FM recruited from a tertiary outpatient clinic in a hospital in Denmark.	Cross sectional study to identify ADL skill deficits in women with FM with reduced ADL motor ability.	No specific framework reported.	Ineffective ADL motor skills was found to limit ADL task performance particularly in moving, bending, calibrating, and reaching.	Medium Study limited to women.

Table 3: Description of Evidence Pulled from Scoping Review (continued)

Author and Year	Sample	Design	Model	Key Findings	Weight of Evidence (H-M-L)
Braun et al., 2020	156 FM patients and 48 age and gender matched controls	Exploratory factor analysis of FM patient cohort to identify differences within subgroups (clusters) within the cohort.	No specific framework identified.	Identified four clusters of patient sub-groups: maladaptive, adaptive, vulnerable, and resilient. Resilient cluster characterized by resilient coping, decreased depression/psychopathologic symptoms, and high relative gene expression of anti-inflammatory cytokines as compared to vulnerable cluster. Problem- and emotion-focused coping strategies and anti-inflammatory cytokine pattern were linked to lower disability and may promote resilience.	Medium Identified physiological and psychosocial characteristics of resilient subgroup of FM patients.
Argaman et al., 2021	27 women with FM	Double blind experimental study investigating neuroplasticity underlying pain relief and daily function following repetitive transcranial stimulation of the motor cortex (a non-invasive chronic pain therapy) in FM patients	No specific framework cited	Transcranial stimulation of the motor cortex decreased FM symptoms and correlated with changes in brain areas associated with pain processing and modulation.	High Findings support FM as a treatable brain disorder
Ozen et al., 2019	44 female patients aged 18-70 newly diagnosed with FM seen at a university physical medicine and rehabilitation outpatient clinic	Comparative effectiveness study comparing physical therapy and acupuncture interventions. One group (N = 22) received 15 sessions of hot pack, transcutaneous electrical nerve stimulation (TENS) and ultrasound to tender points in cervical and upper back regions. Second group (N=22) received 10 sessions of acupuncture.	No framework cited.	No difference in pre and post-treatment scores between groups. No difference in treatment outcomes between physical therapy and acupuncture interventions. Clinical improvement in pain (MPQ-3) and function (FIQ) noted within each group after treatment.	Medium No long term follow-up. No control groups. Small sample size.

Table 3: Description of Evidence Pulled from Scoping Review (continued)

Author and Year	Sample	Design	Model	Key Findings	Weight of Evidence (H-M-L)
Estevez-Lopez, et al., 2017	486 FM patients recruited from FM associations across 8 provinces in Southern Spain	To test differences among sub-groups with FM, a population based cross-sectional study was conducted using multiple assessments of resilience and vulnerability factors to identify adaptation profiles for FM subgroups.	No specific theoretical framework.	Factor and cluster analysis revealed five clinical profiles of modifiable factors associated with FM severity: Adapted, Fit, Poor Performer, Positive, and Maladapted. Successful adjustment to FM requires resilience factors, such as positive affect, emotional repair, and optimism.	High Clear link established between resilience factors and adaptation to FM.
Levy et al., 2016	383 adult patients with rheumatic disorders (including FM) at a rheumatology clinic in Israel.	Cross sectional study of 383 adults at a rheumatology clinic to evaluate the impact of concomitant FM on symptom severity in patients with other primary rheumatic disorders.	No specific theoretical framework.	Concomitant FM was found in 23% of the study population who did not have primary FM. Patients with concomitant FM had greater symptom severity with higher levels of pain, fatigue, and dysfunction.	Medium Demonstrated prevalence of concomitant FM in cohort of patients with other rheumatic diseases and negative impact on symptom severity. Restricted to one clinic in Israel.

Results

Search outcomes

The initial search yielded 650 articles. After duplicates were removed (n=98), the reviewers conducted title and abstract screening on the remaining 552 articles. At this stage, an additional 450 studies were excluded due to non-conformity with inclusion and exclusion criteria. The remaining 102 studies were sought for retrieval and assessed for eligibility. An additional 89 studies were excluded due to issues related to study design or outcomes, no full text availability, wrong patient population, date of publication prior to 2016, article not published in English, or article not research based. Ultimately, 13 studies remained that met all criteria and were included in the scoping review. The authors chose to include studies published during or after 2016 due to a surge in research on fibromyalgia and activities related to functional ability over this time period.

Study characteristics

Of the 13 studies included in this scoping review, all were quantitative studies (n=13). Eight of the studies employed a cross-sectional design. Two studies were experimental, and one was longitudinal. All studies focused on adults 18 years of age and older and included adults with FM in the study population. However, only two studies reported data related to race.^{3,53} In both studies, the overwhelming majority of participants were white.

Most studies recruited study participants from the community and through internet sources including FM associations and websites and from hospital and community clinics and outpatient centers (n = 11). The remaining studies were conducted in a hospital department of neurology (n=1) and a department of physical and

rehabilitative medicine within a local university (n=1). The majority of studies were conducted in Spain (n = 5) followed by the United States (n = 2) and Israel (n = 2). Other countries included Denmark (n=2), Germany (n =1), and Turkey (n = 1). No studies were found from Canada or from African, Australian, or Asian continents (with the exception of one study from Turkey). Sample sizes ranged from 40 to 569 participants. Three studies were published within the last five years while five studies were published in the year 2016. Most of the articles were published between 2016 and 2020 (n = 9). The characteristics of these studies are presented in Table 1. In the majority of studies (n=11), there was no theoretical model identified to guide the study.

Definition of physical function

While few studies examined physical function as a distinct variable, many studies included a measure of the participant's ability to perform activities of daily living (ADLs) based on different measures. Several studies examined physical function by measuring motor skills/physical fitness,^{7,54,55} using fibromyalgia experience scales.^{3,10,56-58} Others assessed functional disability⁵⁹ or self-efficacy.^{60,61} The inconsistency in the measurement of physical function as a discrete, singular concept with clearly defined attributes made it difficult to compare and contrast research findings and to ensure all aspects of the concept were adequately measured.

Measures used to assess physical function

Measures of physical function included a variety of tools ranging from those that directly measured selected physical activities to others that focused on the impact of pain or function on health status. Eight studies used the Fibromyalgia Impact Questionnaire (FIQ) to assess aspects of physical function. The FIQ includes a physical function

subscale. Six studies used some form of the Short Form Health Survey (SF-36; SF-12; SF-12v2). The SF-36 Health Survey includes 36 items grouped in eight sections, one section being physical function. Similarly, the SF-12 version is a short version of the SF-36 questionnaire to assess quality of life. Physical function is measured as part of the physical component summary subscale. Pain self-efficacy scales were used in two studies to assess ability to manage selected ADL tasks and life situations among individuals with pain. One study used a visual analogue scale to assess pain, fatigue, and functional disability.⁵⁹ Another study used the Functional Independence Measure (FIM) which assesses levels of functional independence in ADLs and the Canadian Occupational Performance Measure (COPM) which assesses self-perception of occupational performance (including productivity, self-care, and leisure).⁵⁷ Four studies employed standardized objective performance-based tests or measures to assess physical activity.^{7,54,55,60} In most studies, physical function was a component of a scale or one of many variables being assessed and subsumed under a broad or related category such as physical activity, general functional ability, or quality of life.

Factors related to functional ability

Multiple studies supported the relationship between resilience and functional adaptation among individuals with FM.^{10,58,60} For example, resilience was identified as a protective factor that promoted adaptation and reduced FM severity in two studies.^{7,10} Depression was noted to be a mediating factor in determining functional capacity (as measured by the FIQ which evaluates functional domains affected by FM).⁵⁸ Further, pain catastrophizing and depression mediated the association between clinical pain and

function. An active lifestyle was noted to be associated with lower physical fatigue which reduced FM severity.⁷

Two studies identified clusters or sub-groups related to resiliency of individuals with FM that were associated with reduced disease severity, reduced disability, or improved physical functioning. Braun et al. (2020) found a resilient cluster sub-group which was characterized by resilient coping, low depression scores, and low psychopathological symptoms.¹⁰ Estevez-Lopez et al. (2017) identified five clinical profiles of factors associated with FM severity: Adapted, Fit, Poor Performer, Positive and Maladapted.⁶² Resilience and vulnerability were found to aid in distinguishing among these profiles. The researchers concluded that successful adaptation to FM requires resilience or components of a resilient personality including positive affect and optimism. These studies highlight the importance of resilience in promoting functional adaptation among adults with FM.

Discussion

This scoping review synthesized the extant literature on the impact of FM on physical function and addressed the different ways in which physical function was measured in this work, and the many factors associated with physical function in adults with FM. Based on this review, further research is needed on physical function as a distinct outcome variable. Prior studies demonstrate that physical function scales are often subsumed into health-related quality of life or general function measures. In most studies represented in this scoping review, physical function was examined as a subset of a broader or related concept, such as functional independence, occupational performance, or self-efficacy. For future research, physical function may be defined as the ability to

engage in instrumental activities of daily living (IADL's) and the performance of daily household tasks.¹⁴⁻¹⁶

In terms of demographic data, all studies focused on adults 18 years of age and older with FM in the study population. Five studies focused specifically on women. Only two studies reported data related to race.^{3,53} Furthermore, the preponderance of subjects in fibromyalgia research have identified as white and female. When studied, however, racial/ethnic minorities have been found to have worse physical and psychological outcomes than white counterparts.⁵⁸ The lack of diversity in FM research compromises generalizability of study findings and may contribute to health disparities in FM treatment.

The review noted a major lack of consideration of the impact of FM on physical function among different racial and ethnic groups. Disparities in disease burden and functional status in rheumatic diseases have been reported across different racial/ethnic groups. For example, O'Brien et al. (2024) found that Black and Hispanic participants with rheumatoid arthritis reported lower physical function than their White counterparts.⁶³ Disparities in health care access and quality, education, socio-economic and cultural differences, and implicit bias towards persons from underrepresented populations seeking treatment may contribute to differences in health seeking behaviors, symptom presentation, and disease outcomes.⁷⁰ Therefore, studies of physical function in adults with FM in racially and culturally diverse populations are needed.

Research suggests psychological resilience may play a role in reducing FM severity, managing symptom burden, and improving physical function in persons with FM.⁷⁻⁹ Psychological resilience's relationship with physical function may be due, in part,

to factors such as pain intensity,⁷ depression,^{7,8,63} comorbidities,⁶³ age,^{8,9,64} education,⁶³ income,⁶³ and other social determinants of health.^{24,25} Without understanding how these factors impact resilience and physical function, interventions focused on improving resilience may be compromised by equity issues, inadvertently decreasing treatment efficacy.⁶⁵ It is critical to understand the impact of mediating factors on the relationship between resilience and physical function in order to optimize clinical outcomes and develop individualized therapeutic interventions.

