



Pre and post Covid preferences for working from home

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ARTICLE INFO

Keywords:

Working from home
Travel demand management
Transport policy

ABSTRACT

Working from home (WFH) is being seen as a potential solution to many contemporary problems from congestion to global warming and work-life balance. Since the 1970s, it was assumed that when information technology had developed enough to enable meaningful real-time communication between an employee in their home and a central workplace, there would be a mass uptake of WFH. However, this promise remained largely unfulfilled until the COVID-19 pandemic, where WFH was mandated for workers for whom it was possible. In this research, the results of two surveys conducted in Ireland in June 2019 and July 2020 examining WFH are analysed using cluster analysis and multinomial logistic regression. The paper investigates the factors that impact the desire to WFH more, and how this has changed from 2019 to 2020. In doing this, the impact of the COVID-19 pandemic and the associated normalisation of WFH are assessed. Key variables included in cluster analysis were identified as the participant's age and the time taken to complete their daily commute, with younger people and those with longer commutes included in the cluster with those who would like to work from home more. The composition of the clusters remained roughly the same between the 2019 and 2020 surveys. These factors were also included in the multinomial logistic analysis where it was shown that attitudes changed between the two samples, and in 2020 females, those in the older age categories and public transport users had a greater desire to WFH.

1. Introduction

The coronavirus pandemic of 2020 has had a large impact on many aspects of daily life, particularly in commuting. In March 2020, several countries instituted national lockdown measures or stay-at-home orders. The measures taken in Ireland began with the closure of schools, colleges and childcare facilities on the 12th March 2020, initially for an approximately two-week period ending on the 29th March (Leahy et al., 2020). Despite advances in technology enabling remote working in many industries, WFH has been adopted at rates lower than those projected in the past. In a pilot survey conducted by Ireland's Central Statistics Office (CSO) in 2018, 18% of the respondents reported that they worked from home, most commonly for one or two days a week (Department of Business, Enterprise and Employment, 2019). A 2020 survey of a sample of 63,354 people in the European Union, investigating the rates of remote working during the COVID-19 pandemic found that Ireland had the second-highest rate of WFH of the 27 EU member states throughout the pandemic; 47% of people surveyed worked exclusively from home (Eurofound, 2020).

The objective of this work is to investigate the prevalence of, and public attitude towards, WFH before and during the COVID-19

pandemic, investigating the demographic factors that indicate a greater enthusiasm for WFH, and whether opinions on WFH have altered in the time between the 2019 survey and its 2020 counterpart. A comparison between the two datasets represents one of the main contributions of this work. One key factor that should be taken into account when interpreting these results is that due to the global pandemic in 2020, preferences for WFH may have been higher due to health concerns. Our research did not examine the banking and IT sectors links between professions and the desire to WFH. However, research conducted by Crowley et al (2021) demonstrated that the majority of those most likely to WFH were in the technical services, finance and IT sectors.

The paper is organised as follows: Section 2 details a review of the literature examining the factors that influence WFH and how the pandemic resulted in increased WFH. Section 3 presents an overview of the data collection and the methods used in the study, Section 4 contains the results of the analysis conducted. Finally, Section 5 summarises the main findings and conclusions of the paper.

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<https://doi.org/10.1016/j.tbs.2023.100679>

Received 10 August 2022; Received in revised form 6 July 2023; Accepted 7 September 2023

Available online 9 September 2023

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2. Literature review

2.1. History of and definition of working from home

Much of the literature regarding WFH available from the 1990 s is characterised by the assumption that the advent of new information technology will eliminate the need for a physical commute for many workers. As [Salomon \(1998\)](#) summarises; if information is the good to be transported, there is no need to transport people. For many years, mass uptake of telecommuting has been awaited; it was predicted by AT&T in 1974 that all Americans would be WFH in 1990 ([Korte et al., 1988](#)). The term telecommuting paradox was used in several papers from the late 1990 s and early 2000 s, defined as the curious dichotomy of the small number of telecommuters despite the apparent plethora of telecommuting programs in organizations ([Khalifa and Davison, 2000](#)).

In several studies in the 1990 s it was assumed that the poor uptake of WFH was due to poor telecommunication connectivity in homes ([Handy and Mokhtarian, 1996](#); [Mokhtarian, 1998](#); [Tung and Turban, 1996](#)). With the installation of domestic Wi-Fi now commonplace in homes, WFH while having good connection to colleagues is not the impossibility now than it seemed then, but uptake of WFH remained poor; in 2019, only 5.4% of people employed in the EU usually worked from home, a figure that has remained relatively constant since 2009 ([Milasi et al., 2020](#)). Prior to the COVID-19 Pandemic, the uptake of WFH remained low. [Aguilera et al. \(2016\)](#) suggested that only an extraneous shock would raise the uptake of WFH; the COVID-19 pandemic would appear to be just such a shock.

