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Published

2022

Journal Title

Journal of Public Health

Version

Version of Record (VoR)

DOI

[10.1093/pubmed/fdac017](https://doi.org/10.1093/pubmed/fdac017)

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Compliance with local travel restrictions and face masks during first phase of COVID-19 pandemic in Ireland: a national survey

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ABSTRACT

Background This study examines compliance with local travel restrictions and assesses early uptake of mask wearing, during the initial phase of the coronavirus disease of 2019 (COVID-19) pandemic in Ireland, to inform the ongoing outbreak response.

Methods A series of four nationally representative telephone surveys were developed. Information was collected at a household level and from primary respondents. Multivariable logistic regression estimated the association between sociodemographic characteristics and compliance with the local travel restriction and with mask use in primary respondents.

Results Household compliance with local travel restrictions was similar by region, household size and social position. 73.4% of all household members complied, with high levels maintained over time. Higher proportions reported travelling for non-permitted reasons with time. Older age, female gender and attending higher education were independently associated with compliance to local travel restrictions. Among primary respondents, no factors were independently associated with mask use.

Conclusion High compliance with local travel restrictions during the early stages of the pandemic demonstrates the engagement of the population with public health guidance. Although high compliance with local travel restrictions was generally maintained over time, non-permitted activities increased. Early adoption of mask use before required by national policy or legislation provides further evidence of the responsiveness of the population.

Keywords Covid-19, Compliance, Non-pharmaceutical interventions, Travel restrictions, Face masks

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Introduction

Severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), a highly transmissible novel human pathogen has caused significant morbidity and mortality worldwide and unparalleled economic and social disruption. Despite safe and efficacious vaccines reducing the population burden, ongoing transmission remains a challenge. Moreover, dynamics post vaccination are not fully delineated, a curative treatment for coronavirus disease of 2019 (COVID-19) disease is lacking and the long-term consequences of infection, 'long-Covid', are unknown. In addition, recent viral variants of concern have emerged with increased transmissibility and potential for vaccine escape. Thus, the global pandemic response continues to rely on stringent public health measures or non-pharmaceutical interventions (NPIs) to protect population health. NPIs include 'lockdowns', 'stay-at-home orders', travel restrictions, wearing of masks and physical distancing.¹

The first confirmed case of COVID-19 in the Republic of Ireland (RoI) was identified on 29th February 2020. At the end of March 2020, a 'national stay at home' order was introduced with people permitted to leave home only for 'essential travel' and for exercise within a 2-km limit. The Garda Síochána (the police service) was given new powers to enforce these measures. Shielding or 'cocooning' for those over 70 years of age and certain categories of medically vulnerable people was introduced.² These restrictive public health measures remained in place until May 2020, though the travel restriction eased from 2 to 5 km. Following the initial emergency measures to control the spread of SARS-CoV-2, the Irish government developed and published a road map outlining a phased reopening of society and businesses. The first phase of the roadmap in late May 2020 permitted outdoor meetings of different households and some retail outlets to open. In June 2020, the travel restriction further eased from 5 to 20 km or county, household visits were permitted and additional retail reopened. The reopening of all retail outlets and permission for social gatherings occurred during June 2020. Travel anywhere in RoI was allowed from the end of June 2020.

The first guidance on the use of face masks was provided by the Health Protection Surveillance Centre (HPSC) in mid-May 2020. The use of face masks on public transport became mandatory on 13th July. On 10th August 2020, the wearing of face masks in shops, shopping centers and in public and occupational settings, where it was not possible to adhere to 2-m distancing, was mandated. The wearing of face coverings is enforced by a statutory instrument under the Irish Health Act 1947 as amended in 2020. The Irish government replaced the original phased reopening model with a new framework

