The Role of Partnership Status on Late-Life Physical Function*

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RÉSUMÉ

Cette étude a examiné les voies socio-économiques reliant le statut de partenariat pour le fonctionnement physique en fin de vie, mesuré à l'aide des moyens objectifs, y compris le débit de pointe et la force de préhension. Utilisant la vague 4 de l'enquête SHARE sur la santé, le vieillissement et la retraite en Europe, nous avons couru des modèles multi-niveaux pour examiner la relation entre le statut de partenariat et la fonctionnement physique en fin de vie, en ajustant les caractéristiques des réseaux sociaux, les facteurs socio-économiques et les comportements sanitaires. Nous avons trouvé une relation forte entre le statut de partenariat et le fonctionnement physique. L'incorporation des caractéristiques des réseaux sociaux, des facteurs socio-économiques et des comportements de santé ont montré de relations indépendantes et solides avec le fonctionnement physique. La covariance a atténué l'impact de la cohabitation, la séparation, le veuvage sur la fonction physique; des effets robustes ont été trouvés pour le célibat et le divorce. Analyses séparées par sexe suggèrent que les associations entre la cohabitation, le célibat, le divorce et le veuvage sont plus pour les hommes que pour les femmes. Les résultats indiquent que les liens sociaux sont importants pour l'amélioration du fonctionnement physique.

ABSTRACT

This study examined the socioeconomic pathways linking partnership status to physical functioning, assessed using objective measures of late life physical functioning, including peak flow and grip strength. Using Wave 4 of the Survey of Health, Ageing and Retirement in Europe (SHARE), we ran multilevel models to examine the relationship between partnership status and physical function in late life, adjusting for social-network characteristics, socioeconomic factors, and health behaviours. We found a robust relationship between partnership status and physical function. Incorporating social-network characteristics, socioeconomic factors, and health behaviours showed independent robust relationships with physical function. Co-variates attenuated the impact of cohabitation, separation, and widowhood on physical function; robust effects were found for singlehood and divorce. Sex-segregated analyses suggest that associations between cohabitation, singlehood, divorce, and widowhood were larger for men than for women. Results suggest that social ties are important to improved physical function.

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Healthy aging is a life course process that incorporates multiple domains of aging (Kuh, Cooper, Hardy, Richards, & Shlomo, 2014). Marital status has been robustly linked to death in a number of countries and across time (Trovato, 1991; 1998; Trovato & Lauris, 1989; Waite, 1995; Waite & Gallagher, 2000), and has been associated with as much as a 10-year extension in lifespan (Waite). Many researchers have thus focused on the role of partnerships in broadly benefiting health (Clouston & Quesnel-Vallée, 2012), reducing mortality (Gove, 1973; Travato & Lauris; Travato, 1987) and maintaining function (Unger, McAvay, Bruce, Berkman, & Seeman, 1999). However, while partnership has been robustly associated with health, estimates of the partnership "benefit" are due in part to the stressful and detrimental aspects of divorce (Amato, 2000; Gahler, 2006) and to the negative association between singlehood and health (Carr & Springer, 2010). Moreover, the harms and benefits of partnership status tend to be more concentrated among men (Kiecolt-Glaser & Newton, 2001; Waite; Waite & Gallagher).

Although there may be a robust association between partnership status and health, the mechanisms that structure that relationship are influenced by a range of economic, social, and behavioural factors (Umberson, Crosnoe, & Reczek, 2010). For example, partnerships consistently provide a source of engagement that influences healthy living across the life course (Waite, 1995; Waite & Gallagher, 2000; Stolzenberg & Waite, 2005). Partnerships may encourage individuals to "clean up" health behaviours (Duncan, Wilkerson, & England, 2006) and may influence the types of activities in which individuals engage (Albert et al., 1995; Angevaren, Aufdemkampe, Verhaar, Aleman, & Vanhees, 2008; Kuh et al., 2014;). It may also be that those who have unobserved predispositions to good health are preferentially selected into partnerships (Goldman, 1993). Berkman, Glass, Brissette, and Seeman (2000) have extended this argument to social networks, arguing that they broadly influence health and function over the life course by contributing to factors such as social support (Callaghan & Morrissey, 2008), influence of alters (individuals in a person's social network) over health-related activities and exposures (Christakis & Fowler, 2007; 2008), embedding of individuals with others with similar health lifestyles (Cockerham, 2005; 2007; Murray & Stafford, 2013), or through improved access to material goods (Phelan & Link, 2013). As a result, researchers have linked a person's social-connectedness to a number of health-related outcomes including health behaviours (Christakis & Fowler), self-perceived health (Cohen & Janicki-Deverts, 2009), cancer (Pinquart & Duberstein, 2010), and all-cause mortality (Holt-Lunstad, Smith & Layton, 2010). Furthermore, partnership, across the life course, is likely to improve the general "health reserve": the ability for individuals to resist damage and successfully maintain health including, for instance, cognitive (Stern, 2002; 2009) or physiological (Buchner & Wagner, 1992; Xue, 2011) functioning.