The uptake of WFH is unclear, partly due to the lack of a common definition. In exploring the prevalence of WFH, [Mokhtarian et al. \(2005\)](#) assert the difficulties in providing a definition for a telecommuter. [Mokhtarian \(1998\)](#) uses the terms information worker and non-information worker to distinguish between different types of people who may engage in home-based working. An information worker is the category of person usually identified as having the greatest potential for teleworking.

One of the key findings that the research has shown on travel behaviours pre and post covid is that populations are conducting more daily activities from home. [Mouratidis and Papagiannakis \(2021\)](#) found that in Greece that online learning, shopping and WFH all increased since the during the pandemic. The authors suggest that the longevity of this trend will depend upon the acceptance of participating in day-to-day activities online. Moreover, it has been suggested that the skills, norms and infrastructure put in place to move activities online during the pandemic may result in increased post-pandemic online activities ([Mouratidis and Peters, 2022](#)).

2.2. Determinants of working from home

Globally, women carry out the majority of housework ([Craig and Powell, 2018](#)), and are perceived as the primary care-givers for their children ([Chesley and Flood, 2017](#)). A gender disparity in the level of childcare and housework completed by parents persists even when both parents are in employment or the mother earns more than the father ([Sevilla and Smith, 2020](#)). From this, the assumption is often made that working from home will appeal especially to women ([Bélanger, 1999](#)).

Research was carried out in Canada into issues and challenges faced by those who work from home, with a particular focus on women ([Tremblay, 2002](#)). It was found that the motivations for working from home were, in order of importance, “More flexible schedules”, “Avoid travelling to the office”, “More productive”, “Can be close to their family” and “Improve the quality of their work”, and [Mokhtarian et al. \(1998b\)](#) finds that on average, women rate the advantages of working from home more highly than men, and are likely than men to be motivated by “family, personal benefits, and stress reduction” in working from home. Additionally, it was found women with children “rated the stress reduction and family benefits of telecommuting more highly” than

those with no children.

However, a stated preference to work from home does not necessarily translate to a higher rate of working from home. Numerous studies ([Caulfield, 2015](#); [de Graaff and Rietveld, 2004](#); [Redmond, 2020](#)) find that men are more likely to work from home than women. Additionally, the impact of gender is also explored by [Mokhtarian et al. \(1998a\)](#), finding that women are more likely to want to work from home than men, but men and women were equally likely to actually work from home. This suggests that there are external factors influencing whether a person works from home in addition to their personal preference.

A survey of 76 people in an American study carried out by [Bélanger \(1999\)](#) finds that of the variables investigated- age, years in organisation, computer skills, gender and job category- only gender and job category showed significant differences between telecommuters and non-telecommuters. In terms of job category, information workers without supervisory roles were found to work from home more; it was theorised that a belief that managers should not telecommute “may be entrenched in corporate culture”.

Access to transportation is also a factor in determining an individual’s propensity to work from home. [Mannering and Mokhtarian \(1995\)](#) found a positive correlation between working from home and a higher level of vehicle ownership. In a study of the Greater Dublin Area (GDA), [Caulfield \(2015\)](#) identifies respondents living in more affluent areas with poor links to public transport as being more likely to work from home.

The household size is another influencing factor regarding working from home. In a study carried out in California, [Mannering and Mokhtarian \(1995\)](#) found that a larger household size and small children in the household correlated with a higher likelihood of working from home, while in Ireland, [Redmond \(2020\)](#) used data from a 2018 Labour Force survey and concluded that couples with children were more likely to work from home than either couples without children or single parents.

Education, income and age were also found to be significant factors in determining the prevalence of working from home. [Caulfield \(2015\)](#) finds that, in the Greater Dublin Area, a higher proportion of those over the age of 45 work from home than in other age groups, but that there is little difference in the levels of working from home between those who have completed each educational level. Additionally, the higher prevalence of working from home in affluent areas in the Greater Dublin Area indicated that working from home is linked to higher income, complemented by findings from the Irish Labour Force Survey ([Redmond, 2020](#)), showing that working from home is much more likely among higher paid occupations. Further afield, a study completed in the Netherlands ([Muhammad et al., 2007](#)) finds that those in the 36–65 age category were more likely than younger people to work from home, and that working from home was more prevalent among those with higher incomes and a higher level of education. In the United States, [Dingel and Neiman \(2020\)](#) find that 37% of jobs can “be completed entirely from home”, and that the income for these jobs tends to be higher. These findings show that working from home is more likely to be accessible to those in higher earning jobs.

