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Original Research

Routine testing of close contacts of confirmed COVID-19 cases – National COVID-19 Contact Management Programme, Ireland, May to August 2020



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ABSTRACT

Objectives: The objective of this study was to inform public health practitioners who are designing, adapting and implementing testing and tracing strategies for Coronavirus disease (COVID-19) control.

Study design: The study design is monitoring and evaluation of a national public health protection programme.

Methods: All close contacts of laboratory-confirmed cases of COVID-19 identified between the 19th May and 2nd August were included; secondary attack rates and numbers needed to test were estimated.

Results: Four thousand five hundred eighty six of 7272 (63%) close contacts of cases were tested with at least one test. The secondary attack rate in close contacts who were tested was 7% (95% Confidence Interval [CI]: 6.3 – 7.8%). At the 'day 0' test, 14.6% (95% CI: 11.6–17.6%) of symptomatic close contacts tested positive compared with 5.2% (95% CI: 4.4–5.9%) of asymptomatic close contacts.

Conclusions: The application of additional symptom-based criteria for testing in this high-incidence population (close contacts) is of limited utility because of the low negative predictive value of absence of symptoms.

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Introduction

It is now over six months since an outbreak of a pneumonia of unknown aetiology now named Coronavirus disease (COVID-19) was first identified in Wuhan city, China, in December 2019.¹ By mid-January 2020, the first cases of COVID-19 had been notified outside of China. The virus rapidly spread across the globe, with the first cases notified in Europe and America by the end of January².

The resultant pandemic has caused widespread disruption, morbidity and mortality at a European and global level.³ Timely and effective testing, isolation of cases, contact tracing and quarantine of contacts are the mainstay of the public health response to control

COVID-19.⁴ The European Centre for Disease Prevention and Control (ECDC) recommends maximising testing efforts, with the offering of timely testing to all symptomatic cases. Consideration of testing of asymptomatic persons such as close contacts of a confirmed case is recommended depending on epidemiological situation and resources. A number of other European countries have strategies which include testing asymptomatic close contacts of cases.⁵ A paucity of evidence in this field and a limited understanding of asymptomatic transmission in the community is noted by the ECDC.⁴

There is a need to review and share lessons learnt from varying testing and tracing strategies given that countries are challenged to mobilise scarce resources in response to a complex and dynamic problem. This article will communicate the findings from monitoring and evaluation of an intensive testing strategy conducted by a national contact tracing and testing service in a European country.

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A key feature of this strategy is the routine offering of testing to all close contacts, regardless of symptom status, which enables measurement of secondary attack rates in close contacts. This is shared as a rapid communication to aid design of effective testing strategy to monitor and control COVID-19. It will be of use in informing other countries' approach to contact tracing and testing close contacts.

National Contact Management Programme

The first case of COVID-19 notified in Ireland was on 29th February. Contact tracing for infectious disease control is routinely conducted by eight regional departments of public health with surveillance coordination by the national Health Protection Surveillance Centre (HPSC). Given the scale and speed of the emerging COVID-19 pandemic internationally, a national contact management programme (CMP) was established to undertake high-volume, low-complexity contact tracing in line with ECDC guidance.⁶ This enabled field epidemiological expertise in regional departments of public health to focus on high complexity public health management.

The CMP became operational on the 13th March 2020. The supporting CovidCare Tracker (CCT) IT system went live on the 18th March and is used by both the CMP and by regional departments to support contact tracing. It is now used to support all contact tracing for confirmed COVID-19 cases and close contacts in Ireland. From 19th May 2020 onwards, all close contacts regardless of symptom status were referred for testing. The CCT represents a comprehensive database of the outcome of testing of all close contacts from that period forward.

Methods

'Day 0' and 'day 7' testing strategy for close contacts

Since 19th May 2020, all close contacts of a confirmed case of COVID-19 in Ireland, whether they have symptoms or not, are referred for a severe acute respiratory syndrome coronavirus-2 (SARS-CoV-2) test provided they had not already received a detected result in the past 84 days (12 weeks).⁷ Close contacts are identified according to the ECDC definition.⁶ Cases are defined as confirmed cases by the HPSC and ECDC definition.^{8,9} Close contacts are referred for testing in a community testing centre or a testing at home service. Nasopharyngeal swabs are collected by clinical staff and tested for SARS-CoV-2 nucleic acid.¹⁰