Limitations

This study was limited to those that were published in English or that were in peer reviewed journals. It is also possible that relevant studies could have been overlooked despite the measures taken to adhere to the Joanna Briggs Institute (JBI) scoping review methodology.

Conclusion

This study sought to describe the meaning of physical function, ways to measure physical function, and factors associated with physical function among adults living with FM. Thirteen studies were identified as a result of a scoping review and revealed a variety of measures of physical activity/functional ability were identified, but only a very few measures directly focused on physical function. Several factors were noted to be associated with physical function directly or indirectly, including resilience, depression, and multi-morbidity. Additional factors to be considered in future research might include a more diverse demographic (the populations included in these studies were homogenous and lacked diversity) and pain intensity. A deeper examination of social and/or financial impacts might also be of benefit, as both can have close ties to physical and

psychological health. This scoping review lays a foundation for the development of future research contributing to the advancement of the understanding of factors associated with physical function among adults living with FM.

Chapter 3: The Psychometric Properties of the Connor-Davidson Resilience 10-Item Scale (CD-RISC-10) in Individuals with Fibromyalgia

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Abstract:

Background: Fibromyalgia is a chronic pain condition of unclear etiology with definitive negative effects on psychological health. Research suggests that psychological resilience plays an important role in reducing symptom burden and improving physical fitness/function among persons living with fibromyalgia. The Connor-Davidson Resilience Scale (CD-RISC-10), a scale measuring the concept of psychological resilience, was created by Connor and Davidson to quantify the concept of resilience and measure it in clinical populations.

Purpose: The purpose of this paper is to assess the reliability and validity of the CD-RISC-10 in adults with fibromyalgia.

Method: A descriptive online survey was conducted. Participants with fibromyalgia registered in a national autoimmune registry were invited to complete an online survey. Data was collected on demographic variables including age, sex, race, work status, and education level and measures of resilience, physical function, comorbidities, depression, and pain intensity. Resilience was measured using the CD-RISC-10. The first 200

respondents comprised the study sample. The CD-RISC-10 was assessed for reliability and validity utilizing a Rasch analysis, which was completed using the Winsteps statistical program.

Results: There was evidence of item reliability for the CD-RISC-10, with an item separation of 5.09 and item reliability of .96. All items on the CD-RISC-10 fit with the concept of psychological resilience as evidenced by acceptable INFIT and OUTFIT statistics. None of the items were out of range in the INFIT or OUTFIT statistics. When controlling for age, sex, and comorbidities, there was a significant relationship between resilience and physical function ($R^2=0.35$, $F=22.43$, $p<0.001$) and resilience and pain intensity ($R^2=0.27$, $F=16.83$, $p<0.001$).

Conclusion: Reliable and valid instruments are essential to adequately measure the critical attributes of resilience and to help inform optimal interventions that support the ability of adults with fibromyalgia to overcome adversity. This study found the CD-RISC-10 to be a reliable and valid scale for assessing resilience in adults with fibromyalgia.

Introduction

Fibromyalgia (FM) has been diagnosed in 10 million individuals in the United States,² although this number is thought to be lower than the actual prevalence due to diagnoses based on isolated fibromyalgia symptoms.⁶⁶ FM is a chronic pain condition of unclear etiology with definitive negative effects on sleep and psychological health.^{1,2,66} Individuals with FM are more likely to experience depression and post-traumatic stress disorder (PTSD) when compared to individuals with other chronic pain conditions.⁶⁷ While some research points to central nervous system dysregulation as a cause of these alterations in pain processing, there is no established cause or treatment for FM.¹

Psychological resilience, defined as the ability to recover from perceived adverse or changing situations while retaining self-determination and a positive outlook,^{5,6} plays an important role in reducing symptom burden and improving physical fitness/function among persons living with FM.⁷ Resilience may improve long-term survival rates in adults with chronic pain, with one study showing resilient individuals with chronic pain to be 25% less likely to die in a 10-year period than their non-resilient counterparts.¹¹ Unfortunately, low resilience has been reported in patients with FM.⁸

The Connor-Davidson Resilience Scale (CD-RISC) was developed to measure psychological resilience and quantifies the concept of resilience in individuals with anxiety, depression, and stress reactions.⁶⁸ In developing the scale, resilience was defined as the personal qualities that enable individuals to thrive in the midst of adversity. The researchers then developed a shortened 10-item brief version of the original 25-item scale, with similar reliability and validity. Initially, the scale was used to measure resilience in individuals who had experienced childhood maltreatment.⁶⁹ The original 25-

item CD-RISC yielded five separate factors: (1) personal competence, high standards, and tenacity; (2) trust in one's instincts, tolerance of negative affect, and strengthening effects of stress; (3) positive acceptance of change and secure relationships; (4) control; and (5) spiritual influences.⁶⁹ Conversely, the 10-item CD-RISC yielded two factors, hardiness and persistence.⁶⁹

All versions of the CD-RISC have items that use a 5-point Likert scale ranging from 0 (rarely true) to 4 (true nearly all of the time), with higher scores reflecting greater resilience. The CD-RISC-10 uses self-report, which requires little to no supervision on the part of the researcher. The scale uses equally weighted items with positive wording, which allow for ease of interpretation. Some other advantages include the compatibility of the definition of resilience used for scale development with the definition adopted for this study and the fact that this scale has been used previously in FM populations.^{8,30} Prior use of the CD-RISC-10 in individuals with FM supported evidence of internal consistency (Cronbach's alpha=0.85) and construct, convergent and discriminant validity based on exploratory and confirmatory factor analysis methods, revealing a stable factor structure with 10 items that fit the data with minimal redundancy.⁶⁹ (Additional support for reliability and validity of the measure in other populations is provided in Table 4.)

Table 4: Studies on CD-RISC 10 Reliability and Validity

Author(s)/ Year	Purpose/ Aims	Variables	Sample/ Design	Reliability Evidence	Validity Evidence	Methods Used to Evaluate Evidence
Campbell-Sills & Stein, 2007	To assess psychometric properties of the CD-RISC.	Resilience Anxiety Depression Psychiatric Symptoms Childhood Trauma	Sample: 1,743 subjects at a public university in California. 131 undergrads comprised the subsample for construct validity analyses. Design: Correlational	Internal Consistency of CD-RISC-10: Cronbach's Alpha = 0.85.	Construct Validity: Exploratory factor analysis revealed some items with high overlap. The factor structure of the 25-item scale was not stable across two equivalent subsamples. This resulted in further confirmatory factor analysis and ultimately revision of the scale. The 25-item instrument was reduced to 10 items. The new 10-item scale exhibited good fit ($\chi^2 = 176.10, p < .001$). Construct validity assessed by determining whether CD-RISC scores moderated the relationship between childhood trauma and psychiatric symptoms using hierarchical regression.	This study used both exploratory and confirmatory factor analysis methods to refine the original 25-item CD-RISC into a 10-item scale. Reliability and validity of the revised version was supported. These findings need to be further validated in clinical settings using clinician, behavioral, and biological measures of the construct.

Table 4: Studies on CD-RISC 10 Reliability and Validity (continued)

Author(s) / Year	Purpose/Aims	Variables	Sample/Design	Reliability Evidence	Validity Evidence	Methods Used to Evaluate Evidence
Scali et al, 2012	To examine the effects of psychiatric disorders and lifetime trauma history on the resilience of high-risk women with and without a history of breast cancer.	<i>Dependent:</i> Resilience <i>Independent:</i> Psychiatric Disorder and Lifetime trauma history	<i>Sample:</i> 238 women recruited in waiting rooms of specialist breast radiologists and from a regional cancer hospital in France. <i>Design:</i> Retrospective epidemiological study	Internal Consistency: Cronbach's Alpha = 0.88	No additional evidence for validity provided through this study other than the significant associations with related instruments which may suggest convergent validity.	Internal consistency is acceptable. No test-retest reliability performed. Authors cite other studies confirming validity of CD-RISC 10 but no assessment of validity in this study.
McAllister et al., 2015	To examine the relationship between affect, resilience, and fibromyalgia symptom burden in patients with fibromyalgia.	<i>Dependent:</i> Fibromyalgia Symptom Burden <i>Independent:</i> Resilience and Positive/Negative Affect	Random selection of 858 patients from a fibromyalgia registry at the Mayo Clinic in Minnesota. <i>Design:</i> Correlational	Internal Consistency Cronbach Alpha - 0.92.	Not assessed	Assessment of reliability limited to internal consistency using Cronbach Alpha. No assessment of test-retest reliability or validity in this study.

Table 4: Studies on CD-RISC 10 Reliability and Validity (continued)

Author(s)/ Year	Purpose/Aims	Variables	Sample/Design	Reliability Evidence	Validity Evidence	Methods Used to Evaluate Evidence
Notario- Pacheco et al, 2014	To evaluate the reliability and validity of the CD- RISC 10 in Spanish patients with fibromyalgia.	Resilience, Fibro- myalgia Impact, Pain catastro- phizing, Hospital anxiety and depression, Pain, and Mindful attention awareness	<i>Sample:</i> 208 patients with fibromyalgia recruited from primary care practices by their general practitioners in a city in Spain. <i>Design:</i> Observational, prospective multicenter study/Correlati onal	Internal Consist- ency: Cronbach's Alpha – 0.88 Test-retest reliability – r = 0.89.	Construct Validity: Principal Component Analysis factor solution adequate, KMO test – 0.91 and Barlett's test of sphericity significant (p=0.001). One factor had an Eigenvalue greater than 1, this factor explained 50.4% of score variance. PCA and confirmator y factor analysis revealed no significant differences between groups. <i>Conver- gent validity:</i> CD-RISC 10 signifi- cantly correlated with other psycho- metric instruments	Thorough evaluation of reliability. Convergent (correlation with other instruments) and construct validity (assessed through Principal and confirm- atory factor analysis) addressed.