2.3. Working from home: A panacea?

Intuitively, reducing the number of days that an employee must travel into work would have significant impact on the energy use required for transportation; reducing travel by eliminating commuting trips, reducing congestion levels and therefore reducing transport-related emissions ([de Abreu e Silva and Melo, 2018](#)). However, there is no clear consensus as to whether an increase in WFH reduces overall household travel, or whether a reduction in commuting trips is negated by an increase in non-work trips, or a relocation to an area further from the workplace (assuming some trips to a physical workplace are required) and from effective public transport links.

While much attention has been paid to mitigating the CO₂ emissions

in the transportation sector by use of low-carbon fuel and technology measures, the reduction of CO₂ emissions by reducing transport demand has been a growing focus in recent years (Crowley et al., 2021). Reducing transport demand by WFH is often posited as a solution. Eliminating the commute for significant proportion of workers is instinctively an attractive proposition; by WFH, people would not have to commute to their work locations and thereby travel would be curtailed. However, enabling WFH may have secondary effects that reduce the potential for CO₂ savings (Cerqueira et al., 2020). The two main secondary effects that may lead to increased vehicle distance travelled are an increased number of trips carried out for non-work purposes or a residential relocation to an area further from the workplace, increasing the vehicle distance travelled when a journey to the office was made.

More recently, de Abreu e Silva and Melo (2018) conducted a study of households in Great Britain with one or two workers, using data from the National Travel Survey (2005–2012) to study the effects of teleworking frequency on household-level weekly trips and travel distances by mode, finding that those who worked from home on average travelled further distances than those who worked from a central location. Cerqueira et al. (2020) investigate the relationship between work location (whether home working, telecommuting or working from multiple locations) and the workers' travel patterns and carbon emissions. This research classifies individuals whose main place of work is at home or in the same building as their home as homeworkers or home-based workers. Those who worked wholly from home are referred to as homeworkers, and those who work three or more times a week or once or twice a week and do not identify themselves as homeworkers are classed as teleworkers. Cerqueira et al. (2020) conclude that individuals who work at home travel more kilometres in total for non-work trips on weekdays, and therefore transport-related emissions are higher for home-based workers than for those with a fixed non-home-based workplace, and that teleworkers have the highest greenhouse gas emissions.

The pandemic caused a decrease in mobility worldwide, affecting transport use in all modes, but disproportionately for public transport, while travel by individual modes, whether by car, motorcycle, walking or cycling, did not sustain as large a decrease in use, and in some cases a larger uptake than normal was noted. The long-term implications for public transport, however, are difficult to predict. Research carried out assessing changes in views of WFH before or after the pandemic has not been conducted. Additionally, recent research conducted on factors making it more likely that an individual will work from home tend to be focussed on the characteristics of those who currently work from home rather than those who would like to. This research will therefore add to the body of knowledge on the topic by providing an insight into changes in views towards WFH in Ireland due to the COVID-19 pandemic. Our paper also contributes to the academic literature in this area as it provides a point in time in which policies for WFH were brought in in order to protect public health. It demonstrates how this immediate impact changed preferences linked to working from home.

3. Methods and data collection

3.1. Surveys and data collection

This section of the paper details the surveys conducted and the data collected in each survey. A comparison is made between the socio-economic characteristics of the samples and the general population of Ireland as recorded in the 2016 census. The survey was administered online using a nationwide panel of respondents in June 2019 and July 2020.

Questions regarding WFH in both surveys explored various areas of interest to this research; the reasons participants would or would not work from home and whether they would increase their days of WFH. Additionally, the likelihood of establishing a home or garden office, with or without a subsidy, was investigated. The 2020 survey was completed

during the COVID-19 pandemic, repeating some of the same questions asked in 2019, but with the focus on WFH. Participants in the 2020 survey were also asked about the changes they will make to their travel patterns in the future, and the motivations for making these changes. In total, 583 responses were included from the 2019 survey. Five hundred and sixty seven responses were received in the 2020 survey, and of these 509 completed the survey including the demographic information.

3.2. Survey demographics

The demographic and socio-economic characteristics of the samples responding to the 2019 and 2020 surveys were compared to the demographic information for the population of Ireland as collected in the 2016 census; demographic data can be compared easily between the census and the surveys. Table 1 shows a summary of the comparison between the socio-economic characteristics of the sample responding to the 2019 and 2020 survey and those of the data from the 2016 census, Ireland's most recent census. The data regarding the 2020 survey shows that the age group 35–44 is overrepresented in the survey responses: 37.5% of the survey responses received were in this age group, compared to a 20.9% proportion of the general population. By contrast, the 18–24, 45–54 and 65 + age groups were under-represented in the survey responses. In gender balance, female respondents are over-represented at 66.2% of the survey responses, compared to 48.9% of the general population as shown in the census data.

