



Article

Pet Ownership and Physical Activity in Older Adults: Cross-Sectional Analyses from the NICOLA Study

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Abstract: Aging research indicates that there is increased sedentary behaviour and insufficient physical activity levels across the older adult population. There is a growing body of evidence that suggests that pet ownership can have beneficial physical and mental health effects. Data were drawn from the Northern Ireland Cohort for the Longitudinal Study of Ageing (NICOLA). This questionnaire measured general social demographics such as gender, age, and marital status while also examining elements of physical activity, lifestyle factors (drinking status, smoking status), and education. Two items from the short form International Physical Activity Questionnaire recorded moderate and vigorous activity. Respondents were asked if they owned a pet (Yes/No). The results are based on a secondary data analysis. An ordinal logistic regression revealed that an increase in moderate activity days was associated with pet ownership with an odds ratio of 0.111 (95% CI, −0.036 to 0.337), Wald χ^2 (1) 15.013, $p < 0.001$. An increase in vigorous activity days was associated with pet ownership with an odds ratio of 0.039 (95% CI, 0.004 to 0.342), Wald χ^2 (1) 8.952, $p = 0.003$. Amongst older adults in Northern Ireland, those with a pet were more likely to engage in regular physical activity. This study was based on a small specific sample of the population and showed differences in physical activity levels between pet owners and non-pet owners. Additionally, the study showed that physical activity is extremely low among the older adult population, therefore further investigation is warranted on the reasons for these low levels.

Keywords: pet ownership; older adults; cross-sectional; physical activity; Northern Ireland



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1. Introduction

There is a high prevalence of pet ownership worldwide with over 500 million pets at home, which is estimated to be a pet at home in over half the world's population [1]. In the United Kingdom, approximately 52–62% of the general population own a pet [2–4]. Within the older adult population, around half are pet owners [2]. Pets often offer a companionship, or a level of social connection to humans [5–7]. In older adults, pet ownership may increase when they reach retirement age, as the individuals now have more time to give to a pet. Ageing research on older adults and pet ownership suggests that there are positive benefits on mental and physical wellbeing with pets helping emotional and social needs [8–12]. Friedmann et al. [11] reported that pet ownership was associated with better cognitive function and physical function than those who did not own pets or had no regular contact with pets.

There is a growing body of evidence that suggests that pet ownership can have beneficial physical and mental health effects such as improved life satisfaction reduced loneliness, improved well-being, and reduced non-communicable diseases [5,13,14]. A study by Krauso-Darello et al. [15] noted that human animal interactions can play a therapeutic role in an older adults' life. This suggests that pet ownership can be beneficial to older adults in a number of ways. Studies by McConnell et al. [7] found that pet ownership helped

reduce negativity by providing mental and physical benefits to the owners while helping provide support and essential social needs. A population study in England involving over 68,000 adults assessing the association of dog ownership and mental health demonstrated that dog owners were less likely to have mental illness than non-dog owners, but that the relationship is very complex [16]. Obradovic et al. [10] conducted a case study to explore the role of pet ownership in the daily lives of older adults. The study concluded that owning a pet could provide older adults with a sense of safety and it positively influences mood. Similarly, a qualitative study by Gan et al. [17] suggested that pet ownership may be beneficial in older adults as it can influence positive outcomes, including providing a sense of comfort and safety; purpose, routine, and structure; and a meaningful role for the owner. However, by contrast, a recent systematic review Scoresby et al. [5] suggested that there is significant variability in findings across studies and therefore the evidence does not fully support the benefits of pet ownership on health. Furthermore, other studies have found that pet ownership has a mixed relationship with health outcomes [13,17]. This variability in research findings highlights that pet ownership has many complexities and can be shaped by many different lifestyle factors such as physical activity. Research has shown that pet ownership has been associated with alleviating depression [9,15,18] and increasing physical activity levels [10,19].