The CMP refers all close contacts of COVID-19 cases as soon as possible after being identified as a close contact ('day 0'). 'Day 0' testing is usually performed more than three days after last contact with the case. Close contacts are tested again on the seventh day after their last reported contact with the case if the first test was conducted between 0 and 6 days after last contact. The dates of the 'day 7' test range from six to 8 days after last exposure to the case. Where there is ongoing exposure to the case (e.g. parent of child), the second test (day 7) is undertaken on approximately the 21st day from the onset of symptoms of the index case.¹¹

Close contacts are presumed to be susceptible to infection if they had not been tested before or had not tested positive for SARS-CoV-2 before. 'Day 0' testing commenced on 19th May. 'Day 7' testing commenced on 28th May. Regardless of test results, all close contacts are advised to restrict their movements for 14 days from date of last contact or where there is ongoing exposure 28 days from date of onset of symptoms of the index case.⁷ Active surveillance is undertaken for this period via a daily SMS, which includes public health advice and contact details should the contact develop

symptoms at any point during this period. Should symptoms develop, the contact will be referred for a further test.

Analysis

All close contacts of laboratory-confirmed cases of COVID-19 identified between the 19th May and 2nd August were included. Data sources used were the CCT, a national appointment management system¹² and laboratory results from the National Virus Reference Laboratory and regional microbiology laboratories around the country.

The secondary attack rate is calculated as the number of cases occurring in susceptible persons within the incubation period after exposure to a primary case divided by the total number of exposed susceptible persons.^{13,14} In this report, two estimates for the secondary attack rate are calculated. The numerator for both is close contacts that tested positive (SARS-CoV-2 nucleic acid detected) at either of two tests ('day 0' and 'day 7') and close contacts who developed symptoms during the 14-day active surveillance period and tested positive.

The denominator for the first calculation is the number of close contacts who were tested during the study period with results available at time of analysis. The denominator for the second calculation is all close contacts identified during the study period. This calculation assumes that any close contact identified by the CMP who was not tested would have had a not detected result. Both estimates assume that the index case is the person that identified the close contact in the case interview and that infections among close contacts are secondary to the index case.

Confidence intervals are calculated by the normal approximation binomial method.¹⁵

Results

A total of 7272 close contacts were identified between the 19th May and the 2nd August (Fig. 1). This represents a time after the first peak in the COVID-19 epidemic curve in Ireland. One thousand three hundred ninety eight (19%) of these contacts were not referred for testing by the CMP. The reasons for not referring for testing included the following: if they tested positive in past 84 days, were managed offline by a local department of public health (e.g. in some outbreak settings), were a simultaneous contact of multiple cases and already undergoing active surveillance and referred for testing or had invalid contact information (with the case unable to provide further detail).

Of the 5874 (81%) of close contacts who required further action, a test for COVID-19 was not indicated for 162 (3%) because they had tested positive in the past 84 days or were already scheduled for a test as a simultaneous contact of multiple cases. One thousand one hundred twenty six (20%) of those offered testing at 'day 0' did not attend their scheduled testing appointment, 4419 (77%) had results of a test reported and 167 (3%) were awaiting a test result at the time of analysis.

Fig. 1. Patients required no further action on the CovidCare Tracker in the following instances: tested positive in the past 84 days; managed offline by departments of public health, for example, in some outbreak settings; simultaneous contact of multiple cases; already undergoing active surveillance and referred for testing; invalid contact information provided and case unable to provide further detail. A test may not be indicated if a patient has tested positive in the past 84 days or is already scheduled for a test as a simultaneous contact of multiple cases. Day seven testing is not indicated if a person has a positive 'day 0' test or has had a 'day 0' test in the last 24 h. 'Other' – test results other than detected or not detected, that is, invalid, indeterminate, inhibitory, not tested;