for 'living with COVID-19', which was published in mid-September 2020, attempting to move from a short-term emergency response to a medium-term approach to managing risk. Around this time many European countries including Ireland reintroduced restrictions including curfews, closure of businesses and travel restrictions due to COVID-19 resurgence. In Ireland, there was a large surge at the end of December 2020/early January 2021 requiring the introduction of the highest level of restriction, level 5, of the 'living with COVID-19' framework. Over that winter, numbers of COVID-19 cases hospitalizations and deaths increased across Europe. Eighteen months after the WHO declared a public health emergency of international concern, COVID-19 persists as a global pandemic with 1.8 million new cases in Europe weekly. Many countries are reintroducing restrictions in efforts to control disease transmission. There is thus a critical need for robust evidence on the impact and sustainability of NPIs to inform the ongoing national and global response to the pandemic. The aim of this study is to describe compliance with local travel restrictions, determine if compliance varies by age, gender, social position, education and geographic location and over time, and assess early uptake of mask use.

Methods

This study is reported in accordance with STROBE (The Strengthening the Reporting of Observational Studies in Epidemiology) guidelines for cross-sectional studies.³

Study design

This study is part of a larger research programme examining the health and mental health effects of the COVID-19 pandemic in Ireland as described in detail in the published protocol.⁴ Four short telephone surveys were developed in collaboration with the HPSC and administered in succession to nationally representative samples during the period May–June 2020. The first survey wave of data collection (1 May–14 May 2020) coincided with a national stay at home order and a travel restriction of 2 km applied. Prior to the second wave of data collection (15 May–30 May 2020), the permitted travel distance increased from 2 to 5 km. During the third wave of data collection (1 June–14 June 2020) the travel restriction further eased from 5 to 20 km or within a person's county of residence. The 20 km or county restriction remained in place throughout the final survey wave (15 June–30 June 2020).

Setting and population

The data collection was conducted as an additional module to Omnipoll, a telephone omnibus survey which interviews

a new sample of 1000 adults aged 15 years and over in the RoI every 3 weeks. Eligibility criteria for participation as primary respondent in the current study were: (i) adults aged 18 years and above, (ii) resident in RoI. The Omnipoll sample is selected using random digit-dialing (~80% mobile and 20% landline), with response estimates based on proportion of non-operational and non-answering numbers.

Variables, data sources and measurement

Households

Variables measured at household level included geographic location (county of residence), household size, child in household and social grade. Social grade was categorized based on the occupation of the chief income earner (CIE), and categorized as A (high managerial, administrative or professional), B (intermediate managerial, administrative or professional), C1 (supervisory, clerical and junior managerial, administrative or professional), C2 (skilled manual workers), D (semi and unskilled manual workers), E (state pensioners, casual or lowest grade workers and unemployed with state benefits only) and F (farmers).

Household members

The primary respondent reported age, gender and presence of chronic health conditions for all household members. The primary respondent was asked about personal travel outside the home beyond the local travel restriction, travel beyond the local travel restriction for all household members and reasons for travel. Respondents who reported travelling for work were asked to report the type of work but were not specifically asked if their work met the essential work criterion. The question on local travel varied according to the local travel restriction (2, 5 or 20 km/county) that applied at the time of the survey data collection. A question on the wearing of face masks and place of use was added to Wave 4 of the survey.

Primary respondent level variables

Variables measured at the level of the primary respondent included occupation and education. Occupation was categorized as employed, unemployed, homemaker, student or retired. Education was categorized based on highest level achieved or current attendance according to (i) primary, (ii) secondary, (iii) tertiary or above.

Study size

The target sample for data collection was set at 950 participants for each survey wave based on the size of the Omnipoll survey.

Statistical analysis

Compliance was defined based on the local travel restriction in place at the time of the survey wave. The proportion of the population compliant with the travel restriction was calculated for each household respondent for each survey wave. The proportion of household respondents reporting mask use is reported for the final wave of data collection. Multivariable logistic regression assessed the association between sociodemographic factors and (i) compliance with travel restrictions at any wave for the primary respondents and (ii) compliance with face coverings for the final wave for all respondents. All analyses assumed data were missing at random. Statistical software SPSS version 26, R and Diver Solution (DivePort version 7.0) were used for data analysis.

