Respiratory Virus Testing Capacity and Practices in Acute Hospital Settings in Ireland; Results from a National Laboratory Survey.

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Table of Contents

Table of Contents 1
Key Messages 2
Executive Summary 3
Introduction 3
Objectives 3
Methods 3
Results 3
Conclusion 4
Glossary 5
Introduction 6
Objectives 6
Methods 7
Results 7
Response Rate 7
Availability of respiratory virus testing 8
Laboratory Testing Practices 8
RT-PCR testing 10
Rapid Molecular Tests conducted in laboratories 11
Routine and out of hours availability of respiratory virus laboratory testing 13
Referrals to the National Virus Reference Laboratory 13
Near Patient Testing 14
Discussion 17
Recommendations 17
Acknowledgements 18
References 18
Appendices 19
Appendix 1: Analyses by HSE Health Region 19
Appendix 2: Laboratory Survey Data Dictionary 23

Key Messages

- Of the 40 acute hospital laboratories invited to participate in a respiratory virus testing survey in Ireland between 18 July and 02 August 2023, 30 (75%) responded to the survey.
- The survey shows that respiratory virus testing is widely available in the acute hospital setting in Ireland, with all 30 responding hospitals testing for SARS-CoV-2, 29 (97%) for influenza and 27 (90%) for respiratory syncytial virus (RSV).
- 28 (93%) laboratories reported using multiplex RT-PCR testing for respiratory viruses, including 25 (83%) testing for all three of SARS-CoV-2, influenza, RSV, and 3 (10%) testing for both SARS-CoV-2 and influenza. No laboratories reported using multiplex testing to test for both SARS-CoV-2 and RSV or for both influenza and RSV.
- The two (7%) laboratories that were not currently using multiplex RT-PCR testing were planning to introduce it during the 2023/2024 winter season.
- In addition to RT-PCR testing, 10 (33%) responding laboratories reported using Rapid Molecular Methods in their laboratories for testing for SARS-CoV-2, influenza, and RSV.
- The most common source of specimens tested in the laboratory came from hospital inpatients and ICU/Critical Care which were tested by 28 (93%) laboratories. Twelve (40%) laboratories reported testing specimens from s and residential care facilities, including 11 (37%) that reported testing specimens from both sources.
- Of those testing for influenza, 10 (34%) laboratories conducted additional subtyping of influenza A viruses. None conducted additional influenza B/lineage testing.
- During the winter season, 27 laboratories (90%) offer daily testing for SARS-CoV-2, including out of hours testing which was reported by 25 laboratories (83%). There were 28 laboratories (97%) who reported testing influenza daily, including out of hours testing reported by 24 laboratories (83%). RSV was reported by 24 (89%) laboratories to be tested daily during the winter, with out of hours services provided by 20 (74%) laboratories. The level of daily testing provided during the summer season is less frequent but still widespread.
- 24 (80%) laboratories reported referring specimens to the National Virus Reference Laboratory (NVRL) for additional testing, primarily for surveillance purposes, but also for additional subtyping of influenza A which 14 laboratories (58%) reported.
- Ten (33%) responding hospitals also used Near Patient Testing (NPT) to test for respiratory viruses, primarily in the emergency department.
- Of the 10 sites using near patient testing, molecular based NPT tests are used by eight (80%) sites to test for SARS-CoV-2, six (60%) sites for influenza A and B, and one (10%) site for RSV (untyped).
- Of the 10 sites using near patient testing, 3 (30%) used antigen-based NPT tests to test for SARS-CoV-2.
- No site reported using antigen-based NPT tests to test for influenza or RSV.

Executive Summary

Introduction

The Health Protection Surveillance Centre (HPSC) conducted a survey of testing practices for SARS-CoV-2, influenza, respiratory syncytial virus (RSV) and other respiratory viruses (ORV) in acute hospitals in Ireland in July/August 2023. HPSC developed the survey in consultation with the National Virus Reference Laboratory (NVRL) and experts from acute hospital laboratories.

Objectives

The objectives of the survey were to:

1. Understand the current availability of respiratory virus testing in acute hospitals in Ireland
2. Determine the types of diagnostic testing technology being used (including types of assays and platforms)
3. Assess the availability of multiplex PCR/RT-PCR testing for respiratory viruses
4. Assess the availability of respiratory virus testing provided during the winter and summer seasons, including out of hours testing services
5. Determine current practices for referring specimens to the NVRL for further testing
6. Determine current practices for the use of near-patient testing

Methods

The survey was administered using Qualtrics, a web-based questionnaire platform. Participants from 40 hospital laboratories were invited to participate in the survey from mid-July 2023 to the beginning of August 2023.

The questionnaire collected data on both laboratory testing and near-patient testing (NPT). For laboratory testing, this included the collection of data on the respiratory viruses being tested, the use of singleplex and multiplex testing, the testing platforms and assays being used in the laboratories, the availability of respiratory virus testing services during the winter and summer periods, and referral practices to the NVRL. For NPT, data were collected on the use of molecular and antigen NPTs, including pathogens tested, types of tests used, the settings and reasons for NPT testing, and the availability of NPT testing services during the winter and summer periods.

Results

Of the 40 hospital laboratories in Ireland invited to participate in the survey, 30 (75%) responded to the survey. All 30 (100%) responding laboratories conduct on-site respiratory virus testing using molecular diagnostic testing technology. None of the laboratories reported the use of antigen testing methods in the laboratory. Respiratory virus testing is performed in the laboratory in all 30 hospital laboratories. All 30 laboratories reported testing using PCR/RT-PCR, and 10 (33%) laboratories used rapid molecular tests.

Singleplex PCR/RT-PCR SARS-CoV-2 testing was reported by 19 (63%) laboratories, with no facilities reporting using singleplex PCR/RT-PCR testing for influenza or RSV. Twenty-eight (93%) laboratories reported using multiplex RT-PCR testing for respiratory viruses, including 25 (83%) testing for all three of SARS-CoV-2, influenza, RSV, and 3 (10%) testing for both SARS-CoV-2 and influenza. No laboratories reported using multiplex testing to test for both SARS-CoV-2 and RSV or for both influenza and RSV. The two (7%) laboratories that were not currently using multiplex RT-PCR testing were planning to introduce it during the 2023/2024 winter season. The most commonly used multiplex PCR assay was the Xpert Xpress CoV-2/Flu/RSV with 17 (61%) laboratories using it.

During the winter season:

- 27 laboratories (90%) reported offering a daily testing service for SARS-CoV-2, including an out of hours testing service provided by 25 laboratories (83%)
- 28 laboratories (97%) reported offering a daily testing service for influenza, including out of hours testing provided by 24 laboratories (83%)
- 24 laboratories (89%) reported offering a daily testing service for RSV, including out of hours testing provided by 20 laboratories (74%)

During the summer season:

- 26 laboratories (87%) reported offering a daily testing for SARS-CoV-2, including out of hours testing provided by 25 laboratories (83%)
- 18 laboratories (62%) reported offering a daily testing for influenza, including out of hours testing provided by 18 laboratories (62%)
- 17 laboratories (63%) reported offering a daily testing for RSV, including out of hours testing provided by 16 laboratories (59%)

Of the 30 participating laboratories, 24 (80%) refer specimens to the NVRL for additional testing, with 17 (71%) referring specimens to the NVRL for additional testing for surveillance purposes. The most commonly reported referrals came from ICU (67%) and hospital inpatients (67%). There were 10 laboratories (42%) who referred specimens for SARS-CoV-2 whole genome sequencing (WGS) and four laboratories (17%) referring specimens to test for Avian influenza/other novel influenza viruses.

There were 10 (33%) hospital sites who reported also using NPT for respiratory virus testing. Eight (80%) sites reported the use of molecular NPT to test for SARS-CoV-2, 6 (75%) to test for influenza A and B, and one (13%) to test for RSV (untyped). All sites reporting using molecular NPT are using it in the Emergency Department setting. Most sites (5%) reported using the Abbott ID Now and Roche Cobas Liat molecular NPTs. Three sites reported using antigen tests for NPT to test for SARS-CoV-2, using Clinitest and Roche tests. No site reported using antigen tests for NPT to test for influenza or RSV. Three sites (30%) reported using antigen NPT in the Outpatient Department setting. Almost all of the laboratories using NPT, test daily in the winter and summer periods.

Conclusion

There is widespread availability of respiratory virus testing in acute hospital settings in Ireland. SARS-CoV-2 is the most common pathogen tested for using PCR/RT-PCR. Singleplex assays are only used for SARS-CoV-2 testing. Multiplex PCR/RT-PCR assays to test for respiratory viruses are currently in place in the majority of hospital laboratories and will be in place in all 30 responding hospital laboratories in Ireland during the 2023/2024 winter season. Most laboratories are testing for SARS-CoV-2 on a daily basis all year around including an out of hours service. Testing for Influenza and RSV occurs on a daily basis in the winter (including an out of hours service) but occurs less frequently during the summer. NPT is used in eight acute hospital sites, using molecular based tests, primarily for SARS-CoV-2 and/or influenza. Antigen based NPT tests are only used in three hospital sites and are used to test for SARS-CoV-2 only.

Glossary

Acronym	Definition
HPSC	Health Protection Surveillance Centre
hMPV	Human metapneumovirus
MERS-CoV	Middle East Respiratory Syndrome Coronavirus
NPT	Near Patient Testing
NVRL	National Virus Reference Laboratory
ORV	Other Respiratory Viruses
PCR	Polymerase Chain Reaction
RT-PCR	Reverse Transcriptase Polymerase Chain Reaction
RSV	Respiratory Syncytial Virus
SARS-CoV-2	Severe Acute Respiratory Syndrome Coronavirus 2
WGS	Whole Genome Sequencing

Introduction

Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2) emerged at the end of 2019, and a global pandemic due to SARS-CoV-2 was declared by WHO in March 2020. During the 2020/2021 and 2021/2022 winter seasons, there was a sharp decrease in the circulation of influenza viruses, respiratory syncytial virus (RSV) and other respiratory viruses due to the impact of non-pharmaceutical interventions (e.g. societal restrictions, mask use), however since the lifting of these restrictions the incidence of these viruses has rebounded to levels higher than those seen in the pre-pandemic period [1]. During the most recent winter season (2022/2023), there was a large burden of infections and hospitalisations due to influenza and RSV and the seasonal epidemic for RSV started earlier and lasted longer than was typically observed in the pre-pandemic period [1]. SARS-CoV-2 now co-circulates with influenza, RSV and other respiratory viruses (ORV). There is a risk of co-infection with these viruses, which may result in more severe disease and severe outcomes, and which may complicate case management. There is also a risk of multi-pathogen outbreaks of acute respiratory infections, which may also complicate outbreak management.

