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THE RELATIONSHIP BETWEEN PHYSICAL EXERCISE AND DEPRESSION IN OLDER ADULTS

There is a scarcity of systematic analysis of the relation between physical exercise and mental health. To address this gap, we ask whether physical exercise associates with lower levels of depression among older adults. We hypothesize that physical exercise especially if it typically incorporates other forms of socialisation, may be a socially meaningful activity and may create intimacy that provides social uplift.

We test this hypothesis against alternative hypotheses that relationship characteristics or physical health could account for any association between physical exercise and depression. In addition, we consider whether there are gender dynamics that affect the association between physical exercise and depression. We analyse data from a sample of 243 old adults, male and female, aged 57 to 75 from a survey conducted in Buckinghamshire, England.

Given findings of significant gendered aspects of depression, physical exercise, social support, and aging, we estimate separate results for women and men. Although we find differences between results for men and women for many control variables that correspond to gendered differences in depression, physical exercise that typically incorporates other forms of social interactions has a robust association with lower depression for both women and men.

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ВЗАИМОСВЯЗЬ МЕЖДУ ФИЗИЧЕСКИМИ УПРАЖНЕНИЯМИ И СОСТОЯНИЕМ ДЕПРЕССИИ У ПОЖИЛЫХ ЛЮДЕЙ

Систематических исследований взаимосвязи между физическими упражнениями и показателями психического здоровья проведено недостаточно. Для устранения этого пробела мы задались вопросом: взаимосвязаны ли физические упражнения со снижением уровня депрессии среди пожилых людей? Было выдвинуто предположение о том, что физические упражнения (особенно совмещенные с иными формами социализации) могут превратиться в общественно значимую активность, сближающую людей и вызывающую социальный подъем. Проверялась гипотеза о том, что характеристики взаимоотношений, физическое здоровье могут быть объяснены взаимосвязью между физическими упражнениями и депрессией. Кроме того, исследовались гендерные особенности связи между физическими упражнениями и депрессией. Мы проанализировали данные опроса, проведенного в г. Бакингемшир (Англия) на выборке из 243 пожилых мужчин и женщин в возрасте от 57 до 75 лет.

Принимая во внимание данные о наличии гендерных особенностей депрессии, практики физических упражнений, социальной поддержки и старения, результаты оценивались отдельно для женщин и мужчин. Хотя нам удалось обнаружить гендерные различия по многим переменным (депрессии, практике физических упражнений, разным формам социальных взаимодействий), выявлена надежная связь физической активности с низкой депрессией и у мужчин, и у женщин.

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ВЗАЄМОЗВ'ЯЗОК МІЖ ФІЗИЧНИМИ ВПРАВАМИ Й СТАНОМ ДЕПРЕСІЇ
У ЛЮДЕЙ ПОХИЛОГО ВІКУ

Систематичних досліджень взаємозв'язку між фізичними вправами й показниками психічного здоров'я проведено недостатньо. Для подолання цього пробілу ми задалися питанням: чи взаємозалежні фізичні вправи зі зниженням рівня депресії серед людей похилого віку? Було висунуте припущення про те, що фізичні вправи (особливо сполучені з іншими формами соціалізації) можуть перетворитися в суспільно значиму активність, що зближає людей і стимулює соціальний підйом. Перевірялася гіпотеза про те, що характеристики взаємовідносин, фізичне здоров'я можуть бути пояснені взаємозв'язком між фізичними вправами й депресією. Крім того, досліджувалися гендерні особливості зв'язку між фізичними вправами й депресією. Ми проаналізували дані опитування, проведеного в г. Бакинґемшир (Англія) на вибірці з 243 літніх чоловіків і жінок у віці від 57 до 75 років.

Враховуючи дані про наявність гендерних особливостей депресії, практики фізичних вправ, соціальної підтримки й старіння, результати оцінювалися окремо для жінок і чоловіків. Хоча нам вдалося виявити гендерні відмінності за багатьма змінними (депресії, практиці фізичних вправ, різним формам соціальних взаємодій), був виявлений надійний зв'язок фізичної активності з низькою депресією й у чоловіків, і в жінок.