The global populations' levels of sedentary behaviour have increased while levels of physical activity have decreased due to increased usage of technology, increased TV viewing, car usage, occupational reasons, and time spent sitting at home, amongst other factors [20–22]. These increasing levels of sedentary behaviour and declining levels of physical activity are a public health concern as they present a major risk factor for increased mortality, non-communicable disease, and poor mental health, as well as providing an additional burden to health care system costs [23–25]. Importantly, there is a plethora of literature that demonstrates that health benefits can occur with the uptake of regular and sustained physical activity, which is why it is a vital daily element for all [26–28]. Higher levels of physical activity in adults and older adults improves the incidence of non-communicable health conditions, improves cognitive function, mental health, sleep, and hypertension, among other conditions [22,25–27,29–31]. Additionally, higher levels of physical activity may allow for a healthier society and lower health care expenses [20,25,32,33]. This is particularly important as the increase in worldwide population aging has resulted in an increased prevalence of age-related conditions which may impact health care systems. As people age, they become subject to more physical and mental changes which is why physical activity could play an important role in counteracting ill-health alongside pet ownership.

The World Health Organization [29] recommend adults between the ages of 18–64 years old and 65 years plus should engage in physical activity daily, with at least 150–300 min of moderate activity or 75–150 min of vigorous activity per week. However only approximately a quarter of the European older adult population engage in adequate levels of physically activity [34]. In Northern Ireland specifically, only 41% of participants aged 65–74 years and 10% of participants aged 75 years and older report meeting the guideline of 150 min per week of moderate to vigorous physical activity [35]. Aging research indicates that there is increased sedentary behaviour and insufficient physical activity levels across the older adult population [36,37].

The literature suggests that those who are pet owners are more likely to participate in more regular physical activity [10,19]. Specifically, dog ownership has been associated with higher levels of physical activity in older adults [31,38,39]. Dog walking has been acknowledged as an additional way to get physical activity while providing stress relief, particularly when it is recreational rather than functional [40]. Wu, Luben, and Jones [41] have shown that those who walked dogs consistently were more physically active than those who did not, with activity levels around 20% higher and exhibiting less sedentary behaviour. This is particularly important because as people age sedentary behaviour often increases, therefore any physical activity is important in the ageing process and in the prevention and reduction of serious health conditions in late life.

Physical activity is closely linked with mental health and physical health, therefore increases in levels of physical activity due to pet ownership could be beneficial, particularly to older adults. A study by Potter et al. [42] in the United States examined how dog 'acquisition' affects physical activity and psychosocial well-being. The authors reported that on average, study participants had lower levels of stress and depressive symptoms while physical activity as measured by an ActiGraph demonstrated increased moderate to vigorous physical activity levels by around 20 min per day.

While several studies have examined pet ownership and physical activity [38,42–44], the evidence around pet ownership and physical activity in older adults is still scarce. As such, the aim of the present study was to compare the association of pet ownership and days of moderate and vigorous physical activity levels using secondary data analysis of a nationally representative sample from the Northern Ireland Cohort for the Longitudinal Study of Ageing (NICOLA). A secondary data analysis was used in the current study which seeks to extend upon the limited UK literature on physical activity and pet ownership in older adults (65 years and older). This study is unique as it is the first in Northern Ireland to explore this area. The goal of this research is to inform future papers involving physical activity and pet ownership with regard to public health and provide future suggestions.

2. Materials and Methods

2.1. Study Population

This study involves the use of the WAVE 1 data (collected between February 2014–March 2016) from the NICOLA study, a longitudinal study involving a stratified random sample of 8478 men and women aged 50 years and over that explores why and how certain social, economic, and biological factors are impacting the lives of older adults. NICOLA is an ongoing longitudinal cohort study of ageing in Northern Ireland designed to complement the English Longitudinal Study of Ageing (ELSA) and the Irish Longitudinal Study of Ageing (TILDA). The aim of the NICOLA study is to monitor older adults and examine health, lifestyle, and wellbeing changes over a 10-year period. Participation in the study was completely voluntary. Participants were recruited at random from the POINTER address database or GP Register in Northern Ireland with letters sent to the household. Consent for the study was obtained from all study participants before the commencement of the research with a double-sided form asking for participants' acknowledgment that they understand the study and that they consent to each process of the testing. Ethical approval was obtained by the School of Medicine, Dentistry and Biomedical Sciences Ethics Committee, Queen's University Belfast (SREC 12/23) and the study was conducted according to the guidelines of the Declaration of Helsinki. All participant data were given a unique code so that the data remained anonymous. This secondary data analysis study will only contain the data for adults aged 65 years and older from the NICOLA study (n = 4040).

