



Clark, S., Lucidarme, J., Angel, G., Lekshmi, A., Morales-Aza, B., Willerton, L., Campbell, H., Gray, S. J., Ladhani, S., Wade, M., Ramsay, M. E., Yates, J., Finn, A., & Borrow, R. (2019). Outbreak strain characterisation and pharyngeal carriage detection following a protracted group B meningococcal outbreak in adolescents in South-West England. *Scientific Reports*, 9(1), Article 9990 (2019).  
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**Manuscript Title:** Outbreak strain characterisation and pharyngeal carriage detection following a protracted group B meningococcal outbreak in adolescents in South-West England.

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**Supplementary Table S1:** Meningococcal carriage among the 129 participants in a pharyngeal swabbing exercise. The columns in left-hand box contain the results of real-time PCR (*sodC* and *ctrA*) and sequencing of *PorA* directly from the swab. The columns in the right-hand box contain information on the isolates obtained through *in vitro* culture from the swabs. All swabs were numbered based on ascending *sodC* Ct value. Gray shading indicates positive meningococcal detection.

Swab No.	<i>sodC</i> Ct value	<i>ctrA</i> Ct value	<i>siaD<sub>B</sub></i> Ct value	<i>PorA</i> genotype (direct)	Isolate ID	Phenotype	Geno group	<i>PorA</i>	ST	clonal complex	Comments
1	27.43	27.10	27.54	P1.22,14,36	BRI011	B;1;NT;14	B	P1.22,14,36	2660	ST-213 complex	n/a
2	28.16	ND	ND	P1.5,2,36-2	BRI007	NG;2a;5;2	NG	P1.5,2,36-2	11	ST-11 complex	Partial deletion of capsular locus
3	29.98	ND	ND	P1.18,25-44,38-1	BRI002	NG;15;NT;NT	NG	P1.18,25-44,38-1	823	ST-198 complex	Capsular null locus
4	30.89	ND	ND	NP	~	~	~	~	~	~	~
5	31.44	32.56	33.12	P1.22,14,36	BRI005	B;4;NT;14	B	P1.22,14,36	41	ST-41/44 complex	n/a
6	31.45	32.44	32.97	P1.17-1,23,37	BRI019	B;NT;NT;NT	B	P1.17-1,23,37	1097	ST-41/44 complex	n/a
7	32.09	31.29	ND	P1.7-2,13-9,35-1	BRI006	NG;NT;NT;13	C	P1.7-2,13-9,35-1	278	ST-35 complex	Internal stop codon in polysialyltransferase ( <i>siaDc</i> )
8	32.22	32.23	32.89	P1.7,30-3,38	BRI020	B;NT;7;NT	B	P1.7,30-3,38	13745	ST-213 complex	n/a
9	32.42	33.79	ND	P1.5-1,10-10,36-2	BRI015	NG;NT;5;NT	NG	P1.5-1,10-10,36-2	1655	ST-23 complex	Capsule region A partially missing
10	32.60	34.28	ND	P1.5-1,2-2,36-2	BRI018	Y;NT;5;2	Y	P1.5-1,2-2,36-2	23	ST-23 complex	n/a
11	32.93	ND	ND	P1.18,25-44,38-1	~	~	~	~	~	~	~
12	33.26	32.51	ND	P1.18-7,9,35-1	BRI021	NG;4;NT;9	E	P1.18-7,9,35-1	254	ST-254 complex	Serogroup E not part of routine phenotype testing
13	33.30	33.48	ND	P1.21-7,16,37-1	BRI008	NG;NT;NT;16	E	P1.21-7,16,37-1	1157	ST-1157 complex	Serogroup E not part of routine phenotype testing
14	33.48	39.04	ND	NP	BRI004	NG;NT;5;2	X	P1.5-1,2-5,36-2	5063	Singleton	Serogroup X not part of routine phenotype testing
15	33.55	33.44	ND	P1.5,2,36-2	BRI023	NG;NT;5;2	E	P1.5,2,36-2	60	ST-60 complex	Serogroup E not part of routine phenotype testing
16	33.68	ND	ND	NP	~	~	~	~	~	~	~
17	34.28	38.46	ND	P1.5-1,2-59,36-2	BRI022	NG;4;5;2	W	P1.5-1,-,36-2	910	Singleton	n/a
18	34.62	36.31	ND	NP	~	~	~	~	~	~	~
19	34.68	37.34	ND	NP	~	~	~	~	~	~	~
20	35.10	ND	ND	NP	~	~	~	~	~	~	~
21	35.14	ND	ND	NP	~	~	~	~	~	~	~
22	35.24	ND	ND	NP	~	~	~	~	~	~	~
23	35.30	ND	ND	NP	~	~	~	~	~	~	~
24	35.41	35.53	ND	P1.5,2,36-2	BRI016	NG;NT;NT;2	E	P1.5,2,36-2	13744	ST-1157 complex	Serogroup E not part of routine phenotype testing
25	35.42	ND	ND	NP	~	~	~	~	~	~	~

