An Observational Cohort Study of Longitudinal Impacts on Frailty and Well-Being of COVID-19 Lockdowns in Older Adults in England and Spain

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Data Availability

Data will not be made publicly available yet as analyses are ongoing with the aim of additional publications.

Authors Contributions

C. A. Holland, and S. Varey developed the research concept. C. A. Holland, S. Varey, and I. W. Garner designed the study. I. W. Garner, S. Varey, E. Navarro-Pardo, and C. Marr collected the data. I. W. Garner and C. Marr analyzed the data. I. W. Garner, C. A. Holland, and C. Marr wrote the manuscript. All authors reviewed and approved the final manuscript for submission.

Abstract

To reduce the spread of COVID-19, governments initiated lockdowns, limiting mobility and social interaction of populations. Lockdown is linked to health issues, yet the full impact on health remains unknown, particularly in more vulnerable groups. This study examined impact on frailty and outcomes in high and low COVID-19 risk older adults. We examined health-related behaviours and support resources participants used during lockdown(s). Lockdown impacts in two countries were compared across four time points to examine impacts of different rules.

We recruited 70 participants (aged >70 years) in England and Spain. Participants were allocated to higher or lower COVID-19-risk groups based on UK NHS guidelines. They completed assessments for frailty, quality-of-life, loneliness, exercise frequency and social interaction, coping resources and perception of age-friendliness of their environment. The four assessments took place over a 7-month period.

Frailty was highest at Time 1 (most severe lockdown restrictions) and significantly higher in the Spanish group. It was lower at Time 3 (lowest restrictions), but did not continue to reduce for the English participants. Perceptions of the age friendliness of the environment matched these changes. Coping resources did not mitigate changes in frailty and outcomes over time, but more frequent physical activity predicted more reduction in frailty. Lockdown had a negative impact on frailty, increasing risk of adverse events for older people, but recovery once lockdowns are eased is evidenced. Further research is required to consider longer term impacts and methods to mitigate effects of lockdown on health.

What is known about this topic

- Older adults have the highest risk of suffering adverse effects from COVID-19.

- Lower physical activity and increased loneliness and isolation increase frailty, and so lockdowns may impact on frailty. Increased frailty is expected to increase susceptibility to adverse COVID-19 outcomes.

What this paper adds to this topic

- COVID-19 research is largely cross-sectional, whereas the current study demonstrates change over time in frailty and well-being.

- Impact of restrictiveness of lockdown(s) on older adults' well-being and frailty is demonstrated.

- While use of coping resources varied with lockdown stages, only perceived age friendliness of the environment and physical activity mitigated the impact of lockdown on well-being and frailty.

Introduction

There have been over 4 million worldwide COVID-19-related deaths, with the age-specific fatality rate rising from 0.01% at age 25, to 4.6% at age 75 and 15% at age 85 years (Levin *et al*., 2020). Those most susceptible to severe reactions to COVID-19 are adults aged 65+ (Williamson *et al*., 2020), especially those living with respiratory issues and/or morbid obesity (Onder, Rezza, & Brusaferro, 2020). Medical conditions such as dementia, diabetes, COPD, pneumonia, depression, atrial fibrillation, and hypertension are also risk factors for COVID-19-related hospitalisations and mortality (Atkins *et al.,* 2020).

From March 2020, Spanish and UK governments initiated national lockdowns to reduce COVID-19 transmissions. Exercise was allowed in the UK, but not in Spain, and the UK emphasised the risk to people aged 70+. The effects of lockdown on older adults' health and well-being remains unknown, and there is minimal research assessing the effects of lockdown on frailty. To examine this, different phases of lockdown (i.e. different levels of restrictions) and differences between countries present a useful opportunity to examine associations of effects with severity and phases of restrictions. The two countries chosen (England and Spain) both had high COVID-19 infection rates at the outset of the study.

Frailty is defined as a state of increased vulnerability to negative outcomes when exposed to adversity such as illness or falls (Clegg, Young, Iliffe, Rikkert, & Rockwood, 2013). Therefore, outcomes of COVID-19 infection are more severe for frail older adults (Hewitt *et al*., 2020; Ma *et al*., 2020; Petermann-Rocha *et al*., 2020). Physical and social inactivity caused by lockdown is likely to have an immediate and lasting effect on older adults' health, with pre-pandemic evidence linking low exercise and social engagement to increased risk of frailty, cognitive decline, and dementia (Apóstolo *et al*., 2018; Gale, Westbury & Cooper, 2018; Livingston *et al*, 2020; Oliveira *et al*., 2020). Carriedo *et al* (2020) shown that older

adults who met the global recommendations on vigorous and moderate-vigorous physical activity had higher resilience, positive affect, and lower depressive symptoms than those who did not. However, only 32.7% of Spanish older adults continued during lockdown, while 65.7% reported doing less physical activity (Rodriguez-Gonzalez, *et al.*, 2020). It is therefore important to understand how lockdown restrictions influenced frailty levels and vulnerability to infection over the course of the pandemic.