2.2. Data Collection

The NICOLA study comprised of three elements of data collection: (1) a computer assisted personal interview (CAPI), (2) a self-completion questionnaire (SCQ) and (3) a health assessment which, were performed at the Northern Ireland Clinical Research Facility. This secondary data analysis study used data from the results of the computer assisted personal interview (CAPI) and the self-completed questionnaires from the WAVE 1 of the NICOLA study. Details of NICOLA study assessments can be found online at <https://www.qub.ac.uk/sites/NICOLA/> (accessed on 2 March 2023).

Socio-demographics: This questionnaire measured general social demographics such as gender (male or female), age (65 > 85 years or 85 and older), and marital status (single, married, separated, divorced, widowed, living together) while also examining elements of physical activity (moderate or vigorous days physically active), lifestyle factors (smoking and drinking status), and education.

Physical Activity: This analysis used physical activity components from the NICOLA study which focused on two items from the short form International Physical Activity Questionnaire [45]. These items recorded moderate physical activity (During the last 7 days, on how many days did you do moderate physical activities like carrying light loads, bicycling at a regular pace, or doubles tennis? Do not include walking) and vigorous activity (During the last 7 days, on how many days did you do vigorous physical activities like heavy lifting, digging, aerobics, or fast bicycling?).

Pet-related variable: Respondents were asked if they owned a pet (Yes/No).

2.3. Data Analysis

The data presented here is based on a secondary data analysis. The data was reviewed and any participant under the age of 65 was excluded from the data analysis ($n = 4098$). Additionally, those respondents who did not answer the physical activity items were removed from the dataset ($n = 58$). This left a sample of 4040 participants to be used to examine the influence of pet ownership on moderate and vigorous physical activity. All statistical analysis was conducted on SPSS (IBM SPSS Software, Version 28, IBM Corp, Armonk, NY, USA). Summary statistics for variables were reported for the cohort with variables being categorical and reported in frequencies and percentages. Data were not normally distributed ($p < 0.005$), therefore a chi squared test was conducted to explore the differences between the two categorical variables for pet ownership and days of physical activity. This test was used to see if pet ownership was associated with physical activity. Additional subgroup analysis was examined with age and gender using a chi-square test to explore the differences in pet ownership and physical activity. Cramer's V-test was used alongside the chi-square test to examine the association between the two categorical variables as the effect size, in this study small = 0.07, medium = 0.21, and larger = 0.35. The physical activity variables for vigorous and moderate were recoded into binary variables for each, labelled 0 (not sufficiently active) and 1 (sufficiently active). An ordinal logistic regression was used to examine pet ownership on physical activity levels with covariates of age and gender. For the secondary data analysis, the cross-sectional results of the ordinal regression are reported as odds ratios with 95% confidence intervals which can be interpreted as the increase in the odds of pet ownership associated with increase moderate or vigorous physical activity levels. The significance level was assessed as a p-value of <0.05 being considered statistically significant. Details of the NICOLA study dataset can be found online at <https://www.qub.ac.uk/sites/NICOLA/> (accessed on 2 March 2023) with access to the data available by application through <https://www.qub.ac.uk/sites/NICOLA/InformationforResearchers> (accessed on 2 March 2023).

3. Results

Descriptive statistics regarding the sociodemographic and study characteristics of the study sample ($n = 4040$) are shown in Table 1. The table shows that over half of the respondents were female ($n = 2145$, 53.1%), slightly more than male respondents, and a majority were in the 65 to < 85 years old category ($n = 3699$, 91.6%). A third of the group had primary or some primary education ($n = 1343$, 33.2%), with the next largest group having completed GCSE/Intermediate/Junior/Group certificate of equivalent education status ($n = 1296$, 32.1%). Over half did not own a pet ($n = 2739$, 67.8%). Over half of the respondents were married ($n = 2391$, 59.2%), with 48.6% never smoking ($n = 1964$), while 50.4% ($n = 2038$) would have a drink of a regular basis. A total 86.8% of those who did not own a pet did not take part in any vigorous physical activity which is a higher percentage than those who did own a pet (84.6%). In relation to moderate physical activity, 70.7% of respondents who did not own a pet were not physically active, which was again higher than the 68.4% of those who owned a pet but were not physically active at all during the week.