Ethical considerations

Ethical approval for this research project was obtained from the Clinical Research Ethics Committee of the Cork Teaching Hospitals (CREC Review Reference Number: ECM 4 (b) 05/05/2020 & ECM 3 (eee) 05/05/2020).

Results

Overall, across the four waves of the survey, primary respondents provided data on 3857 households (Wave 1: 977, Wave 2: 954, Wave 3: 965 and Wave 4: 961) comprising 11 171 household members including 2331 children (Table 1). Among the 3857 primary respondents, 55.6% (2143) were males, and 44.4% (1704) were females. The mean age of primary respondents was 48.4 years (Wave 1: 48.1, Wave 2: 48.6, Wave 3: 48.5 and Wave 4: 48.4). Most primary respondents (61–66%) reported having completed third level education. The most common occupational status reported was employed (Wave 1: 59.2%, Wave 2: 63.1%, Wave 3: 65.0% and Wave 4: 65.6%) with approximately one-fifth reporting being retired. Much smaller proportions reported being students (3.6–6.4%), homemakers (2.9–4.1%) or unemployed (5.3–8.0%) with some variation across the survey waves.

Compliance with NPIs

Local travel restrictions

Nearly three-quarters of household members remained within 2 or 5 km of their home during the first two survey waves with similar levels in men and women (Table 2). Compliance dropped during the third survey wave increasing in the final survey wave when the travel restriction was increased to 20 km or within county. A similar pattern

Table 1 Households, household members and primary respondents' characteristics by survey wave

Survey wave Dates	Survey Wave 1 <i>1–14 May 2020</i>	Survey Wave 2 <i>15–31 May 2020</i>	Survey Wave 3 <i>2–14 June 2020</i>	Survey Wave 4 <i>16–30 June 2020</i>
Households	<i>N = 977</i>	<i>N = 954</i>	<i>N = 965</i>	<i>N = 961</i>
Geographic region				
Munster	278 (28.45)	269 (28.2)	252 (26.11)	256 (26.64)
Leinster	561 (57.42)	540 (56.6)	560 (58.03)	546 (56.82)
Connaught	97 (9.93)	102 (10.69)	111 (11.5)	118 (12.28)
Ulster	41 (4.2)	43 (4.51)	42 (4.35)	41 (4.27)
Household size				
Median	3	3	3	3
Range	1–8	1–8	1–8	1–8
1	165 (16.89)	161 (16.88)	162 (16.79)	171 (17.79)
2	301 (30.81)	301 (31.55)	290 (30.05)	288 (29.97)
3	185 (18.94)	148 (15.51)	158 (16.37)	185 (19.25)
4+	326 (33.37)	344 (36.06)	355 (36.79)	317 (32.99)
Children	288 (29.51)	300 (31.51)	319 (33.06)	274 (28.51)
No children	688 (70.49)	652 (68.49)	646 (66.94)	687 (71.49)
Social grade	<i>N (%)</i>	<i>N (%)</i>	<i>N (%)</i>	<i>N (%)</i>
AB	230 (23.5)	222 (23.3)	230 (23.8)	249 (25.9)
C1	372 (38.1)	345 (36.2)	348 (36.1)	314 (32.7)
C2	141 (14.4)	167 (17.5)	156 (16.2)	137 (14.3)
DE	196 (20.1)	182 (19.1)	206 (21.3)	224 (23.3)
F	38 (3.9)	38 (4.0)	25 (2.6)	37 (3.9)
Household members	<i>N = 2817</i>	<i>N = 2771</i>	<i>N = 2825</i>	<i>N = 2758</i>
Gender	<i>N (%)</i>	<i>N (%)</i>	<i>N (%)</i>	<i>N (%)</i>
Male	1435 (50.9)	1415 (51.1)	1400 (49.6)	1344 (48.7)
Female	1368 (48.6)	1345 (48.5)	1433 (50.7)	1410 (51.1)
Age	<i>N (%)</i>	<i>N (%)</i>	<i>N (%)</i>	<i>N (%)</i>
≤ 18	610 (21.8)	615 (22.3)	674 (23.9)	609 (22.2)
19–29	459 (16.4)	432 (15.7)	452 (16)	450 (16.4)
30–39	393 (14.0)	337 (12.2)	340 (12.1)	369 (13.4)
40–49	369 (13.2)	389 (14.1)	424 (15.0)	415 (15.1)
50–59	400 (14.3)	411 (14.9)	441 (15.6)	380 (13.8)
60–69	360 (12.8)	366 (13.3)	294 (10.4)	322 (11.7)
70+	212 (7.6)	204 (7.4)	221 (7.8)	214 (7.8)
Primary respondents	<i>N = 977</i>	<i>N = 954</i>	<i>N = 965</i>	<i>N = 961</i>
Gender	<i>N (%)</i>	<i>N (%)</i>	<i>N (%)</i>	<i>N (%)</i>
Male	539 (55.2)	547 (57.4)	533 (55.5)	524 (54.7)
Female	437 (44.8)	406 (42.6)	427 (44.5)	434 (45.3)
Age	<i>N (%)</i>	<i>N (%)</i>	<i>N (%)</i>	<i>N (%)</i>
18–45	419 (43.3)	384 (40.6)	390 (41.1)	402 (42.4)
45–69	429 (44.4)	457 (48.4)	444 (46.8)	421 (44.4)
70+	119 (12.3)	104 (11.0)	115 (12.1)	126 (13.3)