26	35.44	35.41	35.87	P1.17-1,23,37	BRI024	NG;1;NT;NT	B	P1.17-1,23,37	1423	ST-41/44 complex	Polysialyltransferase (sialDb) phase variable: off
27	35.45	ND	ND	NP	~	~	~	~	~	~	~
28	35.50	38.31	ND	NP	BRI009	NG;NT;5;2	E	P1.5,2,36-2	13744	ST-1157 complex	Serogroup E not part of routine phenotype testing
29	35.54	ND	ND	NP	~	~	~	~	~	~	~
30	35.61	35.96	ND	P1.5,2,36-2	BRI017	W;2a;5;2	W	P1.5,2,36-2	11	ST-11 complex	n/a
31	35.66	ND	ND	NP	~	~	~	~	~	~	~
32	35.86	ND	ND	NP	~	~	~	~	~	~	~
33	35.88	ND	ND	NP	~	~	~	~	~	~	~
34	35.96	ND	ND	NP	~	~	~	~	~	~	~
35	35.99	ND	ND	NP	~	~	~	~	~	~	~
36	36.08	ND	ND	NP	~	~	~	~	~	~	~
37	36.10	ND	ND	NP	~	~	~	~	~	~	~
38	36.17	ND	ND	NP	~	~	~	~	~	~	~
39	36.37	ND	ND	NP	~	~	~	~	~	~	~
40	36.48	ND	ND	NP	~	~	~	~	~	~	~
41	36.66	ND	ND	NP	~	~	~	~	~	~	~
42	36.81	ND	ND	NP	~	~	~	~	~	~	~
43	36.83	ND	ND	NP	~	~	~	~	~	~	~
44	36.83	ND	ND	NP	~	~	~	~	~	~	~
45	37.06	ND	ND	NP	~	~	~	~	~	~	~
46	37.09	ND	ND	NP	~	~	~	~	~	~	~
47	37.37	ND	ND	NP	~	~	~	~	~	~	~
48	37.39	ND	ND	NP	~	~	~	~	~	~	~
49	37.51	ND	ND	NP	~	~	~	~	~	~	~
50	37.59	ND	ND	NP	~	~	~	~	~	~	~
51	37.65	ND	ND	NP	~	~	~	~	~	~	~
52	37.66	ND	ND	NP	~	~	~	~	~	~	~
53	37.66	ND	ND	NP	~	~	~	~	~	~	~
54	37.72	ND	ND	P1.18-7,9,35-1	~	~	~	~	~	~	~
55	37.79	ND	ND	NP	~	~	~	~	~	~	~
56	37.81	ND	ND	NP	~	~	~	~	~	~	~
57	37.87	ND	ND	NP	~	~	~	~	~	~	~
58	38.07	39.25	ND	P1.5-1,10-1,36-2	~	~	~	~	~	~	~
59	38.09	ND	ND	NP	~	~	~	~	~	~	~
60	38.15	ND	ND	NP	~	~	~	~	~	~	~
61	38.18	ND	ND	NP	~	~	~	~	~	~	~
62	38.26	ND	ND	NP	~	~	~	~	~	~	~
63	38.31	38.81	ND	P1.21-7,16,37-1	~	~	~	~	~	~	~
64	38.35	ND	ND	NP	~	~	~	~	~	~	~
65	38.57	ND	ND	NP	~	~	~	~	~	~	~
66	38.60	ND	ND	NP	~	~	~	~	~	~	~
67	38.70	ND	ND	NP	~	~	~	~	~	~	~