Research on physical health or frailty impacts of COVID-19 is less prevalent in the literature than on mental health. After one month of lockdown, mental distress in the UK general population had risen by 7.4% (Pierce *et al.*, 2020). In Spain, people showed high rates of depressive symptomology (18.7%), anxiety (21.6%) and post-traumatic stress symptoms (15.8%; Gonzalez-Sanguino *et al.*, 2020), with rates of anxiety, depression and stress increasing from the first to second month of lockdown (Planchuelo-Gomez *et al.,* 2020). Additionally, 24.7% of Spanish people reported moderate or severe psychological impact while 48.8% showed mental health problems (Parrado-Gonzalez *et al.*, 2020). Whilst these findings provide some understanding regarding implications of lockdown, they are based on general population samples. Specific study of older populations is needed.

Lockdown effects could be severe in older adults prefer face-to-face socialising as opposed to technology use, the main form of interaction in lockdown (Bell *et al.,* 2013), suggesting that older adults have fewer avenues of communication. This may impact on well-being through increased feelings of loneliness and social isolation (Gombault, 2013). The issue is illustrated by Lim, Jivraj, and Scholes (2020) who demonstrated that using the internet for communication was associated with better life satisfaction and lower depression amongst older adults. Additionally, older adults are more likely to live alone and consequently become socially isolated during lockdown. However, some studies have found age to be related to lower psychological risk during the lockdown; García-Portilla, *et al.* (2020), with Rossi *et al.*

(2021) suggesting that resilience mediated the effects of stressful COVID-19-related events on depressive and anxiety symptoms and perceived stress in older groups. Nevertheless, there is evidence that stress, anxiety, and depression were higher in older-old adults generally and those with chronic illness (Picaza *et al*., 2020). Furthermore, Di Gessa & Price, (2021) reported that older adults who were classified as being at greater risk from COVID-19 due to pre-existing health conditions were more likely to have poorer health outcomes. Therefore, we will examine the impact of lockdowns on people aged over 70, purposively sampling to include people living with severe chronic illnesses.

Despite these findings, research has not considered how to mitigate adverse effects of lockdown. With repeated easing and reinstating of restrictions in response to the COVID-19 pandemic, it is reasonable to expect that restrictions will be enforced in countries on a long-term basis. Therefore, we will consider what factors may mitigate the effects of lockdown on older adults, with coping resources, and health behaviours such as physical and social engagement identified as candidate protective factors. The person-fit of a person's environment is also important to consider, whereby both physical and social attributes of one's home and community may contribute to quality of life, particularly in lockdown situations where community support for older people may increase but access to local facilities would decrease. Therefore, the role of the age friendliness of the environment from the person's point of view will also be considered (Garner & Holland, 2019).

The objectives of this study were to assess potential changes in frailty and mental well-being in older adults across a 7-month period through lockdown variations to determine longer-term impacts of lockdowns and how frailty may change as the pandemic continued. We focused on a multidimensional, holistic approach to frailty and its measurement (Garner, Burgess, & Holland, 2020; Gobbens *et al.,* 2012). We also considered if coping resources mitigate any increase in frailty or decline in well-being associated with lockdown, and how frequency of

physical activity and experienced social isolation influenced the trajectory of change in frailty, loneliness, quality of life, and perceptions of environmental age-friendliness (AFEAT).

Hypotheses

1. Measures of frailty, loneliness, social isolation, quality of life, and perceptions of environmental age-friendliness will vary in relation to the severity of COVID-19 lockdown in repeated measures analyses over a 7-month period from the first COVID-19 lockdown.

2. These variations will be different in the two countries where there are differences in lockdown severity.

3. These variations will differ according to level of risk related to presence of significant chronic diseases.

4. Potential modifying factors - coping resources, physical activity, and social engagement/isolation - will be different under the different lockdown severities.

5. These factors will modify adverse effects of lockdown such as frailty[1], loneliness, quality of life, and AFEAT.

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[1] Analyses on frailty exclude physical activity as a covariate because physical activity is part of the frailty assessment

Methods

This report has been written with reference to the STROBE checklist ((Strengthening Reporting of Observational Studies in Epidemiology) von Elm *et al.,* 2007)).

Study Design

A longitudinal cohort design was used for within participants comparisons across four time points at 6-week intervals, starting in May 2020 and ending October 2020. Between-participants comparisons were also possible between participants in England and Spain, and between groups of different levels of COVID-19 risk.

Setting

Participants were recruited in the North West and Midlands of England and in Valencia in Spain. While lockdowns were similar, the first lockdown (Time 1) was stricter in Spain than in the UK with people not allowed out for a walk in Spain and UK residents encouraged to exercise daily. In the region in England where participants were located, the tiers system introduced meant that restrictions were increasing at Time 4.

Participants

Participants were required live in their own home or sheltered accommodation and be aged over 70. They needed to demonstrate Mental Capacity to consent, with all researchers trained in use of the Mental Capacity Act (2007). Recruitment was conducted by advertising on the University ageing research centre website, local senior groups, and via personal approach to

people who had taken part in a previous study for people living with chronic illness, and indicated they would be willing to do so again.

