Table 1. Breakdown of the 4CMenB antigens affording protection among invasive meningococcal B isolates from England, Wales and Northern Ireland over 2007/08 and 2014/15 epidemiological years.

|  |  |  |  |
| --- | --- | --- | --- |
| **No of Antigens contributing to coverage** | **Antigen combination** | **2007/2008****(535 isolates)****n (%)** | **2014/2015****(251 isolates)****n (%)** |
| **0** | None | 144 (26.9) | 86 (34.3) |
| **1** | fHbp | 78 (14.6) | 63 (25.1) |
| NHBA | 42 (7.9) | 14 (5.6) |
| NadA | 0 | 0 |
| PorA | 2 (0.4) | 1 (0.4) |
| *Total* | *122 (22.8)* | *78 (31.1)* |
| **2** | fHbp+NHBA | 160 (29.9) | 44 (17.5) |
| fHbp+NadA | 0 | 5 (2.0) |
| fHbp+PorA | 17 (3.2) | 12 (4.8) |
| PorA+NHBA | 5 (0.9) | 3 (1.2) |
| NHBA+NadA | 2 (0.4) | 0 |
| *Total* | *184 (34.4)* | *64 (25.5)* |
| **3** | fHbp+NHBA+PorA | 84 (15.7) | 23 (9.2) |
| fHbp+NHBA+NadA | 1 (0.2) | 0 |
| *Total* | *85 (15.9)* | *23 (9.2)* |

Table 2 Clonal complex distribution of England, Wales and Northern Ireland meningococcal group B isolates from 2007/08 and 2014/15 and MATS coverage within each clonal complex

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Clonal Complexes** | **2007-2008****n (% of all isolates)** | **2007/08 MATS Coverage (%)** | **2014-2015****n (% of all isolates)** | **2014/15 MATS Coverage (%)** |
| cc269 complex | 176 (32.9) | 72.7 | 60 (23.9) | 53.3 |
| cc41/44 complex | 169 (31.6) | 93.5 | 82 (32.7) | 93.9 |
| cc213 complex | 52 (9.7) | 17.3 | 26 (10.4) | 23.1 |
| Unassigned | 35 (6.5) | 54.3 | 22 (8.8) | 63.6 |
| cc32 complex | 31(5.8) | 100 | 23 (9.2) | 93.1 |
| cc461 complex | 12 (2.2) | 41.7 | 10 (4.0) | 10.0 |
| cc60 complex | 11 (2.1) | 45.5 | 3 (1.2) | 66.7 |
| cc162 complex | 10 (1.9) | 100 | 8 (3.2) | 87.5 |
| cc18 complex | 9 (1.7) | 88.9 | 1 (0.4) | 100 |
| cc35 complex | 8 (1.5) | 37.5 | 9 (3.6) | 33.3 |
| cc11 complex | 6 (1.1) | 100 | 0 | - |
| cc282 complex | 4 (0.8) | 50 | 0 | - |
| cc22 complex | 2 (0.4) | 50 | 0 | - |
| cc254 complex | 2 (0.4) | 100 | 0 | - |
| cc364 complex | 2 (0.4) | 0 | 1 (0.4) | 0 |
| cc8 complex | 1 (0.2) | 100 | 0 | - |
| cc103 complex | 1 (0.2) | 0 | 1 (0.4) | 0 |
| cc174 complex | 1 (0.2) | 0 | 0 | - |
| cc226 complex | 1 (0.2) | 0 | 0 | - |
| cc865 complex | 1 (0.2) | 100 | 1 (0.4) | 0 |
| cc1157 complex | 1 (0.2) | 100 | 3 (1.2) | 33.3 |
| cc4821 complex | 0 | - | 1 (0.4) | 0 |
| **Total % covered** |  | **73.1** |  | **65.7** |

Table 3: Frequency of invasive meningococcal group B isolates in England, Wales and Northern Ireland stratified by number of 4CMenB antigens affording protection and age group for 2007/08 and 2014/15 epidemiological years.