Table 4: Studies on CD-RISC 10 Reliability and Validity (continued)

Author(s)/ Year	Purpose/Aims	Variables	Sample/Design	Reliability Evidence	Validity Evidence	Methods Used to Evaluate Evidence
Heritage et al., 2021	To examine whether CD-RISC 10 scores are consistent with the assumptions of a Rasch model (an item response theory model).	Resilience – CD-RISC 10; Cognitive & Affective Mindfulness; Professional Quality of Life	<i>Sample:</i> 708 nursing student volunteer participants recruited from five Australian and one Canadian university. <i>Design:</i> Correlational	Personal reliability index coefficients (interpreted similar to Cronbach alpha) consistently at 0.80 or higher. Item reliability index coefficients – 0.99)	Principal components analysis revealed unidimensionality of measure (construct validity). Off measure items that violated the assumption of a univariate construct were determined by Eigenvalues greater than or equal to 2. Concurrent validity analysis revealed that the models converged acceptably with R coefficients of 1.00 for each model outlined.	Item reliability assessed using Item Reliability Index Coefficients and Item Separation Index Coefficients. Person score reliability was assessed using the Person Reliability Index and the Person Separation Index coefficients. Construct validity – Unidimensionality assessed through principal components analysis. Concurrent validity – Linear models used to examine concurrent validity. Very thorough examination of item fit, item invariance, unidimensionality, and item dependence.

Table 4: Studies on CD-RISC 10 Reliability and Validity (continued)

Author(s)/ Year	Purpose/ Aims	Variables	Sample/ Design	Reliability Evidence	Validity Evidence	Methods Used to Evaluate Evidence
Silverstein et al., 2021	Assess the psychometric properties of the CD-RISC 10 across gender in African American men and women.	Resilience Gender Traumatic Events Childhood Trauma Alcohol Use Disorder Depression Drug Abuse PTSD Symptoms	<i>Sample:</i> 4,025 trauma exposed Black or African American patients from waiting rooms in GYN and primary care clinics at a publicly funded hospital and from an emergency department waiting room of a pediatric, non-profit hospital in an urban city in the Southeastern U.S. <i>Design:</i> Correlational	Not given	Multiple group confirmatory factor analysis revealed a single factor structure and factor loading equivalence across gender. Item intercepts were not equivalent (scores could not be compared across gender). Findings suggest variance across gender. Fit statistics for unidimensionality revealed excellent fit for men with loadings greater than .60. Item response theory analysis revealed items only provided coverage at low to moderate levels of resilience. The tool did not capture information at high levels of resilience. Item difficulty was similar across gender but there were differences in item discrimination, suggesting the CD-RISC-10 may not be equivalent across gender. Concurrent validity is supported with acceptable correlation coefficients with associated constructs. However, patterns of correlations with related constructs differ between men and women.	Multiple group confirmatory factor analysis, item response theory analysis, and differential item functioning analysis were used to determine item difficulty and gender differences across item discrimination, and item functioning. Concurrent validity across gender was assessed by examining patterns of correlations with related constructs and effect sizes. Data suggest that the CD-RISC-10 is not invariant across gender, displays differential item functioning across gender, and has different correlations with associated constructs across gender. It does not provide full coverage for measuring the construct of resilience in persons with high levels of resilience and should be used cautiously when comparing African American men and women.

Table 4: Studies on CD-RISC 10 Reliability and Validity (continued)

Author(s)/ Year	Purpose/ Aims	Variables	Sample/ Design	Reliability Evidence	Validity Evidence	Methods Used to Evaluate Evidence
Coates, Phares, & Dedrick 2013	To explore the relationship between spirituality, resilience, and psychological distress in low income, African American men. To examine the psychometric properties of the CD-RISC-10 in low income African American men.	<i>Dependent:</i> Psychological Distress <i>Independent:</i> Spirituality Resilience	<i>Sample:</i> 127 low-income, African American men recruited from an urban area in the southeastern U.S. <i>Design:</i> Correlational	Internal Consistency: alpha = .87.	Construct Validity: Structural equation model was tested using the latent variables of resilience and spirituality to predict psychological distress. Resilience was independently correlated with psychological distress and significantly correlated with spirituality ($r = .60$; $p < .001$). The two variables together explained 7.4% of the variance in psychological distress. The CD-RISC -10, was related to other theoretically relevant constructs, providing support for construct validity. Confirmatory factor analysis supported a unidimensional factor structure underlying the CD-RISC, further supporting its construct validity.	Construct validity for the CD-RISC-10 was supported in this study through structural equation modeling and confirmatory factor analysis. Reliability was also confirmed through assessment of internal consistency. However, there is no measure of test-retest reliability or concurrent validity.

The CD-RISC-10 uses a criterion-referenced measurement framework, as one person's performance on the scale is not dependent on another person's rating. As resilience is an integral part of the individualized process of adaptation, it is not logical to compare an individual's ability to adapt in one circumstance to another's ability to adapt in a completely different situation.

While there is evidence in the literature to support the reliability and validity of the scale in general, only two studies focused on populations with FM and reported reliability data.^{8,30} Of these studies, only one addressed validity of the study instrument, suggesting additional research in this area is needed.^{30,35} These findings need to be further validated in clinical settings using clinician, behavioral, and biological measures of the construct.⁶⁹

For the purposes of this study, it was hypothesized that there would be evidence of item reliability and validity, and validity would be supported based on construct validity and INFIT and OUTFIT statistics. There would also be evidence of construct validity based on hypothesis testing. For hypothesis testing, it was postulated that resilience would be associated with physical function and pain intensity, such that stronger psychological resilience would be associated with better physical function and less pain.^{7,8}

Methods

This was a descriptive study using an online survey. The study was approved by the University of Maryland Institutional Review Board. Participants were recruited from the Autoimmune Registry, a national 501c3 non-profit organization serving over 4,500 individuals with autoimmune disorders (presently including FM). Individuals were

invited to participate in this survey if they: 1) had a diagnosis of FM; 2) were 18 years of age or older; 3) had access to the internet; and 4) were able to read and write in English. After providing consent, the first 200 participants to complete the survey were included in the study.

Procedure

A flyer containing the study information and inclusion criteria was e-mailed to participants by the Autoimmune Registry. Once participants indicated they had met the inclusion criteria, they received a link to the electronic informed consent. Following consent, participants were linked to an online survey through REDCap. The collected data were de-identified and stored on a password protected server.

Measures

Data were collected on demographic variables including age, sex, race, work status, and education level and measures of resilience, physical function, comorbidities, depression, and pain intensity. Resilience was measured using the CD RISC-10, a self-report measure that assesses critical attributes of the concept of psychosocial resilience (as previously described above). Participants rate items on a scale from 0 to 4 (not true to true almost all of the time). Scores range from 0 (not true) to 40 (true almost all of the time), with higher scores reflecting greater resilience.⁸

Physical function was measured using items from the Patient Reported Outcomes Measurement Information System Physical Function (PROMIS-PF) scale. PROMIS is a National Institute of Health (NIH) directed initiative aimed at developing validated instruments to measure a variety of health-related experiences. Unlike the concept of disability, physical function measures functions above and below the population mean

and reflects a more comprehensive range of abilities. The PROMIS-PF scale is a self-report measure of self-care and selected activities requiring strength, mobility, and endurance.¹⁵ Examples of items in the scale include ability to dress, wash, and toilet, run, lift heavy objects, walk, participate in strenuous sports, climb stairs, carry groceries, kneel, bend, stoop, and perform chores such as yardwork or vacuuming.³² The tool has been found to have favorable psychometric properties in diverse populations and contexts, including high internal consistency (0.92-0.96), test-retest reliability (0.92 to 0.95) and acceptable construct, convergent and discriminant validity.^{31,33-36}

Comorbidities were measured using the Charlson Comorbidity Index, a weighted index that assesses the number and seriousness of comorbid conditions.⁷⁰ The total score is a sum of the weights of 19 conditions, with higher scores indicating greater mortality risk and more severe comorbid conditions. The Index has been found to have strong interrater reliability (with some sources reporting inter-correlation coefficients of .80 to .93), favorable concurrent validity with other prognostic scales, and predictive validity across a variety of clinical conditions.³⁸

Pain intensity was measured using the PROMIS Pain Intensity scale. This three-item scale measures how much an individual is hurting with higher scores indicating higher pain intensity. A study of patients with osteoarthritis found the Pain Intensity scale to have excellent test-retest reliability (.83 to .93 for pain intensity depending on whether the format was computer adaptive testing or written short form).³¹ Known group and ecological validity were also demonstrated.³¹ Additional studies support strong internal consistency (0.93), sensitivity (74%), specificity (81%), and construct validity.^{35,36}

Depression was measured using the Patient Health Questionnaire (PHQ)-2. The PHQ-2 consists of two items that ask whether, over the last two weeks, the participant has experienced little interest or pleasure in doing things and whether the participant is feeling down, depressed, or hopeless.³⁹ Each item is scored from 0 to 3. Total scores range from 0 to 6. A score of 0 indicates the absence of clinical depression. Cut off scores greater than or equal to 3 have demonstrated optimal sensitivity (64%, 84.7%) and specificity (85%, 95.2%) for the detection of clinical depression in prior studies.^{40,41} The instrument also demonstrates strong internal consistency with Cronbach alpha's ranging from 0.77 to 0.83 across several studies.^{39,41,42} The tool has also been found to have good test-retest reliability (0.79 in one study) excellent discriminant validity (AUCs between 0.80 and 0.85, $p < 0.001$ based on ROC curve analyses of the short and long forms prior to and 3-months following treatment), and good convergent validity with similar depression instruments.^{39,41,42}

Data Analysis

Descriptive statistics and bivariate correlations in SPSS (version 29) were run to describe the sample and evaluate correlations between the variables of interest. The CD-RISC-10 was then assessed for reliability and validity utilizing a Rasch analysis, which was completed using the Winsteps statistical program.