Introduction-formulation of the problem. Despite claims in practitioner and academic circles that physical exercise has beneficial effects on older adults' sense of belonging and self-worth (Pangman and Seguire 2000; Westheimer 2005), there has been little systematic research examining whether physical exercise has a positive association with mental health. Sociological explanations of mental health note the importance of the "sense that one belongs and matters to others" (Thoits 1995:67) and specifically the type of effect attributed to physical exercise (Pangman and Seguire 2000). Physical exercise may involve socio-emotional forces that bring immediate and continuing contributions to mental health by providing a sense of union and promoting feelings of belonging. This article tests this idea by asking whether physical exercise associates with decreased depression among older adults.

Examining the association between older adults' physical exercise and depression can yield significant theoretical and substantive insights. The public tends not to consider how physical exercise might associate with older adults'

mental health, perhaps reflecting the mistaken beliefs that the importance of physical exercise decreases with age and that older people do not participate in physical exercise (Gott and Hinchliff 2003). Nonetheless, transitions associated with aging, for example, leaving the labour force, experiencing the death of a spouse, and physical changes—can alter the ability to practice physical exercise (Cain et al. 2003).

These transitions also influence depression: Throughout the life course, depression follows a U-shaped pattern, reflecting the stability of middle age and the instability of family, work, and personal life transitions in younger and older adulthood (George 1993; Mirowsky and Ross 1999; Yang 2006). However, the transitions of aging do not universally cause depression—approximately one fifth of older adults have symptoms of low to acute depression (Bower 1991). Although changes in social status and relations can result in significant stress for older adults (Moen 2003), increased age generally associates with increased happiness (Yang 2008).

In this article, it is hypothesized that physical exercise associates with lower depression among older adults because physical exercise can be a form of connectivity and a meaningful social activity that provides an uplifting sense of belonging and fosters the development of perceptions of support. The effects of aging and transitions are not uniform, since aging is an active process that people manage through the cultivation and maintenance of social networks and attachment to activities (Bath and Deeg 2005). Successful engagement likely involves pursuing meaningful interaction with others and acting in ways that others expect and respect, in other words, support networks, activities, and roles likely are integrated with each other to create a sense of belonging. As such, physical exercise may have more of an association with lower levels of depression if it engages partners in ways that can induce more shared, emotional responses, which can cultivate both actual and perceived support (Cornwell et al. 2008; Yang 2006). From this perspective, not all physical exercise would associate with improved mental health. Rather, we hypothesize that the association between physical exercise and lower depression depends on whether people are socially connected with their exercise partners, as evidenced by the integration of other forms of socialisation into physical exercise. Physical exercise can overlap with relationships, social support, and physical health, each of which contributes to mental health. Therefore, we examine alternative hypotheses that relation and support characteristics and physical health could account for any association between physical exercise and mental health. Significant differences in experiences of physical exercise could result in different associations between physical exercise activity and depression for women and men (Lauermann et al. 1994; Lindau et al. 2007; Simon 2002; Walker and Luszcz 2009). Attention to these differences should not, however, obscure the possibility that

underlying social processes can affect women and men in similar ways. For instance, despite gendered differences in the formation, quantity, and experience of social support relationships, being in such relationships has similar influence on the well-being of both women and men (Umberson et al. 1996). We attend to the possibility that notwithstanding gendered differences in physical exercise and in how physical exercise associates with physical health and relationships, women and men could both receive similar psycho-social benefits from practicing physical exercise. Accordingly, our analysis uses separate elaboration models for women and men to compare how controlling for a range of influences affects the association between physical exercise and depression and whether physical exercise activity has similar or different effects for men and women. We analyse data from 248 adults ages 57 to 75 from Buckinghamshire. We test our research hypotheses that physical exercise associates with lower depression and that the association between physical exercise and depression is conditioned on whether the physical exercise typically integrates other forms of social interaction.

