Participant Flow

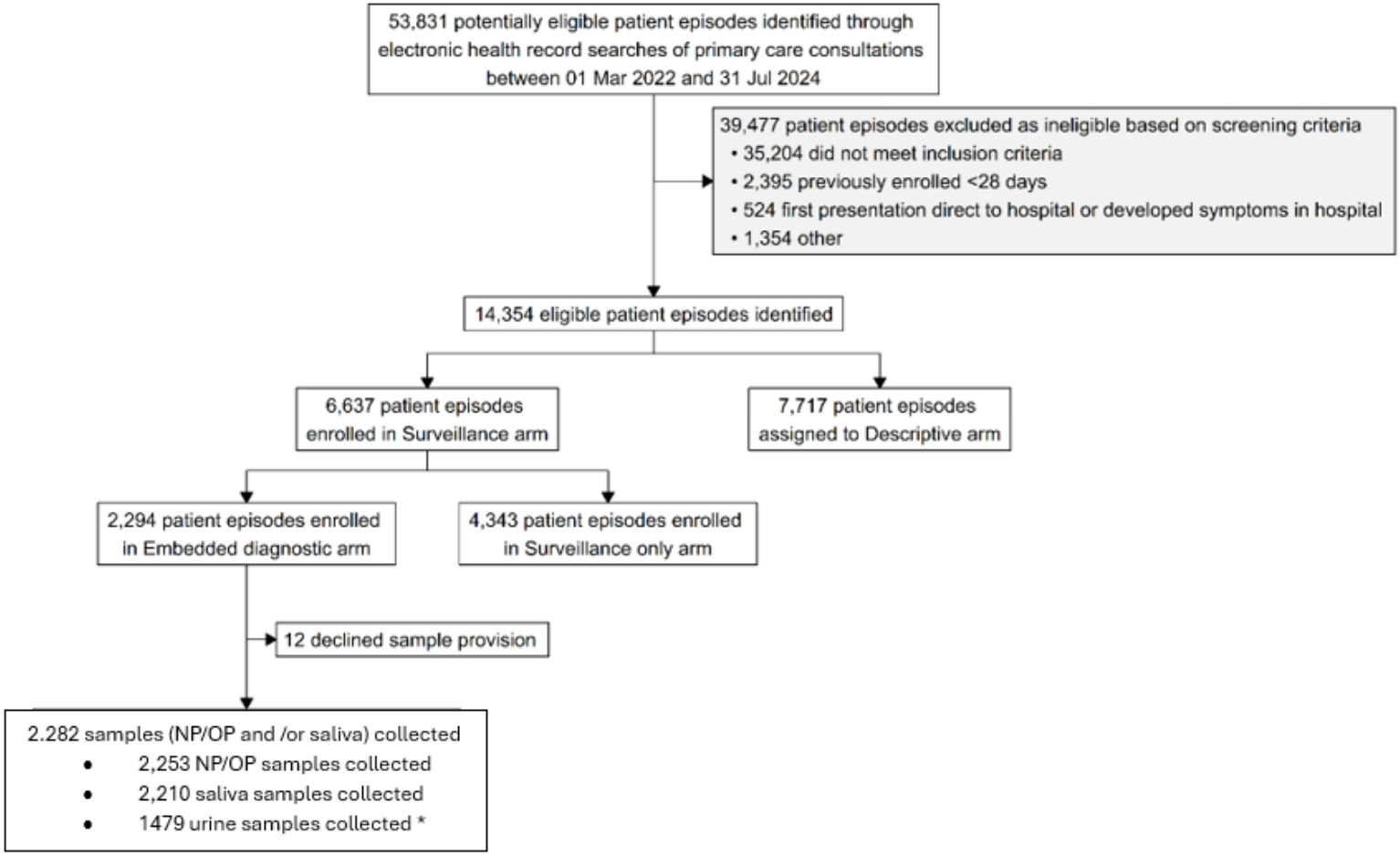


Figure 1: Flow chart showing the number of patients entered into each study arm (embedded diagnostic, surveillance only and descriptive data) with a breakdown of how many participants provided each sample type.
* Urine samples were only collected between 28th Feb 2022 and 20th December 2023.