Ensuring the provision of adequate respiratory virus testing capacity is critical to support the rapid detection, clinical management of, and public health response to respiratory viruses circulating in the general population. This is particularly important during periods of peak activity and community transmission of the viruses, and especially given the co-circulation of multiple respiratory viruses.

The COVID-19 pandemic has driven substantive changes to respiratory virus testing capacity and practice in Ireland and internationally, both in terms of the availability of testing, and also in terms of the types of tests in use – PCR (singleplex or multiplex), other rapid molecular tests, near patient tests (molecular or antigen) and self-taken antigen tests. Near patient tests (NPTs) are defined as tests conducted outside of a laboratory, generally near to, or at the side of, a patient. NPT devices are used by healthcare professionals in hospital or community settings. They are not used for self-testing [2].

It is important to understand what laboratory testing for respiratory viruses is available in Ireland and how it is being used, in order to support decision making and planning for laboratory testing, health service planning, response and capacity building, and to support outbreak management. This information will also support the interpretation of national surveillance data on respiratory viruses.

In this context, the HPSC conducted a survey of acute hospital laboratories in Ireland, in order to describe the current availability for respiratory virus testing in acute hospital settings in Ireland.

Objectives

The survey had the following specific objectives:

1. To assess the overall availability of laboratory and near patient testing for SARS-CoV-2, influenza, RSV and ORVs in acute hospital laboratories in Ireland
2. To describe the types of diagnostic testing technology (including the associated assays and platforms) being used
3. To assess the availability of multiplex PCR/RT-PCR testing for respiratory viruses
4. To assess the availability of testing during the winter and summer seasons, including the availability of out of hours testing
5. To determine practices for referring specimens to the NVRL for further testing
6. Determine current practices for the use of near-patient testing

Self-taken antigen tests were not part of the scope of this survey.

Methods

We contacted consultant microbiologists and laboratory surveillance scientists from all the acute hospital laboratories in Ireland and invited them to complete an online questionnaire between 18 July and 02 August 2023. The questionnaire content was reviewed by the National Virus Reference Laboratory (NVRL) and by other experts working in acute hospital laboratories. The questionnaire collected data on laboratory testing (including singleplex and multiplex testing and testing assays and platforms used), and NPT practices, on the frequency of testing in the winter and summer periods, and on referral practices to the NVRL. Singleplex testing referred to assays targeting a single target sequence of DNA or RNA and that were used to detect a specific virus [3], in other words, assays only targeting SARS-CoV-2 or only targeting influenza or only targeting RSV. Near Patient Testing was defined as "any device that is not intended for self-testing but is intended to perform testing outside a laboratory environment, generally near to, or at the side of, the patient by a health professional" in accordance with the definition proposed by The National Near-Patient Testing Consultative Group [4]. Rapid molecular testing methods are classified as rapid molecular assays that incorporate either traditional RT-PCR or isothermal nucleic acid amplification and are capable of producing results in less than 60 min. [5] The winter period was defined as weeks 40 to 20 (October to the end of May) and the summer period as weeks 21 to 39 (late May to the end of September) in accordance with World Health Organization definitions [6]. The data dictionary for the questionnaire is presented in **Appendix 2**. The questionnaire was administered via the Qualtrics survey platform used by HPSC [7].

We downloaded the survey data from the Qualtrics platform, in MS Excel and conducted a descriptive analysis of the data. Where indicated, we stratified data by HSE health region.

The HSE has assigned all HSE hospitals to a HSE health region [8]. We further assigned hospitals which were not affiliated with any particular HSE hospital group to a HSE health region based on their geographical location, in order to assess geographical availability of respiratory virus testing. For instance, unaffiliated hospitals in Cork were assigned to HSE South West. Unaffiliated hospitals in Dublin were assigned based on their associated community healthcare organisation. Data by individual hospital/hospital group are not reported in the published version of this report.

Results

Response Rate

Of the 40 laboratories invited to participate, 30 (75%) responded to the survey. The response rate by HSE Health Region varied from 60 to 100% and was highest in HSE West and Northwest and HSE Mid-West with 100% response rate, and lowest in HSE South-West (**Table 1**).

Table 1: National laboratory survey response rate by HSE Health Region-July 2023

HSE Health Region	Number of hospitals contacted	Number and (%) of hospitals responding
HSE Dublin and North East	11	7 (63.6)
HSE Dublin and Midlands	10	7 (70.0)
HSE Dublin and South East	7	6 (85.7)
HSE South West	5	3 (60.0)
HSE Mid-West	1	1 (100.0)
HSE West and North West	6	6 (100.0)
Total	**40**	**30 (75.0)**

Availability of respiratory virus testing

Of 30 hospitals that participated in the survey, all 30 (100%) reported that they tested for respiratory viruses, including 30 (100%) that conducted laboratory testing and 10 (33%) that also conducted NPT. There was considerable variation in the use of NPT by HSE Health Region (**Appendix 1, Table 1**). No hospitals in HSE West and North West and less than 30% of hospitals in HSE Dublin and North East and HSE Dublin and South East use NPT.

Laboratory Testing Practices

Table 2 provides an overview of current respiratory virus testing available in the acute hospital laboratory setting in Ireland.

Most laboratories (28, 93%) reported testing specimens from hospital inpatients and intensive care unit (ICU) patients, making these the most common source of specimens. Twelve laboratories (40%) reported testing specimens from nursing homes and twelve (40%) from residential care facilities, including 11 laboratories (37%) that reported testing specimens from both sources. Seven laboratories (23%) reported testing specimens from other residential facilities (direct provision centres, homeless hostels and prisons), and 9 (30%) tested specimens submitted from primary care practices.

Table 2: Overview of respiratory virus testing practices in acute hospital laboratories in Ireland, July 2023.

Laboratory Testing Practices	Number (%)
Total hospital laboratories conducting respiratory virus testing	30 (100.0)
Diagnostic testing technology	
Molecular	30 (100.0)
Antigen	0 (0.0)
Molecular testing	
PCR/RT-PCR	30 (100.0)
Rapid molecular tests	10 (33.3)
Other (Including isothermal amplification, LAMP)	1 (3.3)
Source of tested specimens	
Hospital Inpatients	28 (93.3)
ICU/Critical Care	28 (93.3)
Hospital Emergency Departments	27 (90.0)
Hospital Outpatients	22 (73.3)
Continuing/convalescent/respite care wards	19 (63.3)
Occupational Health	17 (56.7)
Community Hospitals	12 (40.0)
Nursing homes /elderly care homes	12 (40.0)
Residential care facilities (e.g., disability homes)	12 (40.0)
General Practice (GP) / Primary Care	9 (30.0)
Other residential facilities*	7 (23.0)
Other†	2 (6.7)
Singleplex testing¥	
SARS-CoV-2	19 (63.3)
Influenza	0 (0.0)
RSV	0 (0.0)
Multiplex testing	
Currently using	28 (93.3)
Planning to introduce during the 2023/2024 winter season	2 (6.66)
Additional influenza testing	
Influenza A subtyping	10 (34.4)
Influenza B lineage testing	0 (0.0)
Referrals to the NVRL	
Referring specimens	24 (80.0)

**Other residential facilities: (e.g. Direct Provision accommodation, homeless hostels, prisons)*
†Other: Hospice care facility, private/corporate clients
¥ Singleplex testing referred to assays targeting a single target sequence of DNA or RNA and that were used to detect a specific virus [3], in other words, assays only targeting influenza or only targeting RSV.

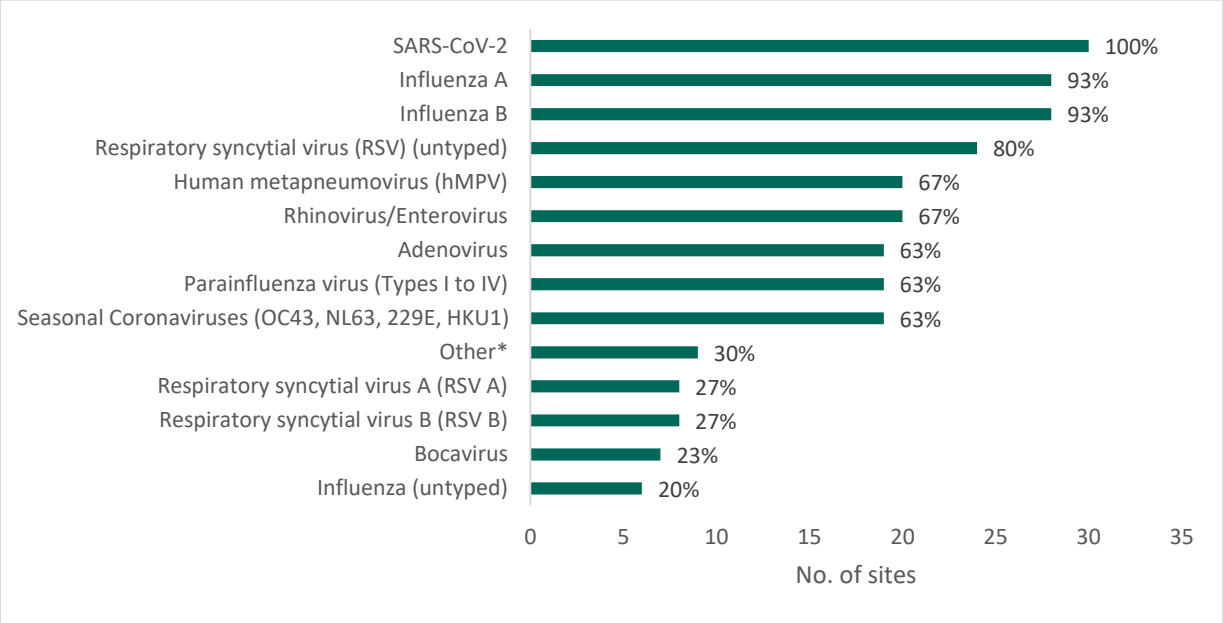
Of the 30 hospitals that reported that they conducted laboratory testing, all-reported the use of molecular methods and none reported the use of antigen testing methods in the laboratory (**Table 2**). All laboratories used PCR testing, with a minority (10, 33%) reporting the use of rapid molecular tests and one laboratory reporting the use of other molecular methods (**Table 2**). Rapid molecular methods were most commonly used in HSE Dublin and Midlands (**Appendix 1, Table 2**). Of 29 laboratories that test for influenza A, 10 laboratories

(34%) conducted additional subtyping of influenza A specimens. None of the surveyed laboratories conducted further classification of influenza B specimens.