Sample size was determined using sample size analysis for four repeated measures with power of 0.8 and alpha of 0.05, for a medium effect size. This gave a required sample size of 24 (GPower®).

50 participants were recruited in England (33 female, 17 male, aged 70-85 years) and 20 in Spain (14 female, 6 male, aged 72-85 years). Of the total, 24 (21 in England, 3 in Spain) were considered 'high risk' (i.e. highly vulnerable to severe effects of COVID-19 and should 'shield[2]', 15 female, 9 male, aged 70-85 years). This was determined by asking participants if they had received a letter from their GP or by making a judgment based on their declared diagnoses, referring to UK NHS lists of high-risk conditions (NHS, 2020). The remaining 46 participants were considered 'low risk' (32 female, 14 male, aged 70-85 years).

Of the initial 70 participants, 65 completed assessments at all time points. The remaining five participants could not be contacted for all assessments.

Variables and Measures

A frailty profile consisting of physical, psychological, social, and environmental domains, derived from the Tilburg Frailty Indicator (Gobbens *et al.,* 2012), and the Community Frailty Index (Garner, Burgess, & Holland, 2020), was used to assess frailty (range 0-1, higher scores indicating greater frailty severity). The 10-item Age-Friendly Environment Assessment Tool (AFEAT; Garner, & Holland, 2019) was used to assess participants' perceptions of how well suited their environment is to meet their needs; range 10-50, higher

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[2] 'Shielding' is an instruction to avoid all physical contact with others.

scores indicating participants perceived their environment to be more age-friendly. Quality of Life (QoL) was assessed using the Control, Autonomy, Self-Realization, and Pleasure 12-item (CASP12; Wiggins *et al.*, 2008); range 12-48, higher scores indicating better QoL. A section of the Adult Social Care Outcomes Toolkit (ASCOT) was used to assess social isolation (assessing number of close friends, family and frequency of interaction with them – higher score indicates less social isolation; Netten *et al.*, 2012). Loneliness was assessed using the shortened UCLA Loneliness Scale (Russell, Peplau, & Cutrona, 1980); range 4-12, higher scores indicate lower feelings of loneliness.

Participants were asked how many days a week they engaged in 30+ minutes of exercise. Responses were coded as an ordinal variable (1 = 0-1 days, 2 = 2-3 days, 3 = 4 days, 4 = 5-7 days). Participants were asked whether any of a list of nine potential factors had helped them to cope during lockdown (family, friends, NHS, watching TV, exercise, community groups, specific organisations, shopping, and humour) and were invited to add others to the list. Level of education was coded as an ordinal variable (1 = None/Primary Education, 2 = Secondary Education to 16 years of age, 3 = Secondary Education to 18 years of age, 4 = Higher Professional or University Education). Current occupation was used as a proxy measure of socioeconomic status. If participants were retired, they were asked to state their profession/main job during their working career. Occupations were coded 1-8 according to the National Statistics Socio-economic classification system (The National Statistics Socio-Economic Classification, 2005). Participants were assessed in their native language by native speakers of that language, using translations of the largely English scales into Spanish for the Spanish group.

The assessments combined to produce a total of 153 items which took approximately 40 minutes to complete.

Ethics

Participants received an information sheet prior to giving consent and were given the opportunity to ask questions. They were informed of their withdrawal and anonymity rights. Ethical procedures aligned with British Psychological Society guidelines and the study received ethical approval from two university ethics committees in England and Spain (England Ref: FHMREC19077; Spain Ref: UV-INV_ETICA-1294940).

Procedure

Participants completed the assessments on four occasions across a 7-month period, spanning two lockdowns. Breakdown of the date of assessments in parallel to a timeline of English and Spanish lockdowns and changing of restrictions is provided in Supplementary Material 1. Assessments were completed via telephone.

Statistical Methods

To assess for significant change in frailty, quality of life, AFEAT, social isolation and loneliness longitudinally (Hypothesis 1) and whether any changes varied according to country (Hypothesis 2) or COVID-19 risk level (Hypothesis 3), a series of 4 (Time) x 2 (country) x 2 (high risk, low risk) mixed-design ANOVA were conducted. The within-subjects factor was Time, measured at four time-points. Age was added as a covariate for analyses. Generalised eta squared statistics (η^2_G) were computed as estimates of effect size. Where there were significant Time x Country, or Time x Risk interactions , post-hoc paired-sample t-tests compared outcomes between each time point separately for the English and

Spanish cohorts or separate risk groups. For all t-tests, p-values were adjusted using Bonferroni's correction to account for multiple comparisons.

To examine whether potential modifying factors, coping resources, physical activity, and social isolation changed over time were assessed using parametric or non-parametric analyses as appropriate (Hypothesis 4). Then, to examine impacts of these variables on frailty, quality of life and loneliness across the time periods, a series of repeated-measures ANCOVA were performed with Time 1 scores for total coping resources, frequency of physical activity, and social isolation as covariates as these variables may impact frailty change (Hypothesis 5).

