

# The Effects of Caregiving on Leisure Time Physical Activity in a Cohort of Manufacturing Workers: A Cross-Sectional Study.

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## Research article

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## Abstract

## Background

While leisure time physical activity (LTPA) has been linked to a myriad of health benefits, many individuals do not get enough LTPA. In this study, we investigated how caregiving responsibilities (for children, adults under age 65, and adults over age 65) affected components of LTPA including exercise, walking, gardening, and housework in a population of manufacturing workers.

## Methods

A cross-sectional study was performed among 857 manufacturing workers who completed a survey assessing caregiving responsibility and LTPA. Linear regression analyses were used to test for associations between caregiving and LTPA.

## Results

We observed that caregivers for children reported significantly ( $p < 0.05$ ) fewer hours of exercise and walking, but more hours of housework, than non-caregivers. We observed no association between caregiving for adults under age 65 or adults aged 65 and older and exercise or walking. Caring for adults under age 65 was associated with a significant ( $p < 0.05$ ) increase in hours spent gardening, and caring for adults aged 65 and older was associated with a significant increase in hours spent performing housework.

## Conclusions

We identified associations between caregiving and physical activity in a population of manufacturing workers. Our results support the development of targeted interventions to promote health in working caregiver populations.

## Background

Leisure time physical activity (LTPA) has been linked to a myriad of health benefits ranging from improved physical and mental health to reduced mortality(1). Unfortunately, many individuals get less LTPA than recommended(2). A recent large epidemiological study reported that only a minority of adults meet activity guidelines, and linked several factors including poorer health, older age, female gender, and lower education to reduced physical activity(3).

Individuals who care for children or adults may have lower LTPA levels. A review of physical activity and parenthood concluded that parents with dependent children were more inactive than non-parents, also stating that the topic has received disproportionately scant research considering the size of the effect(4). More recently, several studies have identified caregiving for children as a predictor of reduced LTPA among women(5–7), and two prospective studies have reported decreased physical activity among both mothers and fathers after having a child(8, 9). Similar patterns emerge among individuals caring for adults, although less has been published on this group. Queen et al.(10), Cuthbert et al.(11), and Fredman et al.(12) all reported associations between caregiving status and decreased LTPA among those caring for adults.

Caregivers who also work outside the home may be especially at risk for reduced LTPA. Working can independently affect LTPA. For example, a systematic review reported associations between long work hours and decreased LTPA (13). Kirk et al.(13) also identified high physical and psychosocial work demands as factors that may affect LTPA. Although employment status has been mentioned as a barrier to physical activity in several studies of the effects of being a parent on LTPA(7, 14, 15), few studies have directly investigated the relationship between caregiving, work, and LTPA.

In order to fully understand how caregiving is associated with LTPA, it is worth looking at its effects on LTPA components. Most studies of the effects of LTPA on health have used cumulative measures of LTPA rather than separately considering the variety of activities that contribute to overall LTPA. For example, the physical activity guidelines suggest that exercises such as jogging or volleyball, brisk walking, gardening activities such as raking the yard, and some housework such as carrying heavy groceries or vacuuming all can contribute to LTPA(1). Caregivers, especially those who are also employed outside the home, may not have enough time or energy to participate in exercise. On the other hand, caregivers may spend more time on tasks such as housework or gardening as part of their caregiving duties, which could contribute positively to their overall physical activity levels(12).

For interventions promoting LTPA to be successful, it is important to understand barriers and facilitators to LTPA within specific populations. Therefore, the objective of this study was to investigate the effects of caregiving on LTPA in a cohort of manufacturing workers. We considered four separate activities that contribute to an individual's overall LTPA levels: exercise, walking, gardening, and housework. This work can assist future research in the design and tailoring of LTPA interventions.

## Materials And Methods

### Study Design and Participants

This study is part of a large longitudinal cohort study involving workers from six medium-sized manufacturing companies in Connecticut (UConn-SAM). Details of site identification and study procedures at each company were published previously(16). The full study protocol and consent agreements were approved by UConn Health's Institutional Review Board (IRB Number 18-072S-2). Researchers obtained written consent from each study participant.