Continued

Table 1 Continued

Survey wave Dates	Survey Wave 1 1–14 May 2020	Survey Wave 2 15–31 May 2020	Survey Wave 3 2–14 June 2020	Survey Wave 4 16–30 June 2020
Education	<i>N</i> (%)	<i>N</i> (%)	<i>N</i> (%)	<i>N</i> (%)
Primary	54 (5.6)	47 (5.0)	61 (6.3)	65 (6.8)
Secondary	256 (26.4)	231 (24.3)	249 (25.9)	274 (28.6)
Tertiary	609 (62.8)	627 (66.1)	615 (63.9)	584 (61)
Attending tertiary	51 (5.3)	44 (4.6)	37 (3.8)	34 (3.6)
Occupation	<i>N</i> (%)	<i>N</i> (%)	<i>N</i> (%)	<i>N</i> (%)
Employed	578 (59.2)	600 (63.1)	627 (65.0)	630 (65.6)
Homemaker	35 (3.6)	39 (4.1)	39 (4.0)	28 (2.9)
Retired	222 (22.7)	192 (20.2)	188 (19.5)	202 (21)
Unemployed	68 (7.0)	76 (8.0)	68 (7.1)	51 (5.3)
Student	63 (6.4)	39 (4.1)	35 (3.6)	42 (4.4)
Other	11 (1.1)	5 (0.5)	7 (0.7)	7 (0.7)

^aThe data in the table are presented using the numbers available for that variable. The numbers in the table may not sum to the totals due to missing data; The levels of missing data were small, $\leq 0.5\%$ for any of variables in Table 1, gender ($n = 61$), age ($n = 49$), education ($n = 19$) and occupation ($n = 5$).

