Research Square

Preprints are preliminary reports that have not undergone peer review.
They should not be considered conclusive, used to inform clinical practice,
or referenced by the media as validated information.

Community pharmacy-based nasopharyngeal sampling is safe and feasible for respiratory virus surveillance in New Zealand

Alex Semprini

alex.semprini@mrinz.ac.nz

Medical Research Institute of New Zealand

Kyley Kerse
Sarah Jefferies
Melemafi Porter
Richard Beasley
Andrea McNeill
Selwyn Te Paa
Trisha Falleni
Gabrielle Shortt
Nicholas Shortt
Alexander Martin
https://orcid.org/0000-0002-0131-5480
Bianca Black
Allie Eathorne
Thomas Hills
Ruth Semprini
Carina Soeteman
Declan Murphy
Shirena Vasan
Martin Lowis
Ben Waite
https://orcid.org/0000-0003-0909-8078
Lauren Jelley

Article

Keywords:

Posted Date: September 10th, 2026

DOI: https://doi.org/10.21203/rs.3.rs-10732386/v1

License: This work is licensed under a Creative Commons Attribution 4.0 International License.
Read Full License

Additional Declarations: There is **NO** Competing Interest.

Abstract

Background

New Zealand's respiratory viral surveillance relies on nasopharyngeal swab (NPS) collection from hospitals and the Sentinel General Practice Respiratory Virus Surveillance Network (SGPRVS). Many New Zealanders face barriers accessing clinical care, and current systems may not accurately reflect circulating respiratory virus epidemiology. We assessed whether community pharmacies could extend NPS-based surveillance.

Methods

We conducted a multi-centre observational study in 22 community pharmacies over two winter and one inter-seasonal period during 2024–2025. Adults with influenza-like illness provided NPS for reverse transcriptase polymerase chain reaction (RT-PCR) analysis at the New Zealand World Health Organisation National Influenza Centre. Detection and collection rates were compared with contemporaneous SGPRVS data using chi-squared tests. Acceptability was assessed using five-point Likert scales.

Results

We found comparable overall positivity between 467 pharmacy and 4181 SGPRVS swabs (238/467 (51.0%) versus 2185/4181 (52.3%); $\chi^2 = 0.28$, $p = 0.59$). Collection rates were similar (mean 0.5 swabs per site per week). Pharmacy rhinovirus detection was higher (15.8% versus 10.3%, $p < 0.001$), and influenza lower (19.5% versus 25.2%, $p = 0.0065$). Two minor adverse events occurred (0.4%), both epistaxis. Most participants found pharmacy-based swab collection convenient (91.7%) and would participate again (96.1%). Investigators felt confident collecting swabs and 25/27 (92.6%) would participate again.

Conclusions

Pharmacy-based NPS collection is feasible, acceptable, and safe with detection rates comparable to the SGPRVS, and enhanced capture of rhinovirus consistent with milder illness. Community pharmacies could extend national surveillance of respiratory viruses and improve representation of populations with limited access to primary care.

Plain English Summary

Knowing which respiratory viruses are spreading in the community helps health services prepare for winter and future pandemics. In New Zealand, the samples used to track these viruses are collected in

hospitals and general practices, however many people are either not unwell enough to attend these or cannot get or afford an appointment. We explored whether community pharmacies could collect swabs from the back of the nose cavity and reach more people. Over two winters, 22 pharmacies took swabs from people with fever and cough for testing. Results were similar to those from the general practices and all participants said they would take part again. Pharmacies can therefore help to support wider virus monitoring.

Introduction

The ongoing COVID-19 pandemic highlighted the serious, multifaceted risk infectious diseases pose to humanity. Respiratory viral pathogens, such as severe acute respiratory syndrome coronavirus-2 (SARS-CoV-2) and influenza present a particular challenge to regional and global health responses, due to high transmission rates, heterogeneity in clinical severity, and the potential to trigger a global pandemic.[1,2]

In 1953 the World Health Organisation (WHO) established the Global Influenza Surveillance and Response System (GISRS), to monitor the international epidemiology and clinical burden of influenza, detect novel respiratory pathogens, viral mutations, and inform pandemic preparedness and response.[3] Currently there are 130 WHO member states involved, each with local surveillance infrastructure that contributes to national public health response and global data sets via the GISRS. In New Zealand (NZ), the NZ Institute for Public Health and Forensic Science (PHF Science), hosts a WHO National Influenza Centre, and leads a programme to collect respiratory illness data from environmental, general practice (GP), and hospital-based sources (Fig. 1).[4]

[Figure 1]

All sampling is via nasopharyngeal swabs, analysed by reverse transcriptase polymerase chain reaction (RT-PCR) at the central PHF Science laboratory. The top layers of the pyramid represent the most severe spectrum of acute respiratory infection, with samples collected from patients admitted to wards and the intensive care units of four hospitals in the Auckland region, NZ's major population centre. PHF Science also requests viral specimens are referred to them throughout the year from patients with severe viral respiratory infections admitted to hospitals around the country, based on various sampling criteria. Primary care and community focused systems collect symptomatic data via Healthline, a national telephone health advisory service, and nasopharyngeal samples through the Sentinel General Practice Respiratory Virus Surveillance network (SGPRVS).[5] The SGPRVS is a network of GP practices which identify up to six patients a week presenting with symptoms of influenza-like illness (ILI) willing to provide a nasopharyngeal swab. The FluTracking system monitors symptomatic trends through a voluntary online reporting tool and the PHF Science wastewater surveillance programme provides information specific to SARS-CoV-2 with a 45% population coverage.[6] NZ virological data from the hospital and GP-based networks is provided to the WHO GISRS, contributing to global surveillance.

Many New Zealanders face significant barriers to accessing healthcare. 14.9% of all adults actively avoid seeing their general practitioner due to cost, with the proportion even higher in vulnerable groups such as Indigenous Māori (18.7%), Pacific (25.1%) and disabled peoples (22.8%).[7] Furthermore, 6% of the population is not registered with a primary care organisation and up to 80% of general practices have ceased new patient enrolment due to stretched resources.[8,9] Compounding this is a fragile workforce, with 34% of NZ GPs intending to retire within five years and 18% considering leaving NZ.[10] These factors, combined with geographic isolation for many rural communities, create systematic biases towards surveillance of healthcare-engaged urban populations, with financial means.

Understanding the circulating burden of respiratory viruses is critical to ensuring a prompt and broad public health response. This is particularly relevant for those populations who experience a disproportionate burden of severe respiratory illness, evidenced by a widening disparity in hospitalisation rates for Māori and Pacific peoples compared to European/Other populations.[11] Novel approaches to surveillance are therefore needed to ensure a representative, agile, and adaptive approach to pandemic prevention, preparedness, and response.[12]

Community pharmacies in NZ continued to provide essential health services during the emergency phase of the COVID-19 pandemic, in the face of unprecedented clinical, societal, and economic pressures. In addition to undertaking supervised antigen-detection rapid diagnostic tests (Ag-RDT), pharmacies were relied upon to deliver COVID-19 vaccination services under an expanded scope, a role which continues today.[13,14] Leveraging this clinical service capacity presents an opportunity to enhance the detection of circulating viruses via expansion of the sentinel virological surveillance network. Prior to the pandemic, a NZ network of research trained pharmacies, the Pharmacy Research Network (PRN) had been established to undertake randomised controlled trials (RCT) embedded in the community, with a mandate to increase representation in research and provide real-world data with high external validity.[15–17] In addition to maintaining routine clinical services, > 150 PRN pharmacies have enrolled and followed up over 2,000 clinical trial participants across NZ demonstrating their unique capacity for clinical research.