Our models include variables for the alternative hypotheses that any association between physical exercise and mental health is due to relationship characteristics (perception of health and social support) or due to underlying physical and mental health. The analysis cannot provide evidence to support stronger causal claims.

Formulation of objectives. In this section, we first develop the twin research hypotheses: (1) that practicing systematic physical exercise associates with lower depression if (2) that physical exercise integrates other forms of social interaction. We then explore alternative hypotheses that any association between physical exercise and mental health reflects the influences of relationship characteristics or physical or mental health. Finally, we review the limited research on the association between physical exercise and mental health among older adults, discussing how gender may influence an association between practicing systematic physical exercise and mental health.

Analysis of recent existing research. Why practicing systematic physical exercise may decrease older adults' depression?

That older adults' engagement in physical exercise may have a positive association with mental health corresponds with theories that hold social support and activity produce mental health. These theories lend support to the idea that practicing systematic physical exercise could be associated with lower depression among older adults, since physical exercise could induce the feelings of belonging associated with perceiving social support and may be a socially meaningful activity. Social support theories maintain that health-promoting resources flow through networks that connect people to one another (Aneshensel 2009; Cornwell et al. 2008; Musick and Wilson 2003). Physical exercise

could be more than the context of developing support; it could also play important roles in forging connections between partners. If physical exercise is a meaningful social experience, it could induce a more exclusive type of increased support of and care for partners. Findings that perceptions of social support influence psychological well-being (Yang 2006) lend support to this idea, since people are more likely to perceive support when it seems exclusive. Activity theory holds that engaging in physical and mental activity underlies healthy aging by providing people with self-concepts and self-esteem while also preventing or mitigating the effects of role loss (Croezen et al. 2009; Lemon, Bengston, and Peterson 1972; Wahrendorf et al. 2008). Research suggests that aging adults experience shifts in the quality of emotions they experience, as passive emotions gain in prominence compared to active emotions. The increased prevalence of depression among older adults compared to middle-aged adults reflects this shift in emotions (Ross and Mirowsky 2008). The discussion of emotional change suggests that the affective character of activity may play an important role in influencing how activity affects mental health: People who participate in activities evoking positive emotion, such as certain forms of physical exercise, could have lower rates of depression. As suggested by activity theory, depression sometimes increases in later life due to transitions that lead people to give up activities that were important for their identity. In adulthood, physical activity, particularly but not exclusively in the context of long-term and systematic practice is normative (Laumann et al. 1994). Physical exercise therefore could have potentially deleterious effects on mental health because it could indicate a loss of a component of one's identity. This idea echoes Umberson, Crosnoe, and Reczek's (2010) conclusion that the symbolic meaning of activity could influence the development of shared understandings that enable health-promoting coping, social support, activity, and relationships. Cultural beliefs about the importance of an activity provide evidence of such symbolic meaning. The general population believes that physical exercise is important for adults' mental health. Transitions of aging possibly could alter the experience of physical exercise, changing its frequency or context (Trudel et al. 2000). Older adults who no longer engage in practicing physical exercise may feel "a lack of tenderness and loneliness" (Weeks 2002:234). Taking part in group or individual physical exercise links with warmth, care, and acceptance that could thereby induce feelings of belonging. As such, physical exercise may be an emergent social experience that reminds people of their connections to others, recalling Durkheim's ([1912] 2001:314) description of effervescent social action as a source of energy much like "contact with a source of heat or electricity to warm or electrify" that binds people into social relations. Such experience "strengthens emotions by bringing all those who share them into more intimate and more dynamic relationship" with each other (Olaveson

2001:100), creating a sense of belonging and mattering and contributing to mental health.