Where car ownership is concerned, it can be seen that the respondents to the 2020 survey have a lower percentage of households owning no cars than the percentage recorded in the 2016 census; 2.4% compared to 15.6% in the general population. The number of households with at least one car or van was higher in the survey sample (97.6%) than for the general population in 2016 (84.4%). Fifty nine percent of the responses indicate that the household owns one vehicle, 16.8% higher than in the census. At 2 vehicles or more, the percentage difference between the survey responses and the census is less than 4% in each case. As is shown in Table 1 the two samples are not a perfect fit to the last Census conducted in Ireland, especially when looking at the gender representation. This caveat should be considered when interpreting the results presented in this paper.

3.3. Analysis methods

The two main methods of analysis used in this paper are cluster analysis and multinomial logistic regression. These methods were chosen due to their extensive use in the literature and ability to robustly examine survey data and enable statistical inference. Descriptive statistics and other modelling approaches could achieve the same outcomes, the authors chose cluster analysis and multinomial logistic regression as they were deemed most suited to the data collected. Cluster analysis refers to a technique that separates a population into a number of clusters based on the observed values of several variables for each individual (Sinharay, 2010), by means of common features rather than on a priori basis. Anable (2005) suggests that transportation research may be lagging market research in use of cluster analysis, but it has been used in a variety of contexts in transportation research (Caulfield and Kehoe, 2021; Ducret et al., 2016; McCarthy et al., 2016; de Oña et al., 2014). Segmentation of populations is a term used predominantly in marketing to describe the process of creating groupings of individuals with common characteristics in order to target advertising messages more effectively (Setini and Caesar Darma, 2020). Traditionally, segmentation of the market has been achieved by splitting the population on a priori segmentation, where the population is split on the basis of one or more predetermined variables.

In this research, two clusters were estimated and they divide the participants in each survey by their response to the statement, "If I could increase my days of remote working by 1 or 2 days a week I would do it". This was the variable that was shown to be strongest variable from the

Table 1
Demographics of the 2019 and 2020 survey samples compared to the 2016 census.

Variable and category	2016 Census Frequency	%	2019 Survey Frequency	%	% Difference	2020 Survey Frequency	%	% Difference
Age								
18–24	392,502	11.0	21	3.8	7.2	23	4.5	6.5
25–34	659,410	18.5	84	15.1	3.4	88	17.3	1.2
35–44	746,881	20.9	151	27.1	–6.2	191	37.5	–16.6
45–54	626,045	17.5	136	24.4	–6.9	43	8.4	9.1
55–64	508,958	14.3	90	16.1	–1.8	119	23.4	–9.1
65+	637,567	17.9	76	13.6	4.3	45	8.8	9.1
Total	3,571,363	100.0	558	100.0		509	100.0	
Gender								
Male	1,825,720	51.1	210	36.5	14.6	172	33.8	17.3
Female	1,745,643	48.9	366	63.5	–14.6	337	66.2	–17.3
Total	3,571,363	100.0	576	100.0		509	100.0	
Car Ownership per household								
No car	257,567	15.6	66	11.6	4	12	2.4	13.2
1 car	696,684	42.3	290	50.9	–8.6	300	59.1	–16.8
2 cars	567,414	34.4	171	30.0	4.4	159	31.3	3.1
3 cars	95,238	5.8	29	5.1	0.7	25	4.9	0.9
More than 4 cars	30,413	1.8	14	2.5	–0.7	12	2.4	–0.6
Total	1,647,316	100.0	570	100.0		508	100.0	
Household Size								
1	399,815	23.5	81	14.1	9.4	65	12.8	10.7
2	486,536	28.6	164	28.5	0.1	135	26.5	2.1
3	297,565	17.5	134	23.3	–5.8	117	23.0	–5.5
4	288,328	16.9	118	20.5	–3.6	114	22.4	–5.5
5	154,841	9.1	45	7.8	1.3	49	9.6	–0.5
6 or more	75,204	4.4	33	5.7	–1.3	29	5.7	–1.3
Total	1,702,289	100.0	575	100.0		509	100.0	

analysis (in both survey cohorts). Several key metrics were observed in creating cluster models, and models that did not meet these requirements were discarded. Firstly, the cluster quality (the silhouette measurement of cohesion and separation, or how cohesive a cluster is) should meet the threshold of “Fair”. The relative importance of each variable included on the overall clustering was determined using Euclidian distance; the models produced should show the binary version of the variable containing the answers to the question “If I could increase my days WFH by one or two days per week, I would” as the most important variable, with a relative predictor importance of 1.0. The other variables included should have a relatively high predictor importance so that clusters are created in which membership depends on more than a single variable. As a rough indicator, the relative importance of the next most important variable in the cluster should be greater than 0.2. Finally, the clusters should be roughly equal in size and between them contain at least 80% of the respondents in each survey.