68	38.70	ND	ND	NP	~	~	~	~	~	~	~
69	38.72	ND	ND	NP	~	~	~	~	~	~	~
70	38.89	ND	ND	NP	~	~	~	~	~	~	~
71	38.92	ND	ND	NP	~	~	~	~	~	~	~
72	39.04	38.97	ND	NP	~	~	~	~	~	~	~
73	39.31	ND	ND	NP	~	~	~	~	~	~	~
74	39.32	ND	ND	NP	~	~	~	~	~	~	~
75	39.35	ND	ND	NP	~	~	~	~	~	~	~
76	39.44	ND	ND	NP	~	~	~	~	~	~	~
77	39.80	ND	ND	NP	~	~	~	~	~	~	~
78	39.83	ND	ND	NP	~	~	~	~	~	~	~
79	40.10	ND	ND	NP	~	~	~	~	~	~	~
80	40.39	ND	ND	NP	~	~	~	~	~	~	~
81	40.62	ND	ND	NP	~	~	~	~	~	~	~
82	40.71	ND	ND	NP	~	~	~	~	~	~	~
83	40.88	ND	ND	NP	~	~	~	~	~	~	~
84	41.08	ND	ND	NP	~	~	~	~	~	~	~
85	41.24	ND	ND	NP	~	~	~	~	~	~	~
86	41.86	ND	ND	NP	~	~	~	~	~	~	~
87	41.97	ND	ND	NP	~	~	~	~	~	~	~
88	42.07	ND	ND	NP	~	~	~	~	~	~	~
89	42.48	38.69	ND	NP	~	~	~	~	~	~	~
90	43.75	ND	ND	NP	~	~	~	~	~	~	~
91	44.70	ND	ND	NP	~	~	~	~	~	~	~
92	44.89	ND	ND	NP	~	~	~	~	~	~	~
93	44.92	ND	ND	NP	~	~	~	~	~	~	~
94	45.03	ND	ND	NP	~	~	~	~	~	~	~
95	45.12	ND	ND	NP	~	~	~	~	~	~	~
96	46.27	ND	ND	NP	~	~	~	~	~	~	~
97	ND	ND	ND	P1.17,9,35-1	~	~	~	~	~	~	~
98	ND	36.70	38.51	P1.22,14,36	~	~	~	~	~	~	~
99	ND	ND	ND	NP	~	~	~	~	~	~	~
100	ND	ND	ND	NP	~	~	~	~	~	~	~
101	ND	ND	ND	NP	~	~	~	~	~	~	~
102	ND	ND	ND	NP	~	~	~	~	~	~	~
103	ND	ND	ND	NP	~	~	~	~	~	~	~
104	ND	ND	ND	NP	~	~	~	~	~	~	~
105	ND	ND	ND	NP	~	~	~	~	~	~	~
106	ND	ND	ND	NP	~	~	~	~	~	~	~
107	ND	ND	ND	NP	~	~	~	~	~	~	~
108	ND	ND	ND	NP	~	~	~	~	~	~	~
109	ND	ND	ND	NP	~	~	~	~	~	~	~
110	ND	ND	ND	NP	~	~	~	~	~	~	~
111	ND	ND	ND	NP	~	~	~	~	~	~	~

112	ND	ND	ND	NP	~	~	~	~	~	~	~
113	ND	ND	ND	NP	~	~	~	~	~	~	~
114	ND	ND	ND	NP	~	~	~	~	~	~	~
115	ND	ND	ND	NP	~	~	~	~	~	~	~
116	ND	ND	ND	NP	~	~	~	~	~	~	~
117	ND	ND	ND	NP	~	~	~	~	~	~	~
118	ND	ND	ND	NP	~	~	~	~	~	~	~
119	ND	ND	ND	NP	~	~	~	~	~	~	~
120	ND	ND	ND	NP	~	~	~	~	~	~	~
121	ND	ND	ND	NP	~	~	~	~	~	~	~
122	ND	ND	ND	NP	~	~	~	~	~	~	~
123	ND	ND	ND	NP	~	~	~	~	~	~	~
124	ND	ND	ND	NP	~	~	~	~	~	~	~
125	ND	ND	ND	NP	~	~	~	~	~	~	~
126	ND	ND	ND	NP	~	~	~	~	~	~	~
127	ND	ND	ND	NP	~	~	~	~	~	~	~
128	ND	ND	ND	NP	~	~	~	~	~	~	~
129	ND	ND	ND	NP	~	~	~	~	~	~	~

~ isolate not obtained

ND: Not detected

NP: No sequencable PCR product obtained

**Supplementary Table S2:** fHbp sequencing results direct from swab (left-hand box) alongside fHbp data from corresponding isolates (right-hand box, where applicable). Discordant results are highlighted in bold text. 'NP' indicates no PCR product was obtained.

