Spatio-temporal patterns of proportions of influenza B cases

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November 12, 2016

Supplementary Material

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S1 Effects of excluding data from 2010 and 2011

Table S1: Effects of setting the start date to 2011-1 and 2012-1.

factor	ref country	time interval	n	θ	ρ	95%CI	p-value	signif
effd1	Mexico	2011-1 to 2015-40	31	2000	0.633	(0.359, 0.806)	1.324e-04	***
effd2	Mexico	2011-1 to 2015-40	31	2000	0.652	(0.388, 0.818)	6.957e-05	****
effd1	China	2011-1 to 2015-40	31	2000	-0.167	(-0.492, 0.199)	0.3683	
longitude	-	2011-1 to 2015-40	31	2000	0.558	(0.255, 0.762)	0.0011	**
latitude	-	2011-1 to 2015-40	31	2000	0.116	(-0.248, 0.452)	0.5341	
effd1	Mexico	2011-1 to 2016-8	31	2000	0.450	(0.114, 0.694)	0.0110	*
effd2	Mexico	2011-1 to 2016-8	31	2000	0.513	(0.194, 0.734)	0.0032	**
effd1	China	2011-1 to 2016-8	31	2000	-0.234	(-0.543, 0.131)	0.2046	
longitude	-	2011-1 to 2016-8	31	2000	0.533	(0.221, 0.747)	0.0020	**
latitude	-	2011-1 to 2016-8	31	2000	-0.018	(-0.370, 0.339)	0.9251	
effd1	Mexico	2012-1 to 2015-40	25	2000	0.563	(0.216, 0.784)	0.0034	**
effd2	Mexico	2012-1 to 2015-40	25	2000	0.599	(0.268, 0.804)	0.0015	**
effd1	China	2012-1 to 2015-40	25	2000	-0.320	(-0.635, 0.086)	0.1187	
longitude	-	2012-1 to 2015-40	25	2000	0.591	(0.256, 0.799)	0.0019	**
latitude	-	2012-1 to 2015-40	25	2000	0.087	(-0.319, 0.466)	0.6785	
effd1	Mexico	2012-1 to 2016-8	25	2000	0.412	(0.020, 0.694)	0.0408	*
effd2	Mexico	2012-1 to 2016-8	25	2000	0.447	(0.063, 0.716)	0.0250	*
effd1	China	2012-1 to 2016-8	25	2000	-0.313	(-0.630, 0.094)	0.1278	
longitude	-	2012-1 to 2016-8	25	2000	0.499	(0.129, 0.747)	0.0112	*
latitude	-	2012-1 to 2016-8	25	2000	-0.064	(-0.448, 0.340)	0.7611	

S2 Proportions of B virus v.s. country median age

Table S2: Summary of correlation tests of proportions of B virus against country median age. A marginally negative correlation is detected when a threshold of 500 cases is used.

factor	time interval	n	θ	ρ	95%CI	p-value	signif
median.age	2006-1 to 2016-8	74	500	-0.295	(-0.491, -0.072)	0.0106	*
median.age	2006-1 to 2008-52	48	500	-0.354	(-0.580, -0.078)	0.0135	*
median.age	2010-1 to 2016-8	74	500	-0.294	(-0.490, -0.071)	0.0109	*
median.age	2010-1 to 2015-40	74	500	-0.283	(-0.480, -0.058)	0.0147	*
median.age	2006-1 to 2016-8	34	2000	-0.025	(-0.361, 0.315)	0.8864	
median.age	2006-1 to 2008-52	30	2000	-0.260	(-0.567, 0.110)	0.1646	
median.age	2010-1 to 2016-8	34	2000	-0.054	(-0.385, 0.289)	0.7610	
median.age	2010-1 to 2015-40	34	2000	-0.120	(-0.440, 0.228)	0.5005	

We downloaded country median age from `https://en.wikipedia.org/wiki/List_of_countries_by_median_age` (checked on March 22, 2016).

