Supplementary Information

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A. Community study sites

1. Macpherson Zone “A” Residential Committee centre
2. Macpherson Zone “C” Residential Committee centre
3. Tembusu Senior Activity Centre
4. TOUCH Senior Activity Centre
5. Teck Ghee Zone “A” Residential Committee centre
6. Teck Ghee Zone “C” Residential Committee
t7. Teck Ghee Zone “F” Residential Committee
t8. Teck Ghee Zone “J” Residential Committee centre
9. Tampines Palmspring Residential Committee centre
10. Hua Mei Mobile Clinic
11. Telok Blangah Residential Committee
12. Ang Mo Kio Community Centre
13. Geylang West Community Centre
14. Sikh Welfare Council
15. Redhill Senior Activity Centre
B. Supplementary Table 1: Multivariable regression analyses for A/HK/H3N2, A/MI/H1N1 and BSplit HAI fold rise at D28 compared to D0, inclusive of the interaction terms between prior influenza vaccination and baseline HAI titer.

| Variables | A/HK/H3N2 Foldrise (95% CI) | p | A/MI/H1N1 Foldrise (95% CI) | p | B-Split Foldrise (95% CI) | p |
|-----------|-----------------------------|---|-----------------------------|---|---------------------------|---|
| Age       | 0.99 (0.95 - 1.02)          | 0.373 | 0.96 (0.92 - 0.99)          | 0.025 | 1.00 (0.98 - 1.02)          | 0.957 |
| Gender    | Ref                         |   | Ref                         |   | Ref                       |   |
| Race      | Male                        | 0.73 (0.52 - 1.02) | 0.068 | 0.75 (0.50 - 1.13) | 0.175 | 1.03 (0.84 - 1.27) | 0.775 |
|           | Chinese                     | Ref | Ref                         | Ref | Ref                       |   |
|           | Malay                       | 1.07 (0.70 - 1.65) | 0.758 | 1.38 (0.82 - 2.31) | 0.226 | 0.96 (0.74 - 1.24) | 0.736 |
|           | Others                      | 1.27 (0.80 - 2.02) | 0.306 | 1.59 (0.91 - 2.77) | 0.104 | 1.28 (0.97 - 1.69) | 0.083 |
|           | Waist/ Hip/ BMI             | 1.23 (0.85 - 1.78) | 0.269 | 1.33 (0.85 - 2.07) | 0.209 | 1.10 (0.88 - 1.37) | 0.418 |
|           | Diabetes                    | 1.15 (0.81 - 1.63) | 0.439 | 1.19 (0.78 - 1.80) | 0.424 | 1.00 (0.81 - 1.23) | 0.999 |
|           | Hypertension                | 0.88 (0.62 - 1.27) | 0.503 | 0.88 (0.57 - 1.35) | 0.549 | 0.95 (0.76 - 1.18) | 0.618 |
|           | Hyperlipidemia              | 0.90 (0.63 - 1.30) | 0.587 | 0.70 (0.45 - 1.09) | 0.114 | 1.03 (0.82 - 1.28) | 0.820 |
|           | Chronic Pulmonary Disease   | 0.53 (0.26 - 1.11) | 0.095 | 0.78 (0.32 - 1.89) | 0.585 | 0.91 (0.59 - 1.42) | 0.694 |
|           | Physical Activity           | Ref | Ref                         | Ref | Ref                       |   |
|           | Light                       | 2.19 (1.15 - 4.18) | 0.019 | 1.01 (0.47 - 2.20) | 0.978 | 0.99 (0.67 - 1.46) | 0.949 |
|           | Intermediate               | 2.74 (1.25 - 6.02) | 0.013 | 0.66 (0.26 - 1.71) | 0.397 | 1.13 (0.70 - 1.81) | 0.621 |
|           | Moderate                    | 3.11 (1.57 - 6.21) | 0.001 | 0.67 (0.29 - 1.52) | 0.340 | 0.95 (0.63 - 1.44) | 0.807 |
|           | Vigorous                    | 3.29 (1.38 - 7.85) | 0.008 | 0.88 (0.31 - 2.50) | 0.808 | 0.59 (0.35 - 1.00) | 0.053 |
| Baseline 25-(OH)-D | 1.01 (0.96 - 1.03) | 0.680 | 1.00 (0.96 - 1.03) | 0.805 | 1.00 (0.99 - 1.02) | 0.610 |
| History of Influenza vaccination | Ref | Ref | Ref | Ref | Ref | Ref |
|           | None                        | Ref | Ref                         | Ref | Ref                       |   |
|           | SH14, NH1415/SH1516, NH1516 | SH16, NH1617 | 0.04 (0.10 - 1.43) | 0.079 | 0.02 (0.1 - 1.48) | 0.076 | 0.28 (0.03 - 2.48) | 0.232 |
|           | SH16, NH1617                | 0.21 (0.04 - 1.11) | 0.066 | 0.71 (0.09 - 5.33) | 0.738 | 0.86 (0.32 - 2.43) | 0.806 |
|           | Baseline AHK titer (Log2 Transformed) | 0.61 (0.54 - 0.69) | <0.001 | 1.02 (0.69 - 1.51) | 0.745 | 1.06 (1.00 - 1.16) | 0.043 |
|           | Baseline AHK titer (Log2 Transformed) | 0.84 (0.67 - 1.06) | 0.140 | 0.87 (0.66 - 1.15) | 0.332 | 0.93 (0.81 - 1.07) | 0.323 |
|           | Baseline BSplit titer (Log2 Transformed) | 1.05 (0.78 - 1.41) | 0.738 | 0.92 (0.65 - 1.31) | 0.661 | 0.81 (0.67 - 0.96) | 0.018 |
|           | SH14, NH1415/SH1516, NH1516: Baseline AHK titer (Log2 Transformed) | 1.31 (0.91 - 1.89) | 0.142 | 1.31 (0.85 - 2.02) | 0.228 | 0.95 (0.76 - 1.18) | 0.651 |
|           | SH16, NH1617: Baseline AHK titer (Log2 Transformed) | 1.24 (1.01 - 1.52) | 0.042 | 0.98 (0.77 - 1.25) | 0.863 | 0.94 (0.83 - 1.06) | 0.323 |
|           | SH14, NH1415/SH1516, NH1516: Baseline AMI titer (Log2 Transformed) | 1.61 (0.87 - 2.97) | 0.127 | 0.91 (0.44 - 1.89) | 0.795 | 1.01 (0.70 - 1.45) | 0.973 |
|           | SH16, NH1617: Baseline AMI titer (Log2 Transformed) | 1.08 (0.80 - 1.47) | 0.608 | 0.75 (0.52 - 1.09) | 0.131 | 1.17 (0.97 - 1.40) | 0.016 |
|           | SH14, NH1415/SH1516, NH1516: Baseline BSplit titer (Log2 Transformed) | 1.84 (0.58 - 5.89) | 0.305 | 3.25 (0.81 - 13.1) | 0.099 | 1.48 (0.73 - 2.98) | 0.277 |
|           | SH16, NH1617: Baseline BSplit titer (Log2 Transformed) | 1.02 (0.65 - 1.61) | 0.929 | 1.30 (0.75 - 2.24) | 0.355 | 0.99 (0.75 - 1.30) | 0.922 |