This social experience could provide social uplift resulting in benefits for mental health, particularly in the face of wider cultural emphases on individualism (Giddens 1992). As an experience, physical exercise activity is distinct due to its social qualities that set apart the shared activity (and participants) from other people (Durkheim [1912] 2001; Giddens 1992; Zelizer 2005). Practices that reinforce social bonding cultivate meaningful ties that distinctively identify a relation between people from other types of relations; that is, intimate ties have an element of social closure (Zelizer 2005). Given the importance of trust physical activities involve some attention to others. Accordingly, we suspect that the power of these experiences to have enduring beneficent effects derives from the qualities of activities that take account of and are oriented toward others. Not all physical exercise experiences, however, are expected to create such a state. Positive meanings seem more likely when partners understand physical exercise and games as a shared, mutual experience—demonstrating awareness of and orientation toward each other and how they each experience the activity within a group (Schalet 2009).

Accordingly, we hypothesize that physical exercise that incorporates more social interaction, such as games, will have a greater effect than just the pleasure associated with practicing physical exercise, because these affectionate actions indicate a greater sense of intimacy and orientation toward another person.

Alternative Hypotheses: Relationship and Physical Health Characteristics as Explanations

Any association between physical exercise and mental health, however, may be spurious, reflecting the underlying influence of relationship characteristics, social support, and physical well-being on both physical exercise and mental health. Given the general associations between health and physical exercise (DeLamater and Sill 2005) and perceived happiness and well-being (Weeks 2002), an association between mental health and physical exercise may simply reflect the influence of relationship status on both physical exercise and mental health. The quality of a relationship and social support could also explain an association between physical exercise and mental health. Perceptions of relationship quality and support might both enhance mental health and increase the likelihood of engaging in systematic physical exercise

Higher levels of health also associates with increased frequency of practicing physical exercise in older adults (Trudel et al. 2000). Finally, functional, objective, or subjective elements of physical health could account for an association between physical exercise and mental health. Decline in physical abilities frequently results in decreasing mental health (Yang 2006). Older adults'

physical health has an association with the frequency with which they engage in physical exercise. Because older adults may believe that their motor ability could indicate their overall health, they could perceive a lack of physical exercise as an indicator of a more general physical decline (Marshall 2008). An association between physical exercise and depression could also reflect side effects of prescription medications that affect physiological functions, such as antidepressants that can both reduce the ability to exercise and indicate pre-existing depression (Kellett 1996).

Gendered Dynamics of Physical Exercise and Mental Health among Older Adults

Although aging is associated with a decline in the frequency of engagement in physical exercise, older adults maintain active lives (Cain et al. 2003; Lindau et al. 2007) and often describe exercising as important (Kontula and Haavio-Mannila 2009; Lindau et al. 2007; Skultety 2007). Similar studies find that exercising improves self-reported happiness, quality of life, self-worth, and well-being (Marsiglio and Donnelly 1991; Rosen and Bachmann 2008). Studies of older adults' exercise habits find those who are not active more likely to rate exercising as unimportant or not of interest than their physically active counterparts (Gott and Hinchliff 2003; Lindau et al. 2007). In short, older adults differ in their opinion of whether exercising has benefits based on whether they have maintained physical activity. These findings, however, rely on individuals' self-assessments of the link between exercise and mental health. As a result, they may reflect desirability biases, since people may prefer to show that their physical activity or inactivity reflects a choice. Examining whether there is an association between practicing systematic physical exercise and mental health can assess if these self-assessments are accurate. Such an examination could also provide insight about the gendering of physical activity among older adults. Gender theories call attention to how social structures, cultural beliefs, and routine interactions reproduce and justify categorical inequalities (Ridgeway and Smith-Lovin 1999; Risman 2004; West and Zimmerman 1987). Physical exercise may have gendered dimensions particular to older adults. As men experience the physical changes of aging, they may place greater emphasis on their physical prowess in order to project masculinity (Meadows and Davidson 2006). This finding is consistent with older adults' self-report data that show men typically rating physical activity as more important than women rate engagement in physical activities (Kontula and Haavio-Mannila 2009; Lindau et al. 2007). In contrast to the self-report data, however, exercising may be particularly socially meaningful and affirming for older women. Engaging in systematic physical activities could affirm older women's desirability in ways that provide uplift and a sense of belonging. As noted by the alternative hypotheses, however, relationship characteristics, social support, and physical health could