|  |  |  |
| --- | --- | --- |
|  | **2007/2008** (n=534\*) (% of age group) | **2014/2015** (n=232\*) (% of age group) |
|  | **N⁰ of antigens coverage afforded by** |  | **N⁰ of antigens coverage afforded by** |
| Age | **0 Ag** | **1 Ag** | **2 Ag** | **3 Ag** | **Age** | **0 Ag** | **1 Ag** | **2 Ag** | **3 Ag** |
| <1(n=150) | 50 (33.3) | 38 (25.3) | 45 (30.0) | 17 (11.3) | **<1**(n=70) | 26 (37.1) | 21 (30.0) | 18 (25.7) | 5 (7.1) |
| 1-2(n=69) | 20 (29.0) | 23 (33.3) | 14 (20.3) | 12 (17.4) | **1-2**(n=55) | 21 (38.2) | 13 (23.6) | 16 (29.1) | 5 (9.1) |
| 3-4(n=105) | 26 (24.8) | 20 (19.0) | 40 (38.1) | 19 (18.1) | **3-4**(n=15) | 7 (46.7) | 1 (6.7) | 5 (33.3) | 2 (13.3) |
| 5+(n=210) | 49 (23.3) | 46 (21.9) | 80 (38.1) | 35 (16.7) | **5+**(n=92) | 28 (30.4) | 35 (38.0) | 20 (21.7) | 9 (9.8) |

\*Age was not reported for one case in 2007/08 and 19 cases in 2014/15.

Table 4: Protection by antigen combination versus clonal complex for invasive MenB isolates during 2007/08 and 2014/15 (n (%)) in England, Wales and Northern Ireland.

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|   | **None** | **fHbp** | **NHBA** | **NadA** | **PorA** | **fHbp+NHBA** | **fHbp+PorA** | **fHbp+NadA** | **NHBA+NadA** | **NHBA+PorA** | **fHbp+NHBA+NadA** | **fHbp+NHBA+PorA** |
| **cc** | 2007/08 | 2014/15 | 2007/08 | 2014/15 | 2007/08 | 2014/15 | 2007/08 | 2014/15 | 2007/08 | 2014/15 | 2007/08 | 2014/15 | 2007/08 | 2014/15 | 2007/08 | 2014/15 | 2007/08 | 2014/15 | 2007/08 | 2014/15 | 2007/08 | 2014/15 | 2007/08 | 2014/15 |
| **103** | 1 (100) | 1 (100) | 0 (0) | 0 | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0 | 0 (0) | 0 | 0 (0) | 0 | 0 (0) | 0 | 0 (0) | 0 | 0 (0) | 0 | 0 (0) | 0 | 0 (0) | 0 |
| **11** | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 2 (33.3) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 1 (16.7) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 2 (33.3) | 0 (0) | 0 (0) | 0 (0) | 1 (16.7) | 0 (0) | 0 (0) | 0 (0) |
| **1157** | 0 (0) | 2 (66.7) | 1 (100) | 1 (33.3) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0 (0) |
| **162** | 0 (0) | 1 (12.5) | 3 (30.0) | 2 (25.0) | 5 (50.0) | 3 (37.5) | 0 (0) | 0 (0) | 1 (10.0) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 1 (10.0) | 2 (25.0) | 0 (0) | 0 (0) | 0 (0) | 0 (0) |
| **174** | 1 (100) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0 (0) |
| **18** | 1 (11.1) | 0 (0) | 8 (88.9) | 1 (100) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0 (0) |
| **213** | 43 (82.7) | 18 (75.0) | 5 (9.6) | 5 (20.8) | 3 (5.8) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 1 (4.2) | 1 (1.9) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0 (0) |
| **22** | 1 (50.0) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 1 (50.0) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0 (0) |
| **226** | 1 (100) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0 (0) |
| **254** | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 1 (50.0) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 1 (50.0) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0 (0) |
| **269** | 48 (27.3) | 26 (44.8) | 26 (14.8) | 25 (43.1) | 13 (7.4) | 1 (1.7) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 85 (48.3) | 6 (10.3) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 1 (0.6) | 0 (0) | 0 (0) | 0 (0) | 3 (1.7) | 0 (0) |
| **282** | 2 (50.0) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 2 (50.0) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0 (0) |

