

Understanding the Correlation between Physical Activity and Clinical Depression in Women: A Review of the Literature

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Abstract

In an effort to understand the correlation between clinical depression and physical activity, a systematic literature review was conducted. Major Depressive Disorder/Clinical depression is a mental illness that can be expensive and debilitating to sufferers. It poses a substantial burden worldwide when not treated effectively clinical depression is likely to lapse into a chronic disease as reported by CDC in 2011). At least 350 million people live with clinical depression and it is the leading cause of disability worldwide as reported by WHO in 2012). It affects not only the person with clinical depression but their families too. The World Health Organization (WHO) also reported that major clinical depression was ranked eighth in low income countries but was first place in middle and high income countries.

Keywords: Depression; Physical; Activity; Women

Introduction

In an effort to understand the correlation between clinical depression and physical activity, a systematic literature review was conducted. Major Depressive Disorder/Clinical depression is a mental illness that can be expensive and debilitating to sufferers. It poses a substantial burden worldwide when not treated effectively clinical depression is likely to lapse into a chronic disease [1-3]. At least 350 million people live with clinical depression and it is the leading cause of disability worldwide [4]. It affects not only the person with clinical depression but their families too. The World Health Organization (WHO) [4] also reported that major clinical depression was ranked eighth in low income countries but was first place in middle and high income countries. According to Azar, Ball, Salmon and Cleland [5] globally clinical depression is the fourth leading cause of disease. One out of twenty Americans reported clinical depression [6]. The World Health Organization [4] reports almost one million people worldwide take their lives due to clinical depression. For every person who commits suicide there are twenty or more who attempt suicide. According to the Centers of Disease Control and Prevention [1-3] clinical depression can adversely affect the progression and outcome of common chronic conditions, such as arthritis, asthma, cardiovascular disease, cancer, diabetes, and obesity. Research shows that clinical depression can also result in increased work absenteeism, use of short-term disability, and a decline in work productivity.

Additional significant information regarding depression related to gender and race is reviewed in this section. Major depression is more common among women 11.7% as compared to men 5.6% [1-3]. The CDC [1-3] states that Whites have a higher prevalence of clinical depression (6.52%) compared to Blacks (4.57%) and Hispanics. In the National Health and Nutrition Examination Survey [6] study 6.7% females reported clinical depression and 4% males. Clinical depression prevalence by race described by the NHANES were, 6.3% Mexican American, 6.0% Non-Hispanic Black and 4.8% Non-Hispanic Whites. People 45-65 years old, women, Blacks, Hispanics, non-Hispanics of other races or multiple races, with less than a high school education, divorcees, individuals unable to work or unemployed and people without health insurance coverage are more likely to meet criteria for major clinical depression [1-3]. Improving quality of life can occur when depressive symptoms are decreased. Physical inactivity is a modifiable risk factor for clinical depression. Research has shown that doing aerobics or a mix of aerobic and muscle-strengthening activities

3 to 5 times a week for 30 to 60 minutes can provide mental health benefits. Evidence has also shown lower levels of physical activity can still be beneficial [3]. Regular physical activity improves psychosocial welfare in short and the long term by reducing feelings of stress, anxiety, and depression [4]. Intervention studies, particularly clinical trials investigating the use of physical activity (PA) as a treatment for clinical depression, have concluded that physical activity is an effective aspect of clinical depression treatment [7].

According to the WHO [4] people with clinical depression often experience reduced energy, fatigue and diminished activity. Clinical depression sufferers also experience decreased mood, reduced interest and enjoyment levels. These symptoms sometimes make engaging in physical activity difficult.

Even though the benefits of PA are well known, strategies to increase PA among people living with clinical depression remain unclear. The purpose of this review of the literature is to better understand correlation between physical activity and clinical depression with an added interest about the impact on women. Specific attention will be given to evaluate sample characteristic, research designs, and outcome measures for PA and clinical depression. Implications for practice, policy and research will be addressed. Understanding the correlation between PA and CD is important for evidence based practice, which assists in the decision making process for patient care. Evidence based practice approach represents assessments from a range of experts on how best to apply a thorough approach to evaluating the quality of scientific evidence.