We hypothesised that pharmacies could extend and enhance current community-based respiratory virus surveillance in NZ, providing gold-standard nasopharyngeal samples to a WHO National Influenza Centre for analysis. This study assessed the feasibility, safety and acceptability of pharmacy-based surveillance in 22 sites across NZ.

Methods

Study design

We conducted a multi-centre, single-group observational study in 22 NZ community pharmacies. Nasopharyngeal swabs were collected between week 18, 2024 and week 39, 2025 to encompass two winter surveillance seasons and one inter-seasonal period. Pharmacy swabs were compared with those

taken in the SGPRVS by 77 GPs over the same period. Ethics approval was obtained on 8 April 2024 from the Central Health and Disability Ethics Committee (2024 FULL 19736) and regulations adhered to during the study. The study was designed and is reported in line with STROBE guidelines.[18]

Participants

Participants were required to be ≥ 18 years, have a self-reported/measured fever ≥38°C and cough with onset ≤ 10 days, be currently registered with a GP, and have a National Health Index patient number.[19] Participants were ineligible if they reported any nasopharyngeal or sinus condition that would impair the swabbing procedure, facial trauma in the last 30 days, surgery or invasive clinical procedures to the facial region or upper airways/sinuses in the last 90 days, history of coagulopathy or current use of anticoagulants, participation in the SGPRVS system or current study in the past four weeks, or current confirmed COVID-19 infection.

Study screening and intervention

Individuals attending pharmacy, presenting with symptoms of ILI and/or seeking treatment, were approached for study screening. Social media and in-store study advertising was used. Informed consent was obtained using a digital PRN study tablet, followed by confirmation of eligibility by the pharmacy-based investigator. A nasopharyngeal swab was then collected by the trained investigator according to the Health New Zealand/Te Whatu Ora specimen collection procedure and stored in an onsite refrigerator.[20] Samples were couriered weekly to the PHF Science laboratory in Wellington, NZ, according to the established cold-chain transportation protocol for the SGPRVS.[5] Swab results were provided to participants by the Medical Research Institute of New Zealand (MRINZ). Ten days following enrolment, study participants completed a digital follow-up survey to assess swab procedure related safety events, and provide feedback on the experience and acceptability of participation. On study completion participating pharmacy-based investigators completed a survey assessing their experience and acceptability of delivering the programme.

Outcome measures

The primary outcome was the proportion of samples received by PHF Science detecting a positive result for a priority acute respiratory pathogen, determined by RT-PCR analysis. Secondary outcomes included: comparison of detection rates and viral subtypes (influenza, SARS-CoV-2, RSV, adenovirus, enterovirus, human metapneumovirus, parainfluenza, and rhinovirus) with the SGPRVS; number of weeks pharmacists completed ≥ 3 samples per week during the peak winter season; time to three samples per week should aberrant inter-seasonal ILI activity emerge; acceptability of patient participation assessed via a five-point Likert scale at day 10 post-swab; and acceptability of pharmacist participation assessed

via a five-point Likert scale at study completion. Adverse events of special interest included epistaxis, local infection, cerebrospinal fluid leakage, local trauma, and swab ingestion or retention.

Statistics and reproducibility

Results are presented using descriptive statistics and graphically where appropriate. For continuous variables, the number of observations, mean, SD, median, minimum, and maximum are presented; categorical variables are summarised by counts and percentages. Ethnicity was classified using the New Zealand Census prioritised ethnicity classification. Results are presented as combined and individual winter seasons, and the inter-seasonal period. Comparison of the mean proportion of weeks where ≥ 3 samples were taken is by simple t-test. Comparison of the proportion of positive results and viral subtype is by Chi-square test. Scatter plots with Locally Estimated Scatterplot Smoothing (LOESS) smoothers are displayed, with smoothing parameters of 0.6 for viral positivity and 0.2 for swab collection rates. Participant and pharmacist acceptability are described by means, SD, median, minimum and maximum, and by counts (n) and proportions.

The primary purpose of the study was to determine operational feasibility of nasopharyngeal swab collection through community pharmacies. To ensure adequate precision of viral positivity rate estimation and allow comparison with the SGPRVS, 477 samples were collected over the study period, including two winter surveillance seasons and one inter-seasonal period. Swab collections were capped at 159 during the inter-seasonal period, to ensure a minimum of 318 swabs during the pooled winter period. Assuming a similar proportion of samples obtained from the SGPRVS during the 2022 winter season (54.3%), 318 samples provides a confidence interval (95% CI) ±5% for the proportion of positive samples. For the inter-seasonal period, assuming the 2022 positivity rate of 30%, 159 swabs provides a 95% CI of ± 7%, widening to ± 15% if sample collection reduced to 50 swabs.

Results

Between week 18, 2024 and week 39, 2025, 487 participants were consented through 20 of the 22 research pharmacies, of which 481 were confirmed eligible and 477 swabbed (Fig. 2). Seven participants were excluded through protocol deviations and three swab samples were not forwarded to the laboratory. Study completion was 97.7% (459/470), with 8 participants lost to follow up and 3 not completing due to a protocol deviation.

[Figure 2]

Demographics and baseline characteristics

Characteristics are reported according to PHF Science aggregate data standards (Table 1). Pharmacy participants had a mean age of 38.5 years (SD 15.8), were predominantly female (312/470, 66.4%) and of European ethnicity (314/470, 66.8%). In the SGPRVS, the mean age was 32.3 (SD 22.3), 387/4181

(57.1%) participants were female and 2256/4181 (54%) of European ethnicity. In the pharmacy group, 385/470 (81.9%) participants were of working age (20 to 64 years) compared to 2282/4181 (54.6%) in the SGPRVS.

Table 1
Participant characteristics, reported to PHF Science standards. *Pharmacy recruitment was restricted to ≥18 years. MELAA = Middle Eastern. Latin American, African.

Variable	Pharmacy N/470 (%)	SGPRVS N/4181 (%)
Sex		
Female	312 (66·4)	2387 (57·1)
Male	158 (33·6)	1764 (42·2)
Unknown	0 (0)	30 (0·7)
Ethnicity		
Asian	58 (12·3)	729 (17·4)
European	314 (66·8)	2256 (54)
MELAA	5 (1·1)	153 (3·7)
Māori	83 (17·7)	642 (15·4)
Pacific peoples	9 (1·9)	274 (6·6)
Unknown/Prefer not to say	1 (0·2)	127 (3)
Age group		
< 5	0 (0)*	474 (11·3)
5 to 19	49 (10·4)*	997 (23·8)
20 to 64	385 (81·9)	2282 (54·6)
65+	36 (7·7)	428 (10·2)

[Table 1]

Among pharmacy participants, 139/470 (29.6%) had received an influenza vaccination and 53/470 (11.3%) a COVID-19 vaccination in the current calendar year, and 5/470 (1.1%) reported use of antiviral medications in the previous 10 days.

Virus positivity

Across the whole study period, overall positivity for respiratory viruses was comparable between the pharmacy (238/467, 51.0%) and the SGPRVS (2185/4181, 52.3%) settings ($\chi^2 = 0.28$, p = 0.59) (Table 2).