S3   Patterns of total confirmations
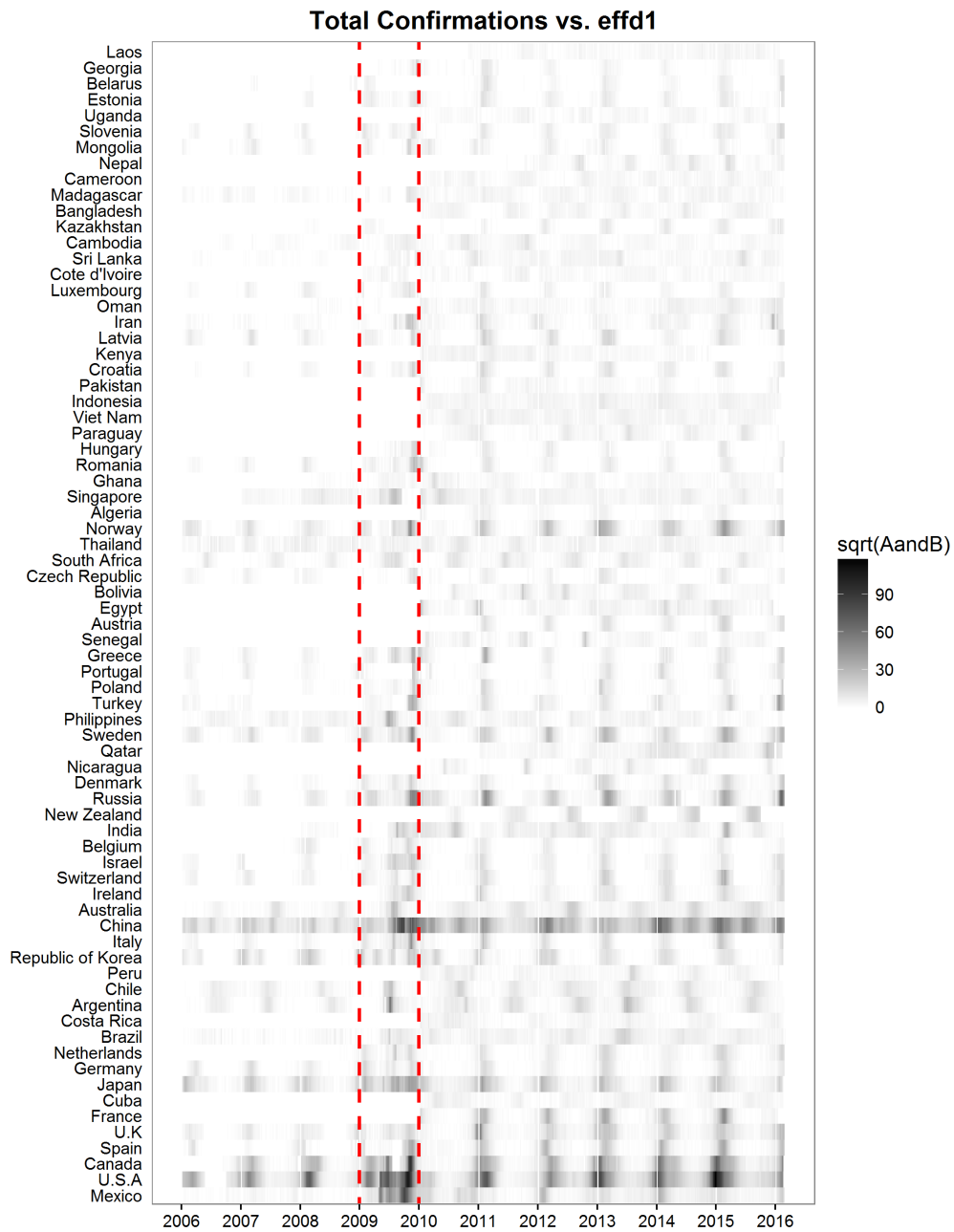
Total Confirmations vs. effd1