To examine prediction of change in frailty, quality of life, AFEAT and loneliness between strict lockdown (T1) and the period with the least restrictions (T3) on mobility and social interaction, change variables were computed between times and country, physical activity, social isolation, and coping resources entered as predictors into linear regressions (Hypothesis 5). The was to determine if coping resources, physical activity or social isolation had an impact on change in outcomes, once country and other potential confounders had been controlled for. Due to power limitations, potential confounder variables (age, education and socioeconomic status) were only included as predictors in the multiple regression models if they had significant bivariate correlations with the relevant outcome.

Sensitivity analyses were completed by imputing missing data and creating a correlation matrix between variables used in analysis and calculating root mean square error (RMSE) between the matrices. A low RMSE (~0.05) score would suggest missing data had minimal impact on analyses.

Data were analysed with SPSS Version 26 and R. Participants with missing data were excluded from analyses on a case-wise basis.

Sample size met power requirements for analyses. Factors that may impact the effect of lockdown on frailty such as physical activity or resources used were analysed as variables of interest rather than as confounders.

Results

Descriptive Statistics

Characteristics of study participants and summary measures for frailty scores, QoL, AFEAT, loneliness and social isolation at each time point for the whole sample are presented in Table 1. At all time points, the median physical activity engagement was 30 minutes of exercise on 5-7 days. Average number of days between each assessment were as follows: Time 1–Time 2, Mean=49.9, SD=7.9; Time 2–Time 3, Mean=55.1, SD=7.5; Time 3–Time 4, Mean=65.6, SD=8.9.

INSERT TABLE 1

A full breakdown of individual coping resources used over time is presented in Table 2.

INSERT TABLE 2

Sensitivity Analysis

A RMSE score of 0.057 was calculated between the imputed and original data correlation matrices, indicating that the missing data had a minimal impact on output.

Hypotheses 1, 2, & 3: *Change in Outcomes over a Seven Month period*

Results of the mixed ANOVA are presented in Table 3 (see Supplementary Material 2 for post-hoc pairwise comparisons).

INSERT TABLE 3

The Spanish cohort were significantly frailer than the English cohort, and the high-risk group were significantly frailer than the low-risk group. A significant main effect of Time, and a significant Time x Country interaction indicated that changes in frailty over time differed between the England and Spain. Pairwise comparisons revealed that in the Spanish cohort, frailty decreased significantly from T1 to T3 ($t(19)$=-3.35, p<.05) and from T1 to T4 ($t(19)$=-4.82, p<.001). In the English cohort, frailty decreased significantly only between T1 and T3 ($t(43)$=-3.21, p<.05).

There were no significant main effects of Country or Risk for AFEAT scores. There was a significant Time effect and a Time x Country interaction. Pairwise comparisons showed that in the Spanish cohort, perceived age-friendliness of the environment significantly increased from T1 to T2 ($t(19)$=5.52. p<.001), T3 ($t(19)$=6.11, p<.001), and T4 ($t(19)$=4.53, p<.01). In the English cohort, there were significant differences between AFEAT scores at T1 compared

to T3 ($t(43)$=2.95, p<.05) and T2 compared to T3 ($t(43)$=2.95, p<.05), again, with AFEAT increasing over time.

No significant group differences or variation over time for quality of life or loneliness were discovered.

Age did not significantly impact on change in outcomes over time.

Hypothesis 4: *Change in potential modifying factors over time*

There were no significant differences between countries or COVID-19 risk groups for social isolation. There was a significant effect of Time and a Time x Country interaction. Pairwise comparisons showed that for the English cohort, Social Isolation score decreased significantly between T3 and T4 ($t(42)$=-2.96, p<.05), participants becoming more isolated between T3 and T4. There were no significant changes in Social Isolation over time in the Spanish cohort. There was also a significant Time x Risk interaction; however, Bonferroni corrected pairwise comparisons were all non-significant.

The English group reported using significantly more coping resources than did the Spanish group. There was also a significant Time x Country interaction; post-hoc comparisons revealed that the number of coping resources being used increased between T3 and T4 in the English cohort ($t(43)$=3.35, p<.05), but there were no significant changes over time in the Spanish cohort.

There were no significant differences across time for either the Spanish or English group in exercise frequency ($\chi^2(3)$=5.09 and 2.29 respectively, p>0.05). There was, however, a significant difference between risk groups, with the low-risk group completing at least 30 minutes of exercise for more days per week than the high-risk group (Mann Whitney U test).

Hypothesis 5: *Impact of modifiers on Change in Frailty and Well-Being Over the Lockdown Period*

The repeated-measures ANCOVA demonstrated that the number of coping resources used did not significantly impact change in frailty ($F(3,186)=1.10$, $p=.348$), loneliness ($F(3,186)=0.60$, $p=.612$), AFEAT ($F(3,186)=1.61$, $p=.193$), or quality of life ($F(3,186)=0.69$, $p=0.545$). Neither social isolation/engagement nor physical exercise significantly impacted the effect of time for loneliness, AFEAT or QoL ($p>0.05$), and social isolation/engagement had no impact on effect of time for frailty.