Table 2
Viral positivity for all swabs

Total positive swabs	**Pharmacy N/467 (%)**	**SGPRVS N/4181 (%)**	**χ^2**	**P**
	238 (51)	**2185 (52·3)**	**0·28**	**0·59**
Influenza	91 (19·5)	1054 (25·2)	7·41	0·0065
A	70 (15)	824 (19·7)	6·02	0·014
H1	43 (9·2)	474 (11·3)	1·93	0·17
H3	27 (5·8)	337 (8·1)	3·02	0·08
B	21 (4·5)	230 (5·5)	0·83	0·36
Enterovirus	2 (0·4)	84 (2)	5·78	0·016
SARS-CoV-2	15 (3·2)	106 (2·5)	0·76	0·38
Respiratory Syncytial Virus	22 (4·7)	262 (6·3)	1·77	0·18
Adenovirus	6 (1·3)	78 (1·9)	0·80	0·37
Human Metapneumovirus	25 (5·4)	166 (4)	2·04	0·15
Rhinovirus	74 (15·8)	431 (10·3)	13·30	0·0003
Parainfluenza	10 (2·1)	153 (3.7)	2.86	0.091
Parainfluenza type 1	1 (0·2)	45 (1·1)	3·19	0·074
Parainfluenza type 2	4 (0·9)	20 (0·5)	1·17	0·28
Parainfluenza type 3	5 (1·1)	88 (2·1)	2·29	0·13

[Table 2]

The predominant virus detected in both settings was influenza with detection statistically significantly lower in pharmacies (19.5% vs 25.2%, χ^2=7.41, p = 0.0065) (Table 2, Fig. 3). Among influenza A subtypes, A/H1 was detected in 43/469 (9.2%) of pharmacy samples versus 474/4181 (11.3%) in the SGPRVS, and A/H3 in 27/467 (5.8%) versus 337/4181 (8.1%) respectively. Influenza B was detected in 21/467 (4.5%) of pharmacy samples versus 230/4181 (5.5%) in the SGPRVS. Enterovirus detection was also significantly lower in pharmacies (0.4% vs 2.0%, χ^2=5.78, p = 0.016).

In contrast, rhinovirus detection was significantly higher in pharmacies (15.8% vs 10.3%, χ^2=13.30, p < 0.001).

No significant differences were observed for SARS-CoV-2 (3.2% vs 2.5%), RSV (4.7% vs 6.3%), human metapneumovirus (5.4% vs 4.0%), adenovirus (1.3% vs 1.9%), parainfluenza type 1 (0.2% vs 1.1%), parainfluenza type 2 (0.9% vs 0.5%), and parainfluenza type 3 (1.1% vs 2.1%) (Table 2, Fig. 3).

[Figure 3]

Pooled winter positivity was 219/412 (53.2%) in pharmacies and 2020/3742 (54.0%) in the SGPRVS (Table 3). During the pooled inter-seasonal period, overall positivity was lower in both settings, 19/55 (34.5%) in pharmacies and 165/439 (37.6%) in the SGPRVS. Inter-seasonal influenza detection was similar between settings (7.3% pharmacy vs 7.5% SGPRVS), as was rhinovirus (12.7% pharmacy vs 13.2% SGPRVS), while SARS-CoV-2 detection was higher than during winter in both pharmacy (5.5% vs 2.9%) and SGPRVS (4.1% vs 2.4%) samples (Table 3).

Table 3
Viral positivity by season

	Pharmacy N/N (%)		**SGPRVS N/N (%)**	
	Winter	**Inter-seasonal**	**Winter**	**Inter-seasonal**
	N = 412	**N = 55**	**N = 3742**	**N = 439**
Total positive swabs	219 (53·2)	19 (34·5)	2020 (54)	165 (37·6)
Influenza	87 (21·1)	4 (7·3)	1021 (27·3)	33 (7·5)
A	68 (16·5)	2 (3·6)	795 (21·2)	29 (6·6)
H1	41 (10)	2 (3·6)	450 (12)	24 (5·5)
H3	27 (6·6)	0 (0)	334 (8·9)	3 (0·7)
B	19 (4·6)	2 (3·6)	226 (6)	4 (0·9)
Enterovirus	2 (0·5)	0 (0)	76 (2)	8 (1·8)
SARS-CoV-2	12 (2·9)	3 (5·5)	88 (2·4)	18 (4·1)
Respiratory Syncytial Virus	22 (5·3)	0 (0)	253 (6·8)	9 (2·1)
Adenovirus	5 (1·2)	1 (1·8)	65 (1·7)	13 (3)
Human Metapneumovirus	23 (5·6)	2 (3·6)	140 (3·7)	26 (5·9)
Rhinovirus	67 (16·3)	7 (12·7)	373 (10)	58 (13·2)
Parainfluenza	8 (1·9)	2 (3·6)	141 (3.4)	12 (0.3)
Parainfluenza type 1	1 (0·2)	0 (0)	43 (1)	2 (0·5)
Parainfluenza type 2	3 (0·7)	1 (1·8)	19 (0·5)	1 (0·2)
Parainfluenza type 3	4 (1)	1 (1·8)	79 (1·9)	0 (0)

[Table 3]

Temporal trends for viral positivity are similar between pharmacy and the SGPRVS settings across the study period (Fig. 4).

[Figure 4]

Swab collection rates

Swab collection rates (swabs/site each week) were similar between pharmacy (mean 0.5, SD 1.2) and the SGPRVS (mean 0.5, SD 1.1) settings. During winter periods, rates were 0.7 (SD 1.4) in pharmacies and 0.8 (SD 1.3) in the SGPRVS. During the inter-seasonal period, rates were 0.1 (SD 0.5) in pharmacies and 0.3 (SD 0.6) in the SGPRVS. In pharmacies, 55/467 (11.8%) of swabs were collected during the inter-seasonal period compared with 439/4181 (10.5%) in SGPRVS (Fig. 5).

[Figure 5]

Achievement of ≥ 3 swabs per site per week was highly variable. During winter periods, the percent of weeks pharmacy sites achieved this ranged from 0 to 45%, compared to 0 to 77.3% for the SGPRVS. The mean percent of weeks where ≥ 3 swabs were achieved was not significantly different for pharmacy and SGPRVS sites, 8.9% (SD 13.0) and 12.3% (SD 18.5) respectively (mean difference 3.4%, 95% CI -5.0 to 11.8%, p = 0.43).

Acceptability

459/470 (97.6%) participants completed the acceptability survey with 421/459 (91.7%) reporting pharmacy-based swabbing convenient, 450/459 (98.0%) confident in having a swab taken by a pharmacy-based investigator, and 441/459 (96.1%) amenable to participating again. More participants reported usually seeing a pharmacist for cold and flu symptoms over their GP (Table 4).

Table 4
Pharmacy participant acceptability.

Convenient having swab taken at same time as asking for advice on symptoms	**Pharmacy N/459 (%)**
Strongly agree	220 (47·9)
Agree	201 (43·8)
Neither agree nor disagree	29 (6·3)
Disagree	8 (1·7)
Strongly disagree	1 (0·2)
Usually see general practitioner when having cold and flu symptoms	
Strongly agree	28 (6·1)
Agree	73 (15·9)
Neither agree nor disagree	115 (25·1)
Disagree	169 (36·8)
Strongly disagree	74 (16·1)
Usually see pharmacist when having cold and flu symptoms	
Strongly agree	48 (10·5)
Agree	160 (34·9)
Neither agree nor disagree	118 (25·7)
Disagree	107 (23·3)
Strongly disagree	26 (5·7)
Confident in competence of investigator taking swab	
Strongly agree	325 (70·8)
Agree	125 (27·2)
Neither agree nor disagree	4 (0·9)
Disagree	4 (0·9)
Strongly disagree	1 (0·2)
Would consent to having swab taken by pharmacist in the future	

Convenient having swab taken at same time as asking for advice on symptoms	**Pharmacy N/459 (%)**
Strongly agree	280 (61)
Agree	161 (35·1)
Neither agree nor disagree	14 (3·1)
Disagree	3 (0·7)
Strongly disagree	1 (0·2)

[Table 4]

27/56 (48.2%) pharmacy investigators completed the acceptability survey comprising pharmacy owners (51.9%), managers (18.5%), pharmacists (25.9%), and one pharmacy-based nurse (3.7%). Of the 19 investigators who performed swabbing, all felt confident in the procedure and 15/19 (78.9%) found it convenient. All considered community pharmacy a good place for respiratory virus testing, and 25/27 (92.6%) would participate again. The median minimum acceptable per-swab fee to the pharmacist was NZD$50 (IQR $45–$100) (Table 5).