Table 1. Socio-demographic and outcome variables (n = 4040).

	Overall (n = 4040)	Owned Pet (n = 1301)	No Pet (n = 2739)
Gender			
Male	1894 (46.9%)	630 (48.4%)	1264 (46.1%)
Female	2145 (53.1%)	671 (51.6%)	1475 (53.9%)
Age			
65 to <85 years old	3699 (91.6%)	1235 (94.9%)	2464 (90.0%)
85 years and older	341 (8.4%)	66 (5.1%)	275 (10.0%)
Smoking Status			
Current	524 (13.0%)	191 (14.7%)	333 (12.2%)
Ex	1546 (38.3%)	529 (40.7%)	1017 (37.1%)
Never	1964 (48.6%)	580 (44.6%)	1384 (50.5%)
Refused	6 (0.1%)	1 (0.1%)	5 (0.2%)
Drinking Status			
Current	2038 (50.4%)	693 (53.3%)	1345 (49.1%)
Ex	893 (22.1%)	274 (21.1%)	619 (22.6%)
Never	1102 (27.3%)	332 (25.5%)	770 (28.1%)
Refused	7 (0.2%)	2 (0.2%)	5 (0.2%)
Education			
Primary or some primary	1343 (33.2%)	445 (34.2%)	898 (32.8%)
GCSE/Intermediate/Junior/Group certificate or equivalent	1296 (32.1)	431 (33.1%)	865 (31.6%)
A-level/Leaving certificate or equivalent	289 (7.2%)	91 (7.0%)	198 (7.2%)
Diploma/Certificate	460 (11.4%)	147 (11.3%)	313 (11.4%)
Primary degree	247 (6.1%)	74 (5.7%)	173 (6.3%)
Postgraduate/higher degree	228 (5.6%)	55 (4.2%)	173 (6.3%)
None or refused	177 (4.4%)	58 (4.5%)	119 (4.5%)
Marital Status			
Married or living as married	2391 (59.2%)	861 (66.2%)	1539 (55.9%)
Single	382 (9.5%)	108 (8.3%)	274 (10.0%)
Separated, divorced, or widowed	1267 (31.4%)	332 (25.5%)	935 (34.1%)
Moderate PA (over last 7 days)			
None	3479 (86.1%)	890 (68.4%)	1937 (70.7%)
1–2 days	283 (7.0%)	151 (11.6%)	375 (13.7%)
3–4 days	135 (3.3%)	93 (7.1%)	189 (6.9%)
5–6 days	56 (1.4%)	46 (3.5%)	98 (3.6%)
Everyday	87 (2.2%)	121 (9.3%)	140 (5.1%)
Vigorous PA (over last 7 days)			
None	2827 (70.0%)	1101 (84.6%)	2378 (86.8%)
1–2 days	526 (13.0%)	98 (7.5%)	185 (6.8%)
3–4 days	282 (7.0%)	41 (3.2%)	94 (3.4%)
5–6 days	144 (3.6%)	16 (1.2%)	40 (1.5%)
Everyday	260 (6.4%)	45 (3.5%)	42 (1.5%)

For the overall sample, only 10.0% of respondents (n = 405) were moderately active on five days or more per week, whereas only 3.5% (n = 143) met the guidelines for being sufficiently vigorously active per week. As shown in Table 1, over 70% of the overall sample did not partake in regular vigorous activity while 86.1% stated they had participated in no moderate physical activity over the last seven days. There was a higher percentage of pet owners who met the guidelines for weekly moderate physical activity (12.8%) in comparison to non-pet owners (8.7%) as shown in Figure 1. This was similar for weekly vigorous physical activity, in which pet owners had a higher percentage (4.7%) than those who were non-pet owners (3.0%) as shown in Figure 2.