Reliability and Validity Testing

Testing of the internal consistency of the CD-RISC-10 was done using a Rasch measurement model and item reliability.⁷¹ An item separation index, which is the equivalent of internal consistency based on logit values,⁷¹⁻⁷³ was obtained. Low item separation (< 3) implies that the person sample is not large enough to confirm the item

difficulty hierarchy. High reliability means that there is a high probability that items estimated with high measures actually do have higher measures than items estimated with low measures. Item reliability is calculated from the Separation Index and is equivalent to KR-20, Cronbach Alpha, and the Generalizability Coefficient. A value of 0.90 or greater is considered acceptable for item reliability.^{43-45,47,71,74}

To measure construct validity, INFIT and OUTFIT statistics were utilized for each item. Fit statistics between 0.4 to 1.6 indicate a good fit of the item to the measurement model.⁷¹ Fit statistics are based on the mean-square calculation which involves dividing the chi-square statistic by degrees of freedom.⁷¹ Values that exceed 1.6 (underfit) indicate unexplained variance in the data, while values lower than .4 (overfit) indicate that the responses are too predictable, and the item is not adding anything. Having a good fit of the item to the measurement model means that the item contributes to the concept being tested. OUTFIT statistics are considered less important than INFIT statistics as they are more sensitive to unexpected observations on items that are very easy or very hard. Item mapping was also done to determine how well the items spread across the full range of the concept of resilience. When the mean item measure is close to the mean person measure on the map, it suggests that there is a good spread of the items across the concept being evaluated. This assures that the difficulty of the items provide a good match overall with the ability of the participants.⁴⁵

Hypothesis testing was conducted by examining the concept of resilience in relation to pain intensity and physical function, which have both individually been shown to have an association with, and possible effects on, psychological resilience.^{8,67,75} Two linear regression models, controlling for age, sex, and comorbidities were done.^{67,76,77}

Specifically, an enter analysis approach was used with an entry level of $<.05$ and a removal level of $>.10$. A significance level of $p<.05$ was used in all analyses. The sample was sufficient to assure a reliable model and to identify an R^2 of $.04$.⁷⁸

Results

Descriptive statistics are reported in Table 1. Of the 200 participants, 184 individuals completed the entire CD-RISC-10 and were included in this analysis. The majority of the participants were between the ages of 36 and 50 (79.5%) and female (93%). Over half of the participants had completed an undergraduate degree (53.5%), and a little under half worked full time (46%). The mean depression score was 4.28 (SD=1.14), indicating that the majority of participants had moderate levels of depression. The mean comorbidity score was 0.19 (SD=0.71), which indicates that the individuals surveyed had very few comorbid conditions. Pain was at a relatively high level for participants with a mean of 8.09 (SD=1.88). Participant physical function varied between little impact of FM to greater impact, with a mean of 56.93 and a standard deviation of 8.03.

Reliability and Validity

Reliability

There was evidence of item reliability for the CD-RISC-10 based on an item separation of 5.09 and item reliability of $.96$.

Table 5: Descriptive Statistics of Sample ($N=200$)

	N (%)	Range	Mean	SD
CD-RISC-10*		23.0-49.0	30.63	4.53
PHQ-2**		2.0-8.0	4.28	1.14
PROMIS Physical Function*		23.0-88.0	56.93	8.03
PROMIS Pain Intensity***		4.0-13.0	8.09	1.88
Comorbidities		.0-5.0	0.19	0.71
Age Category				
18-35	13 (6.5%)			
36-50	159 (79.5%)			
51-68	24 (12%)			
69-88	4 (2%)			
Gender				
Male	14 (7%)			
Female	186 (93%)			
Race				
American Indian/Alaskan Native	35 (17.5%)			
Asian	0 (0%)			
Black/African American	66 (33%)			
Hispanic or Latinx	3 (1.5%)			
Native Hawaiian/Pacific Islander	20 (10%)			
White	76 (38%)			
Education Completed				
Grade School	1 (0.5%)			
High School	75 (37.5%)			
Undergraduate	107 (53.5%)			
Degree				
Master's Degree	16 (8%)			
Doctoral Degree	1 (0.5%)			
Work Status***				
Full Time	92 (46%)			
(40+ hours)				
Part Time	68 (34%)			
(1-39 hours)				
Student	0 (0%)			
Retired	10 (5%)			
Disabled	25 (12.5%)			
Unemployed	4 (2%)			

*16 missing; **2 missing; ***1 missing

Construct Validity

The INFIT and OUTFIT statistics were all within the acceptable range. INFIT statistics ranged between 0.78 and 1.41, and OUTFIT statistics ranged between 0.33 and 1.59 (Table 5).

Table 6: INFIT and OUTFIT Statistics for CD-RISC-10 ($N=183$)

Item	INFIT MNSQ (ZSTD)	OUTFIT MNSQ (ZSTD)	Item Mapping (1=easiest, 8=hardest)
8. I am not easily discouraged by failure.	1.41 (6.84)	1.59 (6.85)	1
2. I can deal with whatever comes my way.	1.09 (1.37)	1.33 (3.57)	2
7. Under pressure, I stay focused and think clearly.	0.88 (-0.33)	1.30 (0.77)	3
5. I tend to bounce back after illness, injury, or other hardships.	1.09 (1.71)	1.07 (0.91)	4
9. I think of myself as a strong person when dealing with life's challenges and difficulties.	1.03 (0.33)	0.95 (-0.28)	4
4. Having to cope with stress can make me stronger.	0.97 (-0.27)	0.84 (-0.98)	5
6. I believe I can achieve my goals, even if there are obstacles.	0.87 (-2.07)	0.77 (-2.53)	6
1. I am able to adapt when changes occur.	0.83 (-0.98)	0.54 (-2.07)	7
10. I am able to handle unpleasant or painful feelings like sadness, fear, or anger.	0.79 (-0.85)	0.33 (-2.43)	7
3. I try to see the humorous side of things when I am faced with problems.	0.78 (-2.07)	0.69 (-2.05)	8

Mapping results revealed that the most difficult item for participants to agree with was item 3, which states “I try to see the humorous side of things when I am faced with problems”. The next most difficult item was a tie between item 10 (“I am able to handle unpleasant or painful feelings like sadness, fear, or anger”) and item 1 (“I am able to adapt when changes occur”). The next most difficult item was item 6 (“I believe I can achieve my goals, even if there are obstacles”), then item 4 (“Having to cope with stress can make me stronger”). The next more difficult items were tied yet again between item 9 (“I think of myself as a strong person when dealing with life’s challenges and

difficulties”) and item 5 (“I tend to bounce back after illness, injury, or other hardships”). The next most difficult item was item 7 (“Under pressure, I stay focused and think clearly”), then item 2 (“I can deal with whatever comes my way”), and finally item 8 was the easiest question (“I am not easily discouraged by failure”) (Table 6).

There were 2 standard deviations between the mean person score and the mean item score, which indicates the item difficulty did not match with the participants. In fact, there were 42 participants (21% of the sample) so high in psychological resilience that they could not be differentiated with the CD-RISC-10.

Hypothesis Testing

Hypothesis testing was conducted by adding the group of variables using an enter method. When controlling for age, sex, and comorbidities, there was a significant relationship between resilience and physical function ($R^2=0.44$, $F=31.61$, $p<0.001$) and resilience and pain intensity ($R^2=0.40$, $F=29.45$, $p<0.001$). Individuals with higher psychological resilience experienced increased physical function and lower pain intensity. For every one unit increase in physical function, resilience increased by .26 units ($p<0.001$); and for every one unit increase in pain intensity, resilience decreased by one unit ($p<0.001$).

Discussion

There was sufficient evidence to support the reliability of the CD-RISC-10 based on item separation index and item reliability estimates provided through Rasch analysis. Furthermore, there was evidence to support the validity of the CD-RISC-10 based on construct validity and hypothesis testing. All of the items fit the model based on INFIT and OUTFIT statistics. Consistent with prior research in this area,³⁰ this study provides

further support for the use of the CD-RISC-10 in measuring psychological resilience in populations with FM.

Many health-related quality of life measures in the literature have acceptable reliability and validity, but their excessive length limits their practical application in the clinical setting. This study also points to the value of using Rasch analysis over classical test theory methods when examining scales that are derived from larger scales that have been shortened in length. The statistical approach that is traditionally employed to shorten instruments may include factor analysis, correlations between the long and short version of the instrument, Cronbach's Alpha, and stepwise regression. These statistics are based on a scaling model that assigns a measure on the scale as the sum of responses to each item on the scale. This type of model, which is based on Classical test theory, does not take into account item hierarchy. Classical test theory does not allow for an ordered continuum of items that represent a unidimensional construct or additivity of rating scale data.⁷⁹

Conversely, the Rasch model allows the researcher to examine the hierarchical structure, unidimensionality, and additivity of health-related quality of life measures. The model is based on the assumption that a subject's response to an item depends on the interaction between a person's ability and the difficulty level of the item. The model creates a line of measurement where items are placed in a hierarchy. Fit statistics indicate how well different items describe the group of subjects and how well each subject fits the group.⁷⁹

It is also important to note that 21% of the study sample could not be differentiated because they were very high in resilience. Prior research using Item

Response Theory and Rasch model analyses reveal a ceiling effect whereby items on the CD-RISC-10 are more likely to provide coverage at low to moderate resilience levels but less likely to reliably measure high levels of resilience.^{28,80} To improve the instrument's scope of measurement of the concept of resilience, the tool should incorporate additional items that capture higher levels of resilience.⁸⁰

Future studies seeking to measure resilience in individuals with FM and other chronic pain experiences may wish to consider developing more difficult items that capture higher resilience levels. For example, in this study, the statement "I am not easily discouraged by failure" was rated as easiest in the item mapping. A parallel statement that may be reflective of a higher level of resilience might be "I choose to embrace failure as an opportunity to learn and grow." This statement reflects a positive mindset that encourages continuous improvement and recognizes that failure can move persons in a forward direction. The second easiest item was "I can deal with whatever comes my way." A statement that takes this response to a higher level might be "I choose to stay positive when nothing is going my way". This statement reflects the ability to maintain a positive outlook in the most negative of situations.

In hypothesis testing, the variables of sex, age, and comorbidities were controlled for, as some FM symptom variability has been noted to occur with sex/gender,^{76,77,81,82} age,⁸³ and comorbid conditions.⁸⁴ Sex, however, was not consistently associated with resilience in the performed regressions. One possible explanation for this finding would be the small number of men included in this study (14 males compared to 186 females). However, this is actually an accurate reflection of the male-to-female proportion seen in fibromyalgia diagnosis throughout the world, as 75-90% of individuals with fibromyalgia

are female.² Another possible explanation lies in the fact that males report lower physical function in response to pain intensity, while women report fewer physical impacts but higher levels of fatigue.⁸²

Study Strengths and Limitations

Strengths of the study included a robust sample size and a higher degree of racial diversity than most studies have reported in the literature. One limitation of the study includes the use of purposive sampling which may not be representative of the general FM population. This sample does reflect a similar proportion of female individuals with fibromyalgia, as 75-90% of individuals with fibromyalgia are female,² and 93% of this sample were female. In addition, data collection relied on participant self-report of FM diagnosis. Future studies should seek to include more male participants and to seek a wider degree of racial diversity in other underrepresented populations. Future research might also gather data at multiple time points and analyze test-retest reliability in the FM population.

Conclusion

Psychological resilience is an important variable to consider when examining the impact of chronic pain and other health challenges experienced by adults with FM. Reliable and valid instruments are essential to adequately measure the critical attributes of resilience and help inform interventions that support the ability of adults with FM to overcome adversity. Future research should evaluate completion of the CD-RISC-10 at multiple time points and add more difficult items to the questionnaire. This study found the CD-RISC-10 to be a reliable and valid scale for assessing resilience in adults with

FM. Further examination of this scale is recommended for other groups experiencing chronic pain and in other FM communities.