Legends for †, ‡, and * are the same as appear in footnote for Table 1

All p values obtained by testing if the coefficient for a particular level of variable is significantly different compared to the reference level chosen for that variable after adjustment for all other variables in the regression model.
C. Seasonal influenza vaccine composition in recent years
(source: World Health Organization).

| Season/Year     | Influenza A/H1N1       | Influenza A/H3N2     | Influenza B                |
|-----------------|------------------------|----------------------|---------------------------|
| SH 2017 (study  | A/Mich/45/2015         | A/HK/4801/2014       | B/Brisbane/60/2008        |
| vaccine)        |                        |                      |                           |
| NH 2016-2017    | A/California/7/2009    | A/HK/4801/2014       | B/Brisbane/60/2008        |
| SH 2016         | A/California/7/2009    | A/HK/4801/2014       | B/Brisbane/60/2008        |
| NH 2015-2016    | A/California/7/2009    | A/Switzerland/9715    | B/Phuket/3073/2013        |
|                 |                        | 293/2013             |                           |
| SH 2015         | A/California/7/2009    | A/Switzerland/9715    | B/Phuket/3073/2013        |
|                 |                        | 293/2013             |                           |
| NH 2014-2015    | A/California/7/2009    | A/Texas/50/2012      | B/Massachusetts/2/2012    |
| SH 2014         | A/California/7/2009    | A/Texas/50/2012      | B/Massachusetts/2/2012    |
| NH 2013-14      | A/California/7/2009    | Cell propagated      | B/Massachusetts/2/2012    |
|                 |                        | prototype virus      |                           |
|                 |                        | A/Victoria/361/2011  |                           |
| SH 2013         | A/California/7/2009    | A/Victoria/361/2011  | B/Wisconsin/1/2010        |
| NH 2012-2013    | A/California/7/2009    | A/Victoria/361/2011  | B/Wisconsin/1/2010        |
| SH 2012         | A/California/7/2009    | A/Perth/16/2009      | B/Brisbane/60/2008        |
| NH 2011-12      | A/California/7/2009    | A/Perth/16/2009      | B/Brisbane/60/2008        |
D. Supplementary Table 2: Sample size calculation table.