account for an association between exercising and mental health. Relationships, social support, and physical health have gendered dimensions that could affect an association between exercising and depression differently for women and men. Cultural beliefs about social support and gender may result in different relationship characteristics influencing an association between exercising and depression for women and men. Among older men, following norms of masculine behaviour decreases the likelihood of seeking preventive care (Springer and Mouzon 2011). Men also rely more than women on partners' social control efforts to promote healthy behaviour (Umberson 1992). Older men, therefore, are less likely to attend to their own physical health than older women, suggesting that an association between physical health and depression may be less robust for men than women.

Methodology. Participants. To test the hypotheses, we use data from a survey conducted among 243 people aged 57 to 75 from South Buckinghamshire, England. The aim was to collect data from a representative sample of the adult population aged between 57 and 75 of both genders. The size of the sample was decided by taking into account the fact that the confidence level set for the study was 95% and the confidence interval was +/-6. Estimation of the population was based on existing statistical data and the size of the population was approximately 73,000.

The weighted response rate was 75.5 percent.

Table 1 reports descriptive statistics for each variable in separate columns for women ($n = 124$) and men ($n = 119$). The dependent variable in our analysis is an 11-item version of the Centre for Epidemiology Studies Depression Scale (CES-D) (Radloff 1977).

Methods and design. Each item asked respondents to rank whether they experienced the phenomenon rarely or none of the time (0), some of the time (1), occasionally (2), or most of the time (3) during the past week. The scale of summed scores for each item has a theoretical range of 0 to 33 and a sample range of 2 to 31; higher values represent greater depressive symptoms.

Among our sample, the 11 items have a Cronbach's alpha of 0.78. We measure participation to exercising with a variable indicating whether the respondent had been involved in practicing systematic physical exercise during the past year. To measure if physical exercise was conducted individually or in a group environment, we include a measure of whether exercising was accompanied by other social interaction such as dining together, visiting and being involved in activities outside the exercising programme. We recorded these responses to distinguish between those who reported never, rarely, or only sometimes engaging in these activities from those who reported usually or always including these activities as part of exercising to distinguish between those for whom this behaviour is typical and those for whom it is not. Measures

of relationship status, quality, and social support serve as controls to test the alternative hypothesis that relationship context accounts for an association between physical exercise and lower depression. Since relationship status may have greater consequence for the association between exercising and depression for men and since relationship and support qualities may have greater effect on this association for women, we enter these sets of variables in separate steps.

Given the importance of social support to relationship quality and differences in sources of support between men and women (Umberson 1992), we include three sets of measures of relationship and support quality.

First, three variables distinguish between respondents who report that they can often rely on a partner, family, and friends if they have a problem from those who could only sometimes or rarely rely on these sources of support. By measuring perceptions of support quality, these variables capture subjective elements of support, which influence health (Cornwell and Waite 2009).

Second, given that the size of support networks is important (Umberson et al. 1996), we include two measures of family and friend network size based on the survey variables concerning the number of close family members (excluding a primary partner) and number of friends respondents had. Since these variables were categorical (0, 1, 2-3, or 4 or more close relatives or friends) and since combinations of the non-zero values create collinearity problems, we use single variables to distinguish between those with four or more close relatives or friends from those with fewer close relatives or friends. Those with larger social networks of friends and family may have more robust support because they are more socially adept (Idler, McLaughlin, and Kasl 2009), which could affect both mental and physical health.