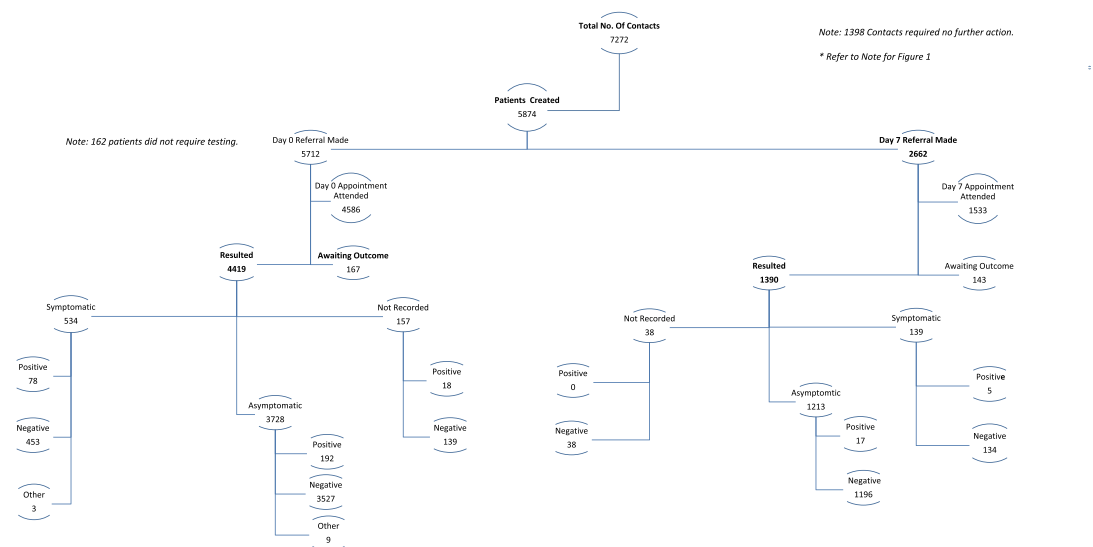


Fig. 1. COVID-19, Contact Tracing Outcomes: ‘Day 0’ and ‘Day 7’ Testing, Ireland, 19th May to 2nd August (n = 7,272).

‘Awaiting Outcome’ – result not yet received by laboratory or undergoing analysis; ‘Day x Appointment Attended’ – appointment marked as attended by electronic appointment system.

Attendance at testing

From a preliminary analysis of those who did not attend their test, attendance rates are lowest in the very young and the elderly. A breakdown of attendance by age group is presented in Table 1.

Secondary attack rate in close contacts

The secondary attack rate in close contacts who were tested was 7% (95% CI: 6.3–7.8%). The secondary attack rate in all close contacts identified was 4.3% (95% CI: 3.8–4.7%). A total of 310 cases were identified from the testing process. Two hundred nine of these (67%) were asymptomatic at the time of referral for testing.

‘Day 0’ testing

At ‘day 0’, 14.6% (95% CI: 11.6e17.6%) of symptomatic close contacts tested positive compared with 5.2% (95% CI: 4.4e5.9%) of asymptomatic close contacts. The positive rate in close contacts tested at ‘day 0’ was 6.5% (95% CI: 5.8e7.2%) (Table 2). The number of close contacts needed to test at ‘day 0’ to identify one case was 15. At ‘day 0’, symptomatic close contacts were three times more likely

to test positive than asymptomatic close contacts (Odds Ratio (OR) 3.2, 95% CI: 2.4 to 4.2 P < 0.0001). The number of symptomatic close contacts needed to test at ‘day 0’ to identify one case was 7; the number of asymptomatic close contacts needed to test at ‘day 0’ to identify one case was 20.

‘Day 7’ testing

‘Day 7’ testing identified an additional 22 cases (7% of new cases identified) (Table 3). There were 2662 close contacts eligible for a ‘day 7’ test (i.e. their first test was collected between 0 and 6 days after last contact and their first test did not detect SARS-CoV-2). Of these, 1129 (42%) did not attend their appointment, 1533 (58%) attended and a ‘day 7’ test was performed. One hundred forty three (9%) of those who attended were awaiting a test result at the time of analysis. The positive rate for close contacts tested at ‘day 7’ was 1.6% (95% CI: 0.9–2.2%). The number of close contacts needed to test at ‘day 7’ to identify one case was 63. The number of symptomatic close contacts needed to test at ‘day 7’ to identify one case was 28, and the number of asymptomatic close contacts needed to test at ‘day 7’ to identify one case was 72.

Discussion

This rapid communication provides an insight into the performance of an intensive national testing strategy focused on close

Table 1 COVID-19, test attendance rates by age group, Ireland, 19th May to 2nd August 2020.

Age group (Years)	0–9	10–19	20–29	30–39	40–49	50–59	60–69	70–79	80+	All
Day 0 tests attended	68%	79%	75%	77%	79%	80%	84%	71%	43%	80%
Day 7 tests attended	44%	58%	57%	55%	55%	62%	67%	46%	29%	58%

Table 2 COVID-19, ‘day 0’ test results, Ireland, 19th May to 2nd August (n = 4419).