Multinomial logistic regression, sometimes referred to as multinomial logit regression or MNL modelling, is one of the most commonly used discrete choice models; the ease of estimation, and the quick production of model indicators; goodness of fit, sign of parameters and log-likelihood and χ^2 values (Louviere et al., 2000), being the main advantages. The research presented in this paper uses this method. In order to perform MNL regression modelling on the data from both surveys. In the MNL models the desire for increased or decreased WFH is used as the dependent variables.

4. Results

4.1. Cluster analysis

The results in this section show that the main variable of interest found was based around a desire to increase (or not) the number of days WFH. As the samples are from before and after the pandemic this is seen as one of the key variables in the analysis. Once the clusters are identified then subsequent policy analysis is conducted on several variables using cross-tabulations in Tables 3 and 5.

In the clusters obtained, the most important variable was the binary

Table 2
Relative predictor importance in the clusters formed from 2019 survey data.

Variable	Scale	Relative predictor importance
Desire to increase days of remote working	Binary	1.00
Free Parking at workplace or education	3 categories	0.30
Age	6 categories	0.27
Commuting time	6 categories	0.10
Setting	4 categories	0.06

version of the “If I could increase my days of remote working by one or two days per week, I would”, with a relative predictor importance of 1.00 (this is a measure of the strength of the variable in the cluster). Scitovski et al (2021) provides a detailed discussion on the estimation and application of cluster methods. This is shown in the model summary below as Desire to increase days WFH. Additional variables included in the cluster analysis models were the availability of free parking at workplace or college, age of respondent, the time taken to travel to employment or education (commuting time), and the setting in which the respondent lives (urban, rural, town or village). The question “Which of the following best describes your current situation?” is asked in both the 2019 and 2020 surveys, but is answered by only 63 of the 583 responses received in 2019, and so this variable could not be used in the combined table.

Two clusters were formed. Cluster 1 contained 217 respondents, and Cluster 2 contained 153 respondents of the total 583. Table 2 shows each of the variables included in the cluster analysis and their relative importance.

Table 3 shows the proportion of the respondents to the survey placed in each category, and therefore the composition of the clusters constructed using data from the 2019 survey. Table 3 shows that almost 80% of the respondents placed in Cluster 1 agree that they would like to increase their days engaging in remote working by one or two days per

Table 3
Composition of clusters formed from 2019 survey data.

Variable	Categories	Cluster 1		Cluster 2		% Difference
		Number	%	Number	%	
Desire to increase days WFH	Yes	172	79.26	3	2.0	77.26
	No	45	20.74	147	98.0	-77.26
Free parking available	Yes	119	54.84	141	94.00	-39.16
	No	78	35.94	7	4.67	31.27
	Don't know	20	9.22	2	1.33	7.89
Age	18-24	19	8.76	1	0.67	8.09
	25-34	52	23.96	17	11.33	12.63
	35-44	72	33.18	43	28.67	4.51
	45-54	56	25.81	28	18.67	7.14
	55-64	9	4.15	48	32.00	-27.85
	65+	9	4.15	13	8.67	-4.52
Time taken to commute to work or college	0 mins	27	12.44	2	1.33	11.11
	Less than 10 min	26	11.98	27	18.00	-6.02
	10 mins - 14 mins	29	13.36	42	28.00	-14.64
	15 mins - 29 mins	69	31.80	43	28.67	3.13
	30 mins - 60 mins	47	21.66	30	20.00	1.66
	More than 60 min	19	8.76	6	4.00	4.76
Setting	I live in a city	67	30.88	38	25.33	5.55
	I live in a large town	66	30.41	58	38.67	-8.26
	I live in a rural village	25	11.52	32	21.33	-9.81
	I live in the countryside	59	27.19	22	14.67	12.52

Table 4
Summary of variables included in cluster analysis and their relative importance.

Variable	Scale	Relative predictor importance
Desire to increase days WFH	Binary	1.00
Likelihood of setting up a home or garden office if a subsidy was available.	Binary	0.60
Current employment situation since the COVID-19 pandemic	5 categories	0.27
Usual commuting mode	9 categories	0.12
Commuting time	6 categories	0.09
Province	4 categories	0.03
Setting	4 categories	0.03

week, while 98% of respondents placed in Cluster 2 disagreed or responded “Neither agree nor disagree” when posed with this statement. Younger respondents are more likely to belong to Cluster 1 than Cluster 2, and respondents placed in Cluster 2 were more than twice as likely as respondents in Cluster 1 to indicate that free parking was available at their workplace or education.