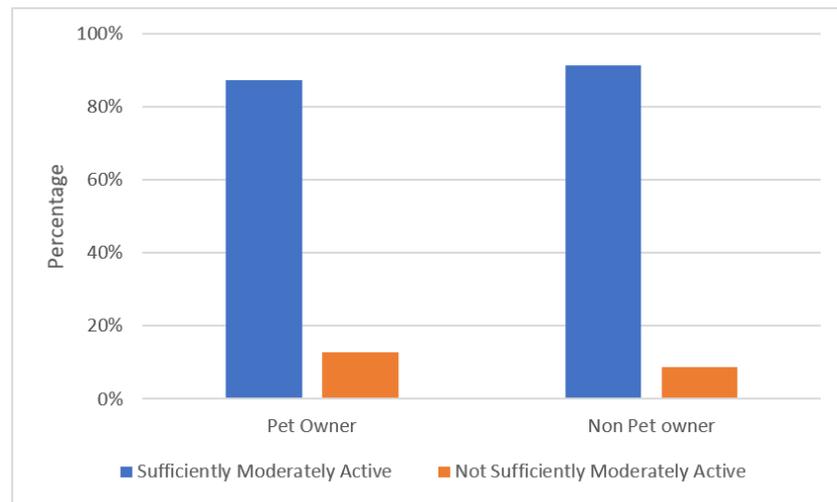


Figure 1. Pet ownership and whether respondents were sufficiently moderately active.

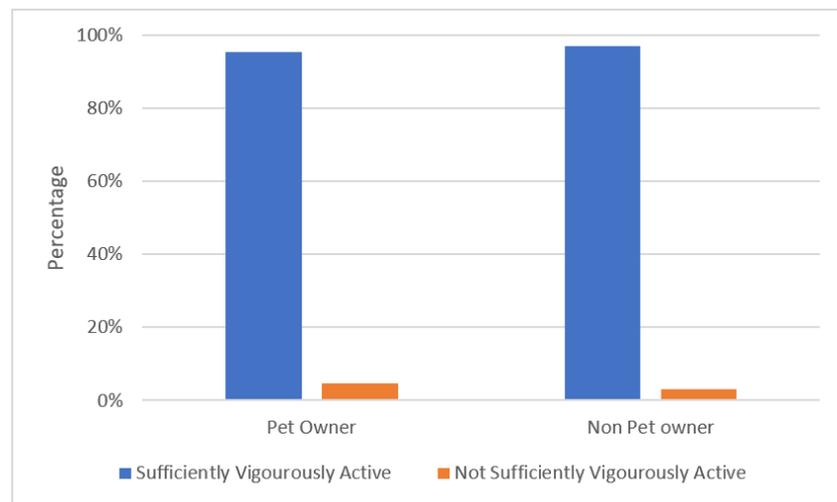


Figure 2. Pet ownership and whether respondents were sufficiently vigorously active.

Data were not normally distributed and therefore chi-squared tests were used to examine differences in physical activity by pet ownership. The association between pet ownership and days of moderate physical activity was significant, $X^2(4, n = 4040) = 27.66, p < 0.001$, Cramer’s $V = 0.083$. This suggests that those who had a pet were more likely to have a higher number of days of moderate physical activity than those who did not own a pet. Similarly, the relationship between days when taking part in vigorous physical activity and owning a pet was shown to be significant, $X^2(4, N = 4040) = 16.99, p = 0.002$, Cramer’s $V = 0.065$. This suggests that those who had a pet were more likely to have a higher number of days of completing vigorous physical activity than those who did not own a pet.

A subgroup analysis examining gender and age were conducted to examine differences in pet ownership and physical activity levels. In terms of physical activity levels, the association between gender and days of moderate physical activity was significant, $X^2(4, n = 4040) = 25.53, p < 0.001$, Cramer’s $V = 0.079$. The association between gender and days of vigorous physical activity was significant, $X^2(4, n = 4040) = 44.19, p < 0.001$, Cramer’s $V = 0.105$. Males were shown to be significantly more active than females. In addition, upon further analysis, males ($p < 0.001$) and females ($p = 0.026$) with a pet were significantly more likely to be sufficiently moderately physically active. However, in terms of vigorous physical activity and pet ownership, there was no significant difference between females ($p = 0.451$).