Review Strategy

PUBMED, CINAHL and PsycINFO are utilized for peer reviewed research. Studies were retrieved by using the phrase "depression and

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Received July 25, 2016; Accepted August 27, 2016; Published August 30, 2016

Citation: Sharpe DK, Collins-McNeil J, Jones JW, Bailey RK (2016) Understanding the Correlation between Physical Activity and Clinical Depression in Women: A Review of the Literature. J Depress Anxiety 5: 249. doi:10.4172/2167-1044.1000249

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physical activity”, a total of 5628 studies were retrieved. The number of studies decreased to 755 after adding the key word “women”. The final 25 articles included all three of the initial key terms (Figure 1).

Sample characteristics

Characteristics from the literature examined were sample size, age, gender, race/ethnicity, education, income and marital status. Sample sizes in the twenty-five studies reviewed ranged from 30 to 61,011 participants. Ten of the studies had sample sizes that were greater than 1001 participants, three studies had 1000 to 501 people [8-10], five had 500 to 101 people [11-15] and seven studies included 100 or fewer participants [5,16-20]. Forty percent of the studies had sample sizes that were 1001 or greater and fifty-two percent had 500 participants or less.

The average age of participants ranged from 20.4 to 78.5 years old. Ten studies that had samples with a mean age between 20-30 and an additional six studies had samples with a mean age of 31-40 [16,21-24]. The mean age in four studies was 51-60 [24-26], and nine had samples that were 61 and older. Four studies contained only young adults in college [17-18,27,28]. While another four involved only older adults or the elderly [8,14,19,28].

Women comprised the majority of participants in 24 of the 25 studies. They represented 100% of the sample in 3 studies [12,21,22] and 51% of the sample in another 14 studies. Eight studies had 26 to 50% women. None of the studies samples had 25% or fewer women participants.

Race and ethnicity of participants were identified in 3 studies. In one study a hundred percent of the sample was one race or ethnicity