Table 5
Pharmacy-based investigator acceptability and reimbursement.

Role in the pharmacy **N = 27 (%)**	
Pharmacy owner	14 (51·9)
Pharmacy manager	5 (18·5)
Pharmacist	7 (25·9)
Pharmacy based nurse	1 (3·7)
Swabbed participants as part of the community pharmacy-based ILI study N = 27 (%)	19 (70·4)
Convenient to swab participants at same time as giving advice on ILI symptoms N = 19 (%)	
Strongly agree	5 (26·3)
Agree	10 (52·6)
Neither agree nor disagree	3 (15·8)
Disagree	1 (5·3)
Strongly disagree	0 (0)
Felt confident swabbing participants N = 19 (%)	
Strongly agree	12 (63·2)
Agree	7 (36·8)
Neither agree nor disagree	0 (0)
Disagree	0 (0)
Strongly disagree	0 (0)
The pharmacy is a good place to test for respiratory infections in our community N = 27 (%)	
Strongly agree	19 (70·4)
Agree	8 (29·6)
Neither agree nor disagree	0 (0)
Disagree	0 (0)
Strongly disagree	0 (0)
The study procedural instructions were easy to understand N = 27 (%)	
Strongly agree	15 (55·6)
Agree	11 (40·7)
Neither agree nor disagree	1 (3·7)

Role in the pharmacy **N = 27 (%)**	
Disagree	0 (0)
Strongly disagree	0 (0)
Swabbing patients/participants was a quick and easy process N = 19 (%)	
Strongly agree	5 (26·3)
Agree	7 (36·8)
Neither agree nor disagree	4 (21·1)
Disagree	3 (15·8)
Strongly disagree	0 (0)
Will participate in the surveillance program again N = 27 (%)	
Strongly agree	19 (70·4)
Agree	6 (22·2)
Neither agree nor disagree	2 (7·4)
Disagree	0 (0)
Strongly disagree	0 (0)
Minimum per swab fee $NZD (Mean, SD)	64·6
Median (IQR)	50 (45 to 100)
Min to Max	10 to 120

[Table 5]

Discussion

Previous assessments of community pharmacy-based respiratory virus testing have not embedded gold-standard RT-PCR testing through a WHO National Influenza Centre.[21] The results show pharmacies to be capable of detecting symptomatic ILI cases and safely obtaining samples, with overall detection of viruses comparable to the current, GP-based system.

Previous studies of pharmacy-based respiratory testing have been limited to assessing symptoms and/or point-of care sample analysis through either Ag-RDT or on-site RT-PCR.[22] In the United States of America, Klepser and colleagues examined the utility of in pharmacy RT-PCR testing to identify influenza and streptococcal pharyngitis, showing reduced time to diagnosis and initiation of treatment.[23] Similarly, a small Canadian study undertook rapid, point of care testing using an immunoassay to confirm Influenza A and B cases, providing direct recommendation to physicians to initiate treatment.[24] In Spain,

the Catalonia sentinel pharmacy network demonstrated earlier detection of influenza epidemics than physician-based systems, but provided syndromic data only.[25] Our study differs in several important respects.

First, we collected nasopharyngeal swabs versus anterior-nares samples, the gold-standard sampling technique for respiratory virus testing. Point-of-care Ag-RDTs, while valuable for acute clinical decision-making, are typically limited to a single or small panel of viruses and rely on anterior nares sampling, shown to have reduced sensitivity and greater dependence on early presentation and symptoms.[23,26,27] However, nasopharyngeal swabs are more uncomfortable, require trained staff and have the potential for more serious, albeit exceedingly rare, complications.[28] They are therefore only routinely available in limited settings, such as hospitals or general practice, limiting the external validity of surveillance data. Our training programme enabled pharmacy-based healthcare professionals to safely perform nasopharyngeal sampling, with only two self-limiting minor adverse events. Published data for significant complications requiring medical evaluation are 0.0012 to 0.026%, none of which occurred in our study.[28] Second, we analysed pharmacy samples using RT-PCR at a WHO National Influenza Centre reference laboratory. This facilitated contribution to both national and international respiratory virus surveillance, to the required analytic standards, thereby allowing characterisation of viral subtypes, and high sensitivity at low viral loads.[21,29,30] Third, using identical collection, transport, and analysis protocols, we directly compared pharmacy-based surveillance with the established SGPRVS, in real-time.

The respiratory viruses identified in pharmacy and general practice were similar, with two notable exceptions. Higher detection of rhinovirus in pharmacies (15.8% vs 10.3%) may reflect enhanced capture of a milder respiratory illness, less likely to lead to a GP consultation, given the associated cost and inconvenience. Conversely, influenza is often more severe, with high fever, myalgia, fatigue, pharyngitis and gastrointestinal symptoms more likely to result in GP attendance, potentially explaining why influenza positivity was significantly lower in pharmacies (19.5% vs 25.2%). The lower prevalence of enterovirus in pharmacies (0.4% vs 2.0%) may also be due to the more severe illness leading to GP review.

This surveillance approach demonstrated high participant acceptability and high relative accessibility to usually under-served groups. There was high participant-reported confidence in pharmacy-based sample collection (98.0%) and willingness to be swabbed again (96.1%), with most finding the process convenient (91.7%). Likewise, the majority of pharmacy-based investigators would participate again (92.6%). Furthermore, 17.7% of pharmacy participants identified as Māori, compared to 15.4% in the SGPRVS. This suggests national respiratory virus surveillance through community pharmacies is a sustainable model with potential to mitigate under-representation in the current SGPRVS. Combined with the proven capability of community pharmacies to deliver critical healthcare services during the COVID-19 pandemic, these findings support their potential role in national surveillance infrastructure for future

epidemic and pandemic prevention, preparedness and response, which could be generalisable to other international contexts.

Several limitations must be acknowledged. Participation was restricted to those aged ≥ 18 years, limiting the surveillance of paediatric respiratory viruses such as RSV. Second, the requirement for participants to be GP registered excluded 6% of the population, in addition to international visitors, despite these groups representing potential sources of novel pathogens. Third, Pacific peoples engagement (1.9%) was lower than both SGPRVS (6.6%) and census (8.9%) despite efforts to include swabbing site in areas of high Pacific representation, indicating targeted engagement strategies are needed to achieve equitable surveillance. Fourth, the pre-specified study outcome of ≥ 3 swabs per site per week had limited utility for evaluating pharmacy-based surveillance performance, which was highly variable. This highlights the importance of a flexible capacity to initiate new swabbing sites in response to network-level swabbing rates, to optimise geographic and demographic representation. Fifth, pharmacies were funded to undertake the study visits under a research contract whereas the SGPRVS receives a single payment per season for participation with patients bearing the consultation cost. Future implementation of pharmacy-based surveillance will need to assess sustainable reimbursement relative to setting, noting the acceptable median per-swab fee reported by pharmacy investigators was NZD$50. Sixth, secondary outcomes were not adjusted for multiplicity of analyses and should not be used to infer definitive differences. For some variables sparse data was a limitation of the analyses. Finally, this was a feasibility study focused on determining safety, performance signals and logistics. As such, it was not powered to detect differences in less common respiratory viruses or to assess vaccine effectiveness for influenza or other respiratory viruses captured in this surveillence, although study samples prospectively contributed to routine national assessments.