Figure S1: Patterns of total confirmations. Countries are ordered according to their effective distances to Mexico (definition 1).
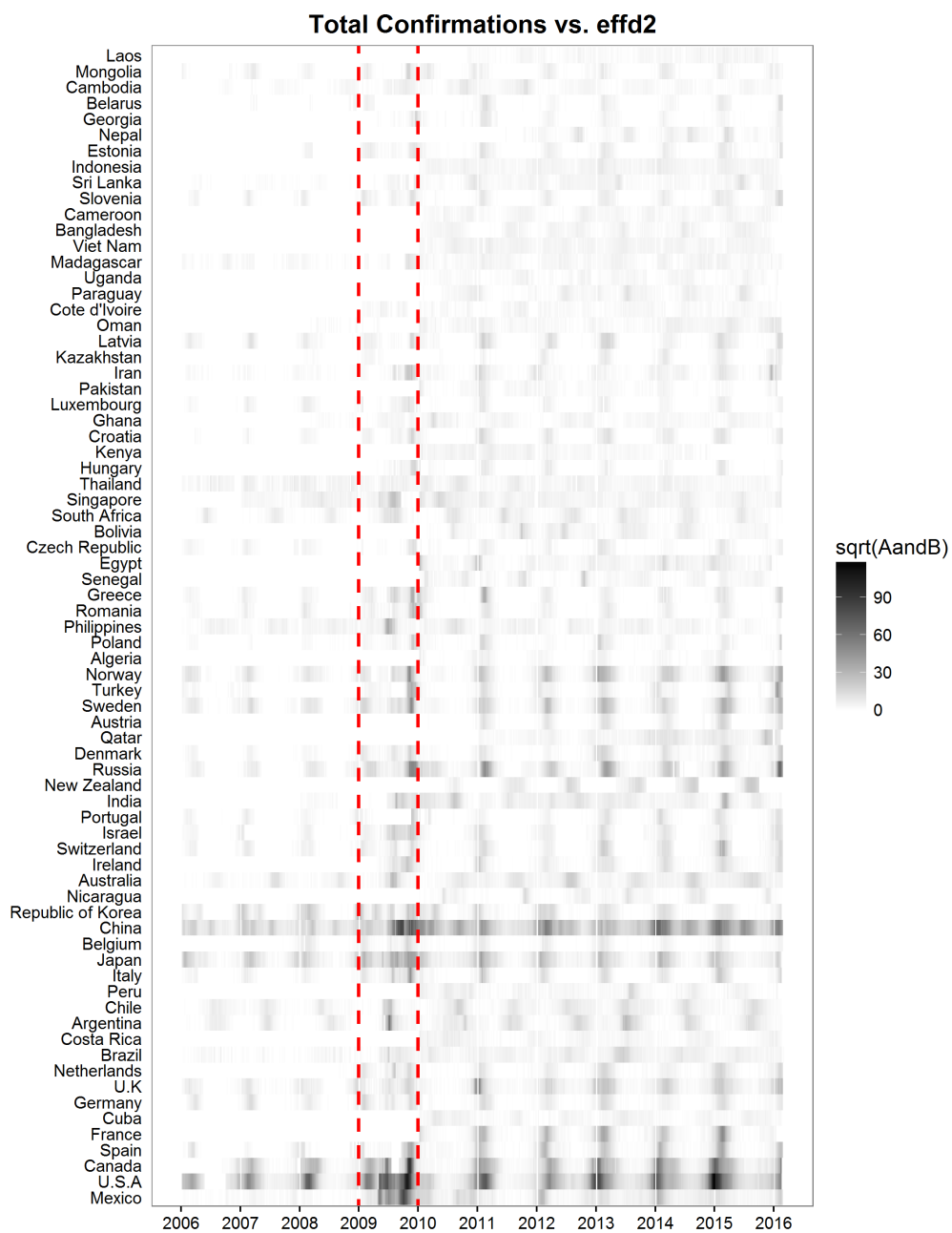
Figure S2: Patterns of total confirmations. Countries are ordered according to their effective distances to Mexico (definition 2).