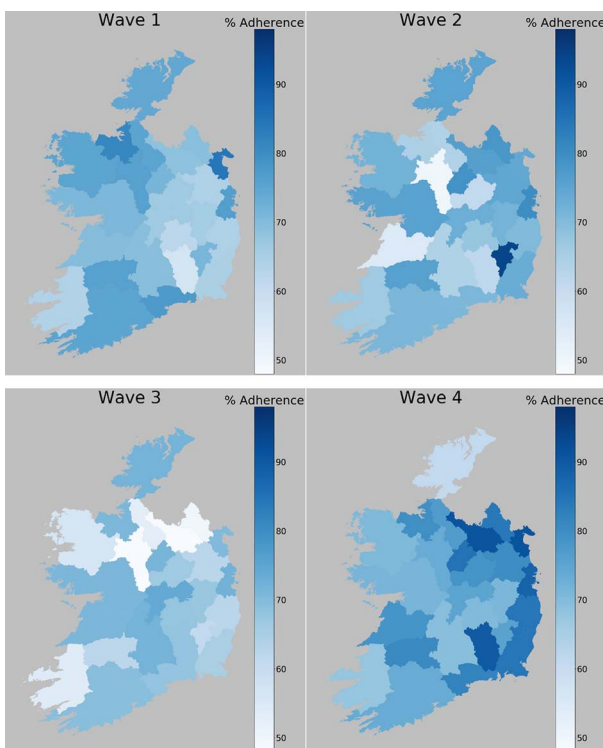


Fig. 1 Compliance with local travel restriction by county of residence and survey wave.

was observed when compliance with the local travel restriction was assessed by county of residence (Fig. 1).

Among those who reported traveling beyond the applicable local travel restriction, reasons in the first three survey waves were primarily work, shopping and attending to needs (Fig. 2). The proportion travelling beyond the local travel restriction

for non-permitted reasons such as exercise, recreational or social activities increased over time, particularly in the final survey wave. The most frequently reported work among those travelling beyond the local travel restriction for paid work in the 2 weeks prior to the survey, was healthcare, across all four waves of the survey; other sectors included retail, transport, maintenance, professional services, manufacturing, public services and agriculture (Supplementary Fig. 1). Overall, similar distributions of employment type among those who travelled were seen over the four waves of data collection.

In the multivariable model combining data from the four survey waves, the factors independently associated among primary respondents with compliance included age (70+ years versus 18–44 years, OR 3.6 [2.6–5.0]), and gender (female versus male, OR 1.2 [1.1–1.4]; Supplementary Table 1).

Face masks

High levels of mask use were reported by both men and women in a range of different settings (Fig. 3). Shops or supermarkets were the most common place of use of masks. The multivariable model did not identify any factors that were independently associated with mask wearing (Supplementary Table 2).

Discussion

Main findings of this study

This study examined compliance with the NPIs of local travel restrictions and use of face masks during the early phase of

Table 2 Compliance with local travel restriction by survey wave

Compliance				
Respondents	Survey Wave 1	Survey Wave 2	Survey Wave 3	Survey Wave 4
All	<i>N</i> = 2817	<i>N</i> = 2771	<i>N</i> = 2825	<i>N</i> = 2758
Primary	<i>N</i> = 977	<i>N</i> = 954	<i>N</i> = 965	<i>N</i> = 961
Dates	1–14 May 2020	15–31 May 2020	2–14 June 2020	16–30 June 2020
Travel restriction	2 km	5 km	5–20 km	20 km/county
Individual household member compliance				
	<i>N</i> (%)	<i>N</i> (%)	<i>N</i> (%)	<i>N</i> (%)
Age group	571 (93.6)	594 (96.6)	622 (92.3)	573 (94.1)
≤ 18	342 (74.5)	310 (71.8)	314 (69.5)	361 (80.2)
19–29	255 (64.9)	213 (63.2)	172 (50.6)	256 (69.4)
30–39	203 (55.0)	223 (57.3)	213 (50.2)	281 (67.7)
40–49	212 (53.0)	262 (63.7)	232 (52.6)	285 (75.0)
50–59	246 (68.3)	252 (68.9)	183 (62.2)	251 (78.0)
60–69	190 (89.6)	172 (84.3)	179 (81.0)	190 (88.8)
70+				
Gender	989 (72.3)	1002 (74.5)	998 (69.6)	1149 (81.5)
Female	1030 (71.8)	1030 (72.8)	905 (64.6)	1044 (77.7)
Male				
Primary respondent compliance				
Household level variables				
	<i>N</i> (%)	<i>N</i> (%)	<i>N</i> (%)	<i>N</i> (%)
Household size				
1	94 (57.0)	85 (52.8)	81 (50.0)	123 (71.9)
2	191 (63.5)	201 (66.8)	152 (52.4)	196 (68.1)
3	121 (65.4)	91 (61.5)	92 (58.2)	127 (68.7)
4+	200 (61.4)	215 (62.5)	173 (48.7)	227 (71.6)
Social grade				
AB	148 (64.3)	148 (66.7)	115 (50.0)	146 (58.6)
C1	209 (56.2)	204 (59.1)	180 (51.7)	214 (68.2)
C2	79 (56.0)	89 (53.3)	67 (42.9)	94 (68.6)
C3	150 (76.5)	133 (73.1)	129 (62.6)	191 (85.3)
DE	20 (52.6)	18 (47.4)	7 (28.0)	28 (75.7)
F				
Child in household				
Children	158 (54.86)	183 (61.0)	140 (43.89)	182 (66.42)
No children	448 (65.12)	407 (62.42)	358 (55.42)	491 (71.47)
Individual level variables				
	<i>N</i> (%)	<i>N</i> (%)	<i>N</i> (%)	<i>N</i> (%)
Education				
Primary	36 (66.7)	35 (74.5)	40 (65.6)	54 (83.1)
Secondary	162 (63.3)	153 (66.2)	143 (57.4)	210 (76.6)
Tertiary	361 (59.3)	368 (58.7)	290 (47.2)	379 (64.9)
Attending tertiary	41 (80.4)	34 (77.3)	22 (59.5)	26 (76.45)