Pharmacy-based nasopharyngeal sampling for respiratory virus surveillance is feasible, safe, and acceptable in New Zealand. Swabbing rates and viral detection were comparable to existing community-based surveillance in the SGPRVS, whilst suggesting enhanced detection of pathogens that cause milder influenza-like illness. The infrastructure established in community pharmacies provides the foundation for future incorporation into routine national and international surveillance. The next priority is a study without age and GP registration restrictions, with targeted recruitment strategies to enhance participation of under-represented populations.

Data availability

Deidentified participant data from this study will be made available on reasonable request to the corresponding author (AS), in accordance with the Medical Research Institute of New Zealand Data Sharing Policy. Requests should specify the proposed use of the data and analyses to be performed, and will be considered on a case-by-case basis.

Code

No custom software was developed for this study. Study data were collected and managed using REDCap (Research Electronic Data Capture), hosted at the Medical Research Institute of New Zealand. All statistical analyses were performed in SAS version [version 9.4] (SAS Institute Inc., Cary, NC, USA).

Declarations

Declaration of interests

The authors declare no competing interests, financial or otherwise, that could appear to influence this work.

Funding sources

Te Niwha Infectious Disease Platform fully funded the study and had no role in the study design, data collection, analysis, interpretation, or reporting. (TN/SWC/24/MRIKK).

References

1. Nelson, P. P., Papadopoulos, N. G. & Skevaki, C. Respiratory Viral Pathogens. in *Encyclopedia of Respiratory Medicine (Second Edition)* (ed. Janes, S. M.) 129–137 (Academic Press, Oxford, 2022). doi:10.1016/B978-0-12-801238-3.11635-6.
2. Leung, N. H. L. Transmissibility and transmission of respiratory viruses. *Nat Rev Microbiol* 19, 528–545 (2021).
3. Ziegler, T., Moen, A., Zhang, W. & Cox, N. J. Global Influenza Surveillance and Response System: 70 years of responding to the expected and preparing for the unexpected. *The Lancet* 400, 981–982 (2022).
4. The Institute of Public Health and Forensic Science. Respiratory illness dashboard. https://www.phfscience.nz/digital-library/respiratory-illness-dashboard/ (2025).
5. The Institute of Environmental Science and Research. Sentinel General Practice Respiratory Virus Surveillance: Protocol 2024. (2024).
6. The Institute of Public Health and Forensic Science. COVID-19 wastewater dashboard. https://www.phfscience.nz/digital-library/wastewater-dashboard/ (2025).
7. Ministry of Health - Manatū Hauora. *Annual Update of Key Results 2024/25: New Zealand Health Survey*. https://www.health.govt.nz/publications/annual-update-of-key-results-202425-new-zealand-health-survey (2025).
8. Health New Zealand - Te Whatu Ora. Enrolment with a general practice and primary health organisation. https://www.tewhatuora.govt.nz/for-health-providers/primary-care-sector/primary-health-organisations/enrolment-with-a-general-practice-and-primary-health-organisation (2025).

9. Mohan, N., Irurzun-Lopez, M., Pledger, M., Jeffreys, M. & Cumming, J. Addressing closed and limited enrolments in general practices in Aotearoa New Zealand: a mixed-methods study. *N Z Med J* 137, 55–64 (2024).
10. Royal New Zealand College of General Practitioners (RNZCGP). Workforce survey. https://www.rnzcgp.org.nz/our-voice/workforce-survey/ (2024).
11. Aminisani, N. *et al.* The Burden of HMPV- and Influenza-Associated Hospitalizations in Adults in New Zealand Before and After the COVID-19 Pandemic, 2012–2023. *J Infect Dis* 232, S47–S58 (2025).
12. Jefferies, S. *et al.* COVID-19 in New Zealand and the impact of the national response: a descriptive epidemiological study. *The Lancet Public Health* 5, e612–e623 (2020).
13. Officer, T. *et al.* Changes in provision of extended community pharmacy services in Aotearoa New Zealand, 2018 to 2022. *BMC Health Serv Res* 24, 1571 (2024).
14. Dalgado, A. *et al.* Need a flu jab? Let's try pharmacy: patient characteristics and experiences with pharmacy immunisation services. *Int J Pharm Pract* 31, 380–386 (2023).
15. Semprini, A. *et al.* Kanuka honey versus aciclovir for the topical treatment of herpes simplex labialis: a randomised controlled trial. *BMJ Open* 9, e026201 (2019).
16. Shortt, N. *et al.* Efficacy of a 3% Kānuka oil cream for the treatment of moderate-to-severe eczema: A single blind randomised vehicle-controlled trial. *eClinicalMedicine* 51, 101561 (2022).
17. Shortt, G. *et al.* Randomised controlled trial of mānuka oil-based ECMT-154™ vs. vehicle control for the topical treatment of eczema, conducted in community pharmacies in New Zealand. *BMC Complement Med Ther* https://doi.org/10.1186/s12906-026-05274-w (2026) doi:10.1186/s12906-026-05274-w.
18. von Elm, E. *et al.* The Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) statement: guidelines for reporting observational studies. *J Clin Epidemiol* 61, 344–349 (2008).
19. Health New Zealand - Te Whatu Ora. National Health Index (NHI). https://info.health.nz/hospitals-services/eligibility-subsidies/national-health-index-nhi (2025).
20. Te Whatu Ora – Health New Zealand. Personal protective equipment (PPE) for the collection of naso/oropharyngeal or nasal swabs specimens - COVID-19. (2023).
21. Jung, E. J. *et al.* Comparison of Nasal Swabs, Nasopharyngeal Swabs, and Saliva Samples for the Detection of SARS-CoV-2 and other Respiratory Virus Infections. *Ann Lab Med* 43, 434–442 (2023).
22. Koski, R. R., Klepser, N., Koski, M., Klepser, M. & Klepser, D. Community pharmacist-provided test and treat programs for acute infectious conditions. *J Am Coll Clin Pharm* 6, 1030–1040 (2023).
23. Klepser, D. G., Klepser, M. E., Murry, J. S., Borden, H. & Olsen, K. M. Evaluation of a community pharmacy–based influenza and group A streptococcal pharyngitis disease management program using polymerase chain reaction point-of-care testing. *Journal of the American Pharmacists Association* 59, 872–879 (2019).