Although partnership has been generally associated with health, a better understanding of how partnership "gets under the skin" or is "embodied" is needed (Krieger, 2005). Embodiment may occur as partnership cumulatively influences physical function over the life course, positively influencing health. Although there is a good understanding of the association between partnership and self-rated health, the association between partnership and physical function remains under-examined. Physical function, using objective biomarkers of aging-related decline such as grip strength and peak flow, is a robust predictor of health (Cooper et al., 2011b; Warburton, Gledhill, & Quinney, 2001a), healthy aging (Warburton, Geldhill, & Quinney, 2001b), brain aging (Clouston et al., 2013), and mortality (Cooper, Kuh, & Hardy, 2010; Rantanen et al., 2003). Physical function is interesting to life course analysts because it is susceptible to a lifetime of exposure to modifiable behavioural and structural factors (Franklin & Tate, 2009). For example, stressful work environments have been shown to negatively influence physical function in later life (Russo et al., 2006). Health behaviours, including physical activity (Paterson & Warburton, 2010) and smoking status (van den Borst et al., 2011), similarly influence physical functioning in late life. Finally, socioeconomic status is a persistent and common cause of health and functioning over the entire life course (Link & Phelan, 2010; Phelan & Link, 2013), and it has been associated with physical function in late life (Brunner et al., 2009; Hurst et al., 2013).

Hypotheses

Partnership may influence physical function; however, this influence is likely to be mediated by its strong

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association with social, behavioural, and economic factors. We hypothesize that partnership will influence physical function. Furthermore, associations between partnership and physical function will be mediated by adjusting for (1) social network characteristics, (2) household income and education, and (3) health behaviours. Finally, we expect that insofar as partnership is related to physical function, that such a relationship will be reduced among women as compared to men.

Methods

Data Source

The Survey of Health, Ageing, and Retirement in Europe (SHARE) biennially interviews a longitudinal panel of individuals aged 50 and older since it began in 2006 (Börsch-Supan et al., 2013). Although SHARE includes data from 19 countries across Europe, three countries – Ireland, Israel, and Greece – were not included in 2010 when SHARE incorporated the first large-scale social networks data collection. Response rates in this sample were 61.6 per cent on average at the household level and 85.3 per cent at the individual level. Nearly 60,000 individuals provided marital status, gender, and age (n = 56,900). We further limited the sample to household members aged 55 and older who were living alone or with a spouse for a final sample size of 31,712.

Measures

Objective measures of *physical function* were collected during in-person interviews. Because physical functioning may indicate different domains of functioning (Clouston et al., 2013), we used two indicators of physical function: grip strength and peak flow. To allow comparability between measures and to ease interpretation, we standardized grip strength and peak flow so that one unit equals one standard deviation. *Grip strength* is measured in kilograms (kg) using a handgrip dynamometer, and indicates the function for individuals to grab and hold onto physical objects. We used the maximum physical function over two trials for the dominant hand; in this sample, the dominant hand is the right hand 93 per cent of the time. *Peak flow* is measured in litres per minute (l/m) using a peak flow meter.

Partnership status was measured using self-reported relationship status. Individuals living in cohabiting relationships were identified either as married or living in a common-law partnership. Individuals further noted if they were not in a partnership, whether they were single (never-married), separated, divorced, or widowed.