When asked for the time taken to conduct their typical commute to their workplace or college response of “0 min” corresponds to the individual WFH or not currently being in employment, and respondents with a journey time of 0 min or less than 15 min are more likely to be placed in Cluster 1. Those with journey times of greater than 15 min are more likely to be placed in Cluster 2. Where setting is concerned, respondents living in a city or in the countryside are more likely to be in Cluster 1, and those living in large towns or rural villages in Cluster 2.

In summary: Cluster 1 contains respondents who would like to work from home to a greater extent. They are less likely to have free parking available at their place of work or education and more likely to have a longer commute and live in the city or countryside. They also tend to be younger than the respondents in Cluster 2.

Cluster 2 contains respondents who do not want to increase their days engaging in remote working. They are more likely to have free parking available at their workplace or place of education, to be older than respondents in Cluster 1, and more likely to have a shorter commute and live in rural villages or large towns.

Additional variables included in the cluster analysis models were

age, mode used to travel to workplace or college, employment status and the time taken to travel to the workplace or to education on the 2020 survey data.

Two clusters were formed. Cluster 1 contained 202 respondents, and cluster 2 contained 221 responses of the total 509 responses included in the data file. Table 4 shows the variables included in the cluster analysis for the 2020 data, the type of variable and its relative importance.

Table 5 shows the proportion of the respondents to the survey placed in each category, and therefore the composition of the clusters constructed using data from the 2020 survey. Table 5 shows that Cluster 1 contains respondents that would like to work from home more. This is highly correlated with the response to the question, “If a subsidy was available towards the cost, how likely would you be to consider setting up a home office or garden office in the future?”, and 80% of respondents in Cluster 1 answered “Very likely” or “Likely” to this question. In Cluster 2, 87.5% of respondents answered “Neither likely nor unlikely”, “Unlikely”, “Very unlikely”, “I don’t have the space” or “Not applicable” to this question.

In terms of mode of transportation, Cluster 1 contains a higher number of people who walk to work or education, or travel by public transport (either by bus or rail). A higher proportion of people who experience travel times of less than 15 min are placed in cluster 2 than in cluster 1. Those whose journeys take between 15 and 30 min are evenly represented in both clusters 1 and 2, and a higher proportion of journeys over 30 min are placed in cluster 1.

The “current situation” variable provides the employment situation for the respondents since the 2020 pandemic, showing that those who are students or work from home currently are more likely to belong to Cluster 1 than Cluster 2, and those who are frontline workers, unemployed, or give their status as “other” than the given options are more likely to be placed in Cluster 2. This suggests that those who are already WFH are more likely to desire to work from home more, and those who cannot work from home (i.e. front line workers) are less likely to want to work from home more. However, it also raises concerns regarding the phrasing of the questions; if someone is not currently WFH, asking whether they agree with the statement “If I could increase my days of remote working by 1 or 2 days a week I would do it” may lead to confusion; it could be interpreted as questioning whether they would desire to work from home if in employment that permitted it, or they may respond “Not applicable” or disagree with the posed statement as they do not or cannot engage in remote working.

In summary, Cluster 1 contains respondents who would like to

Table 5
The composition of clusters formed from the 2020 survey data.

Variable	Category	Cluster 1		Cluster 2		% Difference
		Number	%	Number	%	
Desire to increase days WFH	Yes	180	89.11	0	0.00	89.11
	No	22	10.89	221	100.00	-89.11
Likelihood of setting up a home or garden office if a subsidy was available.	Yes	162	80.20	25	12.3	69.04
	No	40	19.80	196	87.6	-67.70
Current employment situation since the COVID-19 pandemic	Front line worker	25	12.38	49	22.17	-9.79
	WFH	97	48.02	21	9.50	38.52
	Unemployed	51	25.25	74	33.48	-8.23
	Student	11	5.45	2	0.90	4.55
	Other	18	8.91	75	33.94	-25.03
Usual commuting mode	Walk	29	14.36	21	9.50	4.86
	Cycle	5	2.48	6	2.71	-0.23
	Bus/Coach	30	14.85	7	3.17	11.68
	Train/DART/Luas	14	6.93	4	1.81	5.12
	Car (Driver)	98	48.51	116	52.49	-3.98
	Car (Passenger)	8	3.96	7	3.17	0.79
	Other	3	1.49	2	0.90	0.59
	Work mainly at or from home	10	4.95	8	3.62	1.33
	NA	5	2.48	50	22.62	-20.14
	Commuting time	0 mins	8	3.96	43	19.46
	Less than 10 min	20	9.90	27	12.22	-2.32
	10 mins – 14 mins	25	12.38	39	17.65	-5.27
	15 mins – 29 mins	64	31.68	69	31.22	0.46
	30 mins – 60 mins	72	35.64	37	16.74	18.90
	More than 60 min	13	6.44	6	2.71	3.73
Setting	I live in a city	68	33.66	45	20.36	13.30
	I live in a large town	56	27.72	75	33.94	-6.22
	I live in a rural village	42	20.79	44	19.91	0.88
	I live in the countryside	36	17.82	57	25.79	-7.97