24. Papastergiou, J., Folkins, C., Li, W. & Zervas, J. Community pharmacy rapid influenza A and B screening: A novel approach to expedite patient access to care and improve clinical outcomes. *Canadian Pharmacists Journal* 149, 83–89 (2016).
25. Plans-Rubió, P. *et al.* Influenza Syndromic Surveillance Based on Sentinel Pharmacies in Catalonia (Spain) in 2017 – 2020. *Int J Mod Pharm Res* 5, 207–217 (2021).
26. O'Connor, S. K. *et al.* Developing sustainable workflows for community pharmacy-based SARS-CoV-2 testing. *J Am Pharm Assoc (*2003) 62, 253–259 (2022).
27. Dinnes, J. *et al.* Rapid, point-of-care antigen tests for diagnosis of SARS-CoV-2 infection. *Cochrane Database Syst Rev* 7, CD013705 (2022).
28. Kim, D. H., Kim, D., Moon, J. W., Chae, S.-W. & Rhyu, I. J. Complications of Nasopharyngeal Swabs and Safe Procedures for COVID-19 Testing Based on Anatomical Knowledge. *J Korean Med Sci* 37, e88 (2022).
29. Gadenstaetter, A. J., Mayer, C. D. & Landegger, L. D. Nasopharyngeal versus nasal swabs for detection of SARS-CoV-2: a systematic review. *Rhinology* 59, 410–421 (2021).
30. Irving, S. A., Vandermause, M. F., Shay, D. K. & Belongia, E. A. Comparison of nasal and nasopharyngeal swabs for influenza detection in adults. *Clin Med Res* 10, 215–218 (2012).
31. Contributors
32. AS, KK and SJ conceived the study. AS, KK, SJ, GS, RB, TH, NS, STP, TF, SV, ML designed the study. AS, KK, GS, MP, STP, SJ, AMcN, AM, BW, DM, LJ, RS, BB, CS carried out the study. AE analysed the data. AS, KK, SJ interpreted the data. AS, SJ and KK wrote the first draft of the manuscript. KK, SJ and AS acquired funding. All authors critically revised the manuscript and approved the final version. AS, KK and AE had full access to all data in the study and take responsibility for the integrity of the data and the accuracy of the data analysis.
33. Study collaborators
34. The authors thank the 22 participating community pharmacies across New Zealand and the 470 study participants who provided nasopharyngeal swabs for surveillance purposes. We would like to acknowledge and thank: Judy Bocacao, Claire Tarring, Alice Richardson, Amy Bradshaw, Tegan Slater, Srushti Utekar, Karyn Lodder, Mai Anh Sam, and Gemma Hooper from the PHF Science Clinical Virology Laboratory department for the testing and reporting of study samples. PHF Science is funded by the New Zealand Public Health Agency/Te Pou Hauora Tūmatanui to provide national communicable disease surveillance and public health laboratory services, running the WHO National Influenza Centre and the SGPRVS as part of this work. We also thank the general practices and patients who volunteer to participate in the SGPRVS.

Figures

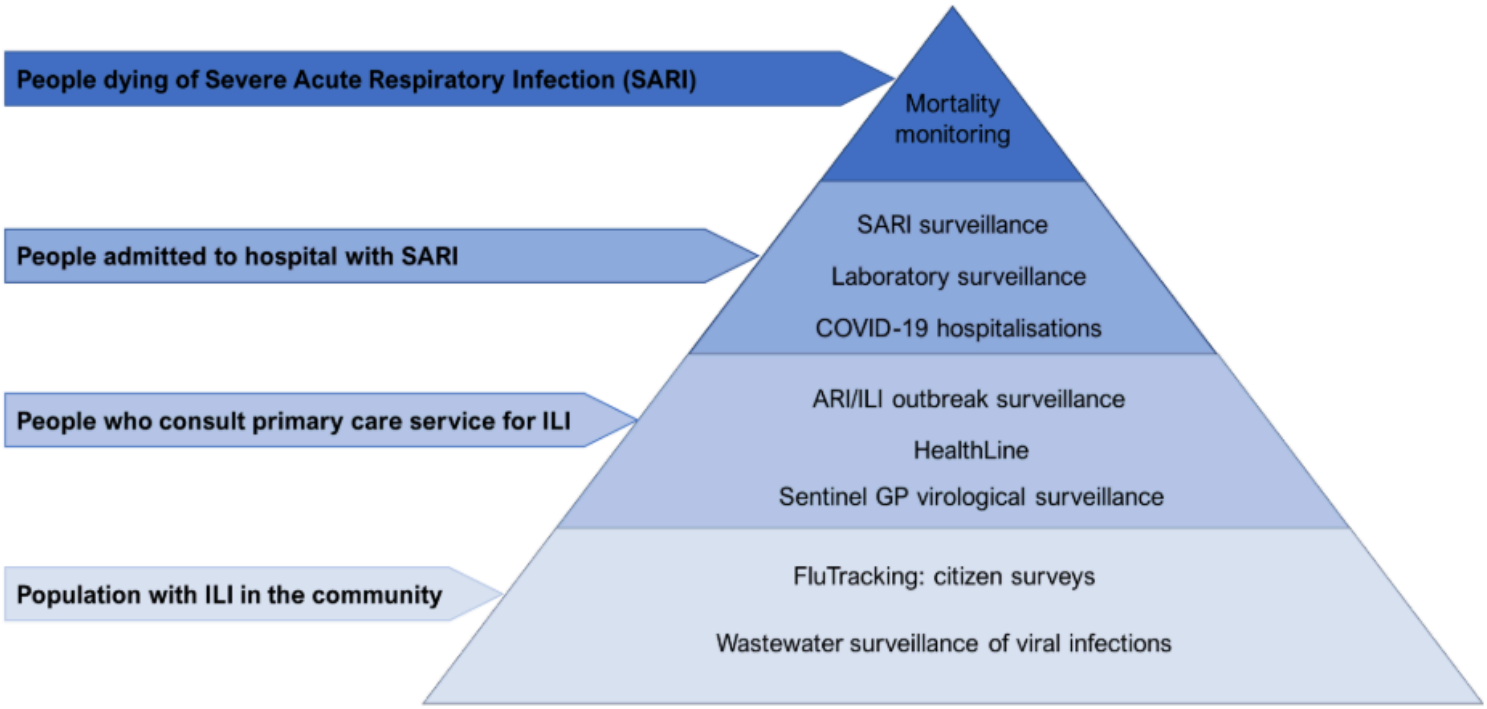


Figure 1

The PHF Science acute respiratory surveillance pyramid. SARI = Severe Acute Respiratory Infection. ILI = Influenza-Like Illness. ARI = Acute Respiratory Illness. © New Zealand Institute for Public Health and Forensic Science Limited 2026. Used with permission. All rights reserved.