Table 4 summarises the regression models predicting changes in frailty, quality of life, and loneliness between Time 1 and Time 3. Significant correlations between potential confounder variables and change scores were found between AFEAT change and age, $r=.27$, $p<.05$, and education, $r=-.30$, $p<.05$. The model predicting change in AFEAT score thus included age and education as predictors. There was a trend towards a significant correlation between age and frailty change, $r=-.24$, $p=.05$. No other significant correlations were observed.

The model predicting change in frailty was significant ($F(5,58)=6.66$, $p<.001$, $R^2=.36$, $R^2_{adj}=.31$). Frailty at Time 1 was significantly associated with change in frailty over time. That is, those who were frailer at Time 1 experienced a greater decrease in frailty severity between Time 1 and Time 3. There was a significant association between physical activity at Time 1 and frailty change, such that those who were more physically active experienced a greater decrease in frailty. There was also a significant association between social isolation and frailty change, such that those who were less socially isolated experienced a smaller decrease in frailty over time.

The model predicting change in quality of life was also significant ($F(5,56)=6.05$ $p<.001$, $R=.35$. $R^2_{adj}=.29$). Initial level of QoL significantly predicted change, but once initial levels had been accounted for, no further variables were predictive of change.

The model predicting changes in AFEAT score was significant ($F(7,56)=4.03$, $p<.01$, $R^2=.34$, $R^2_{adj}=.25$). AFEAT score at Time 1 significantly predicted change over time, but once initial score had been accounted for, no further variables were predictive of change.

The model predicting changes in loneliness was significant, ($F(5,58)=4.09$, $p<.01$, $R^2=.26$, $R^2_{adj}=.20$). Loneliness at Time 1 was significantly associated with change over time, but once initial level of loneliness was accounted for, no further variables predicted change.

INSERT TABLE 4

Discussion

This study examined longitudinal changes in well-being and COVID-19 vulnerability using a measure of frailty, from the first pandemic related lockdown in England and Spain. The study considered whether changes differed between countries across different stages of lockdown and according to individual COVID-19 risk based on diagnosed morbidities. We explored whether factors such as physical activity and social contact, and using coping resources mitigated adverse effects of lockdown.

Our repeated measures covered a range of lockdown severities in each country which was reflected in frailty change. Initial measures were during the most severe lockdown in each country. Spanish participants showed higher levels of frailty, perhaps related to the strictness

of the Spanish lockdown, but with significant improvements with restrictions easing. Frailty severity was highest overall at the first assessment, decreasing significantly between the first and third assessments in both countries, suggesting that as restrictions eased, frailty became less severe. This trend continued in the Spanish cohort, with a significant difference between the first and fourth assessment. Conversely, average frailty increased slightly in the English cohort during the fourth assessment, and frailty was no longer significantly different compared to T1. This discrepancy suggests that restrictions being reintroduced prior to the fourth assessment were having differing effects: in England, regional tier-based restrictions were introduced. North West England had stronger restrictions than other regions, which may explain the reversal in the reduction of frailty severity, underlining the impact of lockdown vulnerability. The tendency for frailty to be more severe when lockdown restrictions are at their highest is a notable finding, given that frailty is a significant risk factor for severe disease outcomes and mortality as a result of COVID-19 (Hewitt *et al*., 2020; Ma *et al*., 2020; Petermann-Rocha *et al*., 2020). Frailty also impacts on vulnerability to non-COVID-19 related adverse outcomes (Morley, 2013), which in a time of depleted health resources may have serious outcomes for individuals. It should be noted, that as the present study did not include a measure of frailty before the pandemic started, we cannot conclude that lockdown directly caused an increase in frailty, but does suggest that while lockdowns reduce the risk of contracting COVID-19, they increase vulnerability to adverse outcomes.

Perceptions of environmental age-friendliness (AFEAT) also varied over time and between countries. In the Spanish cohort, AFEAT increased earlier, at the second assessment. This reflects earlier changes in lockdown restrictions in Spain. In England, participants perceived their environment to be more age-friendly at the time of the third assessment, when lockdown restrictions were at their lowest. However, by the time of the fourth assessment, restrictions had been reintroduced in England, and the difference from Time 1 was no longer significant.

The importance of the environment would be expected to vary with lockdowns as the measure includes items relating to accessibility of services and mobility within the community, and items related to community outreach to include people at risk of social isolation, or feeling a valuable part of one's local community. Previous work has shown that this measure acts as an important moderator of the relationship between frailty and need for formal care (Garner & Holland, 2019), and the variation with lockdown underlines areas for intervention in future lockdowns. This is demonstrated in the effects of lockdown variation on the measure of social isolation used, with a reduction in this measure (indicating more isolation) for the participants in England as a second wave of lockdowns, particularly in areas of the North West of England, began to have effect at Time 4.

