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Grip Strength and Quality of Life among Community-Dwelling Older Adults:

A Literature Review

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Abstract

Loss of muscle strength is one of the key features of aging. Quality of life is a factor that affects productive aging and loss of muscle strength. A literature review was completed to assess the possible relationship between grip strength and quality of life among community-dwelling older adults, as measured through physical health in terms of independence with ADLs/IADLs, physical disability, and mobility. Articles were collected from various peer-reviewed, publish journals using the available databases of Western Michigan University libraries. Databases used include PubMed, Clinical Keys, the National Institute of Health (NIH), Springer Link, Scopus, BioMed Central, Wiley, and Oxford Academic. The following keywords were used: “grip strength”, “quality of life”, “muscle strength”, “older adults”, “physical health”, “physical functioning”, “functional health”, “functional mobility”, and “frailty”. Based upon the literature reviewed, the greater the grip strength, and more generally muscle strength, the greater the quality of life in older adults. Next, research was completed to find different activities and tools that could be used to improve grip strength in an adult outpatient occupational therapy setting. There are currently many tools and activities available to occupational therapy practitioners to address grip strength in their older clientele to improve quality of life.

Generally, it is understood that the more one ages the more muscle strength is lost. Loss of muscle strength causes greater dependence with activities of daily living (ADLs)/instrumental activities of daily living (IADLs), greater risk and occurrence of physical disability, and greater complications with mobility. It is expected and widely accepted that the aging population will face these challenges. A wide examination of the relationship between grip strength and quality of life (QoL) has not been done thus far. Due to the fact that research in this area is relatively new, a comprehensive literature review is warranted. What is not understood is how this impacts QoL. More specifically, how can occupational therapy practitioners (OTP) address strength deficits in an adult outpatient setting with the goal of improving the quality of life of their clients. The purpose of the present review is twofold. The first will discuss the possible relationship between grip strength and quality of life, as measured through independence with ADLs/IADLs, physical disability, and mobility. The second will examine the relationship's implication in an adult outpatient occupational therapy (OT) setting.

Nine studies were examined and used in this literature review. The studies were conducted in France, Norway, Korea, China, Indonesia, Finland, the United States, Israel, and the Netherlands. All the studies used in this literature review measure grip strength or hand grip strength using a Jamar hand-held dynamometer.

It should be noted that most of the research articles measured quality of life indirectly. The indirect measures were areas of ADL/IADL independence, physical disability, and mobility. These measures were used due to the fact that these skills are generally included in QoL assessments. All studies assess these areas of QoL using various questionnaires. Additionally, for the purpose of this review ADL/IADL independence, physical disability, and mobility were the major themes identified.

The primary focus of occupational therapy is our patients' return to improved performance of ADLs and IADLs. Thus, eight of the nine articles examined in this review used ADL/IADL completion and independence as a measure of QoL. Pengpid and Peltzer (2018) used independence and completion of five specific ADLs and 6 specific IADLs as a means to measure physical health in QoL in 7,097 men and women aged 50 years or older in Indonesia. The ADLs examined included activities such as dressing and eating, while the IADLs included household tasks such as preparing meals and shopping. Questionnaires were used to record specific levels of difficulty and independence in these areas. Physical health in QoL was also measured using a perceived health status questionnaire and a shortened physical activity questionnaire. Grip strength was measured using an average score from two trials on the non-dominant and dominant hands of the participants. The analysis concluded that grip strength was positively associated with self-reported health status and was negatively associated with functional disability. Therefore, those with higher self-reported health status demonstrated a stronger grip strength demonstrating the better the health status, the better the grip strength and vice versa. Additionally, those who reported a lower functional disability status, meaning more independence and greater performance when completing ADLs/IADLs, demonstrated a higher grip strength. Again, the lower the disability status and the greater independence and completion of ADL/IADL activities, the stronger the grip strength and vice versa. However, it is important to note, since these connections are only correlational, it cannot be definitively said if either causes the other or if they share a bidirectional relationship.

A large study conducted by Kang, Lim, and Park (2018) in Korea provided additional evidence that grip strength is correlated with QoL. This study included 2,070 Korean men and 2,550 Korean women aged 55 years or older. ADL/IADL function and independence was

measured through The Korean version of the Global Physical Activity Questionnaire (GPAQ) and the European Quality of Life Scale-Five Dimension (EQ-5D). ADLs/IADLs included functional mobility, washing, dressing, working, studying, housework, family management, and leisure participation. Grip strength was measured in standing using the maximum score of the dominant hand after three trials. The analysis yielded that the odds ratios for low grip strength in both men and women significantly increased with age. Men with low grip strength presented with an almost two times greater risk of problems with functional mobility. Women with low grip strength fared worse with having an almost three times greater risk of problems with functional mobility and almost three times greater risk for decreased independence with ADLs/IADLs. Since these areas are included in the GPAQ and the EQ-5D, this led to a greater risk of decreased quality of life in both men and women who present with low grip strength.