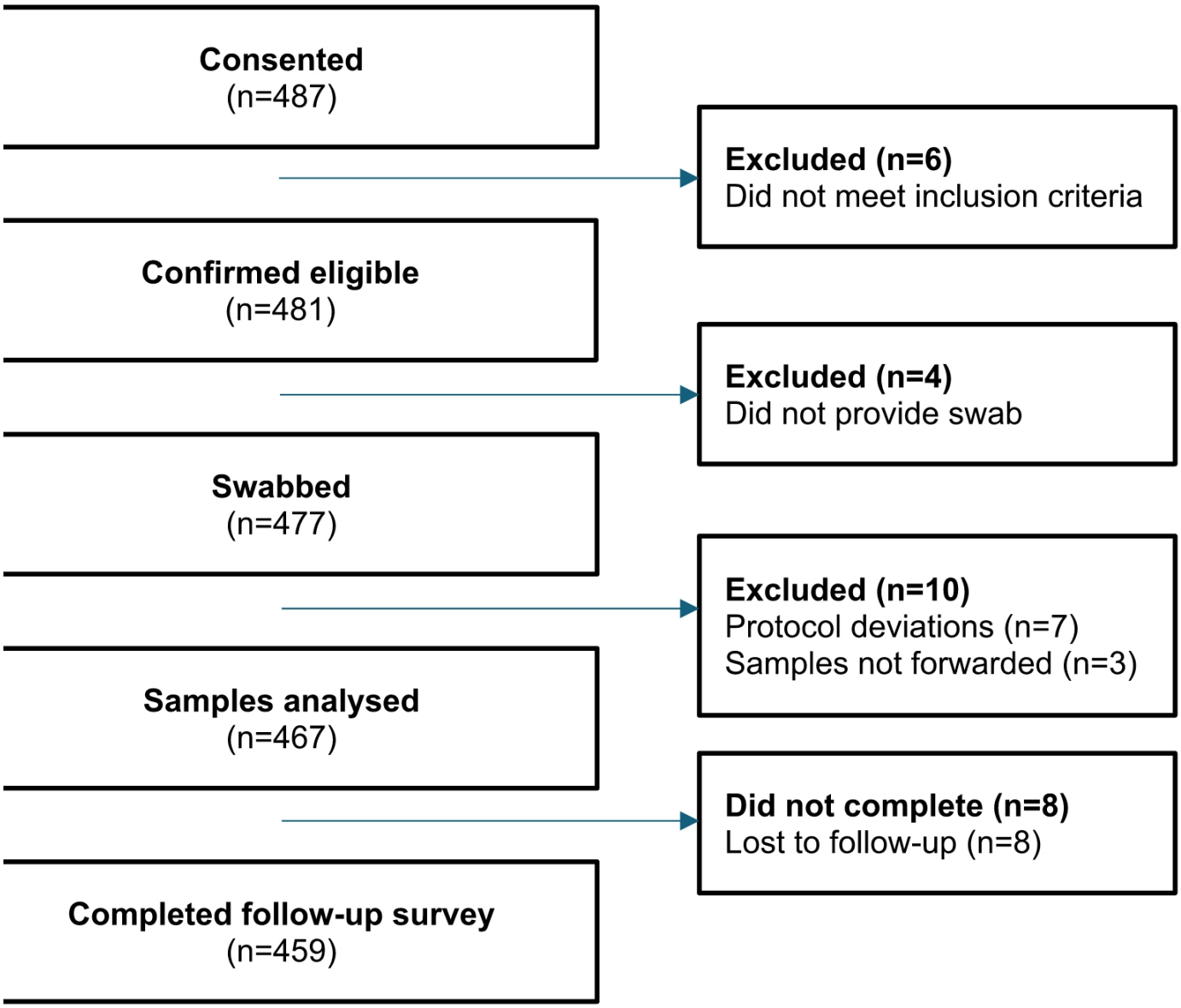


Figure 2

Participant Study Flow

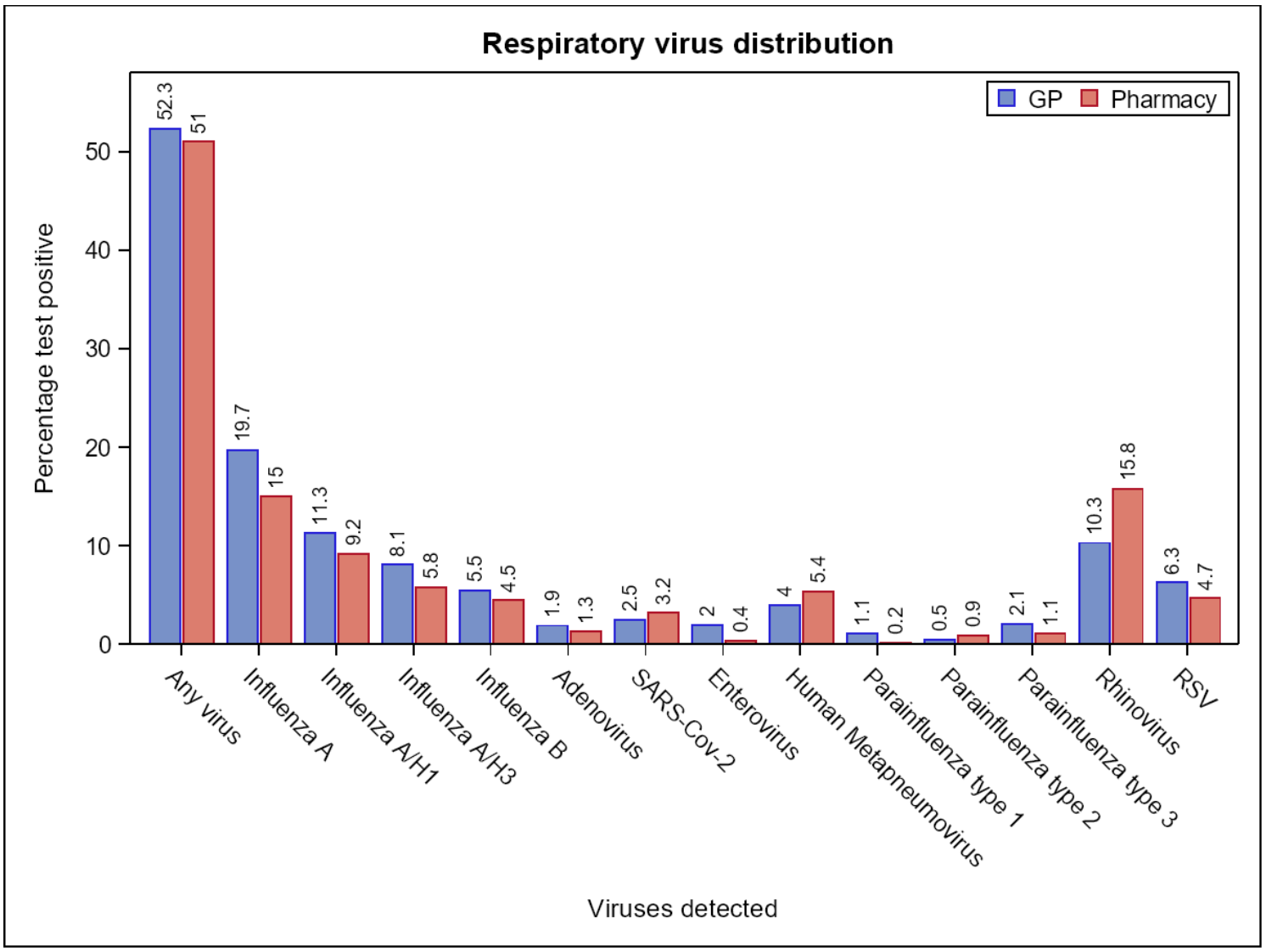


Figure 3

Respiratory virus distribution between pharmacies and the SGPRVS for the whole study period.