Social network characteristics were measured using network size, satisfaction, and emotionality. *Size* measures the number of non-spouse alters with whom the respondent reported sharing a close social tie (ranging from 0 to a maximum of 7); the average social network includes 2.4 members. We further subdivided this measure to indicate the number of friends and family members that respondents reported seeing regularly (none, one, two, or three or more). *Network dissatisfaction* was measured with a binary indicator developed from a 0–10 score recording whether individuals reported that they were satisfied with the size and functionality of their social networks. Due to the highly skewed data (the average overall was 8.9, or highly satisfied), we dichotomized this indicator to note those who reported being dissatisfied (less than 8 of 10). *Emotionality* indicates the feeling of closeness with alters and was measured using an average across non-spouse alters. Emotionality ranged from 1 (not close at all) to 4 (very close), and averages 3.25 (close to very close).

Education was measured in years to help ensure comparability between countries. *Household income* was measured in euros earned from all sources before taxes in the year preceding Wave 4. Over 10 per cent of values were missing for household income, so we tested the robustness of our analyses to selection by replicating these analyses using multiply-imputed income data; sensitivity analyses did not alter our results. To mark behavioural factors, we include indicators of *smoking status* (never-smoked, not currently smoking, or currently smoking), and *physical activity* (whether respondents reported having been physically active at least once per week over the past month).

Finally, we also adjusted for demographic and physical factors including age, sex, and height. We measured age, centred at 65, using the difference between birth year and year and month of interview. Cooper et al. (2011a) noted that the rate of decline in physical function depends on gender; we therefore included in all models an interaction between gender and age, and further completed sensitivity analyses separately among men and women. We measured *height* in centimetres (cm).

Statistical Analysis

The data were cluster-sampled within households, which were in turn nested within countries. Contextual factors, such as cultural or economic differences, are likely to modify late-life function, thus ignoring this structural inequality is inadvisable. We used restricted maximum likelihood in mixed-effects multilevel models (MLMs) to examine the relationship between partnership status and late-life function. An MLM allows us to estimate

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the population average "fixed effects", while also accounting for "random intercepts": the household- and country-level variance structures under the assumption that the sum of the expected deviations at any particular level is zero. An MLM is advantageous in this context because it can allow us to implicitly account for within-group shared exposures including, for instance, differences in culture, genetic heritage, or geography that may positively or negatively influence physical functioning.

In our analysis, accounting for shared household variability may account for different micro-climates and local context while accounting for shared country-level variability may help to account for shared genetic, historical, educational, cultural, or geographic influences. We used *t*-tests to determine whether estimates differed between nested models. We calculated pseudo-R^2 to examine model fit and provide R^2 change to examine the role of additional predictors in improving model fit. We assumed independent error structures and estimate random intercepts at both the country and household levels. We used Huber-White robust standard errors. Here, we provide analysis on the whole sample, and on sex-specific subsets. To ensure comparability, we used sex-standardized measures of physical function. To compare model estimates between these samples, we provided differences, which were tested for significance using two-tailed *t*-tests and pooled standard.

Results

Table 1 provides sample means, standard deviations, and a preliminary examination of the variation between countries and across households. Examining country-level variability using the range in deviations from the sample means adjusted for age, sex, and height, we find substantial differences. There is substantial between-country variation in grip strength and peak flow: mean grip strength ranges from 4.5 kg below average in Spain to 3.4 kg above average in Denmark. Similarly, the percentage of respondents suggesting that they had three or more friends ranges from 0.5 per cent to 6.2 per cent in Poland and Switzerland respectively. Using the country-level variance ratio, we see that country-level differences explain between 1 and 30 per cent of the between-person variability, depending on the measure. Examining household variability, the variability ratio shows that household-level factors may explain a substantial portion of the variation between spouses, often upwards of 70 per cent.

Table 2 provides MLM estimates of associations between partnership status and grip strength. First, we provide

Table 1: Descriptive characteristics including per cent, means, standard deviations, country-level ranges, and both country and household variance ratios (Survey of Health, Ageing and Retirement in Europe, 2010–12)

Variable name	Categories	%	Country Range (Min, Max)
Male		44.14	(43.40, 48.87)
Partnership Status	Married	71.79	(61.35, 80.07)
	Common-law	1.63	(0.00, 8.69)
	Separated	1.12	(0.26, 2.31)
	Single	4.84	(2.63, 8.50)
	Divorced	8.28	(2.06, 12.22)
	Widowed	12.34	(9.16, 18.54)
Family Size	None	53.81	(44.89, 75.29)
	One	20.56	(13.06, 23.86)
	Two	14.60	(7.84, 18.15)
	Three or more	11.03	(3.81, 15.53)
Friendship Size	None	80.03	(67.23, 94.32)
	One	12.43	(4.11, 19.12)
	Two	4.82	(1.04, 8.80)
	Three or more	2.71	(0.52, 6.17)
Network Dissatisfaction		10.72	(4.99, 13.57)