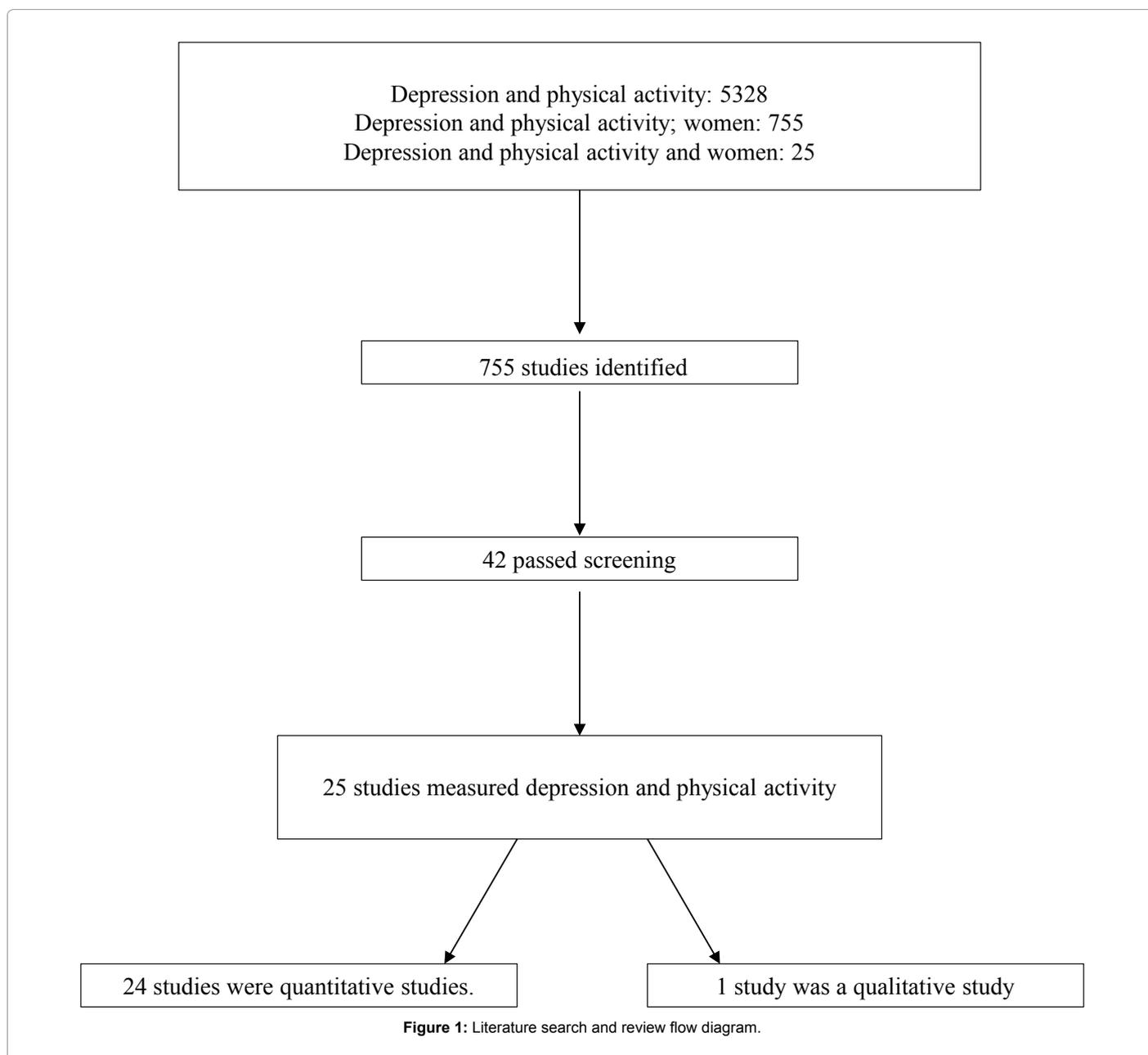


Figure 1: Literature search and review flow diagram.

[12,21,22]. In 11 studies one race made up 99 to 74% of participants. Four studies consisted of 2 to 3 races or ethnic groups and three studies had 4 or more groups. In sixty percent of the studies (15) the number of different races or ethnic groups was not specified.

Nineteen of the twenty five studies disclosed the participants' educational background. Fifty-eight percent of the participants in the studies had college degrees and beyond. People with some college or that were attending college represented 37% of samples. Only 5% of participants had 12 years or less of education.

Four studies identified the mean income level for the sample [16,23,26]. Wilbur et al. [12] reported mean income for subjects was 46,000 dollars. Song and associates [28] reported 37% of the sample had income less than 35,000 dollars. Craft and colleagues [16] reported 74% with income less than 20,000 dollars. Wang et al. [23] ranked the majority of their sample as the "non-poor" but didn't specify parameters of being ranked in this category. The remaining studies did not collect income data.

The majority of the studies had fairly large sample sizes, which produced better, more accurate estimates about the population. There was a wide variation in the ages of the participants. This can be valuable when comparing distribution within certain age groups. The difference in age groups can additionally assist in better understanding tendencies over a lifetime. Many studies were replete of race/ethnicity information. Additionally, the literature revealed that studies which gathered data on marital status and education showed the majority of the subjects were married and had college degrees.

Research design

One qualitative study and 24 quantitative studies were included in the review. Twenty studies used correlational designs. Ten of the correlational studies had a prospective longitudinal design, while one was a retrospective study [27], one quasi-experimental study [12] and three randomized control studies [16,18-19].

Randomized control studies (RCS) were reviewed. RCS's are known as the "gold standard" of research according to Polit and Beck [29]. They are considered as a level 2 evidences. These study designs provide greater confidence in the genuineness of causal relationships due to the observation in controlled situations [29]. Correlational design studies attempt to see if a relationship exists between the two variables, but does not show cause and effect, therefore are limited and weaker in the research claims that are made [29]. Researchers prefer solid causal relationships between variables. Occasionally, correlational studies are unable to clearly explain the nature of relationships between variables. Based on evidence hierarchy 15% of the studies were level 2, 4% were level 3, 77% level 4 and 4% were level 6.