The current study collected data on caregiving, activity, and individual and work-related factors using paper-and-pencil surveys. Surveys were distributed and collected by members of the research team during the formal work day. Participants were given a small financial incentive for completing the survey. All employees at selected sites were considered eligible and invited to participate in the study; no exclusion criteria were specified for individual participants. Employees of all job classifications (including production, sales, administrative, and managerial staff) participated.

## **LTPA**

Four categories of LTPA type and duration were determined by responses to a modified version of the EPIC physical activity questionnaire(17): "Outside of work, in an average week during the past year, how many hours did you spend on each of the following activities: physical exercise such as fitness, aerobics, swimming, jogging, cycling, tennis, etc.; walking, including walking to work, shopping, and leisure time; gardening, yard work, and do-it-yourself activities at home; and housework, such as cleaning, washing, cooking, child care, etc." Response options included: 0/1–3/4–6/7–9/10–12/>12 hours per week. For all activities, we combined responses into three categories in order to improve power: 0–3/4–6/>6 hours/week.

## **Caregiving**

Participants were considered to be caregivers for children if they reported that they personally had responsibility for any children under 18 in their household. Participants were considered to be caregivers for adults under 65 if they reported that one or more adults aged under 65 depended on them for help due to disability or chronic illness. Participants were considered to be caregivers for adults aged 65 or older if they reported that one or more adults aged 65 or older depended on them for help due to disability or chronic illness.

## **Individual and work-related factors**

Individual factors assessed included age (continuous), gender (dichotomous: male/female), and education level (ordinal: less than high school, high school graduate or GED, some college, 2 or 4 year college degree, graduate degree). Work-related factors assessed included schedule control (continuous: level of agreement using a 4-point Likert-type scale with item "I have control over my work schedule" ), overtime (ordinal: "thinking of the past year, which best describes the amount of overtime or extra hours you work in an average month" with response categories of 0–4/5–12/13–24/25–36/37–50/51 + hours), second job (dichotomous: yes/no), and psychological and physical demands (continuous: Job Content Questionnaire 4 point subscales from 1 (strongly disagree) to 4 (strongly agree)(18).

## **Data analysis**

We used chi-squared tests and univariate linear regressions to evaluate the differences in the distribution of exercise, walking, gardening, and housework by caregiving status. We next performed stepwise linear regression analyses (caregiving only, caregiving + individual factors, caregiving + individual factors + work-related factors). All statistical analyses were performed in SPSS version 22. Significance was defined as two-tailed  $p < 0.05$ .

## **Results**

Eight hundred fifty seven individuals participated in the study. Participants in the study population were more likely male, mostly had at least some college education, and mostly did not have a second job. Most participants worked 24 or fewer overtime hours per month, and about half of the participants agreed or strongly agreed that they had control over their work schedules. Participants were 48 years old on average. Fourteen, 13, and 40 percent of participants reported caring for adults under age 65, adults aged 65 or older, and children, respectively (Table 1).

Table 1  
Participant characteristics (N = 857).

		N	(%)
Gender	Male	624	(73)
	Female	233	(27)
Education	Less than high school	24	(3)
	High school graduate or GED	255	(30)
	Some college	192	(23)
	College degree (2 or 4 year)	246	(29)
	Graduate degree	134	(16)
Care for adults < 65	Yes	116	(14)
	No	741	(86)
Care for adults 65+	Yes	104	(13)
	No	753	(87)
Care for children	Yes	333	(40)
	No	524	(60)
Control over work schedule	Strongly disagree	96	(12)
	Disagree	306	(37)
	Agree	400	(48)
	Strongly agree	36	(4)
Overtime	0–4 hours	178	(21)
	5–12 hours	206	(24)
	13–24 hours	189	(22)
	25–36 hours	108	(13)
	37–50 hours	95	(11)
	51 + hours	69	(8)
Second Job	No	773	(92)
	Yes	72	(9)
		Mean	(SD)
Age		48	(12)
Psychological Demands		2.6	(0.5)
Physical Demands		1.9	(0.7)