There was, however, little evidence that loneliness changed significantly over time. Previous research from both the UK and Spain has shown that younger adults may be more at risk of loneliness during lockdown (Bu, Steptoe, & Fancourt, 2020; Losada-Baltar *et al*., 2021), possibly because younger people normally lead more active social lifestyles outside the home and would be at work or places of education and therefore experienced more social disruption due to lockdown measures. The findings reported here support this; social isolation levels among older adults only changed at Time 4, and there was no change in feelings of loneliness. Our parallel qualitative work in the England with some of the same participants (Varey *et al*., in prep) has shown that families and friends made a significant effort to stay in contact during the first lockdown and mood was generally resilient and positive, but by the time of the increasing lockdown restrictions at Time 4, this positivity was giving way to anxiety about how long such isolation would continue for.

To our knowledge, no studies have examined longitudinal changes to quality of life during the COVID-19 pandemic, although one study did report a significant decrease compared to pre-pandemic levels in a sample of older adults (Rantanen *et al*., 2020) and another study

demonstrated negative impact of lockdown longitudinally on health and social well-being of clinically vulnerable older adults (Di Gessa & Price, 2021). While we cannot rule out the possibility that quality of life in our sample may have been higher before the pandemic, there were no significant changes to quality of life over time. That is, in both England and Spain, our older adult sample's quality of life was notably stable throughout periods of lockdown.

Another notable finding is the lack of significant differences between those who were and were not considered high risk. While frailty was significantly more severe in the high-risk group as one may expect, there were no differences in quality of life, AFEAT, social isolation or loneliness. One might have expected those who were at greater risk from COVID-19 to experience negative effects of lockdown more acutely, but this is not apparent. This contrasts with the findings of Di Gessa and Price (2021) indicated above, although they only compared clinically vulnerable with non-clinically vulnerable older adults (controlling for pre-pandemic levels) on assessments that took place during June/July 2020 (using data from the English Longitudinal Study of Ageing, ELSA). Our parallel qualitative work suggests an explanation for our findings (Varey *et al*., in prep) – that those living with significant chronic diseases were already living somewhat restricted lives and so lockdown made less difference to them than to their more active healthy counterparts. It is possible that older adults may have behaved similarly regardless of their risk-level, but more research regarding the physical and psychological effects among those shielding is needed to explore this possibility further.

The majority of the sample reported using social support as a coping resource throughout the study, which may explain the lack of significant improvement in feelings of loneliness and social isolation once lockdown restrictions had eased. Overall, the English group reported using more coping resources than the Spanish group. This may suggest that such coping resources were less available to the Spanish group during lockdown periods. Further studies

should explore whether the Spanish older adults had poorer access to or less knowledge of alternative coping resources or new technologies compared to the English population.

Our analysis of the hypothesised contributory covariates showed that social engagement/isolation, physical activity or number of coping resources used had no impact on changes in quality of life, environmental perceptions and loneliness. However, in relation to changes in frailty, regression analyses showed that physical activity and social engagement/isolation at T1 had significant impacts on change in frailty once contributions of country and initial frailty levels had been accounted for. Those who were more physically active at the time of the first assessment showed greater decreases in frailty severity between the first and third assessments, in line with evidence that high levels of physical activity are linked to reduced risk of frailty (Oliveira *et al*., 2020). This is important and supports the hypothesis that continued physical activity during lockdown could modify changes in frailty and related vulnerability to severe COVID-19 reactions. These findings highlight the importance of maintaining sufficient exercise levels during lockdown and limiting exercise to reduce the spread of COVID-19 will negatively impact on older adults.

Limitations

The differences between T1 and T3 in outcomes indicated that lockdown affected health and well-being. However, as we have no 'pre-COVID' assessment, we cannot confirm the full extent of the effects of lockdown, which may be more severe than analyses suggest.

The sample size, while considered sufficient through power analysis, remains relatively small and therefore generalisability may be limited.

Conclusions

The study examined changes to health and well-being in England and Spain during the COVID-19 pandemic. Results showed similar trends in both countries; as lockdown restrictions were eased, frailty severity decreased, and older adults viewed their environment as being more age-friendly, particularly in Spain where initial lockdown was more severe; differences between the countries seemed to be related to different lockdowns. Changes in perceived environmental age-friendliness is important as it moderates the impact of frailty on social care requirements and quality of life (Garner & Holland, 2019). Social isolation remained largely unchanged except for when English restrictions were re-introduced. There were no significant changes in loneliness or quality of life. Being frailer, more physically active and more socially isolated initially was associated with greater decreases in frailty as lockdowns eased. Addressing physical activity and social isolation should be carefully promoted to mitigate impact on frailty of future lockdowns.