increase their days of WFH and who would install a home or garden office if offered a subsidy. A respondent placed in Cluster 1 is also more likely to travel to work or education by foot or by public transport, to have a longer journey to work or education, to live in a city rather than in a large town or in the countryside, and to live in Dublin specifically. Respondents contained in Cluster 1 were more likely to be engaging in remote working during the COVID-19 pandemic.

Cluster 2 contains respondents who would not like to increase their days WFH and would not like to install a home or garden office if offered a subsidy. Respondents placed in this group are also more likely to drive to work or college and to have a shorter commute than those in Cluster 1. Additionally, those placed in cluster 2 are less likely to live in Dublin and more likely to live in a large town or in the countryside than in a city or rural village. Respondents in Cluster 2 are more likely to be front line workers or unemployed than those in Cluster 2.

4.2. MNL analysis

Table 6 shows the parameter estimates for a multinomial logistic regression model with the variable “Desire to increase days of remote working” as the dependent variable. This variable is a binary variable with the outcomes being a desire to increase the number of days worked from home (yes or no). Table 6 presents two models, one estimated on the 2019 sample and the other on the 2020. Both models present good model fits with both Nagelkerke pseudo-R² being above 0.4.

The first set of results presented in Table 6 represent age. The findings suggest that those in the 25–34 and 35–44 age cohorts had a stronger preference for more WFH in the 2020 sample. This was also true of those in the 55–64 age group and their preferences switched from not wanting to WFH more to being positively disposed to WFH. The variables for gender showed that in the 2019 sample males were more likely to want to have increased WFH, but this changed to females in the 2020 sample.

The findings for free work placed parking show that in the 2020 sample those without this parking had a much higher preference for WFH and in 2019 this cohort had indicated a desire not to WFH. The

Table 6
Multinomial logistic regression model.

Variable	Category	2019		2020	
		B	Sig	B	Sig
Age	18–24	0.599	0.036	0.676	0.075
	25–34	0.395	0.049	0.718	0.077
	35–44	0.142	0.069	0.630	0.035
	45–54	0.010	0.022	0.199	0.082
	55–64	-1.364	0.020	0.644	0.065
	65+	0b	.	0b	.
Gender	Male	0.194	0.073	-0.208	0.062
	Female	0b	.	0b	.
Free parking at workplace/college	Yes	0.235	0.102	0.309	0.005
	No	-0.259	0.017	0.799	0.012
	Don't know	0b	.	0b	.
Mode	Active Modes (walk, cycle)	-0.352	0.005	0.924	0.002
	Public Transport (Bus or rail)	-0.711	0.047	0.637	0.000
	Car or other personal motor vehicle	-0.390	0.018	0.204	0.000
	Work mainly at or from home	0.311	0.058	0.751	0.017
	NA/Not at work or education	0b	.	0b	.
Intercept		-0.839	0.017	-3.699	0.036
Nagelkerke pseudo-R ²		0.459		0.421	

^a The reference category is: Disagree with increased WFH.

^b This parameter is set to zero because it is redundant.

variables for mode of transport for commute show that most would prefer to WFH. The values for public transport users are notable with the estimated coefficient switching from a positive to a negative value, indicating those that use public transport to commute had strong preference for increased WFH.

5. Discussion and conclusions

In the cluster analysis conducted using the data from the 2019 survey, the profile of someone likely to desire to work from home more is a younger person in an urban or rural area (rather than living in a town or village), with a longer commute and free parking at the respondents' workplace or college less likely to be available. The clusters produced in the cluster analysis of the 2020 survey data show that the profile of a person who wants to work from home more is someone who is more likely to travel to work or education by foot or public transport, have a longer journey to work or education, live in Dublin, and live in a city rather than in another setting. They are also more likely to install a home or garden office if offered a subsidy. The cross tabulation of the availability of free parking and cluster membership was significant in the 2020 data, showing that, as in the 2019 data set, those without free parking available are more likely to belong to the cluster containing those who would like to work from home more.