Table 2 shows the distribution of LTPA variables in the study population. Sixty percent of participants reported getting between 0–3 hours per week of exercise, 36% reported 0–3 hours per week of walking, 47% reported 0–3 hours per week of gardening, and 39% reported 0–3 hours per week of housework. In univariate analyses, we observed significant differences in the reported number of hours gardening per week in those caring for adults under age 65 compared to those with no responsibility for younger adults. We observed significant differences in the reported number of hours performing housework per week in those caring for adults aged 65 or older compared to those with no responsibility for older adults. We observed significant differences in the reported number of hours performing housework in those caring for children compared to those with no responsibility for children.

Table 2  
Distribution of LTPA by caregiving status.

		Overall		No adults < 65		Any adults < 65			No adults 65+		Any adults 65+			No Children		Any Children		
		N	(%)	N	(%)	N	(%)	p-value	N	(%)	N	(%)	p-value	N	(%)	N	(%)	p-value
Exercise	0–3 hours/week	518	(60)	431	(59)	83	(72)	0.13	429	(61)	61	(59)	0.92	292	(59)	201	(60)	0.15
	4–6 hours/week	187	(22)	172	(23)	14	(12)		154	(22)	23	(22)		102	(21)	82	(25)	
	> 6 hours/week	150	(18)	130	(18)	19	(16)		126	(18)	20	(19)		97	(20)	50	(15)	
Walking	0–3 hours/week	311	(36)	264	(36)	45	(39)	0.28	263	(37)	36	(35)	0.46	165	(34)	137	(41)	0.07
	4–6 hours/week	274	(32)	243	(33)	30	(26)		229	(32)	30	(29)		162	(33)	104	(31)	
	> 6 hours/week	270	(32)	226	(31)	41	(35)		216	(31)	38	(37)		163	(33)	92	(28)	
Gardening	0–3 hours/week	400	(47)	<b>354</b>	<b>(48)</b>	<b>43</b>	<b>(37)</b>	<b>0.04</b>	339	(48)	43	(41)	0.26	231	(47)	157	(47)	0.26
	4–6 hours/week	237	(28)	<b>203</b>	<b>(28)</b>	<b>33</b>	<b>(29)</b>		195	(28)	28	(27)		127	(26)	99	(30)	
	> 6 hours/week	216	(25)	<b>175</b>	<b>(24)</b>	<b>39</b>	<b>(34)</b>		173	(24)	33	(32)		133	(27)	75	(23)	
Housework	0–3 hours/week	332	(39)	284	(39)	46	(40)	0.31	<b>286</b>	<b>(41)</b>	<b>36</b>	<b>(35)</b>	<b>&lt; 0.01</b>	<b>213</b>	<b>(43)</b>	<b>108</b>	<b>(33)</b>	<b>&lt; 0.01</b>
	4–6 hours/week	231	(27)	204	(28)	25	(22)		<b>201</b>	<b>(28)</b>	<b>18</b>	<b>(17)</b>		<b>144</b>	<b>(29)</b>	<b>80</b>	<b>(24)</b>	
	> 6 hours/week	291	(34)	244	(33)	45	(39)		<b>220</b>	<b>(31)</b>	<b>50</b>	<b>(48)</b>		<b>133</b>	<b>(27)</b>	<b>144</b>	<b>(43)</b>	

**Bold = significant (p < 0.05)**

Those caring for children had significantly lower duration of exercise after controlling for individual factors, and this relationship persisted after controlling for work-related factors (Table 3). There was no association between caring for adults under age 65 or aged 65 and older and physical activity. Older age and female gender were significantly and negatively associated with physical activity, and work schedule control was significantly and positively associated with physical activity, in all models.