Buckley, Stokes, and Samuel (2018) also examined ADLs and grip strength in relation to QoL. Conducted in the United States, 29 female golfers, aged 65-80 years of age, had their QoL measured through functional endurance and ADL completion. This was done through a short functional endurance test, while participants had their respiration rate and heart monitored during completion of various ADLs. The SF-36 was also administered to measure QoL. Grip strength was measured using the maximum values after three trials of both the dominant and non-dominant hands of the participants. Grip strength was found to be highly correlated with functional endurance related to completion of ADLs. Therefore, those who presented with lower grip strength were found to have poorer functional ability, reducing their perceived QoL. Meaning, those with weaker grip strength, even in relatively healthy and active older adults, are more likely to have increased difficulties completing ADL tasks leading to a decrease in QoL.

Stessman et al. (2017) also examined ADL independence and completion in measuring QoL through physical health in 2,247 men and women aged 70 years or older in Israel. The ADLs included in the questionnaire were transferring, dressing, bathing, toileting hygiene, continence, and eating. Physical health was also examined throughout the study as an influencer in all-cause mortality. Grip strength was measured using the maximal score after three trials on the participants dominant hand. The results showed that low grip strength was directly related to functional decline and mortality. Low grip strength was associated with higher risk of functional decline leading to mortality. Specifically, declining grip strength between the ages of 70-90 was strongly associated with increased functional decline, increasing the risk of all-cause mortality. This means that those who presented with lower grip strength had a higher risk of requiring more help with the specified ADL tasks, which suggests an association of increased risk of death. Those who presented with low grip strength between the ages of 70-90 had an extremely high chance of requiring more help with the specified ADL tasks, which in turn is associated an increase in their risk of all-cause mortality.

An experimental study was conducted by Haraldstad et al. (2017) that briefly looked at independence with ADLs/IADLs, including walking and biking. A health-related QoL measure, the SF-12, was used as a direct means to measure QoL which included physical functioning of ADLs/IADLs. Grip strength was measured using one trial of the dominant hand on participants. Both outcome measures were administered pre/post intervention and after the intervention. The experiment was conducted in Norway with 49 men aged 60-81 years of age. Half the participants in the study underwent a 12-week intervention period which consisted of strength training programs which the participants received three times per week. The other half received no intervention and was used as the comparison group. Following the intervention period, the

participants' strength was re-assessed, and they completed the SF-12. The non-intervention group scored significantly lower on the SF-12 after 12 weeks as compared to the intervention group, and there was no change in grip strength. Two categories of the SF-12, physical functioning and general health, significantly improved for the intervention group after the 12 weeks. This indicated a strong causal relationship between grip strength and QoL. Meaning, as the grip strength improved with the intervention group, as did their perceived QoL.

Barbat-Artigas et al. (2013) also used IADLs and leisure activities as methods to measure QoL in 1,462 women aged 75 years or older in France. In this study, IADLs and leisure activities included walking, cycling, swimming, gardening, and gym activity. These activities were measured through self-reported questionnaires, including the type, frequency, and duration of the activities. Grip strength was measured using 3 trials in the dominant hand of the participant in which the highest value was taken. In this study, grip strength was found to be a strong predictor of disability and mortality for this population. Specifically, low grip strength was associated with two times the greater risk of disability and low functional capacity. Therefore, those with lower grip strength were at a higher risk of disability, increased dependence of IADL and leisure activities, and death, than those with a higher grip strength.

Peterson et al. (2017) used independence and completion of ADLs/IADLs as a way to measure QoL through physical health in a quasi-experimental design. In this study, the results obtained from 4,544 participants in the United States were compared to the results obtained from 6,030 participants in China in terms of grip strength and QoL. In the United States, functional disability level was measured through self-report on a questionnaire. In China, functional disability level was measure through independence with ADLs. ALD tasks included dressing, feeding, toileting hygiene, bathing, getting into or out of bed, and continence with urination and

defecation. In the United States, grip strength was measured using the maximal score after three trials on dominant and non-dominant hands of the participants. In China, participants' grip strength was measured using the maximal score after two trials of the dominant and non-dominant hands of the participants. The results showed similar correlations in both countries. In both the United States and China, grip strength was highly correlated with physical disability. In the United States, an individual's physical disability would coincide with the disability level questionnaire. In China, an individual's physical disability would coincide with completion of the specified ADL tasks. For both countries, this means that the lower the grip strength, the higher the risk for physical dysfunction and completion with ADL tasks. Though the results are similar, it is important to note that because of the difference in which the variables were measured and the difference in the number of participants, further evaluation is needed to show a true comparison yielding similar results.