the pandemic in RoI. The data collection period for the survey (May–June 2020) coincided with the initial national pandemic response and a rapidly changing environment in terms of implementation of public health measures and number of

cases of COVID-19. Overall, there are three main findings. Firstly, high levels of compliance with local travel restrictions were observed and maintained across the country, among all social groups, ages, and in men and women with the highest

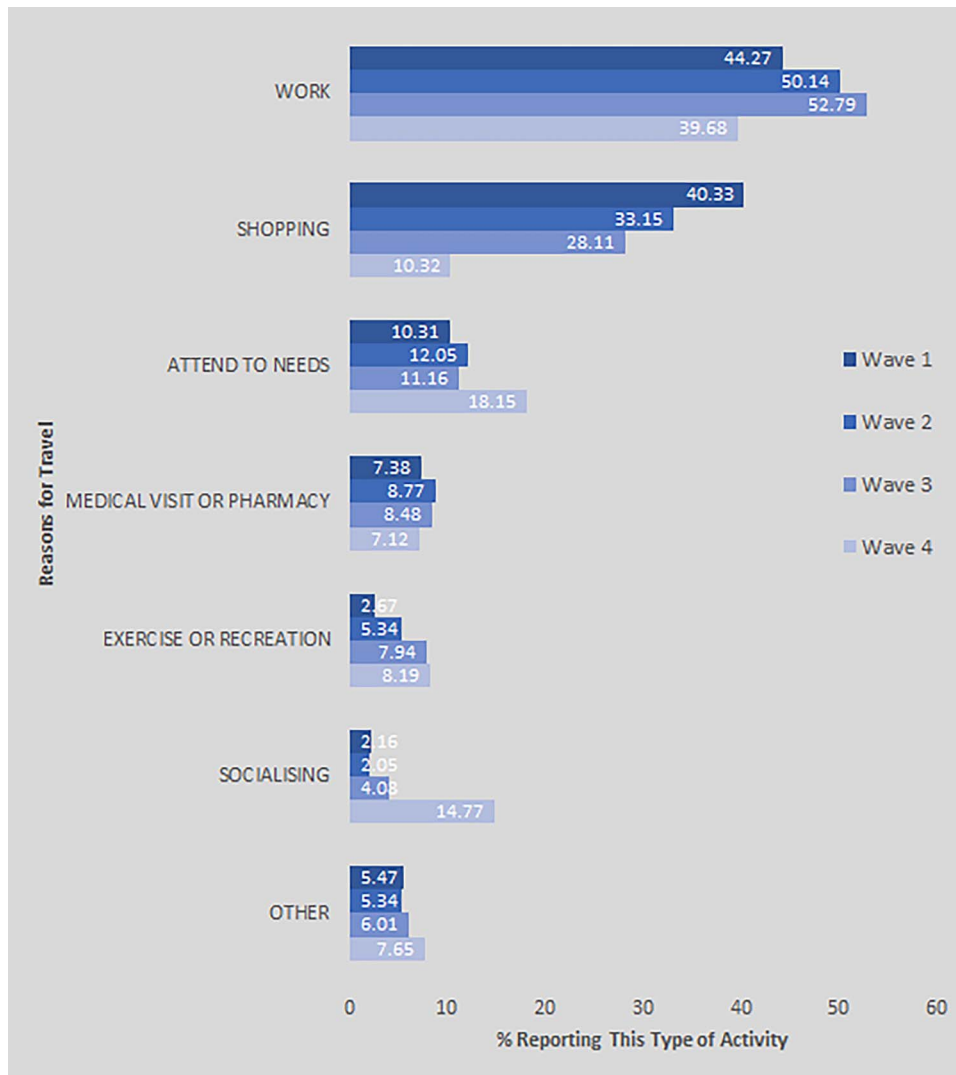


Fig. 2 Reasons for travel beyond the local travel restriction by survey wave.

levels observed in the older people, women and higher social position. Secondly, among those who travelled, most cited permitted reasons including essential work, shopping and caring responsibilities. However, there was evidence of an increase in activities such as socializing in the final survey wave. Finally, the agility of the population response to the pandemic was demonstrated by the high uptake of mask use, particularly among older people, before any policies or legislation were implemented.