Table 3  
Associations between exercise and caregiving, individual, and work-related factors

	Caregiving Only		Caregiving + Individual Factors		Caregiving + Individual + Work-Related Factors	
	Beta	p-value	Beta	p-value	Beta	p-value
Care for Adult(s) < 65	-0.06	0.07	-0.05	0.13	-0.04	0.26
Age			<b>-0.11</b>	<b>&lt; 0.01</b>	<b>-0.13</b>	<b>&lt; 0.01</b>
Female Gender			<b>-0.09</b>	<b>&lt; 0.01</b>	<b>-0.11</b>	<b>&lt; 0.01</b>
Education			<b>0.10</b>	<b>&lt; 0.01</b>	0.04	0.34
Schedule control					<b>0.14</b>	<b>&lt; 0.01</b>
Overtime					0.03	0.45
Second job					0.06	0.09
Psychological demands					0.02	0.64
Physical demands					-0.05	0.20
Care for Adult(s) 65+	0.01	0.69	0.04	0.32	0.04	0.27
Age			<b>-0.12</b>	<b>&lt; 0.01</b>	<b>-0.14</b>	<b>&lt; 0.01</b>
Female Gender			<b>-0.08</b>	<b>0.02</b>	<b>-0.10</b>	<b>&lt; 0.01</b>
Education			<b>0.11</b>	<b>&lt; 0.01</b>	0.04	0.32
Schedule control					<b>0.14</b>	<b>&lt; 0.01</b>
Overtime					0.02	0.62
Second job					0.06	0.11
Psychological demands					0.02	0.68
Physical demands					-0.06	0.18
Care for Child(ren)	-0.04	0.31	<b>-0.09</b>	<b>0.01</b>	<b>-0.09</b>	<b>0.01</b>
Age			<b>-0.13</b>	<b>&lt; 0.01</b>	<b>-0.16</b>	<b>&lt; 0.01</b>
Female Gender			<b>-0.09</b>	<b>&lt; 0.01</b>	<b>-0.11</b>	<b>&lt; 0.01</b>
Education			<b>0.10</b>	<b>&lt; 0.01</b>	0.04	0.36
Schedule control					<b>0.14</b>	<b>&lt; 0.01</b>
Overtime					0.03	0.43
Second job					0.06	0.08
Psychological demands					0.03	0.47
Physical demands					-0.05	0.19
<b>Bold = significant (p &lt; 0.05)</b>						

Those caring for children had significantly lower duration of walking in the unadjusted model as well as after adjusting for individual and work-related factors (Table 4). There was no association between caring for adults under age 65 or aged 65 and older and walking.

Table 4  
Associations between walking and caregiving, individual, and work-related factors

	Caregiving Only		Caregiving + Individual Factors		Caregiving + Individual + Work-Related Factors	
	Beta	p-value	Beta	p-value	Beta	p-value
Care for Adult(s) < 65	0.01	0.83	0.00	0.90	0.00	0.99
Age			0.00	0.91	-0.02	0.69
Female Gender			0.01	0.85	0.01	0.78
Education			<b>-0.09</b>	<b>0.01</b>	-0.08	0.06
Schedule control					0.07	0.08
Overtime					0.06	0.09
Second job					-0.02	0.54
Psychological demands					0.03	0.38
Physical demands					0.06	0.18
Care for Adult(s) 65+	0.04	0.32	0.03	0.33	0.04	0.33
Age			-0.01	0.74	-0.02	0.65
Female Gender			0.01	0.86	0.01	0.86
Education			<b>-0.08</b>	<b>0.04</b>	-0.07	0.12
Schedule control					0.06	0.11
Overtime					0.05	0.16
Second job					-0.02	0.62
Psychological demands					0.03	0.43
Physical demands					0.05	0.21
Care for Child(ren)	<b>-0.08</b>	<b>0.03</b>	<b>-0.08</b>	<b>0.04</b>	<b>-0.08</b>	<b>0.03</b>
Age			-0.02	0.55	-0.03	0.41
Female Gender			0.00	0.96	0.01	0.74
Education			<b>-0.09</b>	<b>0.01</b>	-0.08	0.06
Schedule control					0.07	0.08
Overtime					0.07	0.05
Second job					-0.02	0.58
Psychological demands					0.03	0.49
Physical demands					0.05	0.28
<b>Bold = significant (p &lt; 0.05)</b>						

Those caring for adults under age 65 reported significantly higher duration of gardening in the unadjusted model as well as after adjusting for individual and work-related factors (Table 5). There was no association between caring for adults aged 65 and older or caring for children and gardening. Older age, male gender, greater schedule control, and greater workplace physical demands were positively and significantly associated with gardening.