Variables indicate whether respondents rated their health as poor and whether they reported some or greater difficulty walking one kilometre. If perceived physical health or functional stamina influences exercising behaviour, these variables could account for an association between exercising and mental health. We also include measures of experiences with health conditions. Three variables indicate whether participants perceive themselves as being fit, the extent to which they feel they are healthy and the perception of their heart condition

Finally, variables indicate whether respondents regularly take medication. For exercising, variables measure whether respondents had exercising difficulties during the previous year. These variables are: experiencing pain during exercise and difficulty in exercising regularly. Finally, we include a variable measuring whether respondents state that they engage in social activities with those with whom they exercise.

Participating in team sports corresponds with happiness with socialisation aspect of exercising (Maume, Sebastian, and Bardo 2010) and demonstrates a

degree of simple physical closeness, which could explain an association between exercising and mental health. Furthermore, participants' exercising practices are gendered: Men are more likely than women to engage in exercising alone. (Maume et al. 2010). As such, particularly for men, exercising in a group may be an important relationship status indicating lower levels of confidence.

Analysis

The relationship between the level of depression and each of the other variables is presented separately for men and women.

We estimate separate results for men and women because depression is a gendered response to stress (Simon 2002; Umberson 1992), self-reports suggest the importance of exercising differs for men and women, and previous research finds men and women experience physical health and relationships differently. We treat control variables measuring relationship qualities (relying on) and different characteristics of exercising activity (experiencing pain during exercise and additional socialising) as conditionally relevant variables (Ross and Mirowsky 1992). These conditionally relevant variables apply only to those who exercise systematically. The main effect variables for engaging in systematic exercising show the average effect of these statuses compared to those who did not exercise in the previous year; the conditionally relevant variables show the deviations associated from these average effects for the particular characteristic measured by the variable.

Results. The data collected from a sample of $n=243$ people from Buckinghamshire, England is presented in the Table no 1. For this pilot study the Pearson correlation coefficient was calculated using the formula displayed below. Table one shows that there is a strong negative correlation between the level of physical exercise performed and the level of depression. Higher level of exercise is associated with low depression. The association is slightly greater for men than for women.

According to the data collected in the sample it seems that there is a weak (-0.43 women and -0.23 for men) association between the level of depression and the capacity to maintain a steady frequency of exercising. The association is slightly greater for women than for men.

There is a moderate positive correlation between the depression level and the perceived level of pain during exercising. The association is slightly greater for women than for men.

The capacity to maintain a regular physical exercise programme seems to have a low association with the level of depression. (-0.43 for women and -0.23 for men) The association is slightly greater for women than for men.

There seems to be a fairly strong association between the perceived level of individual fitness and depression. Those people who feel very fit tend to

manifest a low level of depression. The association is slightly greater for men than for women.

$r = r_{xy} = \frac{\sum_{i=1}^n (x_i - \bar{x})(y_i - \bar{y})}{\sqrt{\sum_{i=1}^n (x_i - \bar{x})^2} \sqrt{\sum_{i=1}^n (y_i - \bar{y})^2}}$	Women (n=124)	Men (n=119)
Relationship between depression level and amount of regular physical exercise	-0,75	-0,84
Relationship between depression level and the extent to which exercising is accompanied by socialising with peers	-0,87	-0,81
Relationship between depression level and the perceived level of pain during exercising	0,56	0,61
Relationship between depression level and the capacity to maintain a steady frequency of exercising	-0,43	-0,23
Relationship between depression level and the perceived level of physical fitness	-0,67	-0,76
Relationship between level of depression and the extent to which one can rely on close family	-0,45	-0,56
Relationship between level of depression and the extent to which one can rely on close friends	-0,34	-0,41
Relationship between level of depression and the perceived level of friendliness in the local community	-0,54	-0,56
Relationship between level of depression and the extent to which one is involved in voluntary activities in the community	-0,71	-0,54
Relationship between level of depression and the extent to which one feels valued by local community	-0,75	-0,54
Relationship between depression level and the self-perceived level of general health	-0,56	-0,78
Relationship between depression level and the self-perceived condition of one's heart	-0,34	-0,23
Relationship between depression level and hypertension	-0,24	-0,17
Relationship between depression level and level of medication	0,56	0,58
Relationship between depression level and self-perceived level of overweight	0,62	0,43

While the coefficients for exercising activity for women and men are essentially the same, the elaboration pattern corresponds to the idea derived from gender theories that the association between exercising and depression is gendered. The greater association between what could be defined as “physical activity” factor and depression is the extent to which individuals engage in social activities with those with whom they exercise. ($r=-0.86$). This is in line with

existing theories which express the view that exercising has a strong association with social skills and wellbeing.