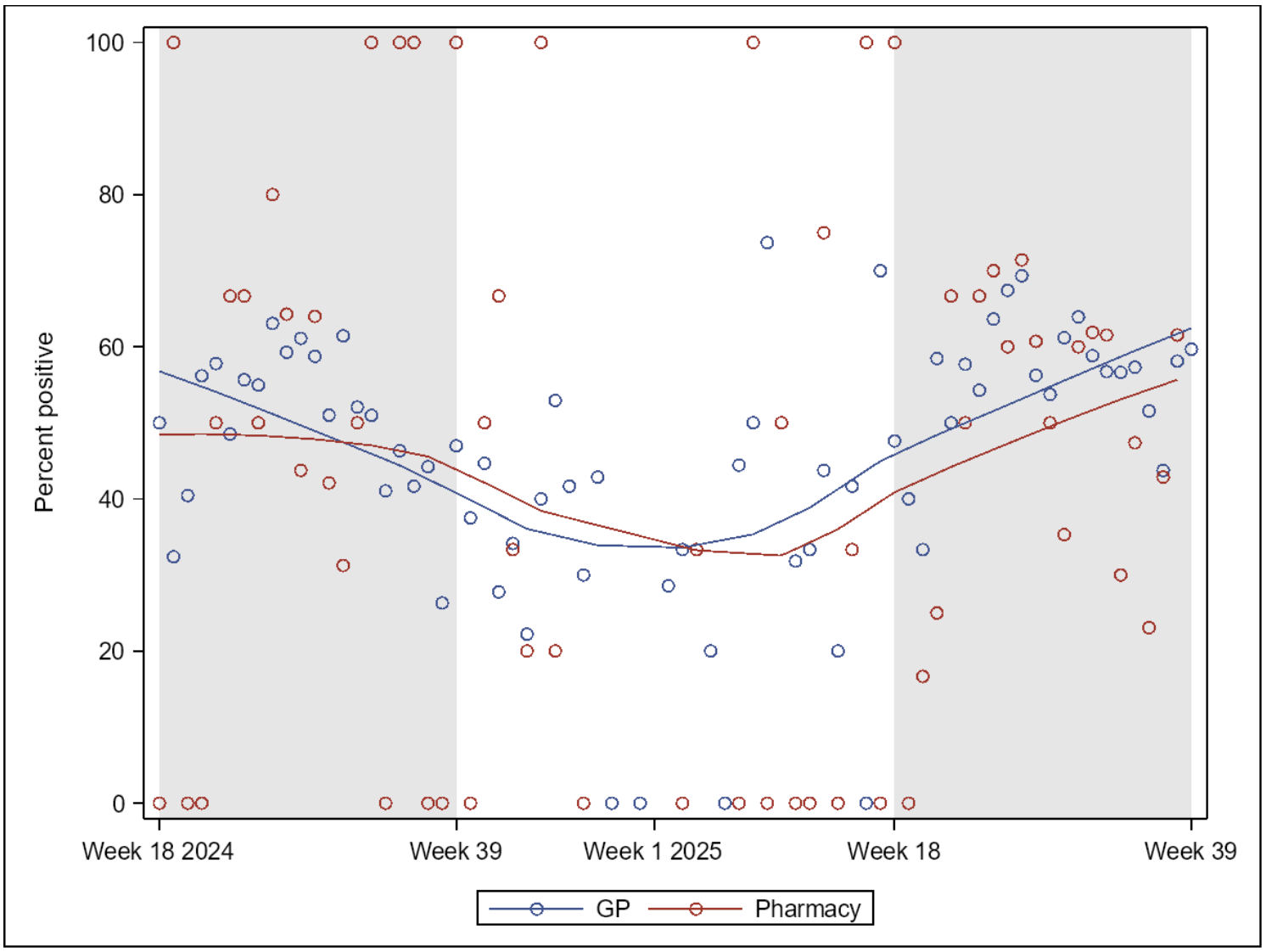


Figure 4

Proportion of positive swabs over time by week, pharmacy versus SGPRVS. Lines represent LOESS smoothing curves (smoothing parameter 0×6) with 95% confidence intervals. Shaded regions indicate winter surveillance periods (weeks 18–39).

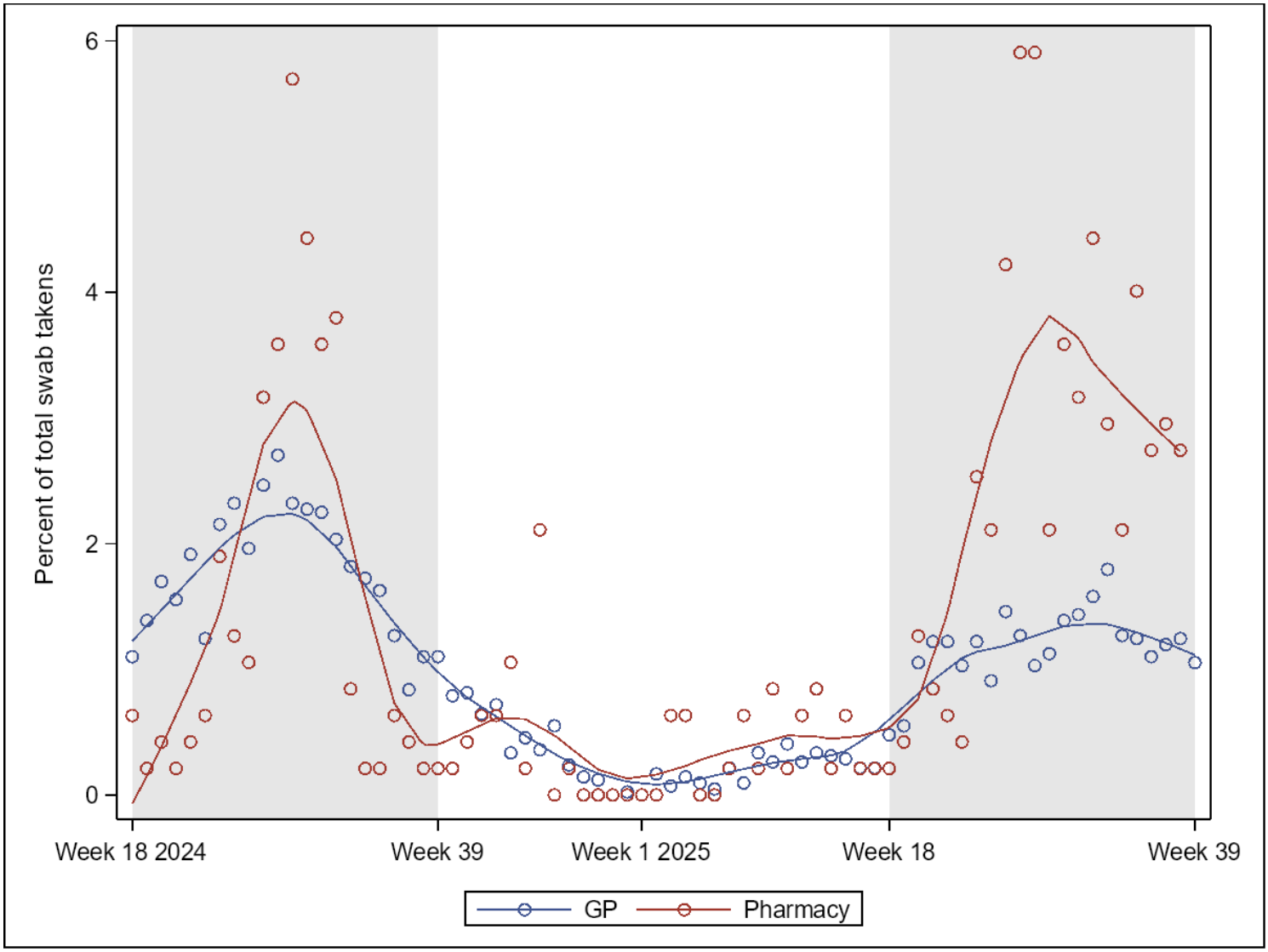


Figure 5

Proportion of total swabs collected per week, pharmacy versus SGPRVS. Lines represent LOESS smoothing curves (smoothing parameter 0×2) with 95% confidence intervals. Shaded regions indicate winter surveillance periods (weeks 18–39).

Supplementary Files

This is a list of supplementary files associated with this preprint. Click to download.

- Tables.docx