Table 1. Baseline Characteristics

Characteristic	Embedded diagnostic study*	All other eligible aLRTD episodes†
	n (%)	n (%)
Total	2,282	12,049
Median (IQR)	60.0 (45.0–71.0)	59.0 (41.0–75.0)
Age group (years)		
18–34	282 (12.3)	1,895 (15.7)
35–49	420 (18.3)	2,403 (19.9)
50–64	652 (28.4)	2,827 (23.5)
65–74	537 (23.4)	1,868 (15.5)
≥75	403 (17.6)	3,056 (25.4)
Gender		
Female	1,433 (62.5)	7,355 (61.1)
Male	861 (37.5)	4,662 (38.7)
Other	0 (0.0)	1 (<0.1)
Missing	0 (0.0)	32 (0.3)
Ethnicity		
White British	1,899 (83.2)	7,097 (58.9)
White other	135 (5.9)	751 (6.2)
Mixed or multiple ethnic groups	36 (1.6)	183 (1.5)
Black British, Caribbean or African	35 (1.5)	424 (3.5)
Asian or Asian British	59 (2.6)	443 (3.7)
Other ethnic group	13 (0.6)	86 (0.7)
Unable to categorise	103 (4.5)	2,222 (18.4)
Missing	2 (0.1)	843 (7.0)
Index of multiple deprivation quintile		
1 (most deprived)	372 (16.3)	2,921 (24.2)
2	367 (16.1)	2,136 (17.8)
3	398 (17.4)	1,958 (16.3)
4	463 (20.3)	2,208 (18.3)
5 (least deprived)	676 (29.6)	2,806 (23.3)
Missing	6 (0.3)	20 (0.2)
Clinical diagnosis‡		
aLRTI	2,159 (93.7)	10,985 (90.8)
eHF	134 (5.8)	996 (8.2)
NI-eCLD	11 (0.5)	111 (0.9)

* The present study focuses on participants recruited into the embedded diagnostic study
† All episodes that met the case definition for aLRTD for the wider AvonCAP GP2 study, excluding those recruited into the embedded diagnostic study16
‡ A small number of participant episodes had a dual diagnosis of aLRTI and eHF.
Abbreviations: acute lower respiratory tract infection (aLRTI), exacerbation of heart failure (eHF), non-infective exacerbation of chronic lung disease (NI-eCLD). interquartile range (IQR).

Outcome Measures

Table 2: Characteristics of pathogen associated aLRTD presentations (N=2282)

	RSV positive n (%)	RSV negative n (%)	Influenza positive n (%)	Influenza negative n (%)	SARS-CoV-2 positive n (%)	SARS-CoV-2 negative n (%)
Total	42	2,240	79	2,203	168	2,114
Socio-demographic characteristics						
Age at consultation (years)						
Median (IQR)	63.0 (54.0–74.0)	60.0 (45.0–71.0)	61.0 (42.0–72.0)	60.0 (45.0–71.0)	61.0 (48.0–70.5)	60.0 (45.0–71.0)
Age group (years)						
18–64	22 (1.6)	1,326 (98.4)	46 (3.4)	1,302 (96.6)	100 (7.4)	1,248 (92.6)
65–74	10 (1.9)	525 (98.1)	19 (3.6)	516 (96.4)	39 (7.3)	496 (92.7)
≥75	10 (2.5)	389 (97.5)	14 (3.5)	385 (96.5)	29 (7.3)	370 (92.7)
Gender						
Female	32 (2.2)	1,391 (97.8)	56 (3.9)	1,367 (96.1)	103 (7.2)	1,320 (92.8)
Male	10 (1.2)	849 (98.8)	23 (2.7)	836 (97.3)	65 (7.6)	794 (92.4)
Ethnic group						
White British	31 (1.6)	1,868 (98.4)	71 (3.7)	1,828 (96.3)	142 (7.5)	1,757 (92.5)
White other	3 (2.2)	132 (97.8)	4 (3.0)	131 (97.0)	9 (6.7)	126 (93.3)
Mixed or multiple ethnic groups	1 (2.8)	35 (97.2)	0 (0.0)	36 (100.0)	4 (11.1)	32 (88.9)
Black British, Caribbean or African	1 (2.9)	34 (97.1)	0 (0.0)	35 (100.0)	2 (5.7)	33 (94.3)
Asian or Asian British	4 (6.8)	55 (93.2)	2 (3.4)	57 (96.6)	5 (8.5)	54 (91.5)
Other ethnic group	0 (0.0)	13 (100.0)	0 (0.0)	13 (100.0)	0 (0.0)	13 (100.0)
*Unable to categorise**	2 (1.9)	101 (98.1)	2 (1.9)	101 (98.1)	6 (5.8)	97 (94.2)
Missing	0 (0.0)	2 (100.0)	0 (0.0)	2 (100.0)	0 (0.0)	2 (100.0)