Variable name	Mean	*SD*		Country Variance Ratio	Household Variance Ratio
Emotionality	1.74	0.50	(1.49, 1.92)	0.95	0.19
Age: 65	0.88	9.97	(–0.43, 4.87)	0.99	0.05
Years of Education	10.75	4.35	(6.14, 13.50)	0.82	0.09
Household Income	9.34	1.28	(8.36, 10.40)	0.70	0.00
Grip Strength	33.19	12.10	(28.69, 36.55)	0.98	0.36
Peak Flow	332.21	160.15	(261.28, 399.6)	0.94	0.19

***SD* = standard deviation**

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Table 2: Multilevel models estimating the relationship between partnership status and peak flow adjusting for social network characteristics, health behaviours, and socioeconomic factors (Source: Survey of Health, Ageing and Retirement in Europe, 2010–12)

Variable name	Category	Model 1		Model 2		Model 3		Model 4	
		B	*SE*	B	*SE*	B	*SE*	B	*SE*
Marital Status	Married	Reference		Reference		Reference		Reference	
	Cohabiting	–0.066	0.039	–0.063	0.038	–0.058	0.040	–0.041	0.038
	Separated	–0.021	0.054	–0.041	0.055	–0.038	0.058	–0.025	0.053
	Single	–0.172	0.023***	–0.186	0.024***	–0.169	0.026***	–0.158	0.027***
	Divorced	–0.045	0.012***	–0.067	0.010***	–0.056	0.013***	–0.034	0.013*
	Widowed	–0.041	0.012***	–0.065	0.014***	–0.036	0.011**	–0.021	0.012
Age		–0.028	0.001***	–0.027	0.001***	–0.025	0.001***	–0.025	0.001***
Male		0.779	0.031***	0.804	0.031***	0.787	0.030***	0.801	0.030***
Age × Male		–0.012	0.001***	–0.012	0.001***	–0.013	0.001***	–0.013	0.001***
Height (cm)		0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002
	None			Reference		Reference		Reference	
Family Network	One			0.057	0.011***	0.051	0.011***	0.043	0.011**
	Two			0.085	0.015***	0.075	0.015***	0.059	0.015***
	Three or more			0.152	0.026***	0.140	0.024***	0.121	0.025***
	None			Reference		Reference		Reference	
Friend Network	One			0.059	0.017**	0.040	0.016*	0.036	0.015*
	Two			0.098	0.029**	0.069	0.028*	0.062	0.028*
	Three or more			0.111	0.028***	0.071	0.026**	0.055	0.025*
Network Dissatisfaction				0.004	0.034	0.011	0.035	0.020	0.034
Emotionality				0.000	0.017	0.008	0.017	0.014	0.017
Years of Education						0.022	0.003***	0.020	0.003***
Household Income						0.044	0.011***	0.039	0.011***
Smoking Status	Non-smoker							Reference	
	Smoked in past							–0.003	0.018
	Smoker							–0.226	0.016***
Physically Active								0.192	0.028***
Random Effects									
Country		0.07	0.02	0.07	0.02	0.05	0.02	0.05	0.02
Household		0.31	0.11	0.30	0.11	0.29	0.11	0.29	0.11
Residual		0.36	0.01	0.36	0.01	0.36	0.01	0.35	0.01
Model Fit									
Pseudo-R^2			0.152***		0.154***		0.158***		0.165***
R^2 Change					0.002***		0.005***		0.011***

***$p < .001$, **$p < .01$, **$p < .05$
B = coefficient
***SE* = standard error**

bivariate estimates (adjusting for age, sex, age × sex, and height) between marital status and partnership. Model fit is significant (pseudo-R^2 = .15, $p < .001$). Analyses of model fit (results not shown) suggest that incorporating the household-level significantly improved model fit over the one-level model ($p < .001$), and further, that adding country significantly improved the model ($p < .001$). Random-effects estimates in Model 1 similarly exhibit shared variation at the household and country levels.