In terms of age, there was a significant difference in days of moderate physical activity ($X^2(4, n = 4040) = 13.07, p < 0.001, \text{Cramer's } V = 0.057$) and vigorous activity ($X^2(4, n = 4040) = 9.51, p < 0.001, \text{Cramer's } V = 0.079$), with those in the 65 > 85 age group being more active than those in the 85 years and older age group. In addition, on further analysis, those in the subgroups of 65 to 85 ($p < 0.001$) and 85 year and older ($p < 0.001$) with a pet were significantly more likely to be sufficiently moderately physically active. However, in terms of vigorous physical activity and pet ownership, there was no significant difference between those in the 85 years age and older age group ($p = 0.694$).

An ordinal logistic regression revealed that an increase in moderate activity days was associated with pet ownership with an odds ratio of 0.111 (95% CI, -0.036 to 0.337), Wald $\chi^2(1) = 15.013, p < 0.001$. An increase in vigorous activity days was associated with pet ownership with an odds ratio of 0.039 (95% CI, 0.004 to 0.342), Wald $\chi^2(1) = 8.952, p = 0.003$.

4. Discussion

The NICOLA study is a longitudinal study of aging in Northern Ireland. The aim of the present study was to conduct a secondary data analysis to compare the association of pet ownership and days of moderate and vigorous physical activity levels in older adults (65 years and older) in Northern Ireland. Previous studies have considered pet ownership and mental health variables, such as depression, which is why this study chose to focus on physical activity variables. Our results show that pet ownership has a positive influence on the physical activity levels of older adults ($p < 0.005$). However, even those who have pets were not often considerably physically active. Overall, while the findings showed a significant difference between pet ownership and levels of moderate/vigorous physical activity, the findings for meeting sufficient levels of physical activity are very low. For the overall sample, only 10.0% of respondents met the five days or more per week that they were sufficiently moderately active, whereas only 3.5% met the guidelines for being sufficiently vigorously active in a week. There was a higher percentage of pet owners who met the guidelines for weekly moderate physical activity (12.8%) in comparison to non-pet owners (8.7%). This was similar for weekly vigorous physical activity, in which pet owners had a higher percentage (4.7%) than those who were non-pet owners (3.0%). In comparison with previous Northern Ireland data showing physical activity in 41% [35] of older adults, this figure within this study is alarmingly low.

Similarly, a study by Park et al. [46] found that dog walkers had significantly higher physical activity levels than non-dog walkers, though this study included Korean older adults with a mean age of 42–45 years old, therefore generalisations cannot be made with this study. Machova et al. [43] also reported a significant difference in dog owners' levels of physical activity compared to non-pet owners. While our current study does not specify the type of pet, similarities can be made between these findings as both show significant differences in physical activity levels, with higher activity levels being shown in those with pets and lower activity levels in those without pets. While not considering older adults, the study by Machova et al. [43] found that people who owned a pet had higher levels of moderate to vigorous physical activity than those who did not own a pet. However, this cannot be generalized across the older adult population, but it does highlight the impact that pet ownership may have on physical activity levels. Peacock et al. [47] explored the association between pet ownership and incidental and purposeful physical activity. The authors noted that physical activity occurred as a result of the pet owners looking after their pets. These findings could be linked with why those pet owners in this study had a slightly higher level of physical activity than non-pet owners.