RT-PCR Testing

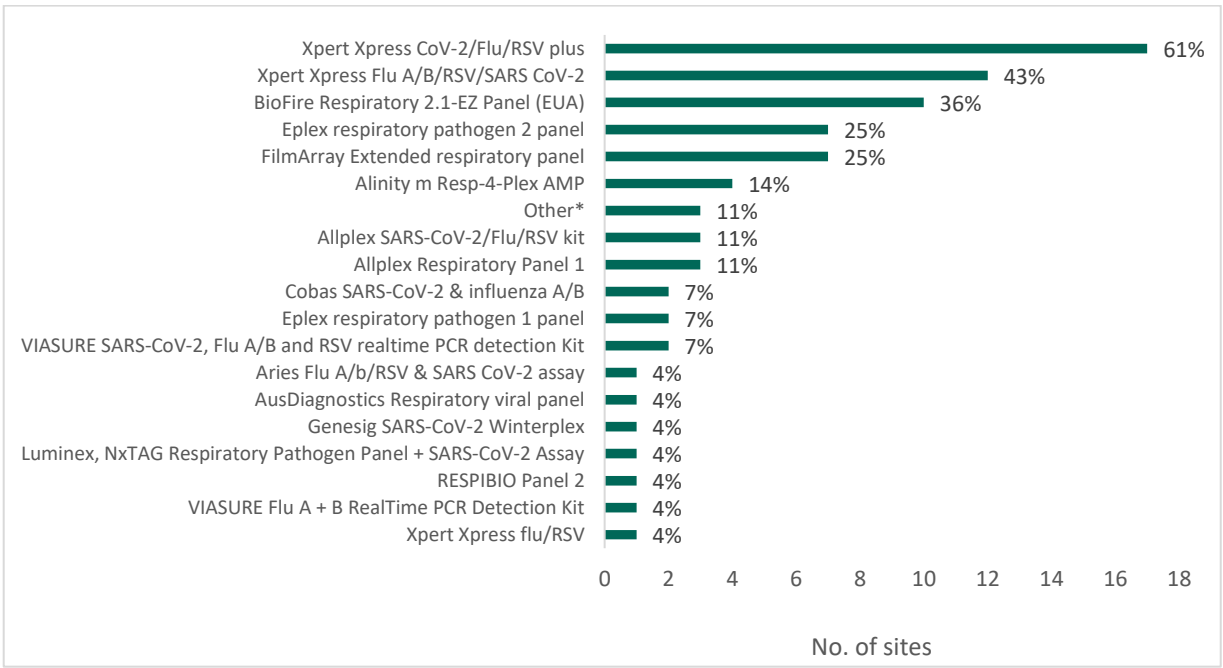
All the responding laboratories reported testing for SARS-CoV-2 using RT-PCR (**Figure 1**). Over 90% of laboratories (28) also reported using this method to test for influenza A and B and 80% (24) reported using RT-PCR to test for RSV (untyped). **Figures 2 and 3** describe the assays and platforms used for RT-PCR testing.

Figure 1: Pathogens tested for using RT-PCR



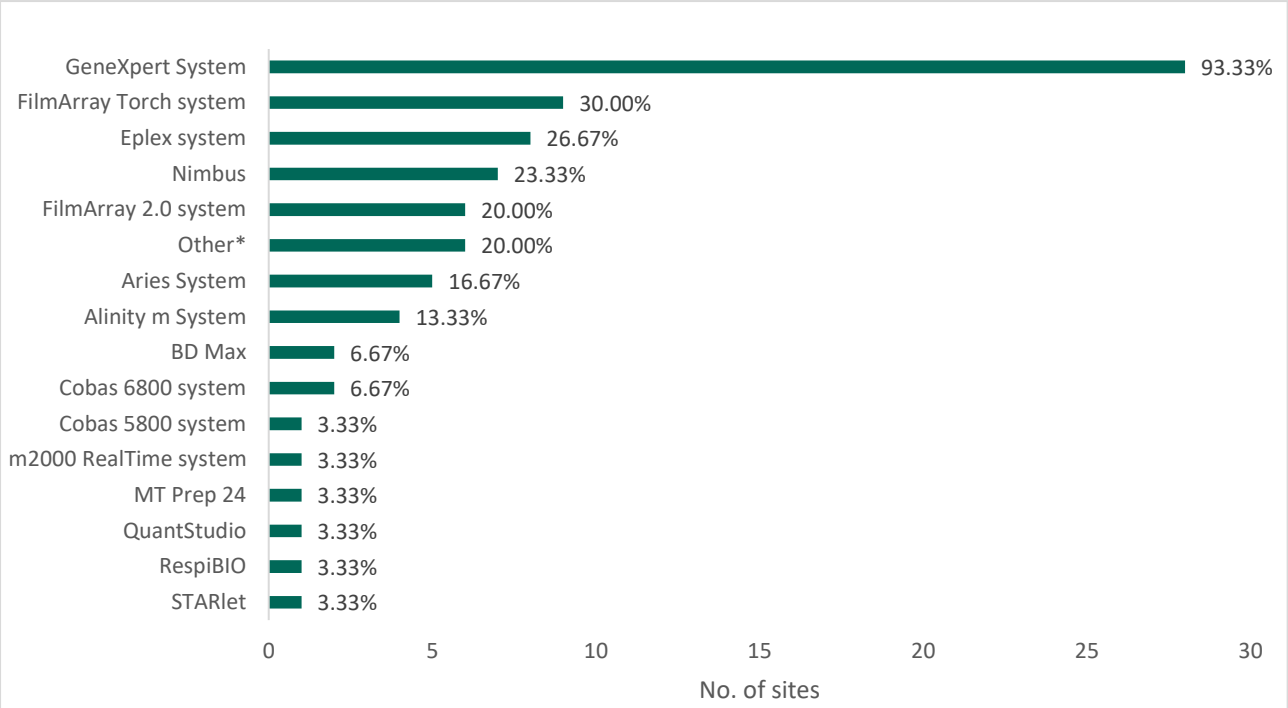
**Other: Middle East Respiratory Syndrome Coronavirus (MERS-CoV)*

Figure 2: RT-PCR multiplex assays used in acute hospital laboratories in Ireland



**Other: Aptima Fusion Multiplex assay, Genetic Signatures Easyscreen Respiratory Plus assay, Tib Mol-biol assay*

Figure 3: PCR testing platforms used in acute hospital testing laboratories in Ireland



**Other: Seegene, Roche FlowFlex, KingFisher Flex, Lightcycler 480II, BioRad CFX96, MagNa Pure, Luminex Magpix*

Nineteen (63%) of the surveyed laboratories reported using singleplex RT-PCR testing for SARS-CoV-2, whereas none reported conducting singleplex RT-PCR testing for either influenza or RSV (**Table 2**). The Xpert Xpress SARS-CoV-2 was the most common singleplex PCR assay in use for SARS-CoV-2 testing and was being used in 18 (95%) of laboratories (**Appendix 1, Table 4**).

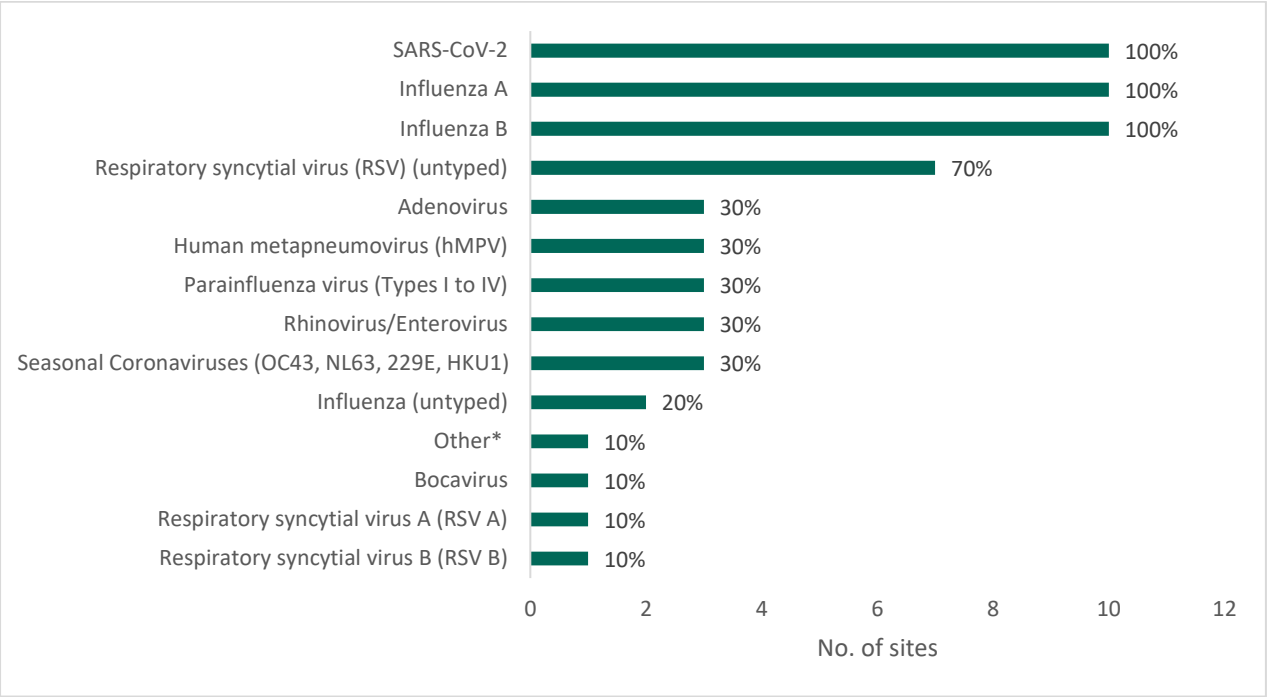
Twenty-eight laboratories (93%) reported using multiplex RT-PCR testing for respiratory viruses (**Table 2**), including 25 (83%) testing for all three of SARS-CoV-2, influenza and RSV, and 3 laboratories (10%) testing for both SARS-CoV-2 and influenza. No laboratories reported using multiplex testing to test for both SARS-CoV-2 and RSV or for both influenza and RSV. Of the two laboratories that reported they were not currently using multiplex testing, both planned to introduce it in the 2023/2024 winter season The Xpert Xpress assay targeting SARS-CoV-2 and untyped influenza and RSV was the most common multiplex assay used and was being used by 17 (61%) of the participating laboratories (**Figure 2**). The GeneXpert System was used by 28 (93%) of the participating laboratories, making it the most widely used testing platform[1] reported (**Figure 3**).