The eighth and final study that examined ADL/IADL function as means to measure QoL was conducted in the Netherlands by Taekema et al. (2010). In this longitudinal study, 555 men and women, all aged 85 years old at baseline were followed from 1997-1999. Their ADL/IADL completion and function and grip strength were measured at baseline, at age 85, and at age 89. ADL/IADL completion and function were measured through the Groningen Activity Restriction Scale (GARS). The GARS included nine ADLs and nine IADLs. Grip strength was measured both times using the maximum values after three trials on the dominant hands of the participants. At baseline, lower grip strength was correlated with poorer scores in functional health domains. At age 89, those who had presented with lower grip strength at baseline had regressed even further, resulting in even poorer scores in functional health domains. In all participants, ADL/IADL completion and functional and grip strength declined, leading to greater dependency.

In this study, low grip strength is seen as a predictor of accelerated dependency of ADL/IADL completion and function, leading to a lower QoL.

The only article included in this literature review that did not include a QoL measurement through ADLs/IADLs was conducted by Sallinen et al. (2010). Conducted in Finland, this study included 1,084 men and 1,562 women aged 55 years or older. The goal of the study was to identify the overall grip strength cut points for both men and women in identifying mobility limitations. QoL was measured through a mobility questionnaire. Grip strength was measured using the maximum value of two to three trials on the dominant hands of the participants. Grip strength was also used as a proxy for overall muscle strength as well. The results yielded that the grip strength cut point for men was 37 kg and the grip strength cut point for women was 21kg. Additionally, those with grip strength below the identified cut points had three times the greater risk of mobility limitations. This means, the lower the grip strength, especially below the cut point, the more likely both sexes are to experience problems and increased independence with mobility.

The following table provides a brief overview of all the literatures discussed:

Authors	Title	Study Design	Country	Variables	Results
Barbat-Artigas, S., Rolland, Y., Cesari, M., Abellan van Kan, G., Vellas, B., & Aubertine-Leheudre, M. (2013)	<i>Clinical relevance of different muscle strength indexes and functional impairment in women aged 75 years and older</i>	Cross-Sectional Prospective Cohort Study	France	IADLs & Leisure - walking, gymnastics, cycling, swimming, and gardening Hand grip Strength (HGS) - maximal score after 3 trials on dominant hand only	HGS found to be a strong predictor of disability and mortality Low HGS associated with 2x increased risk of disabilities and low functional capacity
Buckley, C., Stokes, M., & Samuel, D. (2018)	<i>Muscle strength, functional endurance, and health-related</i>	Limited Cross-Sectional Study	United States	Grip Strength (GS) - maximal score used after 3 trials for both dominant and non-	GS correlated with functional endurance

	<i>quality of life in active older female golfers</i>			dominant hand Functional Endurance - 1-min sit to stand, 30 second wall press, and 2-min stair climb Health-Related Quality of Life (HRQoL) - SF 36 Questionnaire	Loss of muscle strength associated with poorer functional ability, which results in decreased HRQoL
Haraldstad, K., Rohde, G., Stea, T., H., Lohne-Seiler, H., Hetlelid, K., Paulsen, G., & Berntsen, S. (2017)	<i>Changes in health-related quality of life in elderly men after 12 weeks of strength training</i>	Double-Blind Experimental Design	Norway	Health-Related Quality of Life (HRQoL) - SF 12; shortened version of SF 36 Strength - maximal leg extension, leg press, and biceps curl	HRQoL strongly correlated with muscle strength Higher muscle strength correlated to fewer physical limitations and increased ability to carry out ADLs
Kang, S.Y, Lim, J, & Park, H.S. (2018)	<i>Relationship between low handgrip strength and quality of life in Korean men and women</i>	Cross-Sectional Design Study	Korea	Handgrip Strength (HGS) - maximal score used after 3 trials of dominant hand only Quality of Life (QoL) - European Quality of Life Scale - 5 Dimensions (EQ 5D) Physical Activity - Korean Version of Global Physical Activity Questionnaire (GAPQ)	Men with low HGS had poorer QoL, specifically relating to mobility and pain/discomfort Women with low HGS had poorer QoL, specifically relating to mobility, ADLs, and pain/discomfort Synergistic relationship between physical activity and HGS is plausible Therefore, greater HGS may result in greater QoL