| alpha | power | N  | n_non 25-(OH)D deficient | n_25-(OH)D deficient | N ratio | delta | p_non-25(OH)D deficient | p_25-(OH)D deficient |
|-------|-------|----|--------------------------|----------------------|---------|-------|-------------------------|----------------------|
| 0.05  | 0.80  | 237| 182                      | 55                   | 0.3     | -0.20 | 0.40                    | 0.20                 |
| 0.05  | 0.80  | 437| 336                      | 101                  | 0.3     | -0.15 | 0.40                    | 0.25                 |
| 0.05  | 0.80  | 1016| 781                      | 235                  | 0.3     | -0.10 | 0.40                    | 0.30                 |
| 0.05  | 0.80  | 4164| 3203                     | 961                  | 0.3     | -0.05 | 0.40                    | 0.35                 |
| 0.05  | 0.80  | 156 | 120                      | 36                   | 0.3     | -0.25 | 0.45                    | 0.20                 |
| 0.05  | 0.80  | 254 | 195                      | 59                   | 0.3     | -0.20 | 0.45                    | 0.25                 |
| 0.05  | 0.80  | 463 | 356                      | 107                  | 0.3     | -0.15 | 0.45                    | 0.30                 |
| 0.05  | 0.80  | 1068| 820                      | 246                  | 0.3     | -0.10 | 0.45                    | 0.35                 |
| 0.05  | 0.80  | 4332| 3332                     | 1000                 | 0.3     | -0.05 | 0.45                    | 0.40                 |
| 0.05  | 0.80  | 111 | 85                       | 26                   | 0.3     | -0.30 | 0.50                    | 0.20                 |
| 0.05  | 0.80  | 166 | 127                      | 39                   | 0.3     | -0.25 | 0.50                    | 0.25                 |
| 0.05  | 0.80  | 266 | 204                      | 62                   | 0.3     | -0.20 | 0.50                    | 0.30                 |
| 0.05  | 0.80  | 480 | 369                      | 111                  | 0.3     | -0.15 | 0.50                    | 0.35                 |
| 0.05  | 0.80  | 1095| 842                      | 253                  | 0.3     | -0.10 | 0.50                    | 0.40                 |
| 0.05  | 0.80  | 84  | 64                       | 20                   | 0.3     | -0.35 | 0.55                    | 0.20                 |
| 0.05  | 0.80  | 116 | 89                       | 27                   | 0.3     | -0.30 | 0.55                    | 0.25                 |
| 0.05  | 0.80  | 171 | 131                      | 40                   | 0.3     | -0.25 | 0.55                    | 0.30                 |
| 0.05  | 0.80  | 271 | 208                      | 63                   | 0.3     | -0.20 | 0.55                    | 0.35                 |
| 0.05  | 0.80  | 487 | 374                      | 113                  | 0.3     | -0.15 | 0.55                    | 0.40                 |
| 0.05  | 0.80  | 64  | 49                       | 15                   | 0.3     | -0.40 | 0.60                    | 0.20                 |
| 0.05  | 0.80  | 85  | 65                       | 20                   | 0.3     | -0.35 | 0.60                    | 0.25                 |
| 0.05  | 0.80  | 119 | 91                       | 28                   | 0.3     | -0.30 | 0.60                    | 0.30                 |
| 0.05  | 0.80  | 173 | 133                      | 40                   | 0.3     | -0.25 | 0.60                    | 0.35                 |
| 0.05  | 0.80  | 272 | 209                      | 63                   | 0.3     | -0.20 | 0.60                    | 0.40                 |