Rapid Molecular Tests conducted in laboratories

Of ten laboratories reporting the use of rapid molecular tests, all reported using it to test for SARS-CoV-2 and influenza (**Figure 4**). The GeneXpert rapid molecular test was used by nine laboratories making it the most common type of rapid molecular test in use (**Figure 5**).

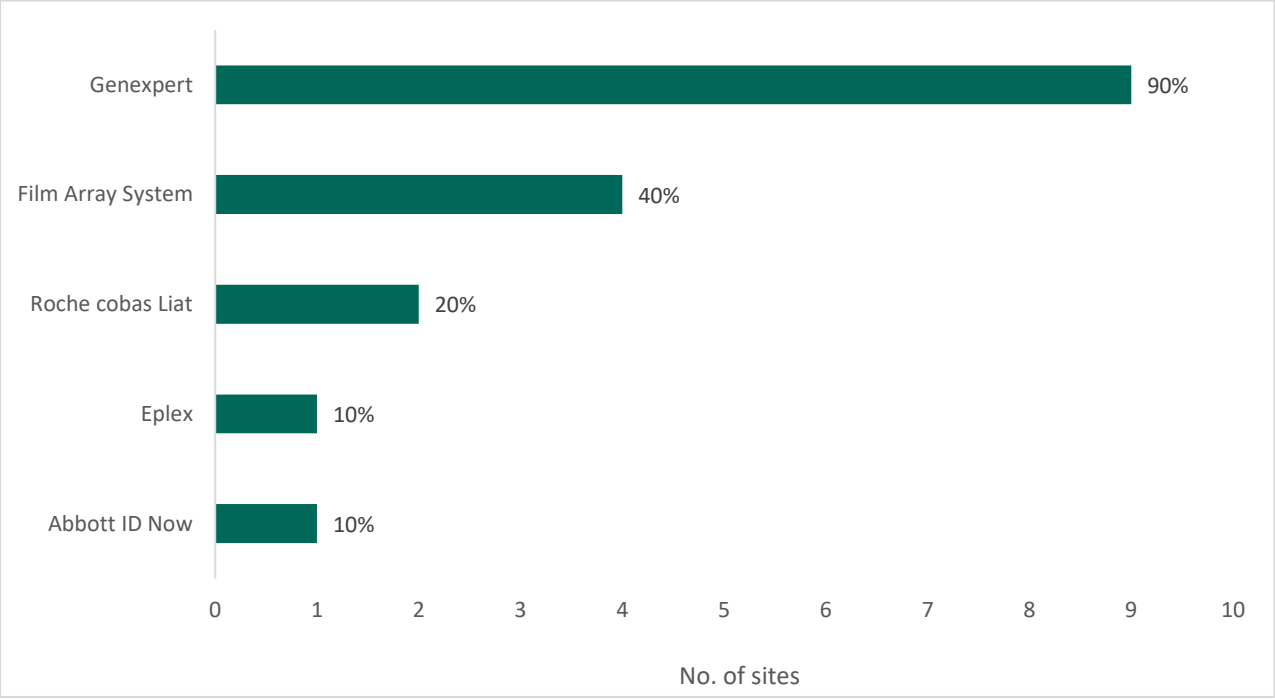
[1] Platform refers to the machine used to test samples, assay refers to the actual test used

Figure 4: Pathogens tested for using Rapid molecular tests in acute hospital laboratories in Ireland. *This does not refer to NPTs that are conducted outside of the laboratory setting.*



**Other: Middle East Respiratory Syndrome Coronavirus (MERS-CoV)*

Figure 5: Rapid molecular tests used in acute hospital laboratories in Ireland



Routine and out of hours availability of respiratory virus laboratory testing

The majority of the laboratories reported providing a daily testing service for SARS-CoV-2 (27, 90%), influenza (28, 97%) and RSV (24, 89%) during the winter season (**Table 3**). Out of hours testing services were reported for SARS-CoV-2 (25, 83%), influenza (24, 83%) and RSV (20, 74%) by laboratories. Most laboratories also provided daily testing during the summer season, in particular for SARS-CoV-2 (26, 87%), and less so for influenza (18, 62%) and RSV (17, 63%). Out of hours testing was also widely available during the summer period.

Table 3: Frequency of molecular testing for SARS-CoV-2, influenza and RSV in acute hospital laboratories in Ireland

	SARS-CoV-2 N (%)	Influenza N (%)	RSV N (%)
Number of laboratories testing for pathogen	30 (100.0)	29 (96.7)	27 (90.0)
Winter period			
Every day (7 days per week)	27 (90.0)	28 (96.6)	24 (88.9)
Every weekday (Monday to Friday)	1 (3.3)	1 (3.4)	3 (11.1)
Selected weekdays only	0 (0.0)	0 (0.0)	0 (0.0)
Other*	2 (6.7)	0 (0.0)	0 (0.0)
Winter period - Out of hours service			
Yes	25 (83.3)	24 (82.8)	20 (74.1)
No	5 (16.7)	5 (17.2)	7 (25.9)
Summer period			
Every day (7 days per week)	26 (86.7)	18 (62.1)	17 (63.0)
Every weekday (Monday to Friday)	2 (6.7)	2 (6.9)	2 (7.4)
Selected weekdays only	0 (0.0)	0 (0.0)	0 (0.0)
Does not test outside of the winter period	0 (0.0)	3 (10.3)	5 (18.5)
Other†	2 (6.7)	6 (20.7)	3 (11.1)
Summer period - Out of hours service			
Yes	25 (83.3)	18 (62.1)	16 (59.3)
No	5 (16.7)	11 (37.9)	11 (40.7)

**Other: As requested for SARS-CoV-2 during winter period*

†Other: As requested for influenza and SARS-CoV-2 and RSV during summer period, as part of screen for allogeneic HSCT recipients

Referrals to the National Virus Reference Laboratory

The majority of acute hospital laboratories that responded to the survey (24, 80%), refer specimens to the NVRL for additional testing (**Table 2**), although the frequency was lower in HSE South West, where only one of the three participating laboratories reported referring specimens (**Appendix 1, Table 7**). Laboratories most frequently reported referring specimens from patients admitted to ICU (16, 67%) and hospital inpatients (16, 67%) (**Table 4**). The most common reason for referring specimens to the NVRL was for additional testing for surveillance purposes (17, 71%), with a majority of laboratories also referring for additional subtyping of influenza A specimens (14, 58%). There were 10 laboratories (42%) who referred specimens for SARS-CoV-2 whole genome sequencing (WGS) and 4 laboratories (17%) referring specimens to test for Avian influenza/other novel influenza virus.

Table 4: Sources of and reasons for NVRL referrals

	Number (%)
Source of respiratory samples referred to NVRL	
ICU/Critical Care	16 (66.7)
Hospital Inpatients	16 (66.7)
Hospital Emergency Departments	12 (50.0)
Hospital Outpatients	9 (37.5)
General Practice (GP) / Primary Care	7 (29.2)
Residential care facilities (e.g. disability homes)	7 (29.2)
Community Hospitals	6 (25.0)
Nursing homes /elderly care homes	6 (25.0)
Continuing/convalescent/respite care wards	5 (20.8)
Occupational Health	5 (20.8)
Other residential facilities*	4 (16.7)
Other†	1 (4.2)
Reasons for referring specimens to NVRL	
Additional testing requested by HPSC for surveillance purposes	17 (70.8)
To request Influenza A subtyping	14 (58.3)
Additional testing requested by local Department of Public Health	12 (50.0)
To test for extended respiratory virus panel	11 (45.8)
For further characterisation of influenza B viruses	10 (41.7)
For SARS-CoV-2 whole genome sequencing (WGS)	10 (41.7)
Confirmation of diagnosis	5 (20.8)
To test for Avian influenza/other novel influenza virus	4 (16.7)
Other¥	2 (8.3)
To request antiviral resistance testing for influenza	2 (8.3)
To request influenza genetic/antigenic testing	2 (8.3)
To request antiviral resistance testing for SARS-CoV-2	0 (0.0)

**Other* residential facilities (e.g. Direct Provision accommodation, homeless hostels, prisons)
†Other: Post-mortem specimens
¥Other: Unexpected or equivocal results, additional testing required for patient care

Near Patient Testing

Ten out of the 30 surveyed hospitals (33%) reported using NPT for respiratory virus testing.