Examining results in Model 1, we find that marital status is associated with peak flow: those who were single, divorced, or widowed had lower peak flow than those who were married. The model provided a good fit for the outcome. Results show significant within-country and within-household shared variance.

Incorporating social network characteristics (Model 2), we find significant relationships between friend and family network size and peak flow, such that larger networks are associated with improved physical

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functioning. We also find that the negative impact of divorce (difference = –.022, $p < .05$) and widowhood (difference = –.025, $p < .05$) increased significantly in size.

Adjusting for socioeconomic factors (Model 3), we find positive associations linking education and income to peak flow. Each year increase in education is associated with an increase in peak flow of approximately 3.4 l/m. Incorporating socioeconomic co-variates attenuates the relationship between cohabitation and peak flow, and it also significantly mediates the relationship between widowhood and peak flow (difference = .03, $p < .05$).

Finally, adjusting for behavioural factors (Model 4), we find a significant relationship between both current smoking status and physical activity with peak flow such that smoking substantially decreases peak flow, while being physically active increases it. Incorporating behavioural factors significantly improved model fit ($p < .001$). Furthermore, we find that the influence of widowhood was attenuated.

Examining the relationship between partnership status and grip strength (see Table 3), we find first that the baseline models fit the data well (pseudo-R^2 = .33, $p < .001$). We further note that there is a significant relationship between being single, divorced, or widowed and lowered grip strength. We also find substantial within-country and within-household shared variance in grip strength.

Incorporating social network characteristics (Model 2), we find only limited results. Grip strength is significantly related to having three or more family members, with having two (but not more) friends, and with being dissatisfied with one's social network. However, incorporating these does not improve model fit (R^2 change = .000, n.s.).

Adjusting for income and education significantly improves model fit. Results suggest that having another year of education is associated with an increase in grip strength. Furthermore, we find that having higher household income was similarly associated with improved grip strength. Incorporating socioeconomic factors reduces the overall impact of social network ties and partnership status, and attenuates the relationship between friendship networks and grip strength. Moreover, adjustment for socioeconomic factors attenuates the relationship between widowhood and grip strength.

Accounting for health behaviours (Model 4), we find that being physically active is associated with improved grip strength while being a current smoker is associated with lower grip strength. Incorporating health behaviours significantly improves model fit; however, it does little to mediate associations between partnership status and grip strength.

Table 4 provides analyses separately for females and males using sex-standardized grip strength and peak flow using fully adjusted models (Model 4 from Tables 2 and 3 above). These results generally show stronger associations between partnership status and both grip strength and peak flow among men. For example, there is a significant difference between genders in the influence of cohabitation, which is associated with both grip strength and peak flow among males but not among females. Similarly, the influence of singlehood is larger for men, although it is significant and negative for women.

Sensitivity Analyses

Missing data can be problematic. We assessed the sensitivity of these results to missing data in two ways. First, we incorporated multiply-imputed income data (using 20 imputations separately calculated by sex), which resulted in similar results. Second, we adjusted for the estimated likelihood of sample selection on the outcome variables, which showed similar results. Insofar as missing data are not missing at random, our results linking partnership to physical function are likely to be unbiased, but our results linking less-permanent factors including social network status or smoking status may be conservative because those who are worst off are most likely to be excluded both from the sample and from engaging in such activities. We present results using unimputed data for two reasons: first, multilevel models provide results that are robust when data are missing at random (Atkins, 2005); and second, incorporating estimated data generally reduces the variability without adding information, an unnecessary trade-off when sample sizes are sufficiently large. We have 15 country-level groups – fewer than 20, which is an often-measured optimal benchmark – which may result in a small bias (5%) in the random effects estimates (Maas & Hox, 2005). We continued using country-level variation because national context plays a significant role in determining physical function, with some countries such as Sweden having particularly high physical function (1 kg above average) while others such as Portugal or Spain have particularly low physical function (3 kg below average). Ignoring this country-level variation results in poorer model fit and yields similar results.