Indices of multiple deprivation (IMD) quintile						
1 (most deprived)	6 (1.6)	366 (98.4)	6 (1.6)	366 (98.4)	14 (3.8)	358 (96.2)
2	8 (2.2)	359 (97.8)	12 (3.3)	355 (96.7)	27 (7.4)	340 (92.6)
3	9 (2.3)	389 (97.7)	14 (3.5)	384 (96.5)	32 (8.0)	366 (92.0)
4	12 (2.6)	451 (97.4)	15 (3.2)	448 (96.8)	46 (9.9)	417 (90.1)
5 (least deprived)	7 (1.0)	669 (99.0)	31 (4.6)	645 (95.4)	49 (7.2)	627 (92.8)
Missing	0 (0.0)	6 (100.0)	1 (16.7)	5 (83.3)	0 (0.0)	6 (100.0)
Household members						
Lives alone	12 (3.1)	381 (96.9)	16 (4.1)	377 (95.9)	22 (5.6)	371 (94.4)
Only adults in the household	6 (1.2)	481 (98.8)	20 (4.1)	467 (95.9)	19 (3.9)	468 (96.1)
Children (aged <18yrs) in the household	22 (2.0)	1,101 (98.0)	35 (3.1)	1,088 (96.9)	76 (6.8)	1,047 (93.2)
Missing	2 (0.7)	277 (99.3)	8 (2.9)	271 (97.1)	51 (18.3)	228 (81.7)
Clinical characteristics						
Clinical diagnosis						
aLRTI	40 (1.9)	2,119 (98.1)	76 (3.5)	2,083 (96.5)	157 (7.3)	2,002 (92.7)
eHF	3 (2.2)	131 (97.8)	5 (3.7)	129 (96.3)	12 (9.0)	122 (91.0)
NI-eCLD	0 (0.0)	11 (100.0)	0 (0.0)	11 (100.0)	0 (0.0)	11 (100.0)
Long-term conditions						
Currently has asthma	19 (2.4)	770 (97.6)	24 (3.0)	765 (97.0)	64 (8.1)	725 (91.9)
COPD	5 (1.4)	340 (98.6)	6 (1.7)	339 (98.3)	21 (6.1)	324 (93.4)
Bronchiectasis	0 (0.0)	111 (100.0)	3 (2.7)	108 (97.3)	11 (9.9)	100 (90.1)
Other chronic lung condition[†]	1 (1.1)	88 (98.9)	7 (7.9)	82 (92.1)	10 (11.2)	79 (88.8)
Heart failure	1 (1.0)	98 (99.0)	3 (3.0)	96 (97.0)	8 (8.1)	91 (91.9)
Diabetes	9 (2.4)	363 (97.6)	9 (2.4)	363 (97.6)	35 (9.5)	337 (90.5)
Number of long-term conditions[‡]						
0	3 (1.0)	295 (99.0)	16 (5.4)	282 (94.6)	17 (5.5)	293 (94.5)