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Table 1: *Descriptive Statistics.*

Outcome	*n*	Mean	Std. Dev	Std. Error	Interquartile Range	Range
Time 1						
Frailty	70	0.280	0.11	0.01	0.13	0.083 - 0.532
QoL	69	35.88	6.07	0.73	8.00	22 – 48
AFEAT	70	33.09	5.36	0.64	6.00	19 - 45
Loneliness	69	9.78	2.24	0.27	3.00	4 – 12
Coping Resources	69	4.67	1.91	0.23	3.00	0 - 8
Social Isolation	68	42.26	14.04	1.70	11.25	16 – 96
Time 2						
Frailty	68	0.254	0.12	0.01	0.16	0.051 - 0.596
QoL	65	35.43	5.35	0.66	7.00	19 - 45
AFEAT	68	35.66	6.22	0.75	9.25	18 - 50
Loneliness	68	9.97	2.25	0.27	3.00	4 - 12
Coping Resources	68	4.632	2.14	0.26	3.00	0 - 8
Social Isolation	68	42.38	12.68	1.54	13.25	20 - 93
Time 3						
Frailty	66	0.223	0.11	0.01	0.13	0.051 - 0.593
QoL	64	35.61	5.21	0.65	7.00	23 - 46
AFEAT	66	37.09	5.99	0.74	7.75	20 - 49
Loneliness	66	10.17	2.12	0.26	3.00	4 - 12
Coping Resources	63	4.81	1.58	0.20	2.00	1 - 8
Social Isolation	66	43.64	12.28	1.51	10.75	19 - 89
Time 4						
Frailty	65	0.221	0.11	0.01	0.13	0.025 - 0.474
QoL	64	35.41	5.28	0.66	8.00	22 - 45
AFEAT	65	35.55	6.18	0.77	8.00	21 - 50
Loneliness	65	9.91	2.23	0.28	4.00	4 - 12
Coping Resources	65	5.05	2.03	0.25	3.00	0 - 9
Social Isolation	65	41.32	10.41	1.29	12.00	22 - 71

Table 2: *Frequencies Analysis showing change in use of Coping Resources Across Time Points.*

		Time 1	Time 2	Time 3	Time 4
Family	**Yes (%)**	57 (81.4%)	55 (78.6%)	58 (82.9%)	57 (81.4%)
	No (%)	13 (18.6%)	13 (18.6%)	7 (10.0%)	8 (11.4%)
	Missing (%)	0	2 (2.9%)	5 (7.1%)	5 (7.1%)
Friends	**Yes (%)**	51 (72.9%)	51 (72.9%)	52 (74.3%)	50 (71.4%)
	No (%)	19 (27.1%)	17 (24.3%)	13 (18.6%)	15 (21.4%)
	Missing (%)	0	2 (2.9%)	5 (7.1%)	5 (7.1%)
NHS	**Yes (%)**	16 (22.9%)	19 (27.1%)	21 (30.0%)	22 (31.4%)
	No (%)	54 (77.1%)	49 (70.0%)	43 (61.4%)	43 (61.4%)
	Missing (%)	0	2 (2.9%)	6 (8.6%)	5 (7.1%)
Watching TV	**Yes (%)**	39 (55.7%)	49 (70.0%)	45 (64.3%)	54 (77.1%)
	No (%)	31 (44.3%)	19 (27.1%)	20 (28.6%)	11 (15.7%)
	Missing (%)	0	2 (2.9%)	5 (7.1%)	5 (7.1%)
Exercising	**Yes (%)**	42 (60.0%)	45 (64.3%)	46 (65.7%)	41 (58.6%)
	No (%)	28 (40.0%)	23 (32.9%)	19 (27.1%)	24 (34.3%)
	Missing (%)	0	2 (2.9%)	5 (7.1%)	5 (7.1%)
Community Group	**Yes (%)**	12 (17.1%)	16 (22.9%)	3 (4.3%)	9 (12.9%)
	No (%)	58 (82.9%)	52 (74.3%)	62 (88.6%)	56 (80.0%)
	Missing (%)	0	2 (2.9%)	5 (7.1%)	5 (7.1%)
Organisation Support	**Yes (%)**	23 (32.9%)	10 (14.3%)	13 (18.6%)	19 (27.1%)
	No (%)	47 (67.1%)	58 (82.9%)	52 (74.3%)	46 (65.7%)
	Missing (%)	0	2 (2.9%)	5 (7.1%)	5 (7.1%)
Food & Drink	**Yes (%)**	28 (40.0%)	30 (42.9%)	27 (38.6%)	35 (50.0%)
	No (%)	41 (58.6%)	38 (54.3%)	38 (54.3%)	30 (42.9%)
	Missing (%)	1 (1.4%)	2 (2.9%)	5 (7.1%)	5 (7.1%)
Humour	**Yes (%)**	56 (80.0%)	40 (57.1%)	44 (62.9%)	41 (58.6%)
	No (%)	14 (20.0%)	28 (40.0%)	20 (28.6%)	24 (34.3%)
	Missing (%)	0	2 (2.9%)	6 (8.6%)	5 (7.1%)

Table 3: *Mixed-design ANOVA Results for Frailty, QoL, AFEAT, Loneliness and Social Isolation (significant effects in bold).*