Chapter 4: Factors Associated with Physical Function in Adults with Fibromyalgia

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Abstract

Background: Fibromyalgia (FM) is a lifelong widespread chronic pain condition impacting 2 to 4% of the world's population. Research suggests psychological resilience, defined as the ability to rebound from adversity and adapt while retaining self-determination and a positive outlook, may play a role in reducing FM severity, managing symptom burden, and improving physical function in persons with FM. A thorough understanding of the impact of resilience on coping with the adverse consequences of FM may enable nurses to develop interventions that assist patients to better cope with the disorder and to live a full and meaningful life.

Purpose: The purpose of this study was to examine factors that impact psychological resilience and physical function among adults with FM.

Method: A cross-sectional survey study was conducted and a purposive sampling method was used to recruit participants. Participants were recruited from the Autoimmune Registry Inc., a national registry containing over 800 persons with FM in the United States. Online survey data was collected on socio-demographic variables (age,

sex, race, education, work status), resilience, physical function, comorbidities, pain intensity and depression. Structural equation modeling was used to test the central hypothesis that age, sex, race, education, work status, comorbidities, resilience, depression and pain intensity were all directly related to physical function.

Results: The model explained 14.9% of the variance in psychological resilience, 25.3% of the variance in pain intensity, 18.6% of the variance in depression, and 38.2% of the variance in physical function. Age and comorbidities were indirectly associated with physical function through psychological resilience, whereas age, comorbidities, psychological resilience, and pain intensity were directly associated with physical function. Depression was the only variable to have neither a direct nor indirect association with physical function but did have a significant direct association with resilience.

Conclusion: Nurses caring for patients with FM are in an ideal position to improve their physical function by providing evidence-based care that fosters physical function with a focus on resilience. Because resilience was found to be directly related to physical function, nurses need to evaluate resilience and utilize known interventions that strengthen resilience, thereby enhancing physical function among adults living with FM. In so doing, adults living with FM can be better equipped to manage their symptoms and to experience improvements in their overall functioning.

Introduction

Fibromyalgia (FM) is a lifelong chronic pain condition,² impacting 2 to 4% of the world's population.⁶⁷ Six to 12 million individuals are affected by FM in the United States.⁸⁵ Of this population, 75 to 90% are women.² FM is likely to be more prevalent than statistics indicate as it is a vague diagnosis that can be mistaken for other conditions due to the multitude of symptoms that accompany the disorder.⁸⁶ Some individuals suffering from FM are better able to cope with the disorder than others.³

Psychological resilience, defined as the ability to rebound from adversity and adapt while retaining self-determination and a positive outlook, may play a role in reducing FM severity, managing symptom burden, and improving physical function in persons with FM.^{5,6,8,7,9} There is a growing interest in the relationship between psychological resilience and physical function among persons with chronic health conditions. Physical function is defined as the ability to perform activities requiring physical effort including activities of daily living (ADL's), instrumental activities of daily living (IADL's), and activities requiring strength and endurance.^{14,15}

Since FM is a chronic, lifelong condition, it is imperative for health care practitioners to gain a better understanding of the factors that promote physical function in persons suffering from FM. A thorough understanding of the impact of resilience on physical function may enable caregivers to develop interventions that lead to improved physical function and assist patients to live full and meaningful lives.

Pain intensity and depressive symptoms have been identified as predictors of physical function in older adults with FM with higher levels of pain and greater depressive symptoms predicting lower physical function.⁹ Patients with FM frequently

experience psychiatric disorders such as post-traumatic stress disorder (PTSD) and depression as a result of their symptoms.^{24,67} Low psychological distress (reduced depression and anxiety, for example) is associated with higher resilience, reduced FM severity, and lower overall FM disease impact.^{8,11} Furthermore, sex^{87,88} and racial⁸⁹ differences may impact the relationship between resilience and physical function.

Resilience is a protective factor in mitigating the physiological and psychological impact of FM. The evidence suggests that resilience plays an important role in helping individuals cope with FM.^{8,90-92} The purpose of this study was to understand factors that impact psychological resilience and physical function among adults with FM.

Specifically, it was hypothesized that: (1) Higher levels of pain intensity and more depressive symptoms and comorbidities will negatively impact physical function in adults with FM, whereas psychological resilience will positively impact physical function in adults with FM; and (2) Comorbidities, age, sex, race, education, work status, depressive symptoms, and pain intensity will be directly and indirectly associated with physical function in adults with FM.

Methods

Design

A cross-sectional survey study was conducted and a purposive sampling method was used to recruit participants. Inclusion criteria included:(1) being aged 18 or older with a self-reported diagnosis of FM; (2) having access to a computer and to complete the online surveys; and (3) being able to read and write in English.

The estimated sample size of 200 participants was based upon the N:q rule for latent variable models. This ratio considers the number of cases (N) to the number of

model parameters that require statistical estimates (q). The recommended sample size to parameters ratio is 20:1. If the N:q ratio is less than 10:1, the replicability of the results are called into question. Given this research study measures 10 distinct variables, at least 100 participants were considered an acceptable minimum (10:1 ratio) while 200 participants were considered a desirable sample size (20:1 ratio).²⁷

Measures

To address the aims of this study, data was collected on socio-demographic variables, resilience, physical function, comorbidities, pain intensity and depression. Sociodemographic variables were collected and included age, sex, race, ethnicity, education, and work status.

Resilience was measured using the Connor-Davidson Resilience Scale (CD-RISC), a 10-item validated self-report measure that assesses critical attributes of the concept of psychological resilience. Participants rate items on a scale from 0 to 4 (not true to true almost all of the time). Scores range from 0 to 40 with higher scores reflecting greater resilience.⁸ The measure has been found to have good reliability (i.e., internal consistency of 0.92)⁸ and acceptable construct and criterion validity across selected populations, disease contexts, and geographic regions.^{8,28-30}

Physical function was measured using the Patient Reported Outcomes Measurement Information System Physical Function (PROMIS-PF) scale. PROMIS is a National Institute of Health (NIH) directed initiative aimed at developing validated instruments to measure a variety of health-related experiences. Item banks are developed using item response theory, yielding a set of comprehensive and calibrated items for measuring the intended domain.³⁷ Unlike the concept of disability, physical function

measures functions above and below the population mean and reflects a more comprehensive range of abilities. The PF scale is a self-report measure of self-care and selected activities requiring strength, mobility, and endurance.¹⁶ The tool has been found to have favorable psychometric properties in diverse populations and contexts, including high internal consistency (0.92-0.96), test-retest reliability (0.92 to 0.95) and acceptable construct, convergent and discriminant validity.^{31,33-36}

Comorbidities were measured using the Charlson comorbidity index, a weighted index that assesses the number and seriousness of comorbid conditions.³⁸ The Charlson comorbidity index has been found to have moderate to good interrater and test-retest reliability and adequate concurrent and predictive validity with correlation coefficients with other indices exceeding 0.40 and significant relationships between the index and mortality, disability, readmissions, and length of stay data.^{93,94} The Index has been used in studies of patients with inflammatory rheumatic diseases including lupus and FM.⁹⁵

Pain intensity was measured using the 3-item adaptation of the PROMIS Pain Intensity scale. This three-item scale measures how much an individual is hurting. In a study of patients with osteoarthritis, researchers found the PROMIS Pain Intensity scale to have excellent test-retest reliability (.83 to .93 for pain intensity depending on whether the format was computer adaptive testing or written short form).³¹ Known group and ecological validity were also demonstrated.³¹ Additional studies support strong internal consistency (0.93), sensitivity (74%), specificity (81%), and construct validity.^{35,36}

Depression was measured using the Patient Health Questionnaire (PHQ)-2. The PHQ-2 is derived from the PHQ-9, which is a validated, widely used scale used to assess depression in clinical practice and research.⁹⁶ The difference between the scales is that

the PHQ-2 asks only about one's interest and pleasure and if the participant feels down and depressed in the past 2 weeks, compared to 9 items in the original PHQ-9. The PHQ-2 items are scored from 0 to 3, with higher scores indicating more depression.

Data Collection Procedures

Participants were recruited from the Autoimmune Registry Inc., a national registry containing over 800 people with FM in the United States. The registry website contained a link to a study information flyer, researcher contact information and a list of screening questions to determine whether potential participants met criteria for inclusion in the study. Once it was determined that inclusion criteria had been met, the participant received a link to the electronic informed consent. After obtaining informed consent, the participant could proceed to complete the online survey. Submission of the completed survey automatically triggered a link to the site where they could enter their e-mail to receive a \$10 gift card. The e-mail address site was used to send the gift card and was not connected with data from the online survey.

Data Analysis Procedures

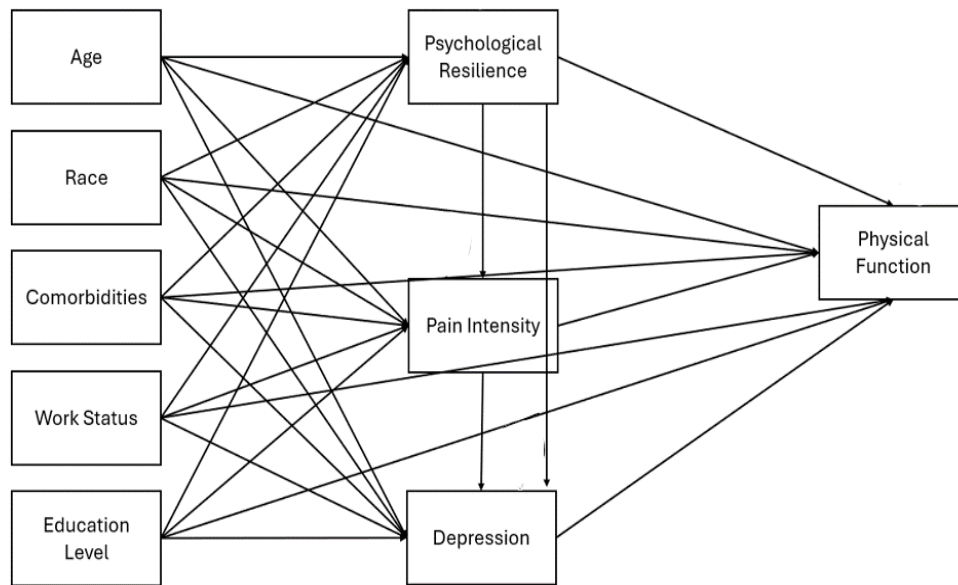
Data were analyzed using the Statistical Package for the Social Sciences (SPSS) software program version 29 and the Amos statistical software program. Descriptive statistics including means, proportions, and ranges were used to describe the sample. To test the hypothesis that pain intensity, depressive symptoms, and resilience positively impact physical function, structural equation modeling (SEM) was used to assess direct impacts of these predictor variables on physical function.⁴⁶ SEM is a multivariate approach that combines multiple regression and factor analysis to estimate a series of interrelated relationships among multiple variables which are hypothesized a priori.⁴⁷

The process of developing and testing the measurement model in this study allowed for the assessment of whether observed variables relating to physical function were indeed good indicators of function. The sample covariance matrix was used as input and a maximum likelihood solution employed. Model fit was estimated based on chi square divided by degrees of freedom (χ^2/df), the root mean square error of approximation (RMSEA), and the comparative fit index (CFI). The larger the probability associated with χ^2/df , the better the fit of the model to the data. A ratio of 3.0 is considered to be a good fit.^{48,49} A RMSEA value of $< .10$ is considered good, and < 0.06 is very good.⁵⁰ The CFI evaluates model fit relative to the null model. The results range between 0 and 1 with numbers closer to 1 indicative of better model fit.⁴⁷ The hypothesized model is provided in Figure 1.