S4 Patterns of proportions of B Lineages
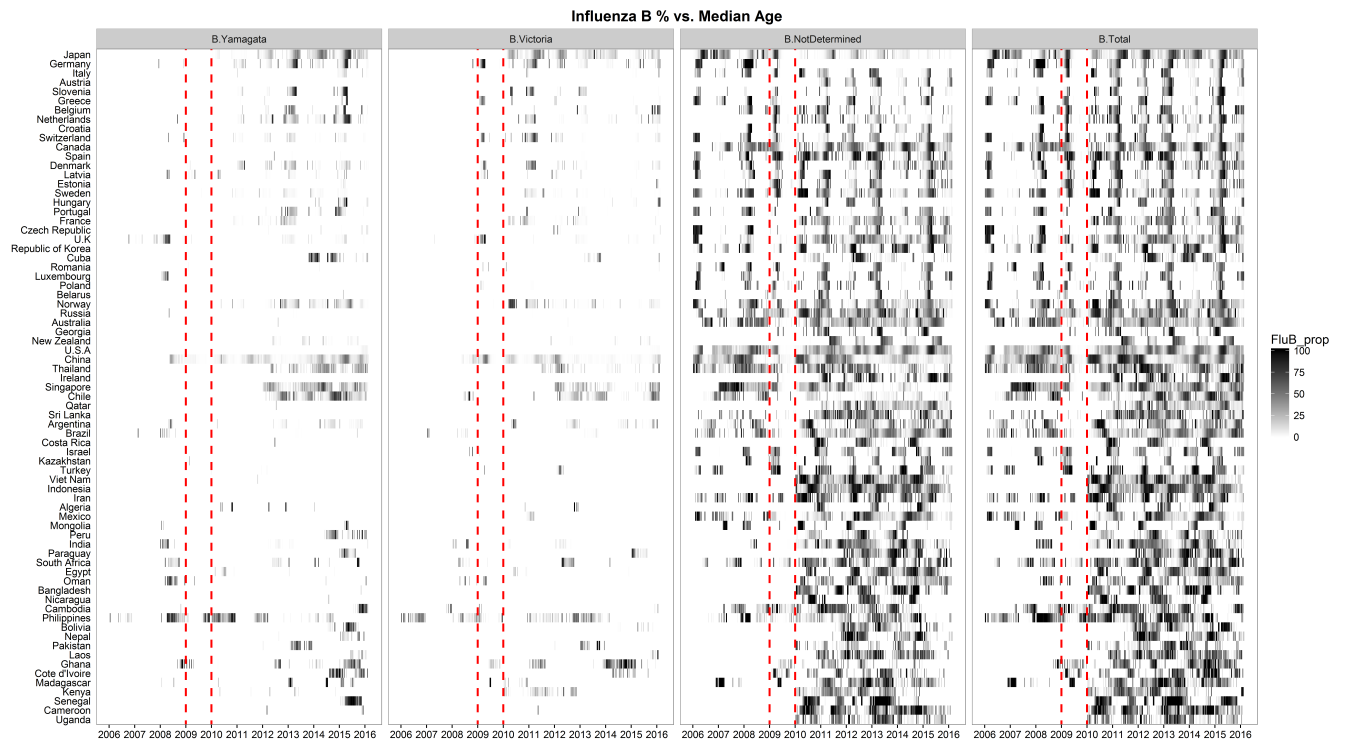
S4.1 Proportions of B Lineages v.s. median age

Figure S3: Patterns of proportions of different B lineages out of total of A and B. Countries are ordered according to the population's median ages.