Table 5  
Associations between gardening and caregiving, individual, and work-related factors

	Caregiving Only		Caregiving + Individual Factors		Caregiving + Individual + Work-Related Factors	
	Beta	p-value	Beta	p-value	Beta	p-value
Care for Adult(s) < 65	<b>0.09</b>	<b>0.01</b>	<b>0.08</b>	<b>0.02</b>	<b>0.08</b>	<b>0.03</b>
Age			<b>0.10</b>	<b>0.01</b>	<b>0.07</b>	<b>0.05</b>
Female Gender			<b>-0.13</b>	<b>&lt; 0.01</b>	<b>-0.13</b>	<b>&lt; 0.01</b>
Education			-0.01	0.68	0.01	0.91
Schedule control					<b>0.08</b>	<b>0.04</b>
Overtime					0.04	0.33
Second job					-0.02	0.52
Psychological demands					0.00	0.93
Physical demands					<b>0.09</b>	<b>0.02</b>
Care for Adult(s) 65+	0.06	0.11	0.05	0.13	0.05	0.14
Age			<b>0.09</b>	<b>0.01</b>	0.07	0.08
Female Gender			<b>-0.13</b>	<b>&lt; 0.01</b>	<b>-0.13</b>	<b>&lt; 0.01</b>
Education			-0.02	0.68	0.02	0.71
Schedule control					0.07	0.08
Overtime					0.04	0.24
Second job					-0.02	0.59
Psychological demands					-0.01	0.89
Physical demands					<b>0.10</b>	<b>0.02</b>
Care for Child(ren)	-0.03	0.41	-0.02	0.69	-0.02	0.69
Age			<b>0.10</b>	<b>&lt; 0.01</b>	0.07	0.06
Female Gender			<b>-0.14</b>	<b>&lt; 0.01</b>	<b>-0.12</b>	<b>&lt; 0.01</b>
Education			-0.03	0.46	0.00	0.95
Schedule control					<b>0.08</b>	<b>0.04</b>
Overtime					0.04	0.24
Second job					-0.02	0.68
Psychological demands					0.00	0.93
Physical demands					<b>0.09</b>	<b>0.03</b>
<b>Bold = significant (p &lt; 0.05)</b>						

Those caring for adults aged 65 and older, and those caring for children, reported significantly higher duration of housework in the unadjusted models as well as after adjusting for individual and work-related factors (Table 6). There was no association between caring for adults under age 65 and housework. Female gender, greater schedule control, and greater workplace physical demands were positively and significantly associated with housework.

Table 6  
Associations between housework and caregiving, individual, and work-related factors