Results of this pilot study indicate that there is a moderate association between the level of depression and individuals' feeling that they can rely on family members for support. The association is slightly greater for men than for women.

The feeling of being able to rely on close friends has a lower association with the level of depression. (-0.34 for women and -0.41 for men)

There seems to be a moderate association between the extent to which people feel safe in the community and the depression levels. Those who feel safer tend to be less depressed. The difference between men and women's result is not statistically significant though.

There is an interesting and great difference between the association between depression and the extent to which man and women participate as volunteers in local community. The association is greater in women (-0.71) than in men (-0.54).

Results indicate also a great difference between the association between depression and the extent to which people feel valued in their community. (-0.75 for women and -0.54 for men).

There is a difference in the gendered patterns of support: For women, being unable to rely on partners and being unable to rely on family have significant associations with increased depressive symptoms; for men, being unable to rely on partners, family, or friends associates with greater depression, although this association is of a lower magnitude than for women.

Interestingly, there is a great difference between the association between depression and the extent to which man and women perceive their health. The association is greater in men (-0.78) than in women (-0.56).

Results of this pilot study indicate that there is a low association between the level of depression and individuals' self-perception of their heart condition. The association is slightly greater for women than for men.

Interestingly the association between the level of depression and the reported level of hypertension is very low. (-0.24 for women and -0.17 for men)

There seems to be a moderate association between the level of medication individuals use and the level of depression. The strength of the association is very similar for women and men (0.56 and 0.58 respectively)

A great difference between the two gender's level of association between depression and perceived level of overweight has been found. The association is greater for women (0.62) than for men (0.43).

For women, but not men, having been diagnosed with hypertension and feeling overweight have significant associations with increased depression

The elaboration patterns also support the idea that gendered processes influence the relations between physical health, sexual activity, and depression differently for women and men, as physical health more closely and directly associates with depression for women than for men. Notwithstanding this stronger direct association between physical and mental health for women, the influence of physical health on the association between exercising and depression is greater for men than women, which corresponds to findings about how masculinity is increasingly important for older men who face physical decline (Meadows and Davidson 2006).

Overall, the elaboration patterns and final models show gender similarity in the association between sexual activity and lower depression among older adults but gendered differences in how relationships, social support, and physical health influence this association. These differences between women and men in how relationship and health characteristics influence the association between sex and depression suggest gendered patterns in how sex, as an activity, is positioned in relation to other sources of belonging, support, and activity. Notwithstanding these gendered dynamics, sexual activity that typically integrates other forms of touch associates with lower depression for both women and men.

Conclusions. Beginning with the insights that belonging and mattering contribute to mental health and that socially meaningful activity can reinforce social support in ways productive of mental health, we hypothesized that being physically active may associate with lower levels of depression among older adults. Rather than seeing all exercising as equivalent, however, we suggested that physical exercise that integrates other forms of social interaction is more likely associated with lower depression because the mutual orientation of social connection may create more of a shared experience and provide more social uplift to people. While controls associated with alternative hypotheses account for about half (for women) and two thirds (for men) of the initial bivariate association between physical activity and lower depression, our final results indicate a significant, negative association between physical activity and depression, conditioned on whether people typically incorporate other forms of social interaction with exercising.