Of these 10 sites, eight (80%) reported using molecular based testing methods (**Table 5**). All 8 sites using NPT molecular tests (100%) used them to test for SARS-CoV-2, six (75%) used them to test for influenza A and B, and one (13%) used them to test for RSV (untyped). Molecular based NPT was not used to test for any other respiratory viruses. The Abbott ID Now and Roche Cobas Liat were each used in 4 (50%) sites, making them the most common molecular NPT tests in use (**Table 5**). Five (63%) sites used molecular NPT for routine testing purposes. All eight sites reported using molecular tests for NPT in the emergency department setting.

In addition to molecular based NPT, 3 (30%) sites reported using antigen tests for NPT, two in HSE Dublin and North East and one in HSE Dublin and Midlands. (**Appendix 1, Table 8**) All three reported using antigen tests

for SARS-CoV-2. Antigen based NPT were not used to test for any other respiratory viruses. (**Table 6**) Two sites reported using Clinitest and one site reported using Roche antigen tests for NPT. Antigen tests for NPT were used by in the Outpatient Departments setting by all three sites.

In hospitals using NPT, almost all used NPT daily, both in winter and in summer (**Table 7**).

Table 5: Overview of molecular based near-patient testing practices in acute hospitals in Ireland

	Number and (%)
Tests	
Molecular based	8 (80.0)
Pathogens*	
SARS-CoV-2	8 (100.0)
Influenza A	6 (75.0)
Influenza B	6 (75.0)
RSV (untyped)	1 (12.5)
Molecular based tests	
Abbott ID Now	4 (50.0)
Roche cobas Liat	4 (50.0)
Genexpert	1 (12.5)
Reasons for testing	
Routine use	5 (62.5)
Seasonal use	2 (20.0)
Other †	3 (30.0)
Settings	
Emergency Department	8 (100.0)
Inpatient wards	2 (25.0)
ICU	1 (12.5)
Maternity ward	1 (12.5)

**Pathogens: Please note that no hospitals reported using NPT to test for the following viruses: Adenovirus, Bocavirus, Human metapneumovirus (hMPV), Influenza (untyped), Parainfluenza virus (Types I to IV), Respiratory syncytial virus (RSV) (A or B), Rhinovirus/Enterovirus, Seasonal Coronaviruses (OC43, NL63, 229E, HKU1) or any other virus.*
†Other: Pre-operation patients, transplant and dialysis wards, outside working hours (e.g. 8pm to 8am)

Table 6: Overview of antigen based near-patient testing practices in acute hospitals in Ireland

	Number and (%)
Tests	
Antigen based	3 (30.0)
Pathogens	
SARS-CoV-2	3 (100.0)
Influenza	0 (0.0)
RSV	0 (0.0)
Antigen based tests	
Clinitest	2 (66.6)
Roche	1 (33.3)
Reasons for testing	
Routine use	2 (66.6)
During outbreaks	2 (66.6)
For health and care workers (occupational health)	2 (66.6)
Pre-operative use in certain circumstances	1 (33.3)
Settings	
Emergency Department	1 (33.3)
Inpatient wards	2 (66.6)
Outpatient departments	3 (100.0)
Occupational Health	2 (66.6)

Table 7: Frequency of near-patient testing for SARS-CoV-2, influenza and RSV in acute hospitals in Ireland

	SARS-CoV-2 Number (%)	Influenza Number (%)	RSV Number (%)
Total number of sites	10 (100.0)	6 (60.0)	1 (10.0)
Winter period			
Every day (7 days per week)	9 (90.0)	6 (100.0)	1 (100.0)
Every weekday (Monday to Friday)	0 (0.0)	0 (0.0)	0 (0.0)
Selected weekdays only	0 (0.0)	0 (0.0)	0 (0.0)
Other*	1 (10.0)	0 (0.0)	0 (0.0)
Summer period			
Every day (7 days per week)	9 (90.0)	5 (83.3)	1 (100.0)
Every weekday (Monday to Friday)	0 (0.0)	0 (0.0)	0 (0.0)
Selected weekdays only	0 (0.0)	0 (0.0)	0 (0.0)
Does not test outside of the winter period	0 (0.0)	1 (16.7)	0 (0.0)
Other*	1 (10.0)	0 (0.0)	0 (0.0)

**Other: Used on day ward as per protocols (if patient is symptomatic)*

Discussion

This survey of respiratory virus testing capacity in acute hospital settings in Ireland demonstrates that there is widespread availability of respiratory virus testing for SARS-CoV-2, influenza and RSV across Ireland, with almost all responding laboratories currently (and all soon to be) using multiplex RT-PCR testing for this purpose. Rapid molecular testing is also widely used by hospital laboratories for this purpose. A majority of laboratories continue to use singleplex RT-PCR testing for SARS-CoV-2 testing. In the era of multipathogenic winters, it is recommended that all laboratories use multiplex PCR tests for detecting SARS-CoV-2, influenza and RSV, rather than singleplex tests. Most laboratories provide a daily and out of hours testing service in winter, and to a lesser extent in summer.

Only 40% of laboratories reported testing specimens from nursing homes and residential care facilities (12 laboratories, of which 11 tested specimens from both sources). Regional Departments of Public Health and Community Support Teams are currently being surveyed to determine respiratory virus testing practices (including where samples are sent for testing) in nursing homes.

Ten responding hospitals also use NPT, primarily in the emergency department setting. NPT is mainly used to test for SARS-CoV-2 through molecular testing methods, however some hospitals are using molecular NPTs to test for influenza also. Only three hospitals reported using antigen-based NPT for SARS-CoV-2 and no hospital sites uses antigen-based NPT to test for influenza and RSV.

These data indicate a substantive (almost three-fold) increase in testing capacity, when compared to the results of a previous survey in 2016 (unpublished data), which reported that only eleven acute-hospital laboratories conducted on-site testing for influenza and RSV. This expansion in testing capacity was almost certainly driven by the COVID-19 pandemic.

This survey was limited by the non-participation of one quarter (n=10) of the invited hospitals. It may be that those hospitals that did not participate were less likely to conduct respiratory virus testing and so excluded themselves from the survey. Consequently, it is possible that this survey may give less insight into testing and referral practices in hospitals that are less resourced for respiratory virus testing and that may benefit from further investment to strengthen their testing capacity.

Another limitation of the survey is that we did not ask whether molecular based NPT was targeted to symptomatic cases, and whether symptomatic cases identified using molecular based NPT were confirmed using RT-PCR. We did not ask about notification practices for symptomatic cases of influenza, RSV and SARS-CoV-2 detected via molecular based NPTs. Given the increased use of molecular based NPTs in practice, it would be useful to understand whether this is impacting on the ascertainment of such cases for surveillance purposes.

Furthermore, this survey did not collect data on multiplex testing capacity, and so there is a lack of data on the volume of multiplex tests that could be processed by laboratories on a daily basis during surge periods, and whether testing capacity varies during the winter and summer periods.

In the wake of the COVID-19 pandemic, with the co-circulation of multiple respiratory viruses, ensuring adequate provision of respiratory virus testing for multiple pathogens is critical to support infection prevention and control and the clinical management of cases of respiratory infection and to inform laboratory testing requirements and public health decision making, including the public health response to seasonal and local epidemics of respiratory viruses. This survey indicates that a robust testing infrastructure for respiratory pathogens is in place in acute hospital laboratories in Ireland.

Recommendations

Given the results of this survey, it is recommended that:

1. Non-responders to the survey are followed up to confirm if they test for respiratory viruses and if so, whether they use multiplex PCR testing for this purpose.
2. A laboratory survey of respiratory virus testing capacity is repeated every three years, to monitor respiratory virus testing availability and practices
3. Future iterations of the survey collect data on the reasons for laboratories continuing to use singleplex tests.
4. Future iterations of the survey clarify confirmation and notification practices for symptomatic cases of SARS-CoV-2, influenza and RSV detected via molecular based NPT
5. Adequate funding and capacity be made available for acute hospital laboratories to ensure all such laboratories in Ireland are using multiplex PCR and other rapid diagnostic technologies to test for multiple pathogens (SARS-CoV-2, influenza and RSV as a minimum) on a year-round basis.
6. Additional work be undertaken (which has already commenced) to better understand the testing pathway for specimens from nursing homes and residential care facilities and to inform recommendations to strengthen this testing pathway if needed.
7. Future surveys to include questions that collect data on multiplex testing capacity within each hospital i.e. the volume of PCR tests which can be undertaken by the laboratory each day in both the winter and summer periods.

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References

1. Health Protection Surveillance Centre (HPSC). 2022. EPI INSIGHT. Epidemiology of Respiratory Syncytial Virus in Ireland for the 2022/2023 season to date. Available at https://ndsc.newsweaver.ie/4otaa688p3/89am10onihz?lang=en&a=1&p=62413235&t=31302970 (Accessed on 15/08/2023)
2. Near-patient testing (hpra.ie) (Accessed on 14/08/2023)
3. Singleplex versus Multiplex Assay - LabCE.com, Laboratory Continuing Education (Accessed on 15/08/2023)
4. Guidelines for safe and effective near-patient testing (NPT) - Corporate (hse.ie) (Accessed 14/08/2023)
5. Clinical Diagnostic Point-of-Care Molecular Assays for SARS-CoV-2 - PMC (nih.gov) (Accessed on 09/10/2023)
6. World Health Organization. Regional Office for Europe. (2011). WHO Regional Office for Europe guidance for sentinel influenza surveillance in humans. World Health Organization. Regional Office for Europe. https://apps.who.int/iris/handle/10665/349780 (Accessed on 15/08/2023)
7. Qualtrics Qualtrics XM // The Leading Experience Management Software (Accessed on 16/08/2023)
8. Health Service Executive 2023. Introducing the HSE's New Health Regions. Published 31 July 2023. Available from: https://assets.hse.ie/media/documents/Introducing_HSE_Health_Regions.pdf (Accessed on 01/08/2023)