Grading the quality of evidence, based on the correlational studies design and their limitations, the grade is moderate. Further research is needed in these studies and would possibly have an impact on the confidence in the estimate or may change the estimates. This means the studies can only suggest but not recommend healthcare professionals to promote physical activity as a means to lessen symptoms clinical depression. The assumption is that making this suggestion to well informed patients that the majority will make the choice but the considerable minority will not. Level-1 evidence is the highest level of evidence and level 7 is the lowest [29].

Theoretical frameworks

The review found additional interventions that were considered

when treating CD. Theoretical frameworks were described for 4 of 5 interventions identified in the review. Two studies used cognitive behavioral technique [12,16]. Social cognitive theory was used in one work [18] and The National Science Framework for Coronary Heart Disease was used in the study by Yohannes et al. [11].

Cognitive behavioral techniques boost motivation to exercise encompasses changing thoughts to affect feelings and actions. Identifying thoughts that undermine your desire to exercise regularly and countering those thoughts with messages that reinforce your exercise motivation can help achieve goals. Cognitive behavioral techniques used were; self-monitoring and goal setting which were to enhance exercise adherence [16].

Social cognitive theory (SCT) explains personality in terms of how a person thinks about and responds to one's social environment and approaches changing health behaviors. Self-efficacy or one's belief in his or her capabilities to successfully execute courses of action is the primary influence on behavior within this model [18]. Self-efficacy for adhering to regular physical activities and overcoming common barriers to regular exercise has been associated with physical activity behavior and improvements in wellbeing [18]. Other SCT strategies are problem-solving, role modeling and supportive feedback.

National Science Framework for Coronary Heart Disease is based on physical activity status, psychological well-being and quality of life. The aim of Yohannes and friends [11] was to examine the interrelationships between measures and determine which baseline factors contribute to these effects. These authors looked at a lifestyle approach for healthcare professionals to use in addition to their services.

Three out of four studies [11,16,18] used the theoretical framework to design the intervention and in their outcome. Wilbur et al. [12] used the framework in the design but not in the outcome.

Intervention design and setting

The intervention designs varied. Interventions ranged from 6 to 24 weeks with 3 lasting 6 to 12 weeks [11,16,18], one design was for 24 weeks [12]. No timeframe was given for the fifth study [19]. Session frequency ranged from 1-2 times per week [11,16] to a 2 group sessions (2 times a week for 4 weeks changing to 3 or more times a week for the remaining 20 weeks), [12] to 10 sessions [19]. Mailey et al. [18] had self-reported internet intervention with prompts. There was a wide range in session length from 45 seconds-35 minutes to 30-40 minutes to 2 hours. The interventionist included clinic staff [11], a nurse practitioner/exercise physiologist [12], and a physical activity counselor with a master's degree in Kinesiology [18] and in 2 studies [16,19] it was unknown. The focused physical activity was walking; seen in 3 studies [12,16,18], cardiac rehabilitation with the use of a treadmill and aerobic exercise [11] and yoga and an exercise group [19].

No one setting was used across interventions, settings included a clinic/home [16], hospital [11] and a community senior cultural center [19]. Another was a home based walking program [12]. Mailey et al. [18] was an internet delivered program.

The frequency and length of PA interventions varied. This finding makes it difficult to compare treatment of the participants. None of the interventions were performed in the same settings or where done by type staff.

Outcome measures for physical activity and clinical depression

In reviewing the literature studies 4 [12,18,20,28] used objective measures for physical activity. Standardized questionnaires for PA

were used in 7 and while 13 used researcher developed questionnaires or one question to assess physical activity. Only 1 study [19] did not measure physical activity.

Objective measures of PA were used in studies. Objective measures seen in the literature include; pedometers, accelerometer and heart monitors. Subjective measures utilized to gain data were questionnaires, self-reporting, 7-day recall, BORG RPE scale, logbooks/dairies, metabolic equivalent of tasks and physical activity self- assessments.

An objective measurement of physical activity used in one intervention was a pedometer [16]. Pedometer is a portable electronic device that counts each step a person takes by detecting the motion of the person's hips. It can be used as an exercise measurer it records how many steps the wearer has walked that day, in miles or kilometers. Pedometers are accurate with a +/- 5% error.