	Caregiving Only		Caregiving + Individual Factors		Caregiving + Individual + Work-Related Factors	
	Beta	p-value	Beta	p-value	Beta	p-value
Care for Adult(s) < 65	0.02	0.59	0.03	0.38	0.03	0.36
Age			-0.06	0.08	-0.06	0.08
Female Gender			<b>0.25</b>	<b>&lt; 0.01</b>	<b>0.25</b>	<b>&lt; 0.01</b>
Education			<b>-0.10</b>	<b>&lt; 0.01</b>	-0.05	0.19
Schedule control					<b>0.09</b>	<b>0.02</b>
Overtime					-0.02	0.64
Second job					-0.02	0.49
Psychological demands					0.04	0.33
Physical demands					0.03	0.36
Care for Adult(s) 65+	<b>0.09</b>	<b>0.01</b>	<b>0.09</b>	<b>0.01</b>	<b>0.09</b>	<b>0.01</b>
Age			<b>-0.07</b>	<b>0.04</b>	<b>-0.08</b>	<b>0.04</b>
Female Gender			<b>0.23</b>	<b>&lt; 0.01</b>	<b>0.23</b>	<b>&lt; 0.01</b>
Education			<b>-0.10</b>	<b>&lt; 0.01</b>	-0.05	0.23
Schedule control					<b>0.08</b>	<b>0.04</b>
Overtime					-0.01	0.87
Second job					-0.04	0.29
Psychological demands					0.02	0.58
Physical demands					<b>0.09</b>	<b>0.01</b>
Care for Child(ren)	<b>0.16</b>	<b>&lt; 0.01</b>	<b>0.18</b>	<b>&lt; 0.01</b>	<b>0.18</b>	<b>&lt; 0.01</b>
Age			-0.02	0.62	-0.02	0.61
Female Gender			<b>0.25</b>	<b>&lt; 0.01</b>	<b>0.25</b>	<b>&lt; 0.01</b>
Education			<b>-0.11</b>	<b>&lt; 0.01</b>	-0.06	0.12
Schedule control					<b>0.08</b>	<b>0.03</b>
Overtime					-0.02	0.56
Second job					-0.02	0.50
Psychological demands					0.42	0.68
Physical demands					<b>0.16</b>	<b>&lt; 0.01</b>
<b>Bold = significant (p &lt; 0.05)</b>						

## Discussion

In this study we sought to investigate the relationship between caregiving and LTPA in a cohort of manufacturing workers. We observed that caregivers for children reported fewer hours exercise and walking, but more hours of housework, than those who did not have responsibility to care for children. We observed no association between caregiving for adults under age 65 or adults aged 65 and older and exercise or walking. Caring for adults under age 65 was associated with a significant increase in hours spent gardening, and caring for adults aged 65 and older was associated with a significant increase in hours spent performing housework.

Our observation that caregiving for children was negatively associated with exercise and walking corresponds to findings of previous studies. A literature review conducted in 2008 reported a large effect of parenthood on LTPA(4). More recently, several cross-sectional and prospective studies have reported similar effects(5–9, 19). Our study adds to the literature on this topic, which has received disproportionately scant research considering the size of the effect(4).

While caregiving for children was negatively associated with exercise and walking, it was positively associated with housework. Similarly, caring for adults was positively associated with gardening and housework, but not associated with exercise or walking. Our findings are supported by some previous studies. For instance, Fredman et al(12) reported less LTPA, but similar overall physical activity, among older spouse caregivers compared to non-caregivers. The observation that caregiving can have differential effects on different components of LTPA has several implications for research and intervention. Using

combined measures of LTPA may lead to misclassification, preventing us from understanding the true effects of caregiving on LTPA components. For example, there has been increasing understanding that physical activities other than exercise can also have health-promoting benefits, and some housework and gardening type activities were mentioned as counting towards meeting the physical activity recommendations in the updated guidelines (1). So, it is possible that the greater duration of gardening or housework observed among caregivers may help to promote their health. However, tasks such as gardening and housework also increase physical load, which might increase risk for some health conditions(12). By understanding the effects of caregiving on LTPA components, we can develop better, targeted interventions.

In this study we chose to separately analyze the effects of caregiving for younger (< 65) and older (65+) adults on LTPA components. We observed several differences – caring for adults under age 65 was only associated with a significant increase in hours spent gardening, while caring for adults aged 65 and older was only associated with a significant increase in hours spent performing housework. Differences in these two populations of caregivers may help to explain the differences in findings. For example, among participants reporting responsibility to care for adults under age 65, 35% indicated that the care recipient was a spouse, compared to only 7% of those reporting responsibility to care for adults aged 65 and older. Similarly, among participants reporting responsibility to care for adults under age 65, 66% indicated that the care recipient lived with them, compared to only 32% of those reporting responsibility to care for adults aged 65 and older. Our findings have implications for interventions, further supporting the need to tailor interventions to specific populations that may have different needs.