Pengpid, S. & Peltzer, K. (2018)	<i>Hand Grip Strength and Its Sociodemographic and Health Correlates among Older Adult Men and Women (50 Years and Older) in Indonesia</i>	Cross-Sectional Design Study	Indonesia	Hand Grip Strength (HGS) - 1 average score from 2 trials on non-dominant hand and dominant hand Self-Related Health Status - questionnaire Functional Disability - difficulty with completion of 5 ADLs and 6 IADLs Physical Activity - Physical Activity Questionnaire; shortened version	HGS positively associated with self-rated health status HGS negatively associated with functional disability
Peterson, M. D., Duchowny, K., Meng, Q., Wang, Y., Chen, X., & Zhao, Y. (2017)	<i>Low Normalized Grip Strength is a Biomarker for Cardiometabolic Disease and Physical Disabilities Among U.S. and Chinese Adults</i>	Quasi-Experimental Design Study	United States & China	Grip Strength (GS) U.S. - maximal score after 3 trials on dominant and non-dominant hand GS China - maximal score after 2 trials on dominant and non-dominant hand Normalized Grip Strength (NGS) - dividing GS by body mass Level of Disability U.S - Physical Functioning Questionnaire Level of Disability China - independence with ADLs	NGS highly correlated with physical disabilities in both U.S. and China Poorer GS indicated increased risk for physical dysfunction
Sallinen, J., Stenholm, S., Rantanen, T., Heliovaara, M.,	<i>Hand-grip strength cut points to screen older</i>	Cross-Sectional Design Study	Finland	Mobility - Walking .5 km & climbing 1 flight of stairs	Cut Points for men - 37 kg Cut Points for

Sainia, P., & Koskinen, S. (2010)	<i>persons at risk for mobility limitation</i>			Handgrip Strength (HGS) - maximal score after 2 trials on dominant hand only	women - 21 kg HGS below cut points associated with 3x greater odds of mobility limitations in men and women
Stessman, J., Rottenberg, Y., Fischer, M., Hammerman-Rozenberg, A., & Jacobs, J. M. (2017)	<i>Handgrip Strength in Older and Very Old Adults: Mood, Cognition, Function, and Mortality</i>	Longitudinal and Cross-Sectional Cohort Study	Israel	Handgrip Strength (HGS) - maximal score after 3 trials on dominant hand only Functional Status - difficulty in performing 6 ADLs Mortality - generally observed through duration of study	Low HGS indicated higher risk for functional decline and mortality Declining HGS age 70-90 strongly associated with increased functional decline and increased risk of all-cause mortality
Taekema, D. G., Gussekloo, J., Maier, A. B., Westendorp, R. G., & de Craen, A. J. (2010)	<i>Handgrip strength as a predictor of functional, psychological and social health. A prospective population-based study among the oldest old</i>	Prospective & Longitudinal Cohort Follow-Up Study	Netherlands	Grip Strength (GS) - maximal score after 3 trials of dominant hand only Competence in ADLs - Groningen Activity Restriction Scale (GARS)	Poorer GS predicted accelerated increase in dependency with ADL performance leading to increased dependency in old age

Examining the relationship between grip strength and health is an up and coming topic.

Grip strength specifically related to QoL has only just begun to be studied. The extant literature suggests that grip strength is strongly correlated with QoL, in terms of independence with ADL/IADL, physical disability, and mobility. However, because of the variation of methodology, outcomes, populations, and study design between each article, the strength of the relationship requires further evaluation.

A strong relationship exists between grip strength and QoL. It is worthwhile to consider what this means in an adult outpatient OT setting. Grip strength is one aspect that can be improved through OT in increasing a client's QoL. OT's have a wide variety of assessments and tools to use at their disposal to accomplish improving grip strength. As with any client, grip strength should only be addressed if it is a deficit area that is impacting function and should be done in ways that are client centered to motivate the client and ensure participation.

The first step for OT's is to choose assessments and outcome measures that examine grip strength, QoL, independence with ADLs/IADLs, and mobility which have been demonstrated to be reliable and valid measures. These assessments are used to demonstrate progress following participation in therapy and aids in justification to funders. To measure grip strength, a Jamar hand-held dynamometer would be used as it has been proven as a valid measure of grip strength and easy to use (Neumann, Kwisda, Krettek, & Gaulke, 2017). The standard measurement procedure, according to the American Society of Hand Therapists (2018), is to have the client seated, with elbow flexed to 90 degrees, glenohumeral joint adducted, forearm in neutral position, and wrist in slight extension. The dynamometer is placed at the 2nd level in the clients hand and they are instructed to squeeze as hard as they can for roughly three seconds. This should be done three times with thirty second breaks in between trials on both the dominant and nondominant hands. The average of all three trials for each hand is used as the final measure. The mean score should then be compared to standardized norms stratified by age and sex to understand the client's performance.