Another tool utilized was an accelerometer which was reported in three studies [18,20,28]. Accelerometers are movement monitors that have the ability to capture intensity of physical activity. Accelerometers operate by measuring acceleration along a given axis. Accelerometers have a 95% confidence.

Two of the researchers used heart monitoring as a measurement of physical activity [12]. A heart monitor is a device used to measure the heart rate in real time or record the heart rate for later study. Heart monitors have various features including average heart rate throughout an exercise period, time in a specific heart rate zone, calories burned, breathing rate, built-in speed and distance. Accuracy of heart rate monitors is 1% or +/- 1 beat per minute.

Subjective measures, used for physical activity in fourteen of the research were questionnaires. Questionnaires are a research instrument consisting of a series of questions and other prompts for the purpose of gathering information from respondents for statistics about a given topic. Self-reported physical activity frequency was utilized in six of the studies [8,10,14,22,27-29]. A 7- day physical activity recall tool was used in three studies [11,15,16]. The BORG RPE Scale was seen in one study [29]. Walking logbook/diary reporting of physical activity was used in two studies [10,12]. Other subjective measures used were the metabolic equivalent of task [9] and self-assessments of physical activity.

Clinical depression measures

Standardized measures of clinical depression were used throughout the twenty-five studies reviewed. The five most frequently used scales were the Beck Inventory (BDI), Hospital Anxiety and Scale (HADS), Center for Epidemiologic Studies Scale (CES-D), Diagnostic and Statistical Manual (DSM-IV)/(SCID) and Geriatric Scale (GDS).

In six studies, The Beck Inventory (BDI) was used [9,13,16,18,20]. The BDI is a series of 21 questions developed to measure the intensity, severity, and depth of in patients with psychiatric diagnoses. Mailey et al. [18] informs that the scale is from 0 to 3, where 0 equals no symptoms and 3 equals severe indication of symptoms. Scores are then added, scores between 10 and 18 are considered indicative of mild to moderate clinical depression, and between 19 and 29 reflect moderate to severe clinical depression. According to Weinsten and associates [29] the BDI demonstrates excellent reliability; Cronbach $\alpha = 0.92-0.93$ and has equivalent validity in that it tends to agree with other measures of clinical depression.

The Center for Epidemiologic Studies Scale (CES-D) was used in five studies [5,12,14,22,26] the CES-D is a widely used 20 item self-report scale which measures the current level of depressive symptomatology

in the general population, with an emphasis on depressed mood during the past week. The CES-D shows excellent internal consistency coefficient alpha >0.88 and test-retest correlation $r >0.5$ [12].

The Hospital Anxiety and Scale (HADS) used in four studies [11,17,24,25] it is a scale commonly used by doctors to determine the levels of anxiety and that a patient is experiencing. The HADS is a fourteen item scale that generates ordinal data. Seven of the items relate to anxiety and seven relate to clinical depression. For clinical depression HADS holds a specificity of 0.79 and a sensitivity of 0.83 [11].

The Diagnostic and Statistical Manual (DSM-IV)/(SCID) of Mental Disorders was used in three studies [10,13,29]. It provides standard criteria for the classification of mental disorders, including diagnosing clinical depression through structured clinical interview. The range in reliability is vast depending on the type of the sample and research methodology.

The Geriatric Scale (GDS) is another scale used twice [8,19], it is a 30 question self-report assessment used to identify clinical depression in the elderly. Individuals without clinical depression range from (0–9), moderately depressed (10–19), and severely depressed (20 or more). Shahidi et al. [19] report calculated validity of $r = 0.96$ Additional measures for clinical depression include the EURO-D Scale [28], K6 scale [21], PHQ-9 questionnaire [29] and clinical depression questionnaires [26].

Frequency of data collection

Three of the studies reviewed were conducted for 2 years with a 2 year follow up [24,25,28]. Another study [14] was for 2 years with information collected at baseline, 12, 24, 36 and a 54 month follow up. Wise, Adams-Campbell, Palmer & Rosenberg [22] research length was for 4 years, baseline 1995 and followed up 2 years later in 1997 but depressive symptoms were not used until in 1999. Six studies looked at physical activity for 1 week [13,15,20,21,28]. Gallegos-Carrillo and colleagues [26] assessed clinical depression and physical activity at baseline and followed up on measurement 6 years later.