Discussion

We used a large and generalizable cross-national dataset to provide robust estimates of the impact of partnership status on physical function in late life. Using multilevel models, we found partnership status to be a robust predictor of physical function. Specifically, after adjustment for social networks, economic factors, and health behaviours, those who were single or divorced had poorer peak flow and lower grip strength than those

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Table 3: Multilevel models estimating the relationship between partnership status and grip strength adjusting for social network characteristics, health behaviours, and socioeconomic factors (Source: Survey of Health, Ageing and Retirement in Europe, 2010–12)

Variable name	Category	Model 1		Model 2		Model 3		Model 4	
		B	*SE*	B	*SE*	B	*SE*	B	*SE*
Marital Status	Married	Reference		Reference		Reference		Reference	
	Cohabiting	–0.035	0.034	–0.033	0.034	–0.030	0.034	–0.024	0.031
	Separated	0.007	0.035	0.005	0.034	0.010	0.032	0.012	0.034
	Single	–0.145	0.013***	–0.144	0.015***	–0.132	0.015***	–0.128	0.016***
	Divorced	–0.053	0.014**	–0.054	0.013***	–0.044	0.013**	–0.040	0.012**
	Widowed	–0.035	0.007***	–0.035	0.007***	–0.017	0.009	–0.010	0.009
Age		–0.029	0.001***	–0.029	0.001***	–0.028	0.001***	–0.026	0.001***
Male		1.357	0.024***	1.361	0.024***	1.352	0.023***	1.346	0.022***
Age × Male		–0.022	0.001***	–0.022	0.001***	–0.022	0.001***	–0.023	0.001***
Height (cm)		0.003	0.002	0.003	0.002	0.003	0.002	0.003	0.002
Family Network	None			Reference		Reference		Reference	
	One			0.002	0.014	–0.001	0.014	–0.008	0.014
	Two			0.003	0.011	–0.002	0.011	–0.013	0.011
	Three or more			0.036	0.014*	0.031	0.014*	0.015	0.014
Friend Network	None			Reference		Reference		Reference	
	One			0.012	0.012	0.002	0.011	–0.005	0.011
	Two			0.037	0.012**	0.021	0.012	0.011	0.013
	Three or more			0.017	0.022	–0.003	0.018	–0.019	0.019
Network Dissatisfaction				–0.032	0.014*	–0.028	0.014	–0.019	0.014
Emotionality				–0.010	0.009	–0.005	0.010	–0.004	0.010
Years of Education						0.009	0.004*	0.008	0.004*
Household Income						0.032	0.006***	0.029	0.005***
Smoking Status	Non-smoker							Reference	
	Smoked in past							0.009	0.010
	Smoker							–0.026	0.012*
Physically Active								0.211	0.023***
Random Effects									
Country		0.02	0.01	0.02	0.01	0.01	0.00	0.01	0.00
Household		0.05	0.01	0.05	0.01	0.05	0.01	0.05	0.01
Residual		0.33	0.01	0.33	0.01	0.33	0.01	0.33	0.01
Model Fit									
Pseudo-R^2			0.330***		0.330***		0.333***		0.338***
R^2 Change					0.000		0.002***		0.007***

***$p < .001$, **$p < .01$, **$p < .05$
B = Coefficient
R^2 = Adjusted variance explained
***SE* = Standard error**

who were partnered. Furthermore, being dissatisfied with one's social network and having fewer social ties outside of one's partnership were also associated with poorer peak flow but not with grip strength. Our results suggest that non-spousal social interaction may be sizable, and may even be large enough to replace some of the substantial negative impact of partnership status on peak flow, but only in specific contexts (e.g., having three or more family members in one's network) does this sort of interaction impact grip strength. Moreover, these results further support research suggesting that social factors influence late-life function.

Strengths and Limitations

Our analyses have a number of limitations. We used cross-sectional data, which are biased by a lack of consideration for change over time (Hofer, Berg, & Era, 2003).

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Table 4: Influence of partnership status by sex on both grip strength and peak flow using fully adjusted models[a]

Variable name	Category	Female		Male		Comparison
Grip Strength		B_{Female}	*SE*	B_{Male}	*SE*	$B_{Female} - B_{Male}$
Marital Status	Married	Reference		Reference		
	Cohabiting	0.014	0.072	–0.063	0.040*	0.077*
	Separated	–0.030	0.072	0.047	0.040	–0.077*
	Single	–0.061	0.020*	–0.271	0.029***	0.210***
	Divorced	–0.039	0.026	–0.073	0.026*	0.034
	Widowed	0.019	0.013	–0.075	0.028**	0.095***
Peak Flow						
Marital Status	Married	Reference		Reference		
	Cohabiting	0.012	0.076	–0.094	0.035*	0.105**
	Separated	–0.062	0.081	–0.011	0.059	–0.051
	Single	–0.094	0.028***	–0.257	0.038***	0.162***
	Divorced	–0.030	0.017**	–0.063	0.042	0.033*
	Widowed	–0.022	0.022	–0.056	0.038	0.034

*****$p < .001$, **$p < .01$, **$p < .05$**
B = Coefficient
***SE* = Standard error**
[a] Results are presented using sex-standardized coefficients. Models adjust for social network characteristics, years of education, household income, smoking status, and physical activity. Results further account for shared country-level variance.