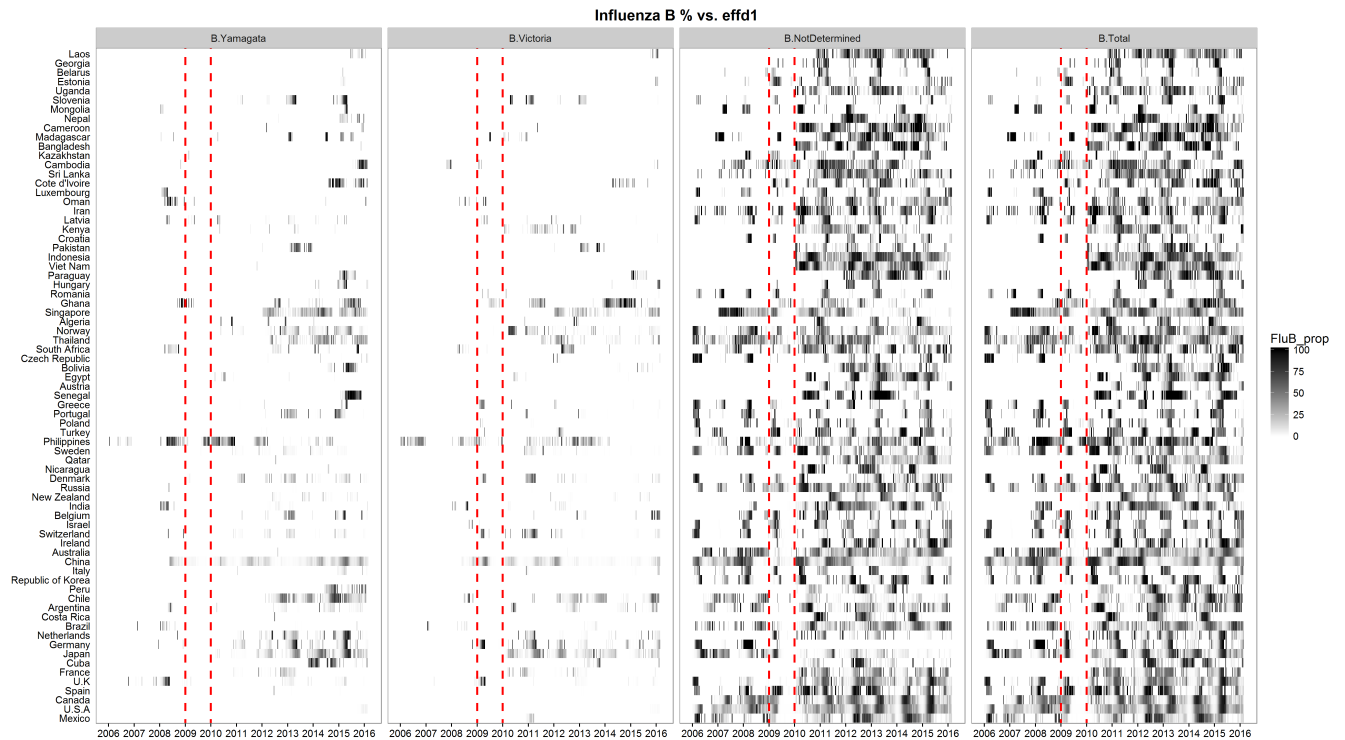## S4.2 Confirmations of B Lineages v.s. effective distances

Figure S4: Patterns of proportions of different B lineages out of total of A and B. Countries are ordered according to the effective distance (definition 1) from Mexico.
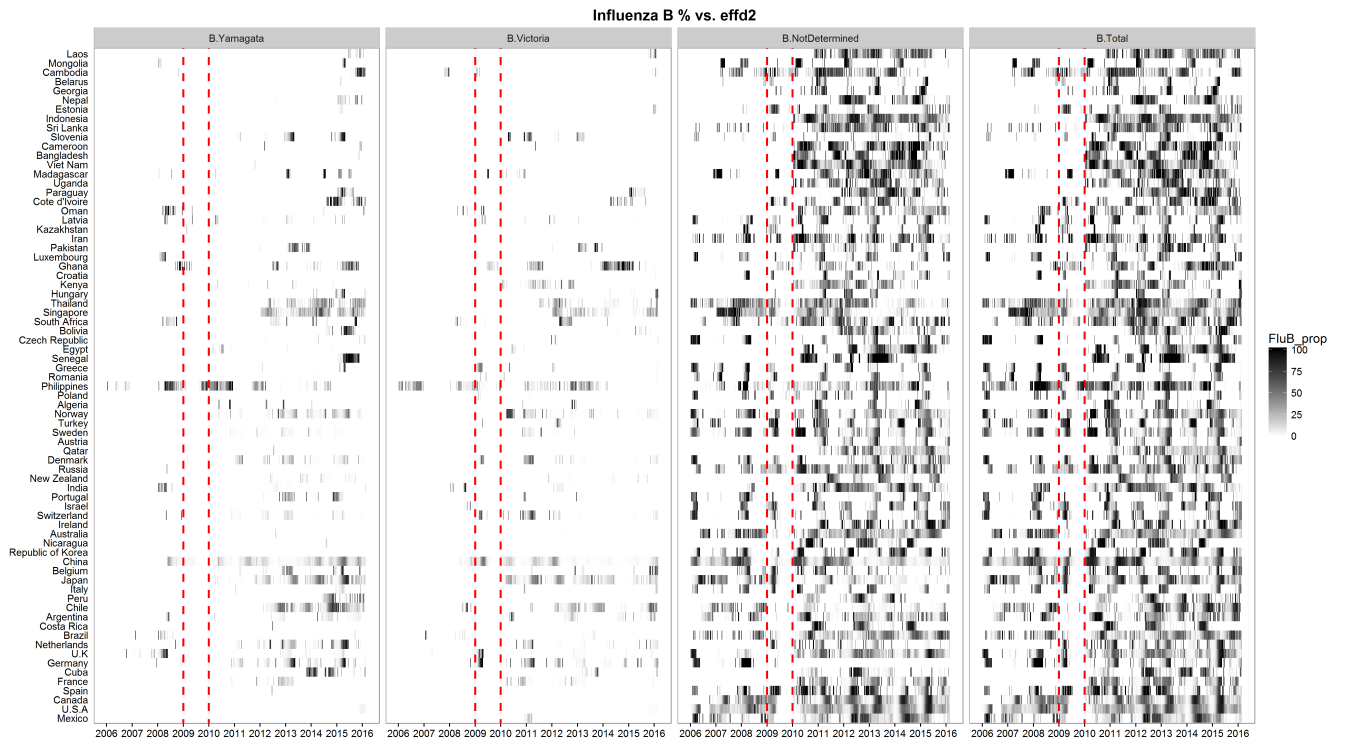
Figure S5: Patterns of proportions of different B lineages out of total of A and B. Countries are ordered according to the effective distance (definition 2) from Mexico.