We did not consider occupational physical activity in our analyses. Our study consisted of manufacturing workers, a population that generally is considered to have high levels of activity during work(20). However, the type of activities performed during work differ from LTPA in several ways. For example, occupational physical activity is generally of too low intensity and long duration for maintaining cardiorespiratory fitness, includes heavy lifting and static postures, is performed without sufficient recovery time, and is performed without worker control(21). As a result, occupational activity tends to not confer the same health-promoting benefits as LTPA.

We found some associations between work-related factors and LTPA. Having higher schedule control was associated with greater exercise, gardening, and housework. Schedule control was chosen as a proxy for worker's occupational status(22). Higher workplace physical demands were associated with greater gardening and housework. This finding especially may have health implications, as workplace physical demands, gardening, and housework all increase physical load, which might increase risk for some health conditions(12).

The results of this study must be considered in light of the study's strengths and limitations. As a strength of this study, we considered several components of LTPA, and found different effects of caregiving on, for example, exercise and walking compared to gardening or housework. A primary limitation of this study is the self-reported measure participants used to recall activities (modified version of the EPIC physical activity questionnaire (17)), which may introduce recall or other biases that could influence our results, and do not provide a complete picture of activity. Most other studies have used self-reported measures for activity as well (10, 12). However, future studies would benefit from using direct measurements such as through accelerometry to provide more detailed, continuous, and direct assessments of activity. Another limitation of this study that should be considered is potential confounding of our results by age. We did adjust for age in our analyses, and observed significant associations between age and exercise and gardening. We also know that age is associated with caregiving, with younger individuals more likely to be caring for children and older individuals more likely to be caring for adults. In secondary analyses (not presented) we stratified our population by age and found similar results to those presented here.

Promoting LTPA among caregivers is beneficial for many reasons. Physically, there are many known health benefits to increased LTPA(1). LTPA also has psychological benefits and has been proposed as an intervention to help counteract some of the stress of caregiving(23). In addition, parental physical activity influences children physical activity(24).

## Conclusions

We identified associations between caregiving and physical activity in a population of manufacturing workers. Our results support the development of targeted interventions to promote health in working caregiver populations.

## Abbreviations

LTPA: Leisure Time Physical Activity

## Declarations

### Ethics approval and consent to participate

The full study protocol and consent agreements were approved by UConn Health's Institutional Review Board (IRB Number 18-072S-2). Researchers obtained written consent from each study participant.

### Consent for publication

Not Applicable

### Availability of data and materials

The datasets used and/or analysed during the current study are available from the corresponding author on reasonable request

## Competing interests

The authors declare that they have no competing interests

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## Authors' contributions

JG designed and performed the analysis and wrote the manuscript. JC, AD, and SN assisted in interpretation of the results and writing the manuscript. RF and MC designed the study and contributed to the manuscript. All authors read and approved the final manuscript.