Swab No.	fHbp allele (from swab)	fHbp peptide (from swab)	Isolate ID	fHbp allele (from isolate)	fHbp peptide (from isolate)
1	65	45	BRI011	65	45
2	22	22	BRI007	22	22
3	66	4	BRI002	66	4
4	928	762	~	~	~
5	<b>288</b>	<b>235</b>	BRI005	<b>4</b>	<b>4</b>
6	<b>522</b>	<b>447</b>	BRI019	<b>19</b>	<b>19</b>
7	24	24	BRI006	24	24
8	<b>1532</b>	<b>401</b>	BRI020	<b>65</b>	<b>45</b>
9	<b>778</b>	<b>499</b>	BRI015	<b>25</b>	<b>25</b>
10	<b>110</b>	<b>110</b>	BRI018	<b>25</b>	<b>25</b>
11	NP	NP	~	~	~
12	13	13	BRI021	13	13
13	68	13	BRI008	68	13
14	108/34*	108/12*	BRI004	34	12
15	386/13*	312/13*	BRI023	13	13
16	108	108	~	~	~
17	<b>47</b>	<b>61</b>	BRI022	24	24
18	928	762	~	~	~
19	108	108	~	~	~
20	30	30	~	~	~
21	15	15	~	~	~
22	323	276	~	~	~
23	NP	NP	~	~	~
24	<b>778</b>	<b>499</b>	BRI016	<b>13</b>	<b>13</b>
25	NP	NP	~	~	~
26	<b>33</b>	<b>31</b>	BRI024	<b>19</b>	<b>19</b>
27	NP	NP	~	~	~
28	13	13	BRI009	13	13
29	1161	925	~	~	~
30	<b>546/13*</b>	<b>456/13*</b>	BRI017	<b>22</b>	<b>22</b>
31	1173	933	~	~	~
32	881	722	~	~	~
33	673	570	~	~	~
34	1035	829	~	~	~
35	NP	NP	~	~	~
36	98	90	~	~	~
37	110	110	~	~	~
38	505	430	~	~	~
39	33	31	~	~	~

40	47	61	~	~	~
41	47	61	~	~	~
42	1542	1179	~	~	~
43	1537	1091	~	~	~
44	1538	1178	~	~	~
45	522	447	~	~	~
46	30	30	~	~	~
47	928	762	~	~	~
48	Mixed	Mixed	~	~	~
49	110	110	~	~	~
50	108	108	~	~	~
51	NP	NP	~	~	~
52	NP	NP	~	~	~
53	505	430	~	~	~
54	110	110	~	~	~
55	NP	NP	~	~	~
56	1282	1008	~	~	~
57	NP	NP	~	~	~
58	1539	n/a**	~	~	~
59	110	110	~	~	~
60	108	108	~	~	~
61	108	108	~	~	~
62	1529	1172	~	~	~
63	110	110	~	~	~
64	108	108	~	~	~
65	NP	NP	~	~	~
66	1431	218	~	~	~
67	NP	NP	~	~	~
68	928	762	~	~	~
69	1541	312	~	~	~
70	NP	NP	~	~	~
71	33	31	~	~	~
72	165	156	~	~	~
73	277	226	~	~	~
74	928	762	~	~	~
75	1530	312	~	~	~
76	NP	NP	~	~	~
77	1528	1171	~	~	~
78	NP	NP	~	~	~
79	277	226	~	~	~
80	47	61	~	~	~
81	971	456	~	~	~
82	1541	312	~	~	~
83	47	61	~	~	~
84	108	108	~	~	~

85	NP	NP	~	~	~
86	NP	NP	~	~	~
87	NP	NP	~	~	~
88	928	762	~	~	~
89	368	312	~	~	~
90	NP	NP	~	~	~
91	368	312	~	~	~
92	108	108	~	~	~
93	350	297	~	~	~
94	NP	NP	~	~	~
95	288	235	~	~	~
96	538	464	~	~	~
97	NP	NP	~	~	~
98	33	31	~	~	~
99	NP	NP	~	~	~
100	68	13	~	~	~
101	NP	NP	~	~	~
102	47	61	~	~	~
103	673	570	~	~	~
104	NP	NP	~	~	~
105	NP	NP	~	~	~
106	NP	NP	~	~	~
107	824	677	~	~	~
108	1531	1174	~	~	~
109	302	245	~	~	~
110	110	110	~	~	~
111	108	108	~	~	~
112	505	430	~	~	~
113	56	69	~	~	~
114	1503	1150	~	~	~
115	1534	1176	~	~	~
116	NP	NP	~	~	~
117	1535	n/a**	~	~	~
118	1536	1177	~	~	~
119	546	456	~	~	~
120	NP	NP	~	~	~
121	NP	NP	~	~	~
122	6	6	~	~	~
123	1540	1173	~	~	~
124	15	15	~	~	~
125	566	490	~	~	~
126	47	61	~	~	~
127	990	799	~	~	~
128	673	570	~	~	~



129	110	110	~	~	~
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\* multiple alleles discerned among traces

\*\* No peptide ID. Internal stop codon

~ isolate not obtained

NP: No sequencable PCR product  
obtained