This is particularly problematic because researchers have suggested that change in physical functioning can be modified by social networks (Unger et al., 1999) and by other life course factors (Peeters, Dobson, Deeg, & Brown, 2013). Our social networks measures are self-reported, truncated, and do not measure informational spread between alters. Similarly, we generally do not have information about the characteristics of alters in the social network, which substantially limits the capability of our analysis to judge selective versus causal patterns. Non-response was substantial, with around 38 per cent of households not reporting; however, within households, over 85 per cent of individuals responded. Such a pattern of non-response supports a view that those who did not respond did so at the household level because of reasons, such as lack of time or interest, and are thus unlikely to bias these results; however, insofar as those who did not respond did so because they were both living alone and of poor functional status, then our results are likely to be conservative.

Finally, because we lack longitudinal data on social networks, we cannot adequately guarantee that results are consistent over time. However, this is the first study of its kind to test the effects on peak flow and grip strength of the relationship of partnership status and social network characteristics in a large generalizable cohort. These analyses use objective measures of function, which improve over self-reported measures. Furthermore, our analyses use multilevel modeling to adjust for potential clustering at the household and country levels, both of which were found to be significant in our results, in a way that is robust to missing data.

Social Inequalities and Health

Fundamental cause theory posits that resources, including money, power, prestige, knowledge, and beneficial social connections can be used to influence health, and their unequal distribution may cause inequalities in health (Link & Phelan, 1995; Phelan & Link, 2013). Our results show, alternatively, that higher household income, more years of education, and larger social networks were associated with improved physical function. Future analysis should seek to examine whether these characteristics are due to causal influences, or matching-related selection.

Berkman et al. (2000) noted that networks are used to seek and receive social support, influence social engagement and attachment, and, finally, access material goods. A similar argument is routinely made when linking partnership status to health (Amato, 2000; Cheung, 2000; Gahler, 2006; Waite, 1995; Waite & Gallagher, 2000; Williams & Umberson, 2004). We noted this similarity and posited that insofar as social networks can replicate or replace spousal ties, incorporating network data may result in mediation of the relationship between partnership status and late-life function. Our results suggest that social network characteristics are predictive of physical function, and further, that having more extra-marital social ties – either family or friends – could help to replace

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the substantial negative effects of exiting or lacking a spousal relationship.

Shared Variability

Social science researchers have long highlighted the role that context plays in influencing health (Diez-Roux, 1998; Murray & Stafforf, 2013). Researchers have noted that societies can work to alter their health profiles by shaping the context in which health is experienced (Clouston & Quesnel-Vallée, 2012; Clouston et al., 2012; Link, 2008; Link & Phelan, 2009). In our results, we found that countries predicted shared variation, and that adjusting for country-level random intercepts significantly improved model fit. Insofar as this is due to contextual, and not genetic, factors, we might expect that societies are shaping physical function. Such a conclusion does receive some support in the literature; for example, a recent systematic review noted that area context influences health and functioning later in life (Yen, Michael, & Perdue, 2009).

Results showed substantial shared variance at the household level. Shared variance could indicate one of two effects: selective or causal. Selection may occur if physical function acts as a marital selector (Goldman, 1993), such that healthier people tend to directly or indirectly attract others who are healthy (Clouston & Quesnel-Vallée, 2012; Hewitt & Turell, 2011; Mare, 2008). However, it is also likely that household dynamics help to shape the behaviours, exposures, and health lifestyles of household members (Cockerham, 2005). These results may reflect contextual factors, such as community-level opportunities for physical activity, stressful environments, or vulnerability at the household or community levels, which may influence both partners' capabilities.