In both 2019 and 2020 surveys, people living in urban settings are included in the clusters formed and those with longer commutes are included in the cluster of respondents more likely to work from home. This suggests that avoiding an onerous commute is attractive for participants in both surveys. Age is included in the 2019 clusters, and the cross tabulation of the age of the respondent and cluster membership in the 2020 data reveals a significant relationship, with younger people more likely to be included in the cluster containing people who would like to work from home more; younger people are more likely to be enthusiastic about WFH. A possible explanation for this is that this generation is more comfortable with technology and, having not been in the workplace long, may be more adaptable. This also seems to be contradictory to evidence that younger people are less likely to work from home (Redmond, 2020), but given that this research investigates the desire to work from home as opposed to the likelihood that they actually do so, this indicates that younger people may be engaged in occupations less conducive to remote working. It is also shown that those who desire to work from home more are also likely to set up a home or garden office, an expected result; an appropriate area in which to work from home for a greater proportion of the week is an attractive prospect. Additionally, those who state that they have free parking available at their college are more likely to belong to the cluster containing those who would not like to work from home more, suggesting that reducing the availability of free and convenient parking at workplaces or colleges may encourage more people to want to work from home more.

However, a key difference between the two sets of clusters created is the inclusion of travel mode in the 2020 clusters, but not in the 2019 clusters, where the cross-tabulation between mode and cluster membership was also not significant; a change in the profile of person likely to work from home more is therefore observed between 2019 and 2020. WFH more appears to be more appealing to those travelling by public transport and by foot, suggesting that policies encouraging a higher uptake of WFH may not have the effect of reducing commuting by the most polluting modes. Additionally, the cluster analysis conducted on the 2020 data shows that those who worked from home during the COVID-19 pandemic are more likely to be included in the cluster of those who would like to work from home more (the equivalent variable in the 2019 data was unusable due to the low number of responses to the relevant question). This indicates that many who worked from home during the pandemic had a positive experience.

Multinomial logistic regression modelling also demonstrates several important points. The results show that females are now more likely to want to WFH and those aged 55–64 indicated that now had a preference for increased WFH. One thing to note is that this finding could be linked to the pandemic at the time of the survey and not wanting to be exposed to COVID-19.

The results of this study provide a unique insight to how preferences for WFH may have changed pre and post pandemic. The findings show

many segments of society did change their preferences and attitudes to WFH between 2019 and 2020. The authors do acknowledge that much more research is required on this topic and that our study is one of many that will try to understand the lasting impacts of the pandemic. Our paper points to some potential areas of concern for policymakers. The findings related to public transport users being more willing to WFH suggest that the demand for this sustainable mode of transport may drop as WFH increases. This is one of the areas examined in the paper that needs further study.

One of the key travel behavior questions that arise from the pandemic is that will this increase in WFH be permanent. Stefaniec et al (2022) conducted further research in Ireland on the desire of workers to abandon commutes and WFH. The findings of this study showed that that desire to continue to WFH persisted and that a large percentage of those that can work from home would consider relocating further away from Dublin city centre. This trend was also seen recently in the results from the 2022 census of Ireland. The findings had shown that the numbers of people that said they worked exclusively from home, across Ireland, increased from 3% in 2016 to 8% in 2022 (CSO, 2023). This is a significant result, given that 10% of commuters in Ireland travel to work using a bus. Both the published research and recent census data seem to suggest that the trend for WFH is likely to continue in Ireland.

The research presented in this paper provides insights into the potential longer-term impacts that the pandemic may have on increased rates of WFH. The real long-term impacts of the pandemic will be researched for many years and how it resulted in an increase in WFH. Given that now almost as many people WFH as take the bus to work, in Ireland, more research is needed on how this change could impact upon the demand for all other modes of transport internationally. More insights are also needed on the potential longer-term climate impacts of WFH, as national car fleets switch to electric vehicles, will the emissions savings related to WFH dissipate.

Transport planners developing policy in this area will need to continue to examine the longer-term trends of WFH and to measure all impacts. If policy interventions are planned in this area, policymakers need to fully consider all the potential impacts. The research presented in this paper suggests that a considerable number of employees have a desire to work from home, for at least part of the week. It will be important to measure the potential impacts of increased WFH, if this is a long-term trend. Impacts upon climate and emissions, communities and society and the demand for public transport will all need to be monitored.

CRedit authorship contribution statement

Athena Richards: Conceptualization, Methodology, Software, Validation, Formal analysis, Investigation, Data curation, Writing – original draft. **Sheila Convery:** Conceptualization, Methodology, Software, Validation, Formal analysis, Investigation, Writing – original draft. **Margaret O'Mahony:** Conceptualization, Methodology, Validation, Investigation, Resources, Writing – original draft, Writing – review & editing, Supervision, Project administration, Funding acquisition. **Brian Caulfield:** Conceptualization, Methodology, Validation, Investigation, Resources, Writing – original draft, Writing – review & editing, Supervision, Project administration, Funding acquisition.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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