Factor	DF	F	p	Generalised η^2
		Frailty[a]		
Country	**1, 60**	**4.91**	**0.031**	**0.06**
Risk	**1, 60**	**6.47**	**0.014**	**0.07**
Time	**3, 180**	**9.27**	**<0.001**	**0.04**
Country * Risk	1, 60	0.19	0.665	0.00
Country * Time	**3, 180**	**2.85**	**0.039**	**0.01**
Risk * Time	3, 180	0.00	1.000	0.00
Country * Risk * Time	3, 180	0.35	0.793	0.00
		QoL[b]		
Country	1, 55	1.68	0.201	0.02
Risk	1, 55	1.46	0.233	0.02
Time[c]	2.67, 146.82	0.64	0.570	0.00
Country * Risk	**1, 55**	**4.15**	**0.046**	**0.06**
Country * Time[c]	2.67, 146.82	0.46	0.691	0.00
Risk * Time[c]	2.67, 146.82	1.40	0.246	0.01
Country * Risk * Time[c]	2.67, 146.82	0.06	0.969	0.00
		AFEAT[a]		
Country	1, 60	1.20	0.277	0.01
Risk	1, 60	0.00	0.995	0.00
Time	**3, 180**	**8.73**	**<0.001**	**0.05**
Country * Risk	1, 60	0.09	0.762	0.00
Country * Time	**3, 180**	**4.29**	**0.006**	**0.03**
Risk * Time	3, 180	0.22	0.885	0.00
Country * Risk * Time	3, 180	0.85	0.470	0.01
		Loneliness[a]		
Country	1, 60	2.70	0.106	0.03
Risk	1, 60	1.39	0.244	0.02
Time	3, 180	2.65	0.050	0.01
Country * Risk	1, 60	1.46	0.231	0.02
Country * Time	3, 180	0.98	0.406	0.00
Risk * Time	3, 180	2.22	0.088	0.01
Country * Risk * Time	3, 180	2.57	0.056	0.01
		Total Coping Resources[d]		

Country	**1, 57**	**55.38**	**<0.001**	**0.33**
Risk	1, 57	0.90	0.348	0.01
Time^c	2.70, 154.12	1.65	0.186	0.01
Country * Risk	**1, 57**	**5.11**	**0.028**	**0.04**
Country * Time^c	**2.70, 154.12**	**3.72**	**0.016**	**0.03**
Risk * Time^c	2.70, 154.12	1.44	0.236	0.01
Country * Risk * Time^c	2.70, 154.12	0.42	0.717	0.00
	Social Isolation^e			
Country	1, 59	2.13	0.150	0.03
Risk	1, 59	0.00	0.981	0.00
Time	**3, 177**	**3.81**	**0.011**	**0.02**
Country * Risk	1, 59	0.65	0.423	0.01
Country * Time	**3, 177**	**7.49**	**<0.001**	**0.03**
Risk * Time	**3, 177**	**4.55**	**0.004**	**0.02**
Country * Risk * Time	**3, 177**	**6.87**	**<0.001**	**0.03**

Note. **Bold** = significant at p < .05

[a] *Six participants excluded due to missing data.* [b] *Eleven participants excluded due to missing data.* [c] *Greenhouse-Geisser correction applied to degrees of freedom due to violation of assumption of sphericity.* [d] *Nine participants excluded due to missing data.* [e] *Seven participants excluded due to missing data.*

Table 4: *Multiple Regression Models Predicting Change in Frailty, Quality of Life, AFEAT and Loneliness and Between Time 1 and Time 3.*

Predictor	β	Std. Error	t	p
Frailty Change				
Country (Spain)	-0.18	0.03	-1.22	.226
T1 Frailty	**-0.48**	**0.11**	**-4.16**	**<.001**
T1 Total Coping Resources	0.05	0.01	0.38	.706
T1 Physical Activity	**-0.31**	**0.01**	**-2.84**	**.006**
T1 Social Isolation	**0.25**	**0.00**	**2.23**	**.029**
QoL Change				
Country (Spain)	-0.09	1.29	-0.61	.541
T1 QoL	**-0.55**	**0.07**	**-5.09**	**<.001**
T1 Total Coping Resources	0.15	0.31	1.08	.284
T1 Physical Activity	0.01	0.37	0.12	.906
T1 Social Isolation	0.08	0.03	0.70	.488
AFEAT Change				
Age	0.08	0.16	0.65	.516
Education	-0.06	0.74	-0.42	.678
Country (Spain)	0.34	2.32	1.83	.072
T1 AFEAT	**-0.36**	**0.13**	**-3.06**	**.003**
T1 Total Coping Resources	0.16	0.43	1.14	.260
T1 Physical Activity	-0.01	0.54	-0.12	.907
T1 Social Isolation	0.03	0.05	0.28	.780
Loneliness Change				
Country (Spain)	0.13	0.59	0.88	.383
T1 Loneliness	**-0.50**	**0.09**	**-4.35**	**<.001**
T1 Total Coping Resources	0.13	0.13	0.94	.353
T1 Physical Activity	-0.08	0.17	-0.69	.495
T1 Social Isolation	-0.02	0.02	-0.18	.857

*Note. Higher scores in the variable Social Isolation indicate lower levels of isolation. **Bold** = significant at p<.05.*