In this study, particularly high levels of compliance were observed in people in the youngest and oldest age groups. In the multi-variable model older age was a predictor of compliance among primary respondents. These findings relate to contextual factors, including the closure of schools, colleges and universities, the existence of additional guidance for those aged seventy years and over to cocoon² and attendance at

work being a permitted reason for travel beyond the local travel restriction.

What is already known on this topic

In the limited international research on compliance with NPIs during the COVID-19 pandemic, few studies have focused on local travel restrictions with most reporting on social distancing and hand hygiene.^{5–10} A study from Norway among adolescents reported higher levels of social distancing among urban (88.3%) than rural (84.4%) residents and higher levels of reporting of hand washing before socializing by girls (72.3%) than boys (66.7%).¹¹ In one US study, overall compliance with Center for Disease Control and Prevention guidelines was high but was suboptimal among men and younger adults.¹² In a study from Hong Kong, female gender was

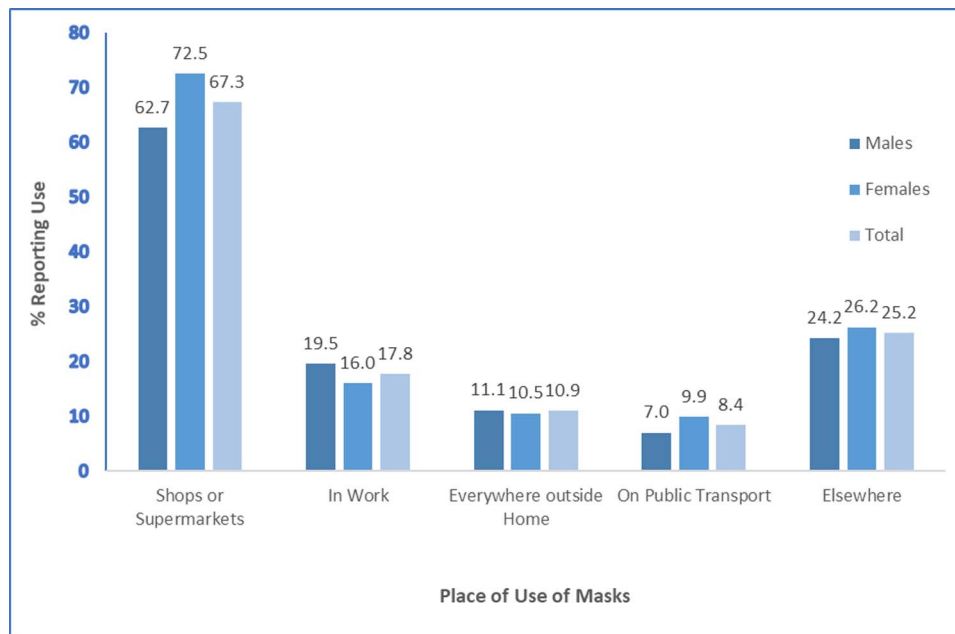


Fig. 3 Compliance with mask use by place of use and gender during survey Wave 4.