Measures used for clinical depression and physical activity were appropriate overall. However more objective measures for PA are needed like pedometers and accelerometers. Data frequency was diverse.

Study Outcomes

Findings from intervention studies will be discussed separately before findings of correlational studies. Four of the five intervention studies measured PA. Findings provided mixed evidence regarding the impact of PA on clinical depression symptoms. Total energy expenditure increased from baseline to 6 weeks ($p < 0.05$) in the study by Yohannes et al. [11]. There was a slight but decrease in energy expenditure from 6 weeks to 12 months, but still remained significant from baseline. Craft and colleague [16] increased minutes walked for both groups at baseline and at 3 month follow up but there was not a significant difference. Intragroup changes in steps was not evaluated at baseline however the clinic group walked significantly more steps at 3-month (steps: mean = 7036.8) than the home group (steps: mean = 4957.6) $p < 0.05$. Wilbur et al. [12] participants had a mean adherence rate of 38% to prescribed PA. Mailey et al. [18] intervention group increase their PA more that than the control but there was no statistical significant.

Clinical depression scores decreased significantly in 3 of the

intervention studies. Yohannes and colleagues [11] study found clinical depression scores went from 7.35 at baseline to 5.73, ($p < 0.05$) after 12 months, (scores between 8–10 indicate probable clinical depression and anxiety and a score greater than or equal to 11 was considered indicative of a clinical depression or anxiety).

Wilbur et al. [12] results showed clinical depression symptoms were significantly reduced from baseline to 24 weeks, ($p = 0.004$) for the enhanced treatment group as compared to the minimal treatment group. They found that walking adherence had a negative association with depressive symptoms. Indicating higher walking adherence from baseline was predictive of lower clinical depression symptoms at 24 weeks. Shahidi et al. [19] uncovered significant improvement in clinical depression from baseline to the end of the 10 sessions. However, there was no difference in effect for the laughter group ($p < 0.001$) and the exercise group ($p < 0.01$). The remaining studies had a decrease in clinical depression but without any significance [16,18].

Correlational Studies

Correlational design studies attempt to see if a relationship exists between the two variables, but does not show cause and effect, therefore are limited and weaker in the research claims that are made [29]. Six studies [8,17,24,27, 27–29] found a negative correlation between PA and clinical depression.

Tyson et al. [17] discovered scores of the clinical depression subscale of the HADS for and PAQ showed a negative correlation ($p = 0.01$) with physical activity. Lee and Park [8] also revealed significant interaction between physical activity (PA) and clinical depression ($p < 0.001$), so as physical activity increased clinical depression decreased.

Wichers and associates [10] saw a significant increase in positive affect after an increase in PA, up to 180 minutes after the PA event ($p < 0.001$) from baseline at two of their follow up periods; T1 (132days) and baseline to T2 (223days). Nevertheless, physical activity had no effect on negative affect in this study.

Taliaferro [27] noticed participants with low (1–2times per week) or moderate (3–5 times per week) frequency levels of toning activities were less likely to feel depressed ($p < 0.5$) and ($p < 0.01$) respectively. They also discovered that people engaging in aerobic activity 3–5times per week and 6–7 week were significantly less like to feel depressed ($p < 0.001$) for both categories. According Song et al. [28] people with mild mood to severe clinical depression who engaged in moderate intensity physical activity had significantly less than those with minimal clinical depression ($p < 0.01$). They also stated that people who engaged in moderate PA (30 min and more than 3 days a week) were 28% less likely to be depressed than those who did not ($p < 0.05$). When comparing the inactive people with moderate or vigorous activity Lee and Parks [8] showed lower baseline levels of clinical depression and fewer depressive symptoms at follow up. In addition to their findings other authors like Harvey et al. [24] noticed that people who engages in more light and intense leisure activities had lower rates of case level clinical depression ($p < 0.001$) this was observed over time.