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **None** | **fHbp** | **NHBA** | **NadA** | **PorA** | **fHbp+NHBA** | **fHbp+PorA** | **fHbp+NadA** | **NHBA+NadA** | **NHBA+PorA** | **fHbp+NHBA+NadA** | **fHbp+NHBA+PorA** |
| **cc** | 2007/08 | 2014/15 | 2007/08 | 2014/15 | 2007/08 | 2014/15 | 2007/08 | 2014/15 | 2007/08 | 2014/15 | 2007/08 | 2014/15 | 2007/08 | 2014/15 | 2007/08 | 2014/15 | 2007/08 | 2014/15 | 2007/08 | 2014/15 | 2007/08 | 2014/15 | 2007/08 | 2014/15 |
| **32** | 0 (0) | 3 (12.5) | 14 (45.2) | 12 (50.0) | 0 (0) | 1 (4.2) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 17 (54.8) | 4 (16.7) | 0 (0) | 0 (0) | 0 (0) | 4 (16.7) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0 (0) |
| **35** | 4 (50.0) | 6 (66.7) | 1 (12.5) | 0 (0) | 2 (25.0) | 3 (33.3) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 1 (12.5) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0 (0) |
| **364** | 2 (100) | 1 (100) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0 (0) |
| **41/44** | 11 (6.5) | 5 (6.1) | 5 (3.0) | 3 (3.7) | 8 (4.7) | 6 (7.3) | 0 (0) | 0 (0) | 1 (0.6) | 1 (1.2) | 46 (27.2) | 32 (39.0) | 15 (8.9) | 11 (13.4) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 3 (1.8) | 1 (1.2) | 0 (0) | 0 (0) | 80 (47.3) | 23 (28.0) |
| **461** | 7 (58.3) | 9 (90.0) | 0 (0) | 1 (10.0) | 3 (25.0) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 2 (16.7) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0 (0) |
| **4821** | 0 (0) | 1 (100) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0 (0) |
| **60** | 6 (54.5) | 1 (33.3) | 2 (18.2) | 2 (66.7) | 2 (18.2) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 1 (9.1) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0 (0) |
| **8** | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 1 (100) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0 (0) |
| **865** | 0 (0) | 1 (100) | 0 (0) | 0 (0) | 1 (100) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0 (0) |
| **UA\*** | 16 (45.7) | 8 (38.1) | 13 (37.1) | 10 (47.6) | 2 (5.7) | 1 (4.8) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 3 (8.6) | 1 (4.8) | 0 (0) | 0 (0) | 0 (0) | 1 (4.8) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 1 (2.9) | 0 (0) |

\*Unassigned

Figure 2: Proportion of invasive meningococcal group B isolates from England, Wales and Northern Ireland during 2007/08 and 2014/15 epidemiological years afforded protection by each vaccine antigen.

**Figure 3: Distribution of relative potencies in MATS for fHbp and NHBA for invasive Meningococcal group B isolates in England, Wales and Northern Ireland during 2007/08 and 2014/15 epidemiological years**

Variant 1

Variant 1

Variant 2

Variant 3

Variant 2

Variant 3

**A**

**B**

**C**

fHbp peptide

fHbp peptide

(A) 2007/08 fHbp variant and peptide (n=442) (B) 2014/15 fHbp variant and peptide (n=226) (C) 2007/08 and 2014/15 NHBA peptide (n=785). Groups accounting for less than five isolates are not included in the plots. Boxes represent the median and interquartile range (IQR) for each distribution and whiskers signify the 75th percentile+1.5xIQR and the 25th percentile-1.5xIQR. The dashed line presents the respective PBT for each antigen and the solid lines are the 95% CIs. Dots signify individual outliers. 2007/08 fHbp PBT:0.021 (95% CI, 0.014-0.031); 2014/15 fHbp PBT:0.012 (95%CI, 0.008-0.018); 2007/08 and 2014/15 NHBA PBT:0.294 (95% CI, 0.169-0.511). LLOQ for 2007/08 fHbp isolates: 0.0009; LLOQ 2007/08 NHBA and all 2014/15 isolates: 0.004.