There are several questionnaires available to OT practitioners to measure quality of life. For example, the SF-12 and SF-36 are both standardized, free, easy to administer, found online, and have been tested for reliability and validity. Detailed instructions on administration are

provided. Independence in ADLs/IADs can be measured through the Functional Independence Measure (FIM), various ADL Checklists, Lawton IADL Scale, Katz Index of Independence of ADLs, and the Stroke Impact Scale (Reed, 2014; American Occupational Therapy Association [AOTA], n.d.). The FIM and many ADL Checklists are mostly based upon observation and self-report but are also free, available online, and reliable and valid measures (Shirley Ryan AbilityLab, 2015). The Lawton IADL Scale, the Stroke Impact Scale, and the Katz Index of Independence of ADLs are also free, online, standardized, and reliable and valid measures (Coyne, 2019; McCabe, 2019; Richardson, Campbell, Allen, Meyer, & Teasell, 2015).

OT practitioners assess mobility as it relates to functional performance. Examples include assessing whether the client can walk to the kitchen to prepare food and whether the client can walk out of their house in case of a fire. OT practitioners may also examine mobility in terms of fall risk. Functional mobility can be measured through the FIM, the AM-PAC, and the Stroke Impact Scale. The AM-PAC must be purchased, but it is standardized and has been tested for reliability and validity. (Reed, 2014; AOTA, n.d.). There are various other assessments that can be used in each of these areas of assessment, however this list includes those which are commonly used in practice.

Treatment within occupational therapy should focus on interventions which are occupation based when possible. Occupation-based activities have shown to be more effective in the recovery and maintenance of hand function, improving grip strength, and in improving self-perception of hand function in daily tasks (Amini, 2011). Examples of occupation-based activities that can be completed in therapy are: squeezing a spray bottle in water plants during a gardening activity, rolling out dough with a rolling pin, wood working projects that require the manipulation of a hammer, etc. There are many more activities that can be used to improve grip

strength, QoL, independence with ADLs/IADLs, and mobility. The main focus is to make sure it is something the client wants to do and that it is related to one of their goals (Vinstrup et al., 2018). N. Hock also specifically suggests that motion be used as a focus in treatment. She continues, “Typically strength returns with return to occupational based activities within the home.” She specifically provides clients with occupation-based activities as much as possible to not only improve strength, but also ROM, an important component of strength. Clients have many tasks within their home they are required to complete, thus identifying occupational-based activities in the home is essential in supporting goal achievement (personal communication, March 22, 2019). Choosing exercises is also a good way to improve these areas (Amini, 2011). What’s most important is choosing activities that address client goals, whether short-term or long-term, and those that promote functional gains. Examples of exercise activities that can be completed in therapy are: wrist extension/flexion, thumb extension/flexion, completing different isometric exercises (Laskowski, 2018), etc. Again, there are many more activities that can be done. There are also several tools that OT practitioners can use to help increase grip strength, QoL, independence with ADLs/IADLs, and mobility. Before selecting specific tools, consideration should be given to the conditions of the clients. As N. Hock notes, an OT wouldn’t use theraputtty as a treatment tool for a client with osteoarthritis because this would worsen its development (personal communication, April 4, 2019). Examples of tools are: theraputtty, Cando Digi-Extender (Vinstrup et al., 2018), slo-foam, Vive hand exercisers, etc. Most tools are easily found online and are decently priced. The more complex the tool is, the greater the cost. Specific tools may also be incorporated into occupation-based activities, rather than just purely for exercise. For example, different weighted rolling pins for a cooking task or higher resistance spray bottles for a gardening task (Flint Rehab, 2018; Vinstrup, et al., 2018). For note, these are

suggested items that can be used, however it is based upon the preference of the practitioner and the conditions of their clients as to what tools, if any, can be used.

Addressing specific client factors, such as muscle functions and movement functions, are the focus of occupational therapy. Without such important factors, function would be greatly impacted and even impossible in many aspects. This includes areas of grip strength, QoL, independence with ADLs/IADLs, physical disability, and mobility. They are areas that can be assessed and treated in an adult outpatient OT setting. Grip strength and its impact on QoL should not be an area that is overlooked, as is evident through its suggested relationship in the existing literature.

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