Appendices

Appendix 1: Analyses by HSE Health Region

Table 1: Availability of respiratory virus testing by HSE Health Region

HSE Health Region	Number of responding hospitals	Number and (%) of hospitals conducting laboratory testing on site	Number and (%) of hospitals conducting Near Patient Testing	Number and (%) of hospitals conducting any respiratory virus testing (either laboratory or near-patient or both)
HSE Dublin and North East	7	7 (100.0)	2 (28.6)	7 (100.0)
HSE Dublin and Midlands	7	7 (100.0)	4 (57.1)	7 (100.0)
HSE Dublin and South East	6	6 (100.0)	1 (16.7)	6 (100.0)
HSE South West	3	3 (100.0)	2 (66.7)	3 (100.0)
HSE Mid-West	1	1 (100.0)	1 (100.0)	1 (100.0)
HSE West and North West	6	6 (100.0)	0 (0.0)	6 (100.0)
Total	**30**	**30 (100.0)**	**10 (33.3)**	**30 (100.0)**

Table 2: Type of molecular testing used by HSE Health Region

HSE Health Region	Number of responding hospitals	Number and (%) of hospitals using PCR/RT-PCR tests	Number and (%) of hospitals using rapid molecular tests	Number and (%) of hospitals using other molecular tests†
HSE Dublin and North East	7	7 (100.0)	1 (14.3)	0 (0.0)
HSE Dublin and Midlands	7	7 (100.0)	4 (57.1)	1 (14.2)
HSE Dublin and South East	6	6 (100.0)	2 (33.3)	0 (0.0)
HSE South West	3	3 (100.0)	1 (33.3)	0 (0.0)
HSE Mid-West	1	1 (100.0)	0 (0.0)	0 (0.0)
HSE West and North West	6	6 (100.0)	2 (33.3)	0 (0.0)
Total	**30**	**30 (100.0)**	**10 (33.3)**	**1 (3.3)**

†Including isothermal amplification, LAMP

Table 3: Singleplex* testing by HSE Health Region

HSE Health Region	Number of responding hospitals	Number and (%) of hospitals using Singleplex tests for influenza	Number and (%) of hospitals using Singleplex tests for SARS-CoV-2	Number and (%) of hospitals using Singleplex tests for RSV
HSE Dublin and North East	7	0 (0.0)	4 (57.1)	0 (0.0)
HSE Dublin and Midlands	7	0 (0.0)	5 (71.4)	0 (0.0)
HSE Dublin and South East	6	0 (0.0)	4 (66.7)	0 (0.0)
HSE South West	3	0 (0.0)	3 (100.0)	0 (0.0)
HSE Mid-West	1	0 (0.0)	0 (0.0)	0 (0.0)
HSE West and North West	6	0 (0.0)	3 (50.0)	0 (0.0)
Total	**30**	**0 (0.0)**	**19 (63.3)**	**0 (0.0)**

* *Singleplex testing is defined as "Singleplex PCR is used to detect one target sequence of DNA or RNA. This assay could be used to detect a specific virus or bacteria or determine if an individual has a gene of interest."*

Table 4: SARS-CoV-2 singleplex assays used by HSE Region

HSE Health Region	Singleplex assays
HSE Dublin & South East	Alinity m, Aries SARS CoV-2 Assay, Genesig RT-PCR SARS COV-2 assay, Xpert Xpress SARS-CoV-2
HSE Dublin & North East	Allplex SARS-CoV-2 Assay, Aries SARS CoV-2 Assay, VIASURE SARS-CoV-2 RealTime PCR detection kit, Xpert Xpress SARS-CoV-2
HSE Dublin & Midlands	Aries SARS CoV-2 Assay, Cobas SARS-CoV-2, Xpert Xpress SARS-CoV-2, Panther SARS-CoV-2 RNA TMA, COBAS LIAT POC, Genetic Signature EasyScreen SARS-CoV-2 assay *Other CoDiagnostics Logix Smart COVID-19 kit
HSE Mid West	n/a
HSE South West	Altona, Cobas SARS-CoV-2, RealTime SARS-CoV-2 assay, Xpert Xpress SARS-CoV-2
HSE West & North West	Aries SARS CoV-2 Assay, VIASURE SARS-CoV-2 RealTime PCR detection kit, Xpert Xpress SARS-CoV-2

Table 5: Multiplex assays used by HSE Region

HSE Health Region	Multiplex Assays
HSE Dublin & South East	Alinity m Resp-4-Plex AMP, Allplex Respiratory Panel 1, AusDiagnostics Respiratory viral panel, BioFire Respiratory 2.1-EZ Panel (EUA), FilmArray Extended respiratory panel, Xpert Xpress CoV-2/Flu/RSV plus, Xpert Xpress Flu A/B/RSV/SARS CoV-2
HSE Dublin & North East	Allplex Respiratory Panel 1, Allplex SARS-CoV-2/Flu/RSV kit, BioFire Respiratory 2.1-EZ Panel (EUA), Eplex respiratory pathogen 2 panel, FilmArray Extended respiratory panel, RESPIBIO Panel 2, VIASURE Flu A + B RealTime PCR Detection Kit, VIASURE SARS-CoV-2, Flu A/B and RSV realtime PCR detection Kit, Xpert Xpress CoV-2/Flu/RSV plus, Xpert Xpress Flu A/B/RSV/SARS CoV-2
HSE Dublin & Midlands	Allplex SARS-CoV-2/Flu/RSV kit, Aries Flu A/b/RSV & SARS CoV-2 assay, BioFire Respiratory 2.1-EZ Panel (EUA), Cobas SARS-CoV-2 & influenza A/B, Eplex respiratory pathogen 1 panel, Eplex respiratory pathogen 2 panel, Genesig SARS-CoV-2 Winterplex, FilmArray Extended respiratory panel, Luminex, NxTAG Respiratory Pathogen Panel + SARS-CoV-2 Assay, Xpert Xpress flu/RSV, Xpert Xpress CoV-2/Flu/RSV plus, Xpert Xpress Flu A/B/RSV/SARS CoV-2, Genetic Signatures Easyscreen Respiratory Plus Assay, Aptima Fusion Multiplex assay
HSE Mid West	Alinity m Resp-4-Plex AMP, BioFire Respiratory 2.1-EZ Panel (EUA), Xpert Xpress Flu A/B/RSV/SARS CoV-2
HSE South West	Eplex respiratory pathogen 1 panel, FilmArray Extended respiratory panel, Xpert Xpress CoV-2/Flu/RSV plus, Xpert Xpress Flu A/B/RSV/SARS CoV-2
HSE West & North West	Alinity m Resp-4-Plex AMP, Allplex Respiratory Panel 1, Allplex SARS-CoV-2/Flu/RSV kit, BioFire Respiratory 2.1-EZ Panel (EUA), Cobas SARS-CoV-2 & influenza A/B, Eplex respiratory pathogen 2 panel, FilmArray Extended respiratory panel, Xpert Xpress CoV-2/Flu/RSV plus, Xpert Xpress Flu A/B/RSV/SARS CoV-2

Table 6: Respiratory virus testing platforms by HSE Region

HSE Health Region	Platforms
HSE Dublin & South East	Alinity m System, Aries System, FilmArray 2.0 system, GeneXpert System, MT Prep 24, Nimbus, STARlet, Roche Flow Flex
HSE Dublin & North East	Aries System, BD Max, Eplex system, FilmArray 2.0 system, GeneXpert System, Nimbus, RespiBIO, Roche Flow Flex
HSE Dublin & Midlands	Aries System, Eplex system, FilmArray Torch system, FilmArray 2.0 system, GeneXpert System, Nimbus, QuantStudio, Roche Flow Flex Other* MagNA Pure, Lightcycler
HSE Mid West	Alinity m System, FilmArray Torch system, GeneXpert System, Cobas 5800 system
HSE South West	Cobas 5800 system, Cobas 6800 system, FilmArray Torch system, GeneXpert System, Other*KingFisher Flex, Lightcycler 480II , BioRad CFX96 thermocyclers
HSE West & North West	Alinity m System, Aries System, Cobas 6800 system, Eplex system, FilmArray Torch system, FilmArray 2.0 system, GeneXpert System, m2000 RealTime system, Nimbus

Table 7: Number and percentage of acute hospital laboratories referring specimens to the NVRL for additional testing, by HSE Region

HSE Health Region	Number and (%) of laboratories referring specimens to NVRL	Number and (%) of laboratories not referring specimens to NVRL
HSE Dublin and North East	6 (85.7)	1 (14.3)
HSE Dublin and Midlands	6 (85.7)	1 (14.3)
HSE Dublin and South East	5 (83.3)	1 (16.6)
HSE South West	1 (33.3)	2 (66.7)
HSE Mid-West	1 (100)	0 (0.0)
HSE West and North West	5 (83.3)	1 (16.7)
Total	**24 (80.0)**	**6 (20.0)**

Table 8: Overview of near patient testing (NPT) by HSE Region

HSE Health Region	Number of hospitals using NPT	Number and (%) of hospitals using molecular tests for NPT	Number and (%) of hospitals using antigen tests for NPT
HSE Dublin and North East	2	1 (50.0)	2 (100.0)
HSE Dublin and Midlands	4	3 (75.0)	1 (25.0)
HSE Dublin and South East	1	1 (100.0)	0 (0.0)
HSE South West	2	2 (100.0)	0 (0.0)
HSE Mid-West	1	1 (100.0)	0 (0.0)
HSE West and North West	0	0 (0.0)	0 (0.0)
Total	**10**	**8 (80.0)**	**3 (30.0)**

Table 9: Molecular tests used for near patient testing by HSE Region

HSE Health Region	Molecular tests
HSE Dublin and North East	Roche cobas Liat
HSE Dublin and Midlands	Abbott ID NOW, Roche cobas Liat
HSE Dublin and South East	Abbott ID NOW, Genexpert
HSE South West	Abbott ID NOW, Roche cobas Liat
HSE Mid-West	Abbott ID NOW
HSE West and North West	n/a

Table 10: Antigen tests used for near patient testing by HSE Region

HSE Health Region	Antigen tests
HSE Dublin and North East	Roche, Clinitest
HSE Dublin and Midlands	Clinitest
HSE Dublin and South East	n/a
HSE South West	n/a
HSE Mid-West	n/a
HSE West and North West	n/a