Results

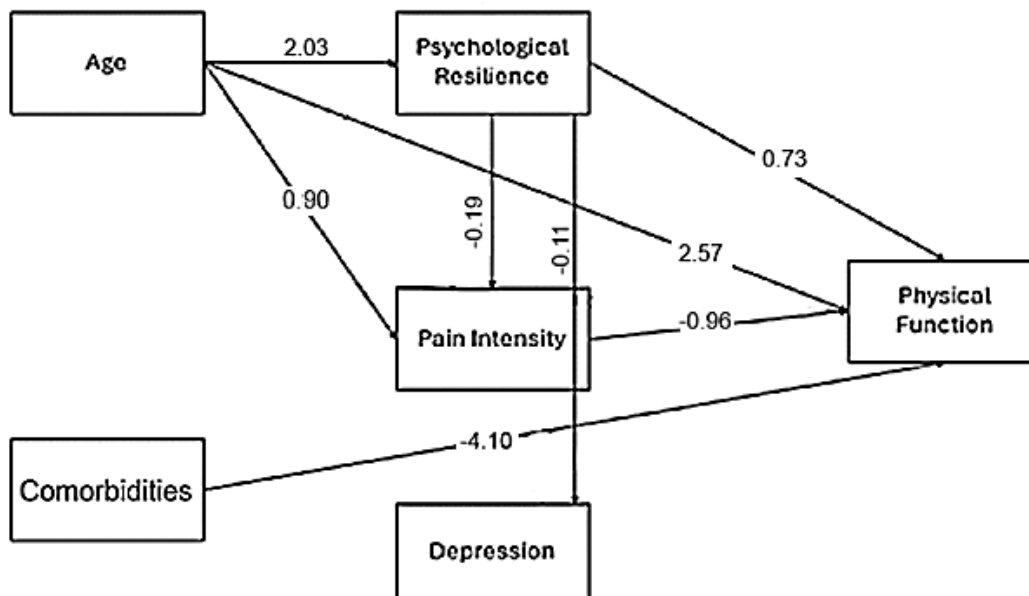
Table 5 provides demographic information of the participants. A majority of participants were female ($n=186$, 93%), between the ages of 36 and 50 ($n=159$, 79.5%) and identified as non-white ($n=124$, 62%). The mean physical function score was 56.93 ($SD=8.03$), indicating function was relatively decreased in the sample. A mean pain score of 8.09 ($SD=1.88$) out of a possible 9 points indicated that this sample experienced a relatively high level of pain. The mean resilience score (30.63, $SD=4.53$) was relatively low in this sample, although the range indicated at least some individuals scored well on the measure, indicating higher-than-average resilience in some of the participants. Testing of the full hypothesized model (Figure 3) resulted in 10 out of 25 paths being significant. There was poor fit of the data to the model, with a χ^2/df of 108/11, or 9.81 ($PCMIN=9.84$) and a RMSEA of 0.21.

Figure 3: Hypothesized SEM Model



Nonsignificant variables were excluded from the model, with retesting of a new model. The revised model resulted in 8 out of 8 paths being significant (Figure 4). The model fit improved with a χ^2/df of 16/5, or 3.2 (PCMIN=3.21) and a RMSEA of 0.10. The revised model explained 15% of the variance in psychological resilience, 25% of the variance in pain intensity, 19% of the variance in depression, and 38% of the variance in physical function. Age, comorbidities, psychological resilience, and pain intensity were directly associated with physical function with older age, fewer comorbidities, higher resilience, and lower pain intensity associated with higher levels of physical function. Age and comorbidities were indirectly associated with physical function through psychological resilience. Depression was the only variable to have neither a direct nor indirect impact on physical function.

Figure 4: Revised SEM Model



As shown in Figure 4, race, education level, and work status were not associated with resilience, pain intensity, depression, or physical function. Comorbidities were not associated with pain intensity or depression. Age impacted resilience ($\lambda=2.03$) and pain intensity ($\lambda=0.90$) such that those who were older had increased pain intensity and stronger psychological resilience. Age was not associated with depression. Resilience had a significant direct effect on pain intensity ($\lambda=-0.19$), depression ($\lambda=-0.11$), and physical function ($\lambda=0.73$) such that those who were more resilient had less pain, fewer depressive symptoms and better physical function. Resilience also had a significant indirect effect on physical function through pain intensity.

Discussion

While the full hypothesized model did not fit the data, the revised model showed eight significant relational paths. Together, age, comorbidities, resilience, pain intensity, and depression explained 38% of the variance in physical function. Specifically, our

results found that 1) age and comorbidities were both directly associated with physical function and indirectly associated through psychological resilience; 2) psychological resilience was both directly associated with physical function and indirectly associated through pain; and 3) depression was not found to be either directly or indirectly associated with physical function.

Age, Comorbidities and Psychological Resilience

Model testing in this study showed that age and comorbidities were directly associated with physical function, with older age correlating with improved physical function. While one might assume that younger age would predict better physical function, our data did not support this assumption. The majority of the study sample (86%) were 50 or younger. It is possible that the sample did not include enough older adults with chronic health issues that impacted their physical function for this variable to reach statistical significance.

Age and comorbidities were also indirectly associated with physical function through psychological resilience. Specifically, older age and fewer comorbidities were associated with greater resilience which then led to improved physical function. The association between older age and stronger resilience has been shown in prior research.^{97,98}

Psychological Resilience and Pain

Psychological resilience was shown to be directly linked to physical function. Psychological resilience may lead to resilient reintegration such that the individuals not only bounce back from the exposure to a challenging experience but they learn from it and grow. Richardson's Resiliency Model⁹⁹ describes resilience as a process of

reintegration following a disruption in homeostasis. Reintegration is an introspective process that results in insight or growth through disruption. Following exposure to a stressor, an individual may experience a disruption in homeostasis. This disruption can lead to dysfunctional re-integration, re-integration with loss, re-integration back to homeostasis, or resilient re-integration. Resilient re-integration involves factors which help to restore balance and lead to personal growth in response to adversity.⁹⁹ The process of resilient re-integration may help FM patients better manage their conditions, learn coping strategies, and ultimately improve their overall physical function.

Our study also noted that resilience was associated with physical function indirectly through pain intensity. This finding suggests that pain intensity can mediate the relationship between resilience and physical function. Resilient coping may reduce the negative impact of pain intensity which could lead to improved physical function.¹⁰ Interventions that may play a significant role in promoting resilient re-integration include mental health and cognitive-behavioral therapies, meditation and mindfulness based interventions, and exercise training programs.¹⁰

It should be noted that our measure of resilience may have certain limitations. The CD-RISC-10 was used in our study and prior research has supported the reliability and validity of the CD-RISC-10 with strong internal consistency;^{8,69,100} and evidence of construct,^{30,69,101} convergent,³⁰ and concurrent validity.¹⁰¹ Some studies, however, have noted a ceiling effect. Our prior testing of the measure using a Rasch measurement model also showed that 21% of the sample was so high in resilience, the CD-RISC-10 could not meaningfully differentiate between them. Future use of the measure might benefit from additional items that are more challenging.^{28,102} For example, a higher level of resilience

might be reflected in changing one item on the CD-RISC-10 to read “I embrace failure in order to learn and grow”. Another statement that might be added could be “I choose to stay positive when difficulties arise”.

Depression

Finally, depression was not found to have a direct or indirect impact on physical function. This is contrary to a prior research study noting that depression was the strongest predictor of functional capacity (as measured by fibromyalgia impact questionnaire (FIQ) scores which include physical function) and explained 29% of the variance in scores,⁵⁸ and another study demonstrating that FM patients with a higher risk of depression had higher FIQ scores.¹⁰³ Differences may be due to measurement issues. In our study, the physical function scale focused on activities persons believed they were able to perform but not whether they actually performed them. Other studies have evaluated function by measuring functional capacity which asks participants to report on the activities they actually performed.¹⁰⁴

* * *

Additional variance of physical function may be explained by factors found in prior studies but were not included in this model. These factors include fatigue, physical activity, and psychological distress.^{7,28} For example, in one study,⁷ an active lifestyle was found to be associated with lower levels of physical fatigue, which in turn was associated with reduced FM severity. Further the findings from that study noted that high resilience was also associated with lower psychological distress and reduced FM severity.⁷ In another study of 439 women with FM, moderate to vigorous physical activity was independently associated with less pain, less fatigue, and less overall disease severity.⁷⁶

Similarly, a study of 424 women with FM revealed that higher levels of physical fitness and increased subjective well-being (included affect, and cognitive well-being) were associated with lower FM symptom severity.¹⁰⁵

Moreover, our study focused specifically on depression but did not address other forms of psychological distress such as anxiety or emotional trauma. It also did not measure fatigue or physical activity (a concept that is different from physical function). To more comprehensively consider the factors associated with physical function, it may be helpful to examine the combined effects of resilience, physical activity, physical fatigue, and other forms of psychological distress on physical function in individuals with FM.

Strengths and Limitations

One strength of this study was the use of a national sample and robust analytic methods using SEM to examine factors that impact psychological resilience and physical function among adults with FM. However, the sampling was limited in that participants were recruited from a single online registry and thus findings may not be generalizable to populations that are not connected to FM groups. The study was further limited by its cross-sectional design, which did not allow for causation to be tested. A third limitation centered around measurement challenges and the use of subjective reporting for all measures which could be biased due to social desirability or recall bias, limiting generalizability. Future research may wish to include objective measures of physical function. Finally, the lack of diversity in FM research compromises generalizability of study findings and may contribute to health disparities in FM treatment. Future studies

should seek to include more male participants and to seek a wider degree of racial diversity in other underrepresented populations.