1-2	16 (1.8)	873 (98.2)	26 (2.9)	863 (97.1)	70 (8.2)	779 (91.8)
3-4	12 (1.9)	624 (98.1)	22 (3.5)	614 (96.5)	42 (6.8)	576 (93.2)
≥5	11 (2.4)	448 (97.6)	15 (3.3)	444 (96.7)	26 (6.6)	367 (93.4)
Cambridge multimorbidity score‡						
< median CMS score§	20 (1.8)	1,133 (98.2)	42 (3.6)	1,112 (96.4)	88 (7.6)	1066 (92.4)
≥ median CMS score§	22 (1.9)	1,107 (98.1)	37 (3.3)	1,091 (96.7)	80 (7.1)	1,048 (92.9)
Rockwood frailty score						
1–3 (not frail)	31 (1.8)	1,711 (98.2)	68 (3.9)	1,674 (96.1)	118 (6.8)	1,624 (93.2)
4–6 (mild to moderate frailty)	7 (2.6)	258 (97.4)	5 (1.9)	260 (98.1)	8 (3.0)	257 (97.0)
7–9 (severe frailty)	1 (5.3)	18 (94.7)	0 (0.0)	19 (100.0)	1 (5.3)	18 (94.7)
Missing	3 (1.2)	253 (98.8)	6 (2.3)	250 (97.7)	41 (16.0)	215 (84.0)
Smoking status						
Never smoked	15 (1.8)	800 (98.2)	28 (3.4)	787 (96.6)	73 (9.0)	742 (91.0)
Current smoker	5 (1.3)	368 (98.7)	11 (2.9)	362 (97.1)	23 (6.2)	350 (93.8)
Ex-smoker	22 (2.0)	1,070 (98.0)	40 (3.7)	1,052 (96.3)	72 (6.6)	1,020 (93.4)
Missing	0 (0.0)	2 (100.0)	0 (0.0)	1 (100.0)	0 (0.0)	2 (100.0)
Alcohol status						
Current alcohol drinker	24 (2.1)	1,110 (97.9)	38 (3.4)	1,096 (96.6)	81 (7.1)	1,053 (92.9)
Not currently drinking	18 (2.0)	872 (98.0)	29 (3.3)	861 (96.7)	70 (7.9)	820 (92.1)
Missing	0 (0.0)	258 (100.0)	12 (4.7)	246 (95.3)	17 (6.6)	241 (93.4)
Body mass index kg/m^2						
Underweight (<18.5)	1 (4.2)	23 (95.8)	1 (4.2)	23 (95.8)	3 (12.5)	21 (87.5)
Healthy weight (18.5–24.9)	6 (1.5)	407 (98.5)	16 (3.9)	397 (96.1)	16 (3.9)	397 (96.1)
Overweight¶ (≥25.0)	25 (1.8)	1,331 (98.2)	48 (3.5)	1,308 (96.5)	81 (6.0)	1275 (94.0)
Missing	10 (2.0)	479 (98.0)	14 (2.9)	475 (97.1)	68 (13.9)	421 (86.1)
SARS-CoV-2 vaccination status						
≥3 doses	39 (1.9)	1,986 (98.1)	72 (3.6)	1,953 (96.4)	152 (7.5)	1,873 (92.5)
2 doses	2 (1.6)	125 (98.4)	3 (2.4)	124 (97.6)	8 (6.3)	119 (93.7)
1 dose	0 (0.0)	24 (100.0)	1 (4.2)	23 (95.8)	3 (12.5)	21 (87.5)