Interestingly, an early study, in 2006, by Thorpe et al. [39] found that dog owners differed in terms of physical activity compared to those non-pet owners, however those pet owners that were not dog walkers did not differ from non-pet owners. Furthermore, a study by Albright, Cui, and Allen [9] found that dog owners had better subjective health and were more likely to take part in exercises such as walking than their non-pet owner counterparts. Shibata et al. [31] reported how important physical activity was in older

adults and that those pet owners who had dogs were more likely to be sufficiently active than non-pet owners. For example, a survey in 2019 in Northern Ireland highlighted that a majority of pet owners were dog owners, 31% higher than any other type of pet [48]. This indicates that the type of pet may have an influence on the levels of physical activity, which should be examined in any further longitudinal studies. However, a similarity with this study is that pet owners were more likely to be sufficiently active. Overall, while significant differences may be evident in this study, both groups had relatively low moderate to vigorous physical activity levels, therefore pet ownership may not necessarily explain higher levels of physical activity. While the secondary analysis showed significant differences similar to the studies discussed above, there were slight differences in results between our study and these previous studies. For example, different styles of questions were asked with regard to pet ownership and type of pet, and differences were evident in the age range allowed in an age study, as each country had slightly different ages for their older adult sample.

There are several possible avenues for future research. Firstly, an investigation into the effect of pet ownership on wellbeing and mental health could be important to explore and would help further explain why physical activity levels in this age group are currently alarmingly low. Secondly, exploring the association between pet ownership and physical activity could be measured longitudinally with ActiGraph. Thirdly, assessment of pet ownership with types of sporting activity and whether the participants attend the gym, fitness classes, or are a part of a sporting group or activity could be an area for further research.

Limitations

This is the first secondary analysis study in Northern Ireland, to our knowledge, which explores the association between pet ownership and levels of moderate or vigorous activity levels in adults aged 65 years and older. The strengths of the study include findings on the older adult population, who can be a hard-to-reach population, the large sample size, and the fairly even gender split of the sample. A secondary data analysis helped to understand the nature of working with older adults and enabled the researchers to answer certain research questions. However, while these analyses benefited from the use of a nationally representative dataset for older adults, there are several limitations that must be acknowledged.

Conducting a secondary data analysis can be beneficial because it leads to the ability to access data on larger samples that individuals would not normally be able to reach. However, secondary data analysis has its challenges, as the researchers in this study did not collect the data and therefore have no control over what is contained within the dataset. Within the dataset, specific variables were collected in categories rather than a continuous variable, which is different than we may have chosen. In this study, we used cross-sectional data as the longitudinal data was not yet available and, thus, the direction of the association cannot be established [49]. The findings of this study are not representative of the general population and the overall older adult population across the United Kingdom; however, it does provide insight into this topic and therefore may spark further insights for future research. The self-reported nature of the data is subjective therefore we cannot exclude over- or under-reporting of physical activity. Additionally, accelerometer data, which is objectively measured, would be beneficial in calculating physical activity levels. Future studies should also include a comparison between the types of pets owned and levels of physical activity.

5. Conclusions

An active lifestyle involving physical activity is essential as adults age in order to allow them to live healthy lives and reduce/prevent poor physical and mental health conditions. However, as shown in the study, only a small percentage of older adults were reaching sufficient weekly activity levels. Those older adults who own a pet showed significantly higher physical activity at both moderate and vigorous intensity levels, which suggests

that pet ownership could be important in the ageing population. Furthermore, there were differences in pet ownership and physical activity (moderate levels) across gender and age categories. However, the type of pet owned could influence this and, therefore, this is something that should be examined further. Pet ownership has many different factors impacting it, such as type of pet, as some pets, such as dogs, can be taken for walks, thereby possibly increasing activity levels. Therefore, future research is warranted to establish the true extent of the relationship between these variables using a qualitative study to further explore how owning a pet could increase physical activity levels by also examining the type of pet owned.

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Institutional Review Board Statement: Ethical approval was obtained by the School of Medicine, Dentistry and Biomedical Sciences Ethics Committee, Queen’s University Belfast (SREC 12/23).

Informed Consent Statement: Consent for the study was obtained from all study participants before the commencement of the research. All participants in the original study (NICOLA project) agreed to data being used for publications.

Data Availability Statement: The data from the Northern Ireland Cohort for Longitudinal Ageing (NICOLA) are available but restrictions apply to the dataset, Data access is available through the UK Data Archive (<https://www.data-archive.ac.uk/> (accessed on 2 March 2023)).

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Conflicts of Interest: The authors declare no conflict of interest.

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