The association between physical exercise and depression, therefore, is not a mere artefact of relationship status or quality or physical health. Indeed, the patterns of elaboration in the analysis suggest that not accounting for health problems—which did not have a significant, direct association with depression suppresses the association between physical exercise and lower depression. Contrary to studies in which older adults who are physically inactive report exercising is unimportant (Gott and Hinchliff 2003; Lindau et al. 2007), these findings imply that lack of physical exercise among older adults may associate

with greater depression. Our analysis also examined whether the association between physical exercise and mental health among older adults is gendered. Contrary to self-report studies showing older men rating physical exercise as more important to them than older women rated physical exercise (Kontula and Haavio-Mannila 2009; Lindau et al. 2007; Skultety 2007), we find gender similarity in the general association between physical exercise activity and lower depression but gender differences in details about this association (Umberson et al. 1996). Although differences between women and men for the main effect variables are not always statistically significant, the differences run counter to conventional wisdom: a higher magnitude coefficient between physical exercise and lower depression for women and a stronger conditioning of this association on integration of other forms of touch for men. This pattern may reflect the gendering of exercising because men are more likely than women to rely on friends for socialisation (Simon and Barrett 2010; Umberson 1992). These findings emphasise the importance of considering the gendered nature of exercising behaviour and the potential consequences of change in the “symbolic dimensions” of physical exercise (Graf and Schwartz 2011). Beliefs about appropriate gendered behaviour may influence how women and men approach physical exercise, presenting gender normative behaviour (men concerned with physical fitness; women interested more in ancillary activities rather than exercising). Gendered behaviour patterns could result in physical exercise being less mutually oriented and also lead to women being less likely to pursue or physical exercise, both of which could have adverse mental health consequences. Indeed, the gap between self-report studies and our findings may demonstrate that older women and men draw on cultural repertoires when discussing physical exercise, possibly reproducing gendered patterns of exercising behaviour.

The findings of gender differences in how health and relationship characteristics influence the association between physical exercise and depression hold further implications. While more dimensions of physical health associate with depression for women, physical health has greater consequence for the association between physical exercise and depression for men. This finding is consistent with research that shows physical exercise particularly important for older men (Meadows and Davidson 2006), suggesting that cultural beliefs about masculinity, control, and virility may influence the gendered patterns we observe (Cornwell and Laumann 2011). Additionally, consistent with literature concerning the gendered nature of the association between physical exercise and depression (Simon 2002; Simon and Barrett 2010; Umberson 1992; Walker and Luszcz 2009), we found relationship qualities have a greater influence on the association between physical exercise and depression for older women than they do for men. Conversely, relationship status exerts a greater influence on the association between physical exercise and mental health and has a stronger

direct association with depression for older men than for older women. Finally, the elaboration patterns imply that research attempting to account for an association between depression and social activities, such as religious participation, should examine whether gender influences these activities' association with depression (Idler, Boulifard et al. 2009; Schnittker 2001; Sternthal et al. 2010). The finding that physical exercise associates with lower depression but that depression does not associate with the frequency of exercising lends support to our theoretical interpretation; the pair of findings is consistent with the possibility that there is not joint or reverse causation. Yet it also raises the question: Why is there no association between frequency of exercising and depression? We offer two potential explanations, revealing suggestions for future research.

First, people may understand physical exercise as a component of identity that is not associated with how frequently they engage in physical exercise, as suggested by activity theory and interview-based studies with older adults about physical exercise (Davidson 2006). This possibility suggests further research on the temporal structure –an understanding of the meaning of time, including appropriate intervals and pacing, and the anchoring of time for one realm of activity based on other activities (Larson 2010).

Second, physical exercise may simply have a long resonance to induce perceptions of support and belonging. Increased professional attention to a connection between physical exercise and healthy aging (Scherrer 2009) could further enhance this resonance. This argument is consistent with findings of inter-cohort changes in older adults' exercising expectations and norms (Fisher 2010).

It must be stressed that this study is part of a pilot for large scale study that intends to use a factor analysis method in order to identify the factors mostly linked to depression. This future study needs to involve a sample of at least one thousand participants.

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