No vaccine recorded in EHR[#]	1 (0.9)	105 (99.0)	3 (2.8)	103 (97.2)	5 (4.7)	101 (95.3)
SARS-CoV-2 vaccination status						
Vaccine <12 months	34 (2.1)	1,611 (97.9)	20 (2.4)	811 (97.6)	123 (7.5)	1,522 (92.5)
Vaccine ≥12 months	7 (1.3)	523 (98.7)	36 (4.6)	751 (95.4)	40 (7.5)	490 (92.5)
No vaccine recorded in EHR[#]	1 (0.9)	106 (99.1)	23 (3.5)	641 (96.5)	5 (4.7)	102 (95.3)
Influenza vaccination status						
Vaccine <12 months	16 (2.1)	752 (97.9)	15 (2.0)	753 (98.0)	63 (8.2)	705 (91.8)
Vaccine ≥12 months	17 (1.7)	1,011 (98.3)	44 (4.3)	984 (95.7)	68 (6.6)	960 (93.4)
No vaccine recorded in EHR[#]	9 (1.9)	477 (98.1)	20 (4.1)	466 (95.9)	37 (7.6)	449 (92.4)
Pnuemococcus vaccination status						
Vaccine within 5 years	3 (1.5)	191 (98.5)	11 (5.7)	183 (94.3)	14 (7.2)	180 (92.8)
Vaccine after 5 years	14 (2.1)	652 (97.9)	24 (3.6)	642 (96.4)	57 (8.6)	609 (91.4)
No vaccine recorded in EHR[¶]	25 (1.8)	1,397 (98.2)	44 (3.1)	1,378 (96.9)	97 (6.8)	1,325 (93.2)

* Ethnicity terms unable to categorise include: 'British or mixed British', 'Ethnic category not stated', 'Refusal by patient to provide information about ethnic group', 'English – ethnic category 2001 census', 'Ethnic group not recorded', 'Ethnic category – 2001 census', and 'Ethnic category – 2011 census England and Wales'.

† Other chronic lung conditions included cystic fibrosis, pulmonary hypertension, pulmonary fibrosis and chronic pleural disease.

[‡] The conditions included in the long-term condition count were the 20 most clinically important long-term common conditions included in the Cambridge Multimorbidity Score (e.g. COPD, asthma, hypertension, anxiety/depression) and four additional respiratory conditions (bronchiectasis, cystic fibrosis, chronic pleural disease and pulmonary fibrosis).

§ The Cambridge Multimorbidity Score (CMS) sums weighted values of 20 long-term conditions. Median CMS score 0.8.

¶ Overweight category includes patients affected by obesity (BMI≥30)

No vaccination recorded in electronic health records

Abbreviations: acute lower respiratory tract infection (aLRTI), exacerbation of heart failure (eHF), non-infective exacerbation of chronic lung disease (NI-eCLD), Cambridge Multimorbidity Score (CMS), body mass index (BMI), Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2), chronic obstructive pulmonary disease (COPD), electronic healthcare record (EHR), index multiple deprivation (IMD), interquartile range (IQR).

Table 3. Characteristics of pneumococcal antigen positive and negative cases

Characteristic	UAD positives n(%)	UAD negatives n (%)
Total	24 (1.6%)	1433 (98.4%)
Socio-demographic characteristics		
Median age (IQR) [years]	64.5 (53.8–73.2)	60.0 (45.0–71.0)
Age group [years]		
18–49	5 (20.8%)	432 (30.1%)
50–64	7 (29.2%)	437 (30.5%)
65–74	7 (29.2%)	327 (22.8%)
≥75	5 (20.8%)	237 (16.5%)
Gender		
Female	17 (70.8%)	900 (62.8%)
Male	7 (29.2%)	533 (37.2%)
Indices of multiple deprivation (IMD) quintile		
1 (most deprived)	4 (16.7%)	237 (16.5%)
2	4 (16.7%)	234 (16.3%)
3	3 (12.5%)	253 (17.7%)
4	7 (29.2%)	300 (20.9%)
5 (least deprived)	6 (25.0%)	407 (28.4%)
Missing	0 (0%)	2 (0.1%)
Ethnic group		
White	23 (95.8%)	1264 (88.2%)
Mixed or multiple ethnic groups	0 (0%)	20 (1.4%)
Black British, Caribbean or African	0 (0%)	25 (1.7%)
Asian or Asian British	1 (4.2%)	35 (2.4%)
Other ethnic group	0 (0%)	6 (0.4%)
Uncategorisable*	0 (0%)	81 (5.7%)
Missing	0 (0%)	2 (0.1%)
Household members		
Lives alone	11 (45.8%)	236 (16.5%)
Lives with children	1 (4.2%)	302 (21.1%)
Lives with only adults	11 (45.8%)	710 (49.5%)
Missing	1 (4.2%)	185 (12.9%)
Clinical characteristics		
Clinical diagnosis		
Community acquired pneumonia	0 (0%)	11 (0.8%)
Non-pneumonic lower respiratory tract infection	24 (100%)	1422 (99.2%)
Long-term conditions		
COPD	6 (25.0%)	216 (15.1%)
Currently treated asthma	12 (50.0%)	504 (35.2%)
Bronchiectasis		
Other chronic lung condition§	2 (8.3%)	49 (3.4%)
Heart failure	2 (8.3%)	48 (3.3%)

