
**Preliminary report of the results of the
Study to Investigate COVID-19 Infection in
People Living in Ireland (SCOPI):
A national seroprevalence study, June-July
2020**

August 17th 2020



Key Findings

- 1,733 study participants (aged 12-69 years), who were randomly selected from the communities in Sligo and Dublin, provided a symptom history and a blood sample for testing for antibodies to SARS-CoV-2 (the virus that causes COVID-19). The response rate was 35% overall; 30% in Dublin and 44% in Sligo.
- 33 study participants were found to have antibodies to SARS-CoV-2.
- Among 12-69-year olds:
 - The seroprevalence (proportion of the population with antibodies to SARS-CoV-2) for people living in Ireland was estimated as 1.7% (95% Confidence Interval (CI): 1.1-2.4%) *.
 - The seroprevalence for Dublin and Sligo was 3.1% (95% CI: 2.1-4.5) and 0.6% (95%CI: 0.2-1.4) respectively. There was no significant difference in the seroprevalence between different age-groups or between men and women among the populations in Sligo, Dublin or nationally.
 - 73% of participants with antibodies to SARS-CoV-2 reported symptoms in line with the national case definition for COVID-19 (i.e. one or more of the following symptoms: fever, cough, shortness of breath, loss of sense of smell, or loss of sense of taste).
 - One third (33%) reported loss of sense of smell and/or taste.
 - 27% of participants with antibodies to SARS-CoV-2 did not report any symptoms from the COVID-19 case definition.
- Based on these findings, we estimate that 59,500 (95% CI: 39,800-85,200) people in Ireland aged between 12 and 69 years of age have been infected with SARS-CoV-2. This is 3.0 (95% CI: 2.0-4.3) times higher than the number of confirmed cases aged 12-69 years notified in Ireland.
- The vast majority of people living in Ireland are unlikely to have been infected with SARS-CoV-2 by the time of the study. This highlights the continued importance of public health measures, including physical distancing, respiratory etiquette, hand hygiene and the use of face coverings, until a vaccine for COVID-19 is universally available.

The HSE would like to thank all the participants who provided their time, information, support and blood samples to help us learn about the COVID-19 pandemic in Ireland.

** The 95% confidence interval provides information on how precise a result is. A 95% confidence interval is a range of values that you can be 95% certain contains the true result. In the example above, with a prevalence of 1.7%, we are 95% confident that the true result lies between 1.1% and 2.4%.*

Background

As of 17th August 2020, there have been 27,313 confirmed cases of COVID-19 in Ireland, which have been notified to regional Departments of Public Health and the Health Protection Surveillance Centre (HPSC). However, measuring numbers of confirmed cases of COVID-19 only captures a portion of infections for a variety of reasons. According to the European Centre for Disease Prevention and Control (ECDC), between 6 and 41% of people with COVID-19 may have no symptoms. Others will only suffer mild symptoms and may not seek medical attention. Due to a global shortage of laboratory reagents and nasopharyngeal swabs in March and April 2020, some people with symptoms may not have been tested. Our knowledge of COVID-19 has also increased and some symptoms, such as loss of sense of smell, were not recognised at the beginning of the pandemic. Therefore, the true extent of COVID-19 infection among people living in Ireland is currently not known.

Serological tests measure the antibody response to infection in an individual. Antibodies to SARS-CoV-2 (the virus that causes COVID-19) are produced over several weeks after infection with the virus. The presence of antibodies indicates that a person was infected with the COVID-19 virus, irrespective of whether the individual had severe or mild disease, or even infection without any symptoms. Knowing the proportion of the population who have been infected helps to inform the public health response. The National Public Health Emergency Team (NPHET) therefore requested that this seroprevalence study be carried out.

Study Design

The study protocol was adapted from the World Health Organization (WHO) protocol, 'Population-based age-stratified sero-epidemiological investigation protocol for COVID-19 virus infection', to suit the Irish context. A cross-sectional study of people living in two geographical areas in Ireland, one with a high incidence of confirmed COVID-19 cases (Dublin) and the other with a lower incidence of confirmed COVID-19 cases (Sligo), was performed as recommended by WHO. We extrapolated the findings from these two areas to give an estimated overall prevalence for Ireland. The study was approved by the National COVID-19 Research Ethics Committee and overseen by a Steering Group.