Appendix 2: Laboratory Survey Data Dictionary

Item	Type	Values and coding	Definition
Name of laboratory	Text		Name of laboratory
Consent		Y/N	Participant giving consent to their personal data being used for the purposes of the survey
Completed by	Text		Name of participant
Job title	Selected choice		Selected Choice
Job title - Other	Text		Specify other job title
Contact number	Number		Contact phone number of participant
Contact email	Text		Email address of participant
Respiratory testing performed		Y/N	Does the lab conduct respiratory virus testing on-site (including molecular or antigen-based methods, in either the laboratory or another location near the patient (near-patient testing
Respiratory testing location	Multiple choice		Where is the respiratory testing performed
		choiceId:1	Hospital Laboratory
		choiceId:2	Near patient testing (outside the laboratory in a location near the patient)
Referral source	Multiple choice		Referral source of the respiratory samples
		choiceId:1	General Practice (GP) / Primary Care
		choiceId:2	Hospital Emergency Departments
		choiceId:3	Hospital outpatients
		choiceId:4	Hospital inpatients
		choiceId:5	ICU/Critical Care
		choiceId:6	Continuing/convalescent/respite care wards
		choiceId:7	Community Hospitals
		choiceId:8	Nursing homes / elderly care homes
		choiceId:9	Residential care facilities (e.g. disability homes)
		choiceId:10	Other residential facilities (e.g. Direct Provision accommodation, homeless hostels, prisons)
		choiceId:11	Occupational health
		choiceId:12	Other (please specify)
	Text		To specify any other referral source of respiratory samples tested not listed above
Diagnostic testing technology	Multiple choice		Type of respiratory virus diagnostic testing technology used
		choiceId:1	Molecular
		choiceId:2	Antigen
Molecular testing type	Multiple choice		Type of molecular testing performed
		choiceId:1	PCR/RT-PCR

Item	Type	Values and coding	Definition
		choiceId:2	Rapid molecular tests (also known as point of care tests)
		choiceId:3	Other (including isothermal amplification, LAMP)
	Text		To specify any other type of molecular testing not listed above
	Multiple choice		Respiratory viruses tested for on-site using PCR/RT-PCR
Respiratory viruses PCR/RT-PCR		choiceId:1	SARS-CoV-2
		choiceId:2	Influenza (not typed)
		choiceId:3	Influenza A
		choiceId:4	Influenza B
		choiceId:5	RSV untyped
		choiceId:6	RSV A
		choiceId:7	RSV B
		choiceId:8	Adenovirus
		choiceId:9	Parainfluenza virus (Types 1 to IV)
		choiceId:10	Human metapneumovirus
		choiceId:11	Rhinovirus/Enterovirus
		choiceId:12	Seasonal Coronaviruses (OC43, NL63, 229E, HKU1
		choiceId:13	Bocavirus
		choiceId:14	Other
	Text		To specify any other respiratory virus tested not listed above
	Multiple choice		Respiratory viruses tested for on-site using rapid molecular tests (also known as point of care tests)
Respiratory viruses POCT		choiceId:1	SARS-CoV-2
		choiceId:2	Influenza (not typed)
		choiceId:3	Influenza A
		choiceId:4	Influenza B
		choiceId:5	RSV untyped
		choiceId:6	RSV A
		choiceId:7	SARS-CoV-8
		choiceId:8	Adenovirus
		choiceId:9	Parainfluenza virus (Types 1 to IV)
		choiceId:10	Human metapneumovirus
		choiceId:11	Rhinovirus/Enterovirus
		choiceId:12	Seasonal Coronaviruses (OC43, NL63, 229E, HKU1)
		choiceId:13	Bocavirus
		choiceId:14	Other
	Text		To specify any other respiratory virus tested not listed above
	Multiple choice		Respiratory viruses tested for on-site using other molecular methods (such as LAMP)
		choiceId:1	SARS-CoV-2

Item	Type	Values and coding	Definition
Respiratory viruses other molecular		choiceId:2	Influenza (not typed)
		choiceId:3	Influenza A
		choiceId:4	Influenza B
		choiceId:5	RSV untyped
		choiceId:6	RSV A
		choiceId:7	RSV B
		choiceId:8	Adenovirus
		choiceId:9	Parainfluenza virus (Types 1 to IV)
		choiceId:10	Human metapneumovirus
		choiceId:11	Rhinovirus/Enterovirus
		choiceId:12	Seasonal Coronaviruses (OC43, NL63, 229E, HKU1)
		choiceId:13	Bocavirus
		choiceId:14	Other
	Text		To specify any other respiratory virus tested not listed above
		Y/N	Does the lab conduct on-site singleplex PCR/RT-PCR testing for influenza (i.e. testing that is only for influenza)
Singleplex influenza testing	Multiple choice		Singleplex PCR/RT-PCR assays used to detect influenza
Singleplex influenza assays		choiceId:1	In-house developed assay
		choiceId:2	Commercial assay
	Text		To specify the commercial assay
		Y/N	Does the laboratory conduct on-site PCR/RT-PCR testing that only tests for SARS-CoV-2
Singleplex SARS-CoV-2 testing	Multiple choice		Singleplex PCR/RT-PCR assays used to detect SARS-CoV-2
Singleplex SARS-CoV-2 assays		choiceId:1	Alinity m
		choiceId:2	Allplex SARS-CoV-2 Assay
		choiceId:3	Altona
		choiceId:4	Aries SARS CoV-2 Assay
		choiceId:5	BD SARS-CoV-2
		choiceId:6	Cobas SARS-CoV-2
		choiceId:7	EPlex SARS CoV-2 Test
		choiceId:8	Genesig RT-PCR SARS COV-2 assay
		choiceId:9	RealTime SARS-CoV-2 assay
		choiceId:10	RESPIBIO Panel 1
		choiceId:11	VIASURE SARS-CoV-2 RealTime PCR detection kit
		choiceId:12	Xpert Xpress SARS-CoV-2
		choiceId:13	Other
	Text		To specify any other singleplex assay(s) to detect SARS-CoV-2

Item	Type	Values and coding	Definition
		Y/N	Does the laboratory conduct on-site PCR/RT-PCR testing that only tests for RSV
Singleplex RSV testing	Multiple choice		Singleplex PCR/RT-PCR assays used to detect RSV
Singleplex RSV assays		choiceId:1	In-house developed assay
		choiceId:2	Commercial assay
	Text		To specify the commercial assay
		Y/N	Does the laboratory conduct on-site PCR/RT-PCR multiplex testing
Multiplex testing	Multiple choice		
Multiplex assays		choiceId:1	AlinitymResp-4-PlexAMP
		choiceId:2	Allplex RespiratoryPanel1
		choiceId:3	AllplexSARS-CoV-2/Flu/RSVkit
		choiceId:4	AriesFluA/B&RSVassay
		choiceId:5	AriesFluA/b/RSV&SARSCoV-2assay
		choiceId:6	AusDiagnosticsRespiratoryviralpanel
		choiceId:7	BioFireRespiratory2.1-EZPanel(EUA)
		choiceId:8	CobasSARS-CoV-2&influenzaA/B
		choiceId:9	CobasInfluenzaA/B&RSVUCTest
		choiceId:10	Eplexrespiratorypathogen1panel
		choiceId:11	Eplexrespiratorypathogen2panel
		choiceId:12	GenesigSARS-CoV-2Winterplex
		choiceId:13	FilmArrayExtendedrespiratorypanel
		choiceId:14	FTDSARS-CoV-2/FluA/FluB/HRSVAssay
		choiceId:15	IDNOWInfluenzaA&B2
		choiceId:16	Luminex,NxTAGRespiratoryPathogenPanel+SARS-CoV-2Assay
		choiceId:17	NxTAGCoVExtendedpanelassay
		choiceId:18	RESPIBIOPanel2
		choiceId:19	RESPIBIOPanel3
		choiceId:20	TaqPathCOVID-19/fluA/B&RSVkit
		choiceId:21	TaqPathCOVID-19Combokit
		choiceId:22	VIASUREFluA+BRealTimePCRDetectionKit
		choiceId:23	VIASURESARS-CoV-2,FluA/BandRSVrealtimePCRdetectionKit
		choiceId:24	XpertXpressflu/RSV
		choiceId:25	XpertXpressCoV-2/Flu/RSVplus
		choiceId:26	XpertXpressFluA/B/RSV/SARSCoV-2
		choiceId:27	Other
	Text		To specify the other multiplex assay(s)
	Multiple choice		
Platforms		choiceId:1	Alinity m System
		choiceId:2	Aries System

Item	Type	Values and coding	Definition
		choiceId:3	BD Max
		choiceId:4	Cobas 5800 system
		choiceId:5	Cobas 6800 system
		choiceId:6	Cobas 8800 system
		choiceId:7	Eplex system
		choiceId:8	FilmArray Torch system
		choiceId:9	FilmArray 2.0 system
		choiceId:10	GeneXpert System
		choiceId:11	Highplex Alliance
		choiceId:12	MT Prep 24
		choiceId:13	MT Prep Access
		choiceId:14	MT Prep XL
		choiceId:15	m2000 RealTime system
		choiceId:16	Nimbus
		choiceId:17	QuantStudio
		choiceId:18	RespiBIO
		choiceId:19	STARlet
		choiceId:20	Ultraplex Alliance
		choiceId:21	Verigene System
		choiceId:22	V-Lab96 VIASURE Real Time PCR platform
		choiceId:23	V-Flex System
		choiceId:24	Other
	Text		To specify the other platform(s)
	Multiple choice		The rapid molecular tests (also known as point of care tests) used in the laboratory
Rapid molecular tests		choiceId:1	Abbott ID NOW
		choiceId:2	Biofire Spotfire
		choiceId:3	Film Array System
		choiceId:4	Genexpert
		choiceId:5	Quidel Savanna
		choiceId:6	Roche cobas Liat
		choiceId:7	Other
	Text		To specify the other rapid molecular test(s)
		Y/N	Subtype influenza A positive specimens
Type influenza A		Y/N	Further classification of influenza B specimens
Type Influenza B	Single choice		Frequency of influenza PCR/RT-PCR testing during the winter period (i.e. approximately October to May)
Frequency influenza PCR/RT-PCR winter		choiceId:1	Every day (7 days per week)
		choiceId:2	Every weekday (Monday to Friday)
		choiceId:3	Selected weekdays only
		choiceId:4	Other