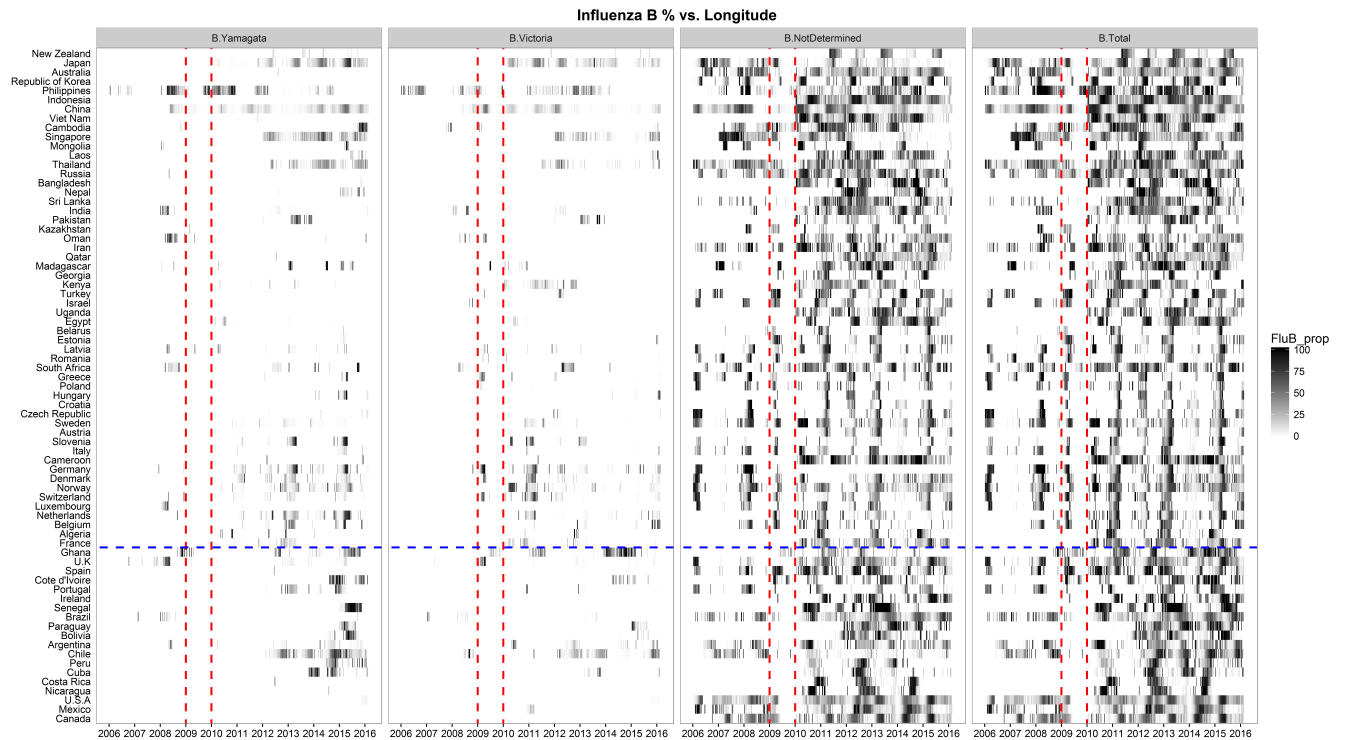## S4.3   Proportions of B Lineages v.s. longitude and latitude