Sampling strategy and recruitment

Working with the Central Statistics Office (CSO), random samples of individuals that were representative for each county in the study in terms of age and sex were selected from the HSE Primary Care Reimbursement Service (PCRS) database. The PCRS database contains records of almost 3 million people who avail of primary care services in Ireland (<https://www.hse.ie/eng/staff/pcrs/about-pcrs/>). People from 12 to 69 years of age were eligible to take part in the study. Participation was limited to this age group because of the practical difficulties of obtaining blood samples from children under 12 years of age and because people aged 70 years and above were advised to stay at home and not to undertake non-essential journeys at the time the study was being carried out.

During the week of 15th June 2020, we posted letters inviting 2,000 people in Sligo and 3,200 people in Dublin to take part. An information leaflet describing the study was enclosed with the letter. Further information was available on the study website www.hse.ie/scopi. A free phone line

was set up to provide further details to invitees and to allow them to opt in or opt out of participating in the study. Reminder letters were sent out during the week of 29th June 2020.

Efforts were made to ensure that the study would be inclusive and that invitees with varying levels of ability (both physical and cognitive) would be facilitated to take part. All invitees were provided with the option of accessing decision-making assistance through an advocacy service, access to an online easy-to-read version of the participant information leaflet, wheelchair-accessible testing sites, and sign language interpreters or the use of video calls for lip reading. An interpreter service was also offered to those for whom English was not a first language.

Data collection and blood testing

Participants who agreed to take part were contacted by the research team and completed a short questionnaire by phone. The interviewer asked if they had previously had symptoms of COVID-19 or if they had been tested or diagnosed with COVID-19 since February 2020. They were then invited to attend a HSE testing site (one in North Dublin, one in South Dublin and one based in Sligo) where a serum blood sample was collected for analysis. Blood sampling took place between 22nd June and 16th July 2020. Data from the questionnaires and the laboratory testing results were entered into a secure custom-built database. Participants were provided with their individual results by letter. Their GP was also provided with the result if the participant consented to this.

All samples were tested in the National Virus Reference Laboratory (NVRL). The NVRL used the Abbott Architect SARS-CoV-2 IgG Assay to detect antibodies (IgG) to SARS-CoV-2 in the samples collected. This assay has a sensitivity and specificity of 93% and 100% respectively (<https://www.gov.uk/government/publications/covid-19-laboratory-evaluations-of-serological-assays>).

Any samples testing positive or with a borderline result (i.e. within 25% of the cut-off value) using the Abbott Architect assay underwent confirmatory testing with the FORTRESS (Wantai)-2 Assay. Only samples which were borderline or positive in the Abbott assay, and confirmed by the second FORTRESS assay, were reported as positive, reducing the likelihood of false positive results.

Statistical analysis

Adjusting for varying participation rates by invitees, using a technique known as weighting, the prevalence of antibodies to SARS-CoV-2 was estimated for the populations of Dublin and Sligo. In order to estimate a national prevalence using the data collected in Dublin and Sligo, we categorised all 26 counties into "high" or "low" incidence by using the national crude incidence rate among 12-69 year olds at the end of June (550 per 100,000) as a cut-off value. We then used the age-sex population distribution in each county in combination with the high/low incidence categorisation to calculate a weighted national prevalence of SARS-CoV-2 antibodies, along with the corresponding 95% confidence intervals (overall and by age and sex). Calculations were based on the 2016 population census. The relationship between the presence of antibodies to SARS-CoV-2 and reported symptoms or previous diagnosis of COVID-19 was also examined.

Study coordination

The study was designed and coordinated by the HSE Health Protection Surveillance Centre (HPSC). All laboratory testing and interpretation was carried out by NVRL.

Source of funding

The study was funded by the HSE.

Results

In Dublin, 913 participants had a blood sample taken for serological testing, which is 30% of the 3,043 people who were contactable and eligible to take part. In Sligo, 820 participants had a blood sample taken for serological testing, which is 44% of the 1,863 people who were contactable and eligible to take part. The overall response rate was 35%.

In Dublin, 28 participants were confirmed as having antibodies to SARS-CoV-2 (defined as seropositive). This corresponds to a weighted seroprevalence of 3.1% (95% CI: 2.1-4.5%). Based on these findings, we estimate that 31,900 (95% CI: 20,900-46,300) 12-69-year olds in Dublin have had a previous infection with SARS-CoV-2. This number is 3.4 (95% CI 2.3-5.0) times higher than the number of confirmed cases aged 12-69 years in Dublin notified by 16th July. Seroprevalence was not statistically significantly different by age group or by sex in Dublin (Table 1).