Result	Symptomatic No. (%)	Asymptomatic No. (%)	Not recorded No. (%)	Total No. (%)
Positive	78 (15)	192 (5)	18 (11)	288 (7)
Not detected	453 (85)	3527 (95)	139 (89)	4119 (93)
Other (invalid/inhibitory/indeterminate)	3 (<1)	9 (<1)	0 (0)	12 (<1)
Total	534 (100)	3728 (100)	157 (100)	4419 (100)

Table 3
COVID-19, 'day 7' test results, Ireland, 19th May to 2nd August (n = 1390).

Result	Symptomatic No. (%)	Asymptomatic No. (%)	Not recorded No. (%)	Total No. (%)
Positive	5 (4)	17 (1)	0 (0)	22 (2)
Not detected	134 (96)	1196 (99)	38 (100)	1368 (98)
Other (invalid/inhibitory/indeterminate)	0 (0)	0 (0)	0 (0)	0 (0)
Total	139 (100)	1213 (100)	38 (100)	1390 (100)

contacts of cases. Four thousand five hundred eighty six of 7272 (63%) close contacts of cases of COVID-19 were tested with at least one test as part of the contact tracing cycle. The secondary attack rate in close contacts who were tested was 7% (95% CI: 6.3–7.8%). At the 'day 0' test, 14.6% (95% CI: 11.6–17.6%) of symptomatic close contacts tested positive compared with 5.2% (95% CI: 4.4–5.9%) of asymptomatic close contacts. The number of close contacts needed to test at 'day 0' to identify one case was 15, and the number of close contacts needed to test at 'day 7' to identify one case was 63. The results of this analysis support the continuation of the current testing strategy. In the close contact population, the absence of symptoms has a low negative predictive value. The prevalence of asymptomatic carriage is high enough in the close contact population that using symptoms to determine testing strategy is not useful.

During the analysed time period, the positive rate for all SARS-CoV-2 nucleic acid tests in Ireland varied between 0.5 and 2%. Any close contact, regardless of symptoms, is more likely to become a case of COVID-19 than the general population. Symptomatic close contacts were three times more likely to test positive for COVID-19 than asymptomatic close contacts (OR 3.2, 95% CI: 2.4 to 4.2, $P < 0.0001$). However, this report highlights that testing of both symptomatic and asymptomatic close contacts is important in case finding. Two hundred nine (67%) of the new cases identified were asymptomatic at the time of referral for testing. If the threshold for testing had been based on the presence of symptoms in the Irish context (with asymptomatic close contacts not being tested), this would have led to a high proportion of the new cases not being identified.

The secondary attack rate in close contacts reported in this article (7%) sits between a low of 0.45% reported in a study of active surveillance of close contacts from the United States of America (US)¹³ and a high of 9.7% reported in Shenzhen, China.¹⁶ The symptomatic secondary attack rate of 0.45% (95% CI: 0.12–1.6) reported in the US study from January and February 2020 likely reflects the lower prevalence of COVID-19 at that time in the US. This study represents a time in the US before a large number of COVID-19 cases had been identified, many weeks before the first peak in their epidemic curve in April 2020.¹⁷ Asymptomatic close contacts were not tested in the US study which is also likely to have contributed to the lower reported secondary attack rate. The secondary attack rate in close contacts reported in Shenzhen in January and February 2020¹⁶ is comparable with the results from Ireland. Assuming those with a missing test result were uninfected, they found that the secondary attack rate was 6.6% (95% CI: 5.4–8.1%), with the secondary attack rate increasing to 9.7% (95% CI: 7.9–11.8%) if those with missing results were removed from the denominator.

Conclusion

Ireland is continuing its current testing and tracing strategy in relation to close contacts of cases of COVID-19. Overall, this testing and tracing strategy has proved particularly useful in identifying asymptomatic cases of COVID-19. Application of additional symptom-based criteria for testing in this high-incidence

population (close contacts) is of limited utility because of the low negative predictive value of absence of symptoms.

Author statements

Ethical approval

This article presents aggregate data with no person identifiable information. This is a report on monitoring and evaluation of a service in line with the object of the Health Service Executive defined in the Health Act 2004.¹⁸ Testing and contact tracing are conducted under the Infectious Diseases Regulations, 1981, as amended.^{19,20} Contact tracing is undertaken under the authority of Medical Officers of Health, who are public health physicians. Participation in testing is currently voluntary for close contacts.⁷

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Competing interests

None declared.

Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.puhe.2020.10.008>.

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