Item	Type	Values and coding	Definition
	Text		To specify any other frequency of testing
		Y/N	Does the laboratory offer an out of hours testing service for influenza during the winter period (approximately October to May)
Influenza out of hours testing in winter	Single choice		Frequency of influenza PCR/RT-PCR during the summer period (i.e. approximately June to September)
Frequency influenza PCR/RT-PCR summer		choiceId:1	Every day (7 days per week)
		choiceId:2	Every weekday (Monday to Friday)
		choiceId:3	Selected weekdays only
		choiceId:4	Does not test outside of the winter period
		choiceId:5	Other
	Text		To specify any other frequency of testing
		Y/N	Does the laboratory offer an out of hours testing service for influenza during the summer period (approximately June to September)
Influenza out of hours testing in summer	Single choice		Frequency of SARS-CoV-2 PCR/RT-PCR testing during the winter period (i.e. approximately October to May)
Frequency SARS-CoV-2 PCR/RT-PCR winter		choiceId:1	Every day (7 days per week)
		choiceId:2	Every weekday (Monday to Friday)
		choiceId:3	Selected weekdays only
		choiceId:4	Other
	Text		To specify any other frequency of testing
		Y/N	Does the laboratory offer an out of hours testing service for SARS-CoV-2 during the winter period (approximately October to May)
SARS-CoV-2 out of hours testing in winter	Single choice		Frequency of SARS-CoV-2 PCR/RT-PCR during the summer period (i.e. approximately June to September)
Frequency SARS-CoV-2 PCR/RT-PCR summer		choiceId:1	Every day (7 days per week)
		choiceId:2	Every weekday (Monday to Friday)
		choiceId:3	Selected weekdays only
		choiceId:4	Does not test outside of the winter period
		choiceId:5	Other
	Text		To specify any other frequency of testing
		Y/N	Does the laboratory offer an out of hours testing service for SARS-CoV-2 during the summer period (approximately June to September)
SARS-CoV-2 out of hours testing in summer	Single choice		Frequency of RSV PCR/RT-PCR testing during the winter period (i.e. approximately October to May)

Item	Type	Values and coding	Definition
Frequency RSV PCR/RT-PCR winter		choiceId:1	Every day (7 days per week)
		choiceId:2	Every weekday (Monday to Friday)
		choiceId:3	Selected weekdays only
		choiceId:4	Other
	Text		To specify any other frequency of testing
		Y/N	Does the laboratory offer an out of hours testing service for RSV during the winter period (approximately October to May)
RSV out of hours testing in winter	Single choice		Frequency of RSV PCR/RT-PCR during the summer period (i.e. approximately June to September)
Frequency RSV PCR/RT-PCR summer		choiceId:1	Every day (7 days per week)
		choiceId:2	Every weekday (Monday to Friday)
		choiceId:3	Selected weekdays only
		choiceId:4	Does not test outside of the winter period
		choiceId:5	Other
	Text		To specify any other frequency of testing
		Y/N	Does the laboratory offer an out of hours testing service for RSV during the summer period (approximately June to September)
RSV out of hours testing in summer		Y/N/Don't know	Planning on using multiplex PCR / RT-PCR testing for respiratory viruses in the future
Multiplex plan	Single choice		When will multiplex PCR/RT-PCR testing for respiratory viruses be introduced
Multiplex introduced		choiceId:1	To be introduced during the 2023/2024 winter season (October 2023 to May 2024)
		choiceId:2	To be introduced after the 2023/2024 winter season
		choiceId:3	Don't know
			Provide further information on when multiplex PCR / RT-PCR testing for respiratory viruses will be introduced
Multiplex further information		Y/N	Does the laboratory refer any clinical respiratory specimens to the National Virus Reference Laboratory (NVRL) for additional testing
NVRL referral	Multiple choice		
NVRL referred specimens' source		choiceId:1	General Practice (GP) / Primary Care
		choiceId:2	Hospital Emergency Departments
		choiceId:3	Hospital outpatients
		choiceId:4	Hospital inpatients
		choiceId:5	ICU/Critical Care
		choiceId:6	Continuing/convalescent/respite care wards
		choiceId:7	Community Hospitals
		choiceId:8	Nursing homes / elderly care homes

Item	Type	Values and coding	Definition
		choiceId:9	Residential care facilities (e.g. disability homes)
		choiceId:10	Other residential facilities (e.g. Direct Provision accommodation, homeless hostels, prisons)
		choiceId:11	Occupational health
		choiceId:12	Other
	Text		To specify the other source(s)
	Multiple choice		
NVRL specimen referral reasons		choiceId:1	Confirmation of diagnosis
		choiceId:2	To test for extended respiratory virus panel
		choiceId:3	To request Influenza A subtyping
		choiceId:4	For further characterisation of influenza B viruses
		choiceId:5	To request antiviral resistance testing for influenza
		choiceId:6	To request antiviral resistance testing for SARS-CoV-2
		choiceId:7	To request influenza genetic/antigenic testing
		choiceId:8	For SARS-CoV-2 whole genome sequencing (WGS)
		choiceId:9	To test for Avian influenza/other novel influenza virus e.g. to test for HPAI in exposed worker (vet, culler etc)
		choiceId:10	Additional testing requested by HPSC for surveillance purposes
		choiceId:11	Additional testing requested by local Department of Public Health
		choiceId:12	Other
	Text		To specify the other reason(s)
	Multiple choice		What pathogens are tested for using near-patient testing (NPT)
Respiratory viruses NPT		choiceId:1	SARS-CoV-2
		choiceId:2	Influenza (not typed)
		choiceId:3	Influenza A
		choiceId:4	Influenza B
		choiceId:5	RSV untyped
		choiceId:6	RSV A
		choiceId:7	SARS-CoV-8
		choiceId:8	Adenovirus
		choiceId:9	Parainfluenza virus (Types 1 to IV)
		choiceId:10	Human metapneumovirus
		choiceId:11	Rhinovirus/Enterovirus
		choiceId:12	Seasonal Coronaviruses (OC43, NL63, 229E, HKU1)
		choiceId:13	Bocavirus
		choiceId:14	Other
			To specify any other respiratory virus not listed above
	Multiple choice		Are the NPTs used in the laboratory antigen or molecular based tests

Item	Type	Values and coding	Definition
NPT test type		choiceId:1	Molecular based
		choiceId:2	Antigen based
	Multiple choice		Molecular near-patient testing (NPT) tests used
Molecular NPTs		choiceId:1	Abbott ID NOW
		choiceId:2	Biofire Spotfire
		choiceId:3	Film Array System
		choiceId:4	Genexpert
		choiceId:5	Quidel Savanna
		choiceId:6	Roche cobas Liat
		choiceId:7	Other
	Text		To specify any other molecular NPT test(s)
	Multiple choice		Antigen near-patient testing (NPT) tests used
Antigen NPTs		choiceId:1	Flowflex
		choiceId:2	Roche
		choiceId:3	Clinitest
		choiceId:4	Other
	Text		To specify any other antigen NPT test(s)
	Multiple choice		Under what circumstances is near-patient testing (NPT) used
NPT circumstances		choiceId:1	Routine use
		choiceId:2	Seasonal use
		choiceId:3	During outbreaks
		choiceId:4	During peaks in hospital bed pressures
		choiceId:5	For health and care workers (Occupational health)
		choiceId:6	Other
	Text		To specify any other circumstance(s)
	Multiple choice		Which settings does the laboratory use NPT
NPT settings		choiceId:1	Emergency Department
		choiceId:2	Inpatient wards
		choiceId:3	ICU
		choiceId:4	Outpatient departments
		choiceId:5	Occupational Health
		choiceId:6	Continuing/convalescent/respite care wards
		choiceId:7	Other
	Text		To specify any other setting(s)
	Single choice		Frequency of influenza NPT during the winter period (i.e. approximately October to May)
Frequency NPT influenza winter		choiceId:1	Every day (7 days per week)
		choiceId:2	Every weekday (Monday to Friday)
		choiceId:3	Selected weekdays only
		choiceId:4	Other
	Text		To specify any other frequency of testing

Item	Type	Values and coding	Definition
	Single choice		Frequency of influenza NPT during the summer period (i.e. approximately June to September)
Frequency NPT influenza summer		choiceId:1	Every day (7 days per week)
		choiceId:2	Every weekday (Monday to Friday)
		choiceId:3	Selected weekdays only
		choiceId:4	Does not test outside of the winter period
		choiceId:5	Other
	Text		To specify any other frequency of testing
	Single choice		Frequency of SARS-CoV-2 NPT during the winter period (i.e. approximately October to May)
Frequency NPT SARS-CoV-2 winter		choiceId:1	Every day (7 days per week)
		choiceId:2	Every weekday (Monday to Friday)
		choiceId:3	Selected weekdays only
		choiceId:4	Other
	Text		To specify any other frequency of testing
	Single choice		Frequency of SARS-CoV-2 NPT during the summer period (i.e. approximately June to September)
Frequency NPT SARS-CoV-2 summer		choiceId:1	Every day (7 days per week)
		choiceId:2	Every weekday (Monday to Friday)
		choiceId:3	Selected weekdays only
		choiceId:4	Does not test outside of the winter period
		choiceId:5	Other
	Text		To specify any other frequency of testing
	Single choice		Frequency of RSVNPT during the winter period (i.e. approximately October to May)
Frequency NPT RSV winter		choiceId:1	Every day (7 days per week)
		choiceId:2	Every weekday (Monday to Friday)
		choiceId:3	Selected weekdays only
		choiceId:4	Other
	Text		To specify any other frequency of testing
	Single choice		Frequency of RSV NPT during the summer period (i.e. approximately June to September)
Frequency NPT RSV summer		choiceId:1	Every day (7 days per week)
		choiceId:2	Every weekday (Monday to Friday)
		choiceId:3	Selected weekdays only
		choiceId:4	Does not test outside of the winter period
		choiceId:5	Other
	Text		To specify any other frequency of testing
	Text		Additional information to add
Comments			