In Sligo, five participants were confirmed as seropositive. This corresponds to a weighted seroprevalence of 0.6% (95% CI: 0.2%-1.4%). Based on these findings, we estimate that 300 (95% CI: 100-700) 12-69-year olds in Sligo have had a previous infection with SARS-CoV-2. This number is 2.4 (95% CI 0.8-5.8) times higher than the number of confirmed cases aged 12-69 years notified in Sligo by 16th July 2020. Seroprevalence was not statistically significantly different by age or by sex in Sligo (Table 1).

Seroprevalence results for Dublin and Sligo are summarised in Table 1 overleaf.

Table 1. Estimated COVID-19 seroprevalence in Dublin and Sligo, by age and sex, June-July 2020

Subset		Dublin			Subset	Sligo		
		Seropositive in study				Seropositive in study		
		Number	Weighted prevalence (%)	95% CI		Number	Weighted prevalence (%)	95% CI
Sex	Females	18	3.6	2.1-5.7	Females	2	0.4	0.1-1.6
	Males	10	2.6	1.2-4.8	Males	3	0.7	0.1-2.3
Age group	12-19 years	2	2.2	0.3-7.9	12-39 years	1	0.3	0.0-1.6
	20-29 years	7	4.7	1.9-9.4				
	30-39 years	5	3.0	1.0-6.8				
	40-49 years	6	3.1	1.1-6.7	40-69 years	4	0.9	0.2-2.3
	50-59 years	3	1.9	0.4-5.6				
	60-69 years	5	3.2	1.1-7.3				
All population 12-69 years		28	3.1	2.1-4.5		5	0.6	0.2-1.4

Table 2 describes the estimated national seroprevalence. Overall, the sample results correspond to a weighted national seroprevalence of 1.7% (95% CI: 1.1-2.4%). Based on these findings, we estimate that 59,500 (95% CI: 39,800-85,200) 12-69-year olds in Ireland have previously been infected with SARS-CoV-2. This is 3.0 (95% CI 2.0-4.3) times higher than the number of confirmed cases aged 12-69 years notified in Ireland by 16th July 2020. The national seroprevalence estimates were also not statistically significantly different by age or by sex.

Table 2. Estimated COVID-19 seroprevalence in the 12-69 years population in Ireland, June-July 2020

Group		Estimated prevalence in Irish population 12-69 years		
		Number seropositive	Weighted prevalence (%)	95% CI
Sex	Females	20	1.8	1.1-2.9
	Males	13	1.5	0.8-2.7
Age	12-19 years	3	1.4	0.3-4.3
	20-29 years	7	2.3	0.8-5.1
	30-39 years	5	1.4	0.4-3.5
	40-49 years	7	1.8	0.7-3.7
	50-59 years	5	1.5	0.5-3.6
	60-69 years	6	1.7	0.6-3.8
All	Population 12-69 years	33	1.7	1.1-2.4

Of the 33 participants with antibodies to SARS-CoV-2, 24 (73%) reported symptoms that fit the current national COVID-19 case definition, i.e. at least one of the following five symptoms: fever, cough, shortness of breath, loss of sense of smell, or loss of sense of taste. Overall 11 (33%) of the 33 seropositive participants reported loss of sense of smell and/or taste. Six people (18%) reported other symptoms associated with COVID-19, such as fatigue and muscle aches, but did not meet the case definition. Three people who tested positive (9%) reported having no symptoms of COVID-19.

Participants who were antibody positive were more likely to fit the COVID-19 case definition (73%), than participants who were antibody negative (26%) and this difference was statistically significant. A small number of participants (4%) who were antibody negative reported loss of their sense of smell and/or taste.

Ten participants reported that they had a laboratory confirmed infection with COVID-19 in the past; eight (80%) of these were antibody positive. Neither of the two participants who reported a laboratory confirmed infection but who tested antibody negative had severe disease which required hospitalisation. These two participants were diagnosed in March and early May.

Discussion

The weighted national seroprevalence of 1.7% (95% CI: 1.1-2.4%) suggests that the vast majority of people living in Ireland were unlikely to have been previously infected with SARS-CoV-2 at the time of the study, which took place 10 to 14 weeks after the peak of reported cases in Ireland, which occurred in the week of 12th April 2020. This time lag between the peak of cases and the SCOP study is an important consideration, as our understanding of the body's immune response is that

antibodies usually develop within 2-3 weeks following an infection, and in the case of SARS-CoV-2 antibodies, probably persist for at least 3 months. Given that 10-14 weeks had passed since the outbreak peak, it is unlikely that antibody levels would have declined to a significant extent as to cause an underestimation of the prevalence rate.