Partnership and Functioning

We found support for research suggesting that there is a substantial health benefit to partnerships (Waite, 1995; Waite & Gallagher, 2000). Specifically, we found that individuals in marital partnerships had higher physical function than those who remained single or were divorced. There are substantial stressors involved in divorce, both financial and emotional that may negatively impact overall health but may not be as substantial during separation (Hewitt & Turrell, 2011). These analyses support such a conclusion, with divorce – but not separation – showing a robust negative impact on physical functioning. Indeed, divorce broadly influenced health, with those who were divorced having, on average –6.5 l/m lower peak flow and –.44 kg lower grip strength than those who were not; effects that roughly correspond to the negative effect of having an extra 1.5–1.7 years of extra aging.

Cohabitation is often shown to be a significant predictor of marital dissolution (Mard, 2011), intimate partner violence and depression (Urquia, O'Campo, & Ray, 2012), and mortality (Liu & Reczek, 2012; Scafato et al., 2008). We did not find that those in marital partnerships had better physical functioning over cohabiting couples, but we did find that men in cohabiting partnerships fared worse than did those in marital partnerships. This provides marginal support for prior results showing that marital relationships are healthier than cohabiting ones among men (Waite, 1995), but also suggests that cohabiting partnerships may simply be different from other types of partnership (Wu, 2000). One reason for such may be that even in socially supportive regions, they are less stable than marital unions (Ménard, 2011). Because partnership structure depends on social context, these results may not be widely generalizable beyond societies, like those in Europe or Canada, where cohabitation is a common form of long-term stable relationships (Beaujot, 2000).

The effect of partnership status was substantially smaller among women. These results extend prior work noting that women are less susceptible to partnership-related benefits or detriments than are men (Gahler, 2006) to domains of physical functioning. Differing relationships between partnership status and physical functioning between genders could reflect differences in partnership benefits, selective factors, or coping mechanisms during divorce or singlehood. Our results do not clarify the mechanisms through which inequalities may arise. Longitudinal research is needed that examines these different explanations in more detail.

Mechanisms

Individuals who engage in physical and cognitive activities may be better protected from declines in function and are more likely to live longer, healthier lives (Cooper et al., 2011b; Dumurgier et al., 2009; Thompson et al., 2003; Valenzuela, Sachdev, Wen, Chen, & Brodaty, 2008). We found that larger and more satisfying social networks were protective of peak flow, even after adjusting for smoking status and socioeconomic status. We also found that engagement in regular physical activity was associated with better physical functioning overall. This extends earlier work showing that social engagement can help to protect health and improve healthy aging (Barnes, De Leon, Wilson, Bienias, & Evans, 2004; Krueger et al., 2009; Zunzunegui, Alvarado, Del Ser, & Otero, 2003).

One reason that men may benefit more from partnership than women is that they engage in more risky behaviours prior to partnership (Duncan et al., 2006). We found that incorporating health behaviours explained some of the influence of divorce and of widowhood on

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peak flow, but were not explanative of relationships between partnership and grip strength. Nevertheless, such behaviours were commonly associated with physical function as a whole and are believed to be integral to social network dynamics. There are substantively interesting reasons to believe that partnership does not uniformly improve health behaviours (Reczek, 2012); more research is needed to examine the extent to which associations between partnership status and health behaviours may be explained by shared, improved contexts or by selective forces early in life.

Incorporating social network characteristics was a significant addition to the model for peak flow, but provided less robust results for grip strength. For peak flow, we found that incorporating social networks also increased the influence of partnership status. Such an increase is suggestive of a "buffering" mechanism if individuals actively supplement partnerships with non-spousal friends and family. Such friendships, if lasting and stable, may effectively replace the role of spouse during times of high stress or when spouses are unavailable, and may further replicate the social engagement benefits that spouses otherwise provide.

Policy Implications

Marital policies have been previously proposed to incentivize marriage and discourage separation or divorce. However, these policies tend to ignore the substantial difficulties that can face individuals when trying to find partners: for example, that the chances of finding a partner are heavily dependent on the partnership market (Lichter, LeClere, & McLaughlin, 1991). Our results suggest that a substantial part of the partnership benefit in physical functioning is due to factors, such as socioeconomic inequalities and health behaviours, which may be more tractable to intervention. Similarly, efforts to increase social connectivity may lead to an improvement in the overall functioning among older individuals. These factors may further reduce partnership-related inequalities if change is focused on increasing involvement among those who are otherwise socially isolated. This offers further support for the growing policy interest in "network interventions" (Valente, 2012).

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