Figure S6: Patterns of proportions of different B lineages out of total of A and B. Countries are ordered according to longitude.
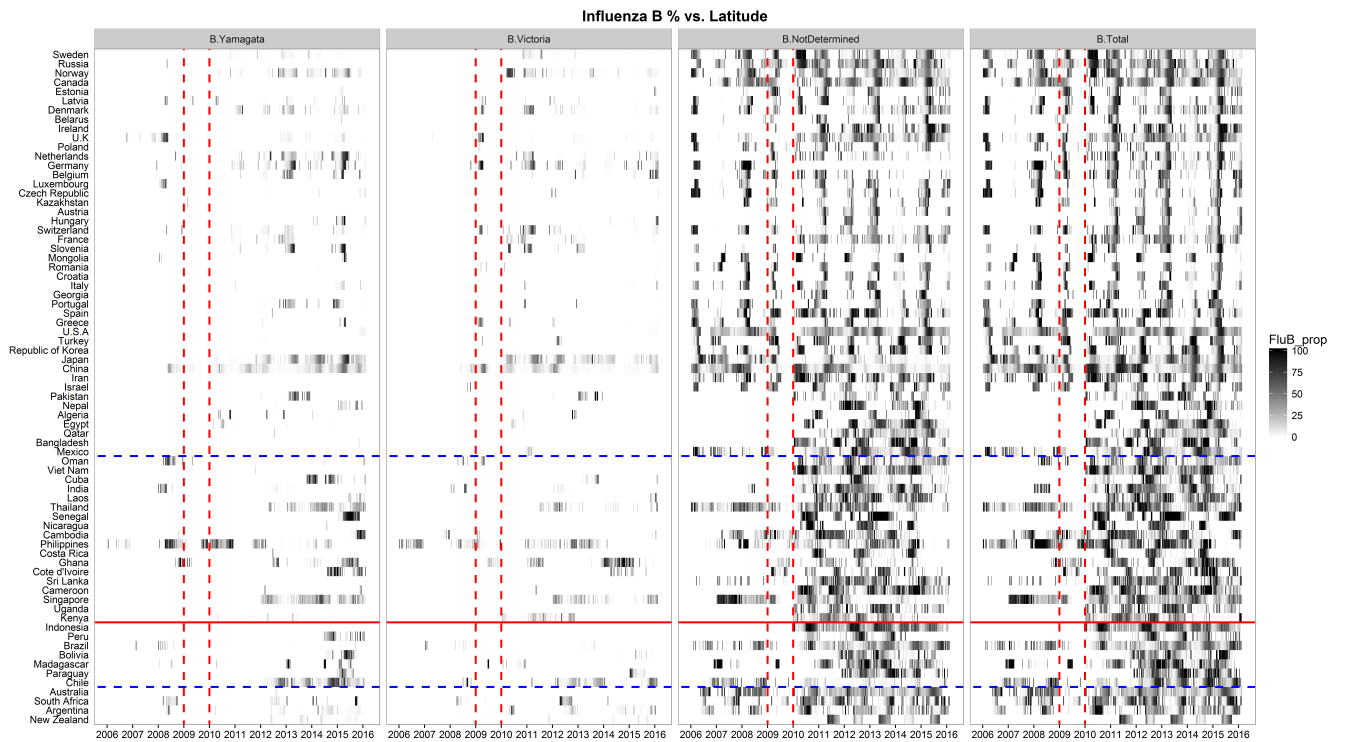
Figure S7: Patterns of proportions of different B lineages out of total of A and B. Countries are ordered according to latitude.