This is the first national population-based seroprevalence study for COVID-19 performed in Ireland. It is not surprising that a low seroprevalence of 1.7% was observed here. Other countries in Europe, such as Spain and Italy, where there was a much more intense epidemic, have reported national seroprevalence estimates of 5% and 2.5% respectively. According to the European Centre for Disease Prevention and Control, Ireland currently ranks 7th in Europe in terms of the number of tests performed per head of population. Even though this high level of testing had not been in place earlier in the pandemic, we estimate that the total number of COVID-19 infections that have occurred in Ireland is only three times higher than the number of confirmed cases detected through PCR testing. This contrasts with other countries, such as Spain and the USA, where the national seroprevalence estimates suggest that the true number of infections was up to 10 times higher than the number detected through PCR testing. It is important that the high level of PCR-based diagnostic testing that has been performed in Ireland to date continues in future. The underestimation of case numbers highlights the importance of seroprevalence studies as a complement to case-based surveillance, as not all symptomatic people will seek health care or have a COVID-19 PCR test, while those who are asymptomatic are unlikely to be detected through case-based surveillance.

A key strength of this study is the random selection of individuals who are representative of the population living in Dublin and Sligo, in terms of age and sex. Participants living in residential facilities were not excluded. Every effort was made to ensure that all invited participants could take part, through the use of assisted decision-making services and interpreters. The response rates for both counties are comparable to other large seroprevalence studies. Spain's ENE-COVID survey reported a response rate of 51% for whole blood sample testing, while researchers in Hungary had a response rate of 59%. In a Swiss study, 35% accepted the invitation to take part and in the USA a similar study reported a response rate of 23%.

The proportion of those with antibodies to SARS-CoV-2 who did not report symptoms that fit the Irish COVID-19 cases definition was 27%. Only 9% reported no symptoms. There are a number of factors that may explain these results. Participants were asked when they were interviewed in June if they had any symptoms since February 2020, so there could have been an element of recall bias, which may have underestimated the proportion of those with symptoms. On the other hand, it is also possible that there was some volunteer bias, as those who had experienced any possible symptoms of COVID-19 since February may have been more likely to accept the invitation and participate in the study. All of the symptoms reported may not have been related to COVID-19 and could therefore have overestimated the proportion of those with symptoms.

This study had some limitations. As per the WHO protocol, recruitment took place in only two geographical areas. The sampling frame used was not a national register, as none is available for research purposes in Ireland. However, the PCRS database has nearly 3 million records, covering about 60% of the Irish population. Response rates across the different age groups were not equal and younger people, particularly young men, were under-represented. Unequal response rates are a common feature of research studies like this one and this issue was addressed in the compilation of results.

There may be limitations regarding the antibody tests used. It is possible, but not yet clear, that individuals who had mild disease or were asymptomatic are less likely to develop a detectable antibody response. Therefore, some mild infections may not have been detected. Even in those with clearly symptomatic infection, a small percentage of people do not appear to make antibodies to the virus and therefore this small group will not be detected in a seroprevalence study.

In conclusion, the estimated low prevalence of antibodies to SARS-CoV-2 means that the majority of people living in Ireland are unlikely to have been infected with COVID-19 and are still susceptible to infection. As SARS-CoV-2 is a new virus, it is still unclear if antibodies to SARS-CoV-2 provide protective immunity to future COVID-19 infections. This highlights the continued importance of public health measures, including physical distancing, respiratory etiquette, hand hygiene and the use of face coverings, until a vaccine for COVID-19 is available.

These results will be shared with the WHO in an anonymised format to add to the global knowledge base on COVID-19.

HSE HPSC Study Co-ordination Team: Aoife Colgan, Fiona Culkin, Patricia Garvey, Laura Heavey, Meadhbh Hunt, John McCusker, Thomas Roux, Michele Tait, Lelia Thornton, Derval Igoe (Principal Investigator)

SCOPI Steering Group: Dr Derval Igoe (Chair), Dr Janice Bailie, Fiona O'Callaghan, Dr Aoife Colgan, Dr Jeff Connell, Paul Crowley, Fiona Culkin, Dr Cillian de Gascun, Paula Dempsey, Dr Patricia Garvey, Dr Laura Heavey, Professor Frank Kee, Professor Mary Keogan, Dr Nuala O'Connor, Dr Margaret O'Sullivan, Dr Siobhan O'Sullivan, Michele Tait, Dr Lelia Thornton

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