associated with higher levels of uptake of personal hygiene practices and avoidance of travel to China.¹³ In a study from Ethiopia assessing uptake of social distancing the only factor associated with higher levels of adherence was age.¹⁴ Becher et al. assessed compliance with social distancing measures in nine countries in mid-April 2020 examining a range of individual (age, gender and political ideology) and macro (COVID-19 fatality rates and strictness of lock-down measures).¹⁵ The relationship between these factors and compliance with NPIs varied widely emphasizing the need for country specific evidence. In another cross-country study, Meier *et al.* reported similarly high levels of support for governmental measures in the Netherlands, Germany and Italy related to avoiding social gatherings, selective closure of public places, and hand hygiene and respiratory measures (95.0–99.7%) but considerable variation between the countries in adherence with social distancing and self-initiated hygienic measures.¹⁶ Country specific evidence is needed to identify predictors of compliance with local travel restrictions to appropriately tailor public health campaigns and interventions to their target populations.

The current study was undertaken before any national guidance or legislation in Ireland on the use of face masks. Despite this a high proportion of survey respondents reported wearing masks in different settings with similar levels of use in men and women. Attitudes and behaviors related to the use of face masks during the pandemic vary considerably worldwide. In a study of over 200 000 people from low and middle income countries, large variation was reported in use of face

masks.¹⁷ A study on mask wearing in the US reported higher levels of mask use among women, non-white or Hispanics, older people and in lower socio-economic groups. The study demonstrated significant geographic variation in mask use in the USA with the highest reported level of use along the coasts, southern border and in large urban areas.¹⁸

What this study adds

Behavior change is crucial to reducing SARS-CoV-2 transmission, however with decreased motivation to adhere to social restrictions over time, the capability of reducing such transmission decreases. Our study demonstrates consistently high compliance with local travel restrictions over the four survey waves across different sociodemographic groups providing some evidence of sustained behavior change. However, these surveys were administered over a relatively short time, and during a very dynamic period in the country's early phase response to the pandemic. Moreover, the local travel restrictions varied over the survey waves, were less stringent over time and the emergence of socializing in the final survey wave demonstrates the challenge of sustained behavior change. To successfully control the COVID-19 pandemic, individuals' motivation and capability to comply with NPIs over time must be addressed.¹⁹

This national study estimates compliance in the general population with local travel restrictions during the early phase COVID-19 pandemic response providing evidence across socio-demographic characteristics. Reporting on four survey

waves at different time points with over 950 primary participants in each survey wave, providing data on nearly 12 000 people, this study captures a large group of individuals and households, representative of the RoI.

Limitations of this study

Limitations of the study include the cross-sectional timing of the data collection and the relatively short time frame. The data were collected over 2 months during the first introduction of local travel restrictions and therefore may have limited applicability to the maintenance of compliance behavior. A question on the use of face masks was added to the final survey wave providing some evidence on their use.

The COVID-19 pandemic presents unprecedented challenges for health policy makers and clinicians dealing with radically altered requirements for health system delivery and clinical care. Health systems and clinicians need timely evidence to support policy and practice, and this is a particular challenge in the context of a rapidly evolving and threatening situation. These data provide insights into the early phases of the RoI national pandemic response and can be used to inform future preparedness and to optimize and successfully implement effective public health measures for COVID-19 prevention and control.

Funding

This work was supported by the Health Research Board.

Supplementary data

Supplementary data are available at the *Journal of Public Health* online.

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