Multiple studies reviewed whether PA levels differed among women who were depressed and those that were not. In a study completed by Mata et al. [13] there were no differences between participants in depressed and control groups with respect to frequency, intensity or duration of PA over the week ($p = 0.12$). Numerous correlational studies revealed some significant associations between physical activity, clinical depression and gender. Active women at baseline, who were inactive at 2 year follow up had a 51%, (CI 95%: 1.07–1.50)

greater probability of developing clinical depression at 4 year follow up and a 46% (95% CI: 1.02–1.46) and greater probability at the 6 year follow up [23]. Leisure time physical activity (LTPA) was not predictive of significant clinical depression scores among men however, greater LTPA was significantly predictive of lower clinical depression scores for women $p < 0.05$ [9]. DesMeules et al. [23] revealed leisure time physical activity had preventive effects on clinical depression for women but was not statistically significant for men. Some of the other correlational studies demonstrated intensity or dose related results. Azar and associates [15] reported that women at risk for clinical depression, with low self-efficacy for vigorous PA were statistical significant ($p < 0.05$) for having lower likelihoods of being active. They also perceived that high self-efficacy for vigorous PA correlated to demonstrate significant interaction with the risk of clinical depression in predicting LTPA ($p < 0.05$) in women. In a qualitative study Azar and colleagues [5] women with clinical depression said their mood influenced their PA, which suggests that clinical depression clearly influences whether or not they participate in physical activity.

Discussion

Insufficient physical activity is one of the lifestyle activities recognized to be closely associated with depressive symptoms and disability. Physical activity is defined as bodily movement from skeletal muscle contractions with energy expenditures (USDHHS in 2013) and incorporates exercise and lifestyle activity of modest or vigorous intensity. Regular physical activity can improve the health and quality of life to people of all ages, regardless of the presence of a chronic disease or disability. Among adults and older adults, physical activity can lower the risk of clinical depression, strokes, high blood pressure and early death (USDHHS in 2013). It is essential that healthcare professionals to have excellent understanding of physical activity's role in enhancing both physical and psychological health in consumers.

Some of the research designs limited the ability to use the information for evidence based practice. The majority of the literature reviewed was classified as level 4 evidence. Level 4 can only show association. More research at level 1 or level 2 would provide evidence to support causality.

Several of the studies were limited to one item questions for clinical depression and PA. The authors relied on self-reporting of symptoms instead of an objective measure. Self-reporting allows participants to possibly manipulate their responses to avoid embarrassment. A major strength of measurements is that it eliminates subjectivity and presumptions. Elliot and colleagues [28] discovered that females self-reported higher incidents of than clinician reported clinical depression, which caused over reporting. Several of the literature failed to report baseline physical activity and didn't discuss how clinical depression effected PA [12,16] were just a couple. More researchers need to utilize objective measures for PA. Standardized measures for clinical depression should be used as opposed to author created measures. Some limitations were identified in the review. However, the overall findings indicate that PA reduces depressive symptoms.

Physical activity focused care should be implemented into practice by Advance Practice Nurses (APNs), Physicians, and Physician's Assistants. This can be accomplished by providing physical activity prescriptions. Prescribing practitioners can also provide information on PA resources that are available in the community. Policies should be constructed to assess level of PA and clinical depression at each appointment. The authors recommend conducting additional interventional studies regarding PA in women with CD. Conducting

an intervention study will provide accurate information regarding PA's impact on CD. An intervention study will allow investigators to determine the effectiveness of the intervention of exercise. A PA plan can be prescribed to participants and ongoing monitoring of CD can occur congruently with the PA plan. An intervention study can be conducted with ease. Also, easily established safety and cost-saving protocols can be developed.

Conclusion

A significant amount of relevant information regarding PA and CD was reviewed in this manuscript. During the review some factors relating to women and depression were focused on. The prevalence of clinical depression in women is significantly higher than men. There is evidence which suggests physical activity can reduce clinical depression. There is not enough research available on African American women, physical activity and clinical depression. More research is suggested to understand why women are the more depressed and how to get women more physically active.

Conducting a Literature review has significant value to providers. This enables prescribers to review data and determine if strategies should be implemented in practice. It provides information on policy development. Literature reviews can also assist with quality assurance and project enhancement.

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