Despite these limitations, this research has added to the body of literature, supporting the direct impact of resilience on the promotion of physical function in adults with FM and the mediating impact of pain on the relationship between resilience and physical function. The findings gleaned from these studies may inform future researchers and practitioners in developing interventions to optimize physical function in adults with FM by strengthening resilience through interventions that promote resilient re-integration.

Conclusion

Nurses caring for patients with FM are in an ideal position to improve their physical function by providing evidence-based care that is individualized to the needs of their patients and fosters resilience. It is critical to understand the impact of mediating factors on the relationship between resilience and physical function in order to optimize clinical outcomes and develop individualized therapeutic interventions. The findings from this study affirm the importance of promoting psychological resilience and ultimately improving physical function in adults with FM.

Exploration of resilience and physical function provides a lens informed by the experience of persons living with FM and not by prior assumptions or observations of care providers. The insights gleaned from this study have the potential to benefit persons with FM by leading to an improved understanding of the factors that impact physical function in adults with FM. This will help inform FM care and add to the knowledge base on how to assist individuals with FM in better coping with their disorder.

These findings help to inform future research and practice by serving as a foundation for interventions focused on strengthening resilience, and thereby enhancing physical function, among adults living with FM. In so doing, adults living with FM may become better equipped to manage their symptoms and to experience improvements in their overall functioning.

Chapter 5: Discussion, Inferences, and Suggestions for the Future

The purpose of this dissertation was to: 1) conduct a scoping review of the literature on factors associated with physical function in adults with fibromyalgia (FM); 2) assess the reliability and validity of the 10-item Connor-Davidson Resilience Scale in adults with FM; and 3) explore the direct impact of psychological resilience, pain intensity, depressive symptoms, comorbidities, age, sex, race, education, and work status and the indirect association of comorbidities, age, sex, race, education, and work status through resilience, pain intensity, and depressive symptoms on physical function among adults with FM. The three manuscripts comprise Chapters 2, 3, and 4 of this dissertation.

The first manuscript, entitled “Physical Function in Adults with Fibromyalgia: A Scoping Review” synthesized the extant literature on the impact of FM on physical function, identified measures of physical function, and examined factors associated with physical function in adults living with FM. The second manuscript entitled “The Psychometric Properties of the Connor-Davidson Resilience 10-Item Scale (CD-RISC-10) in Individuals with Fibromyalgia” examined psychometric properties of the Connor-Davidson Resilience Scale in a sample of adults with FM using Rasch and DIF analyses. The third manuscript entitled “Factors Associated with Physical Function in Adults with Fibromyalgia” employed structural equation modeling to test a model of factors associated with resilience and physical function in adults with FM. This chapter summarizes the major findings of these manuscripts, implications for nursing practice and education, recommendations for future research, and study strengths and limitations.

Study Findings

Physical Function in Adults with Fibromyalgia: A Scoping Review

The purpose of this scoping review was to synthesize applicable literature on physical function among adults living with FM, to elucidate gaps in the literature, and to recommend directions for future research related to physical function among those living with FM. The Joanna Briggs Institute (JBI) scoping review methodology was used to identify and synthesize studies.⁵² PubMed, Embase, CINAHL, and PsycINFO databases were searched. The literature search encompassed adults with FM (population) and the concept of physical function. Each database search was tailored to the individual databases using standardized terms to describe article content, such as Medical Subject Headings (MeSH) and Emtree terms, for physical function and FM. Articles were screened using Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines. Search terms were developed based on variations of the following key phrases: physical function, instrumental activities of daily living, fibromyalgia, and chronic pain. The resulting thirteen articles were comprehensively reviewed.

Findings revealed a variety of measures of physical activity/functional ability but only a few measures of true physical function. Few studies have examined physical function as a distinct variable. Prior studies demonstrate that physical function scales are often subsumed into health-related quality of life or general function measures. In most studies represented in this scoping review, physical function was examined as a subset of a broader or related concept, such as functional independence, occupational performance, or self-efficacy.

Several factors were noted to be associated with physical function directly or indirectly, including resilience, depression, and multi-morbidity. To date, models of FM severity have either neglected to include factors that mediate the relationship between FM severity and function or have omitted physical activity/functional ability from the model.^{8,106}

This scoping review provided information on current studies examining physical function in adults with FM, measures of physical function, and factors associated with physical function. This review may aid researchers in the selection of measures that best capture the critical attributes of the concept of physical function and factors that may impact physical function. Additional factors to be considered in future research should include a more diverse demographic (the populations included in these studies were homogenous and lacked diversity) and pain intensity. Additional studies of physical function in adults with FM in racially and culturally diverse populations are needed. A deeper examination of social and/or financial impacts may also be of benefit, as both may be closely tied to physical and psychological health.

For the practitioner, this review can inform clinical practice by raising awareness of the importance of physical function in patients with FM and by addressing factors that promote physical function such as interventions that optimize resilience and manage depressive symptoms. In summary, this scoping review laid a foundation for the development of future research contributing to the advancement of the understanding of factors associated with physical function among adults living with FM.

The Psychometric Properties of the Connor-Davidson Resilience 10-Item Scale (CD-RISC-10) in Individuals with Fibromyalgia

The purpose of this study was to assess the reliability and validity of the 10-item Connor-Davidson Resilience Scale (CD-RISC-10) in adults with FM. This instrument was evaluated in a sample of 200 adults with FM using Rasch analysis. Reliability was assessed using item separation. Construct validity was assessed based on model fit and INFIT and OUTFIT statistics. Construct validity was also evaluated using hypothesis testing. Specifically, it was hypothesized that resilience would be associated with physical function and pain intensity, such that stronger psychological resilience would be associated with better physical function and less pain. A linear regression analysis was done to test the relationship between resilience with pain intensity and resilience with physical function.^{8,67,80}

This study supported the reliability and validity of the Connor-Davidson Resilience Scale in measuring the concept of psychological resilience in a sample of adults with FM. Specifically, there was evidence of item reliability for the CD-RISC-10, given an item separation of 5.09 and item reliability of .96. All items on the CD-RISC-10 fit with the concept of psychological resilience, evidenced by acceptable INFIT and OUTFIT statistics close to 1. None of the items were out of range in the INFIT or OUTFIT statistics. However, there were 2 standard deviations between the mean person score with the mean item score, which indicates the item difficulty did not match with the participants. In 42 participants (21% of the sample) psychological resilience was so high that they could not be differentiated with the CD-RISC-10.

In regard to hypothesis testing, when controlling for age, sex, and comorbidities, as hypothesized there was a significant relationship between resilience and physical function ($R^2=0.44$, $F=31.61$, $p<0.001$) and resilience and pain intensity ($R^2=0.40$, $F=29.45$, $p<0.001$). Individuals with higher psychological resilience experienced increased physical function and lower pain intensity. For every one unit increase in physical function, resilience increased by .26 units ($p<0.001$); and for every one unit increase in pain intensity, resilience decreased by one unit ($p<0.001$). In hypothesis testing, the variables of sex, age, and comorbidities were controlled for, as some FM symptom variability has been noted to occur with sex/gender,^{77,76,81,82} age,⁸³ and comorbid conditions.⁸⁴

In summary, there was sufficient evidence to support the reliability of the CD-RISC-10 based on item separation index and item reliability estimates provided through Rasch analysis. Furthermore, there was evidence to support the validity of the CD-RISC-10 based on construct validity and hypothesis testing. All of the items fit the model based on adequate INFIT and OUTFIT statistics.

It is important to note that, in Rasch measurement mapping, 21% of the sample was so high in resilience they could not be differentiated using the CD-RISC-10. Other studies have found a similar ceiling effect whereby items on the CD-RISC-10 were more likely to provide coverage at low to moderate resilience levels but less likely to reliably measure high levels of resilience.^{28,80} Future studies seeking to measure individuals with FM and other chronic pain experiences should consider adding more challenging items. Examples of such items might be “I choose to embrace failure as an opportunity to learn and grow” which reflects a positive mindset that encourages continuous self-

improvement or “I choose to stay positive when nothing is going my way” which reflects the ability to maintain a positive outlook even in in the most difficult of situations.

Overall, the findings support the reliability and validity of the CD-RISC-10, which is consistent with prior research in individuals with FM.³⁰ The sample used for psychometric testing included mostly white women. Future testing of the measure should include a sample with greater racial and gender diversity.

Factors Associated with Physical Function in Adults with Fibromyalgia

The purpose of this study was to explore the direct impact of psychological resilience, pain intensity, depressive symptoms, comorbidities, age, sex, race, education, and work status and the indirect association of comorbidities, age, sex, race, education, and work status through resilience, pain intensity, and depressive symptoms on physical function among adults with FM. It was hypothesized that higher levels of pain intensity and numbers of depressive symptoms and comorbidities would negatively impact physical function in adults with FM, while psychological resilience would positively impact physical function in adults with FM. A second hypothesis was that comorbidities, age, sex, race, education, and work status would directly and indirectly impact physical function through resilience, pain intensity, and depressive symptoms in adults with FM.

With regard to model testing, the dependent variable in this study was physical function. Data was analyzed using the Statistical Package for the Social Sciences (SPSS) software program version 29. Descriptive statistics including means, proportions, and ranges were used to describe the sample. To test the hypothesis that pain intensity, depressive symptoms, and resilience positively impact physical function, structural equation modeling (SEM) was used to assess direct impacts of these predictor variables

on physical function using the Amos statistical program.⁴⁶ SEM is a multivariate approach that combines multiple regression and factor analysis to estimate a series of interrelated relationships among multiple variables which are hypothesized a priori.¹⁰⁷ The process of developing and testing the measurement model in this study allowed for the assessment of whether observed variables relating to physical function were indeed good indicators of function. The sample covariance matrix was used as input and a maximum likelihood solution employed. Model fit was estimated based on chi square divided by degrees of freedom (χ^2/df), the root mean square error of approximation (RMSEA), and comparative fit index (CFI). The larger the probability associated with χ^2/df , the better the fit of the model to the data. A ratio of 3.0 is considered to be a good fit.^{48,49} A RMSEA value of $< .10$ is considered good, and <0.06 is very good.¹⁰⁸ The CFI evaluates model fit relative to the null model. The results range between 0 and 1 with numbers closer to 1 indicative of better model fit.⁴⁷

The revised model explained 15% of the variance in psychological resilience, 25% of the variance in pain intensity, 19% of the variance in depression, and 38% of the variance in physical function. Age, comorbidities, psychological resilience, and pain intensity were directly associated with physical function with older age, fewer comorbidities, higher resilience, and lower pain intensity associated with higher levels of physical function. Age and comorbidities were indirectly associated with physical function through psychological resilience. Depression was the only variable to have neither a direct nor indirect impact on physical function.