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## References

1. Piercy KL, Troiano RP, Ballard RM, Carlson SA, Fulton JE, Galuska DA, et al. The Physical Activity Guidelines for Americans. *Jama*. 2018;320(19):2020-8.
2. Services OoDPaHPUDoHaH. Healthy People 2020: Data Search - Physical Activity.
3. Bennie JA, De Cocker K, Teychenne MJ, Brown WJ, Biddle SJH. The epidemiology of aerobic physical activity and muscle-strengthening activity guideline adherence among 383,928 U.S. adults. *The international journal of behavioral nutrition and physical activity*. 2019;16(1):34.
4. Bellows-Riecken KH, Rhodes RE. A birth of inactivity? A review of physical activity and parenthood. *Preventive medicine*. 2008;46(2):99-110.
5. Abell LP, Tanase KA, Gilmore ML, Winnicki AE, Holmes VL, Hartos JL. Do physical activity levels differ by number of children at home in women aged 25-44 in the general population? *Women's health (London, England)*. 2019;15:1745506519871186.
6. Carson V, Adamo K, Rhodes RE. Associations of Parenthood with Physical Activity, Sedentary Behavior, and Sleep. *American journal of health behavior*. 2018;42(3):80-9.
7. Limbers CA, McCollum C, Ylitalo KR, Hebl M. Physical activity in working mothers: Running low impacts quality of life. *Women's health (London, England)*. 2020;16:1745506520929165.
8. Hull EE, Garcia JM, Kolen AM, Robertson RJ. Parenthood and Physical Activity in Young Adults: A Qualitative Study. *Journal of physical activity & health*. 2015;12(6):782-8.
9. Hull EE, Rofey DL, Robertson RJ, Nagle EF, Otto AD, Aaron DJ. Influence of marriage and parenthood on physical activity: a 2-year prospective analysis. *Journal of physical activity & health*. 2010;7(5):577-83.
10. Queen TL, Butner J, Berg CA, Smith J. Activity Engagement Among Older Adult Spousal Caregivers. *The journals of gerontology Series B, Psychological sciences and social sciences*. 2019;74(7):1278-82.
11. Cuthbert CA, King-Shier K, Tapp D, Ruether D, Culos-Reed SN. Exploring Gender Differences in Self-Reported Physical Activity and Health Among Older Caregivers. *Oncology nursing forum*. 2017;44(4):435-45.
12. Fredman L, Bertrand RM, Martire LM, Hochberg M, Harris EL. Leisure-time exercise and overall physical activity in older women caregivers and non-caregivers from the Caregiver-SOF Study. *Preventive medicine*. 2006;43(3):226-9.
13. Kirk MA, Rhodes RE. Occupation correlates of adults' participation in leisure-time physical activity: a systematic review. *American journal of preventive medicine*. 2011;40(4):476-85.
14. Cramp AG, Bray SR. Understanding exercise self-efficacy and barriers to leisure-time physical activity among postnatal women. *Maternal and child health journal*. 2011;15(5):642-51.
15. Mailey EL, Huberty J, Dinkel D, McAuley E. Physical activity barriers and facilitators among working mothers and fathers. *BMC public health*. 2014;14:657.
16. Cherniack M, Dussetschleger J, Farr D, Dugan A. Workplace cohort studies in times of economic instability. *American journal of industrial medicine*. 2015;58(2):138-51.
17. Wareham NJ, Jakes RW, Rennie KL, Mitchell J, Hennings S, Day NE. Validity and repeatability of the EPIC-Norfolk Physical Activity Questionnaire. *International journal of epidemiology*. 2002;31(1):168-74.
18. Karasek R, Brisson C, Kawakami N, Houtman I, Bongers P, Amick B. The Job Content Questionnaire (JCQ): an instrument for internationally comparative assessments of psychosocial job characteristics. *Journal of occupational health psychology*. 1998;3(4):322-55.
19. Gropper H, John JM, Sudeck G, Thiel A. The impact of life events and transitions on physical activity: A scoping review. *PLoS one*. 2020;15(6):e0234794.
20. Jørgensen MB, Gupta N, Korshøj M, Lagersted-Olsen J, Villumsen M, Mortensen OS, et al. The DPhacto cohort: An overview of technically measured physical activity at work and leisure in blue-collar sectors for practitioners and researchers. *Applied ergonomics*. 2019;77:29-39.
21. Holtermann A, Krause N, van der Beek AJ, Straker L. The physical activity paradox: six reasons why occupational physical activity (OPA) does not confer the cardiovascular health benefits that leisure time physical activity does. *British journal of sports medicine*. 2018;52(3):149-50.
22. Dugan AG, Barnes-Farrell JL, Fortinsky RH, Cherniack MG. Acquired and Persistent Eldercare Demands: Impact on Worker Well-Being. *Journal of applied gerontology : the official journal of the Southern Gerontological Society*. 2019;733464819870034.

23. Loi SM, Dow B, Ames D, Moore K, Hill K, Russell M, et al. Physical activity in caregivers: What are the psychological benefits? Archives of gerontology and geriatrics. 2014;59(2):204-10.
24. Garriguet D, Colley R, Bushnik T. Parent-Child association in physical activity and sedentary behaviour. Health reports. 2017;28(6):3-11.

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