Diabetes	7 (29.2%)	223 (15.6%)
Number of long-term conditions¶		
0	4 (16.7%)	179 (12.5%)
1–2	5 (20.8%)	614 (42.8%)
3–4	5 (20.8%)	389 (27.1%)
≥5	10(41.7%)	251 (17.5%)
Cambridge multimorbidity score		
Median (IQR)	1.4 (0.3-2.9)	0.7 (0.2-1.9)
Rockwood frailty score		
No frailty (1-3)	17 (70.8%)	1126 (78.6%)
Mild frailty (4-6)	4 (16.7%)	141 (9.8%)
Moderate or severe frailty (7-9)	1 (4.2%)	9 (0.6%)
Missing	2 (8.3%)	157 (11.0%)
Smoking status		
Never smoked	6 (25.0%)	501 (35.0%)
Current smoker	5 (20.8%)	240 (16.7%)
Ex-smoker	13 (54.2%)	691 (48.2%)
Missing	0	1 (0.1%)
Alcohol status		
Current drinker	16 (66.7%)	694 (48.4%)
Not currently drinking	7 (29.2%)	571 (39.8%)
Missing	1 (4.2%)	168 (11.7%)
Body mass index		
Underweight	1 (4.2%)	21 (1.5%)
Healthy weight	9 (37.5%)	310 (21.6%)
Overweight	7(29.2%)	426 (29.7%)
Obesity	7 (29.2%)	615 (42.9%)
Missing	0 (0%)	61 (4.3%)
Season		
Peak (Oct–Mar)	13 (54.2%)	858 (59.9%)
Off-peak (Apr–Sep)	11 (45.8%)	575 (40.1%)
Vaccination status (≥65 years only)		
Influenza vaccine ≤12 months	10 (83.3%)	518 (91.8%)
SARS-CoV-2 vaccine ≤12 months	3 (25.0%)	337 (59.8%)
Pneumococcal vaccine ≤5 years	1 (8.3%)	76 (13.5%)
Pneumococcal vaccine > 5 years	6 (50.0%)	295 (52.3%)
No pneumococcal vaccine recorded in EHR	5 (41.7%)	193 (34.2%)

Abbreviations: aLRTI, acute lower respiratory tract infection; CAP, community-acquired pneumonia; COPD, chronic obstructive pulmonary disease; EHR, electronic healthcare record, IMD, index multiple deprivation; n/N, number, IQR, interquartile range; UAD, urine antigen detection assay

† In the UK, patients aged ≥ 65 years are eligible for Pneumococcal vaccination (PneumoVax®, PPV23) once, and annual influenza vaccine.

*Ethnic-specific thresholds were applied, incorporating specific BMI cut-points of 18.5, 23, and 27.5 kg/m^2 for Asian or Asian British and Black, Black British, Caribbean, or African. For all other ethnicities, standard BMI cut-points of 18.5, 25, and 30 kg/m^2 were used.

Adverse Events:

There were no adverse events associated with this study.