Race, education level, and work status were not associated with resilience, pain intensity, depression, or physical function. Comorbidities were not associated with pain

intensity or depression. Age impacted resilience and pain intensity such that those who were older had more pain and stronger psychological resilience. Age was not associated with depression. Resilience had a significant direct effect on pain intensity, depression, and physical function such that those who were more resilient had less pain, fewer depressive symptoms and better physical function. Resilience also had a significant indirect effect on physical function through pain intensity.

In summary, in this study, resilience was found to directly impact physical function. Resilience also had an indirect effect on physical function through pain intensity suggesting that pain intensity may mediate the relationship between resilience and physical function.

Implications for Nursing Education and Practice

The insights gleaned from this research have the potential to benefit persons with FM by leading to an improved understanding of the factors that impact physical function in adults with FM. Exploration of resilience and physical function provides a lens informed by the experience of persons living with FM and not by prior assumptions or observations of care providers. This will help inform FM care and add to the knowledge base on how to assist individuals with FM in better coping with their disorder.

Nurses caring for patients with FM are in an ideal position to improve their physical function by providing evidence-based care that is individualized to the needs of their patients and fosters resilience. The finding that resilience is directly related to physical function helps to inform clinical practice by encouraging nurses to evaluate resilience and utilize known interventions that strengthen resilience, thereby enhancing physical function among adults living with FM. In so doing, adults living with FM can be

better equipped to manage their symptoms and to experience improvements in their overall functioning. To evaluate psychological resilience, nurses caring for patients with FM can use the CD-RISC-10 to assess the level of resilience in their patient populations and implement interventions that may improve their resilience. Interventions that may play a significant role in promoting psychologic resilience include mental health and cognitive-behavioral therapies, meditation and mindfulness-based interventions, and exercise training programs.¹⁰ The goal in strengthening resilience is to help individuals optimally manage their FM symptoms and engage in their highest level of physical function. In addition, psychologically strengthening resilience should also ultimately lead to helping the individual reach resilient re-integration and grow from the experience. Resilient re-integration is an introspective process that results in insight or growth through disruption.⁹⁹

The findings from this study also affirm the importance of pain management in promoting psychological resilience and ultimately improving physical function in adults with FM. Nurses should be educated on the impact of pain intensity in mediating the relationship between resilience and physical function and should focus on evaluation of pain and implementation appropriate interventions to decrease pain in patients with FM.¹⁰⁹ To leverage patient resilience and maximize physical function, pain management should be considered an important cornerstone of care. Nurses should be educated on best practices in acute and chronic pain management with key outcomes that address improved quality of life, function, and activities of daily living.¹¹⁰ Pain care should incorporate not only pharmacological approaches but restorative therapies, interventional and behavioral approaches, and complementary and integrative health.¹¹¹ Moreover,

nurses should be on the forefront of advancing pain research and policy that promotes patient centered care in the diagnosis and management of pain disorders.¹¹⁰

Nursing programs should place greater emphasis on evidenced based pain management in their curricula. An integrative review of literature on nursing students' knowledge and attitudes towards pain management revealed that, internationally, nursing students have limited knowledge of pain management, due, in part, to lack of education.¹¹² They also often harbor` negative attitudes and misconceptions regarding pain and the use of pain medications.¹¹²

Implications for Research

Physical Function

Research on factors associated with physical function using psychometrically validated measures of resilience ensures more accurate measurement of critical attributes and inform interventions to optimize resilience and promote physical function. It is critical to understand the impact of mediating factors on the relationship between resilience and physical function to optimize clinical outcomes and develop individualized therapeutic interventions.

Measurement of physical function in research with individuals with FM has not been consistent or well conceptualized. Many earlier studies considered physical function within health-related quality of life or general function measures. Instruments such as the Short Form (SF) 36 Health Survey, the SF 12 Health Survey, and the Fibromyalgia Impact Questionnaire (FIQ) include subsections or subscales that measure physical function as a component of overall function or health related quality of life.^{3,10,54,56,57,105,113,114} Additional studies in our scoping review considered physical

function as a subset of functional independence,⁵⁷ occupational performance,⁵⁷ or self-efficacy.⁶¹

In the current study, physical function was defined as the ability to perform activities requiring moderate physical effort, including instrumental activities of daily living (IADL's) and performance of household tasks (e.g. carrying groceries, twisting a lightbulb, doing yardwork).¹⁴⁻¹⁶ Physical function differs from physical activity, as it refers to routine activities that are essential to living an independent life, while physical activity refers to any bodily movement produced by skeletal muscles that requires energy expenditure.¹⁷ While individuals living with FM are generally able to perform activities of daily living (ADL's), such as eating, toileting, and basic ambulation, higher level physical function (e.g., doing yardwork) is often limited in the FM population.¹⁸

In this dissertation work, physical function was measured using items from the Patient Reported Outcomes Measurement Information System Physical Function (PROMIS-PF) scale. PROMIS is a National Institute of Health (NIH) directed initiative aimed at developing validated instruments to measure clinical outcomes across diverse research and clinical settings, allowing for comparisons between different patient populations. Unlike the concept of disability, physical function measures functions above and below the population mean and reflects a more comprehensive range of abilities. The PROMIS-PF scale is a self-report measure of self-care and selected activities requiring strength, mobility, and endurance.¹⁵ From the original PROMIS-PF measure, 20 items were selected, with items encompassing one's ability to dress, wash, run, lift heavy objects, walk, participate in strenuous sports, climb stairs, carry groceries,

and perform chores such as yardwork or vacuuming.³² The items produced a skewness of -.421 and created a normal bell curve when analyzed (see Figure 5).

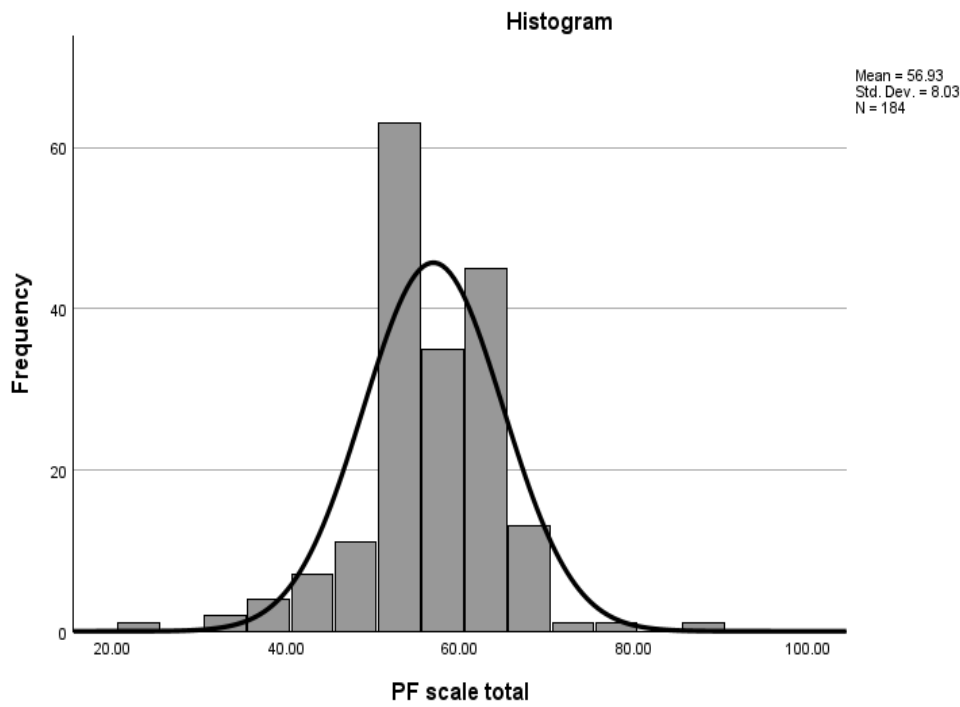


Figure 5: PROMIS-PF Histogram

Measurement of resilience is also challenging to address when working with individuals with FM. The Connor-Davidson Resilience Scale was found to be a reliable and valid measure of psychological resilience in a sample of adults with FM. As noted above, a recommendation in the use of this measure is to add more challenging items. There are, however, other types of resilience identified in the literature that may influence outcomes among individuals with FM. For example, physical resilience is the ability to recover or optimize function when dealing with age or disease related loss. Health resilience is the ability to maintain health in the midst of adversity. Physiological resilience is the capacity of the human body to mobilize physiological resources to build, maintain, and repair itself.¹¹⁵ Future research on factors impacting physical function in

individuals with FM should consider incorporating measures that capture these other types of resilience.

Finally, additional research is needed to develop and test interventions to strengthen resilience in individuals with FM. Interventions found in the literature to build resilience include cognitive-behavioral therapies, mindfulness-based interventions, acceptance and commitment therapy (accepting events in the present and committing to positive behavior change), attention and interpretation therapy (developing awareness of body sensations, thoughts, and emotions), problem solving therapy (helping individuals to analyze problems and set goals), and self-inoculation (exposing persons to mild forms of stress to enhance and strengthen coping skills).¹¹⁶ These types of therapies may contribute to improved psychological resilience.¹¹⁷

Strengths and Limitations

Strengths of the study included a robust sample size and the use of a national study sample. A significant challenge of this study was related to the use of purposive sampling which limits generalizability of study findings. Specifically, all participants were from an online registry and these individuals may be different from other patients with fibromyalgia that are not as engaged in groups such as the Autoimmune Registry. Another limitation is the cross-sectional design, which precludes any causal interpretation. A third limitation involved the use of subjective reporting for all measures, which could lead to social desirability or recall bias, limiting validity of the findings. Future research, for example, may wish to include objective measures of physical function. Despite these limitations, this research has added to the body of literature supporting a psychometric resilience measure and tested a model of factors associated

with resilience and physical function in adults with FM. The findings gleaned from these studies may inform future researchers and practitioners in developing interventions to optimize physical function in adults with FM.

Summary

This chapter summarizes key findings from this dissertation study including implications for nursing practice and research and strengths and limitations of this body of research. This dissertation contributes to the research literature on resilience and physical function among adults with FM by providing evidence to support the reliability and validity of a resilience measurement tool and by testing a model of factors associated with physical function that may inform future interventions that will assist individuals with FM in better coping with their disorder.

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