S5   A variety of models with or without region as a random-effect factor

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A variety of models with or without region as a random-effect factor
Linear mixed model fit by REML ['lmerMod']
Formula: r ~ pop + long + abslat + effd + (1 | region)
   Data: rr

REML criterion at convergence: -162.7

Scaled residuals:
     Min       1Q   Median       3Q      Max
-2.41305 -0.52911  0.05728  0.69284  2.02150

Random effects:
 Groups   Name        Variance  Std.Dev.
 region   (Intercept) 0.0004447 0.02109
 Residual             0.0042312 0.06505
Number of obs: 77, groups:  region, 19

Fixed effects:
            Estimate Std. Error t value
(Intercept)  0.274755   0.009241  29.731
pop         -0.002384   0.008135  -0.293
long         0.022551   0.009811   2.299
abslat      -0.004060   0.008993  -0.451
effd         0.022670   0.009025   2.512


Correlation of Fixed Effects:
      (Intr) pop    long   abslat
pop    -0.008
long    0.019 -0.238
abslat  0.058 -0.009  0.050
effd    0.010  0.295 -0.418 -0.012
Linear mixed model fit by REML ['lmerMod']
Formula: r ~ specimens + long + abslat + effd + (1 | region)
   Data: rr

REML criterion at convergence: -161.5

Scaled residuals:
     Min       1Q   Median       3Q      Max
-2.41554 -0.48051 -0.00582  0.73237  2.03358
```

```
Random effects:
 Groups    Name          Variance  Std.Dev.
 region    (Intercept)   0.0006186 0.02487
 Residual                0.0039121 0.06255
Number of obs: 75, groups:  region, 19

Fixed effects:
             Estimate Std. Error t value
(Intercept)  0.277405   0.009716  28.550
specimens    0.007829   0.008800   0.890
long         0.027741   0.010224   2.713
abslat      -0.003936   0.009331  -0.422
effd         0.021356   0.009560   2.234

Correlation of Fixed Effects:
          (Intr) spcmns long   abslat
specimens -0.055
long       0.066  0.020
abslat     0.092 -0.126  0.073
effd      -0.045  0.381 -0.381 -0.075

Call:
lm(formula = r ~ pop + long + abslat + effd, data = rr)

Residuals:
      Min        1Q    Median        3Q       Max
-0.171101 -0.042221  0.005935  0.045810  0.153983

Coefficients:
             Estimate Std. Error t value Pr(>|t|)
(Intercept)  0.273880   0.007732  35.420  < 2e-16 ***
pop         -0.002944   0.008209  -0.359  0.72089
long         0.026653   0.008857   3.009  0.00361 **
abslat      -0.003699   0.007762  -0.477  0.63510
effd         0.020509   0.008941   2.294  0.02472 *
---
Signif. codes:  0 *** 0.001 ** 0.01 * 0.05 . 0.1   1

Residual standard error: 0.06785 on 72 degrees of freedom
  (1 observation deleted due to missingness)
Multiple R-squared:  0.2703,Adjusted R-squared:  0.2298
F-statistic: 6.668 on 4 and 72 DF,  p-value: 0.000127


Call:
```

```
lm(formula = r ~ specimens + long + abslat + effd, data = rr)

Residuals:
     Min        1Q    Median        3Q       Max
-0.16828  -0.03902   0.00469   0.04140   0.15632

Coefficients:
             Estimate Std. Error t value Pr(>|t|)
(Intercept)  0.276333   0.007702  35.877  < 2e-16 ***
specimens    0.009057   0.008577   1.056 0.294610
long         0.032161   0.008998   3.574 0.000641 ***
abslat      -0.004274   0.007685  -0.556 0.579894
effd         0.020039   0.009602   2.087 0.040523 *
---
Signif. codes:  0 *** 0.001 ** 0.01 * 0.05 . 0.1   1

Residual standard error: 0.06656 on 70 degrees of freedom
  (3 observations deleted due to missingness)
Multiple R-squared:  0.3043,Adjusted R-squared:  0.2646
F-statistic: 7.656 on 4 and 70 DF,  p-value: 3.552e-05

Single term deletions

Model:
r ~ pop + long + abslat + effd + (region)
       Df Sum of Sq     RSS     AIC F value  Pr(>F)
<none>               0.22646 -402.83
pop     1  0.001002 0.22747 -404.49  0.2388 0.62703
long    1  0.006700 0.23316 -402.59  1.5977 0.21166
abslat  1  0.000100 0.22656 -404.80  0.0238 0.87799
effd    1  0.019464 0.24593 -398.48  4.6411 0.03569 *
region 18  0.104956 0.33142 -409.51  1.3904 0.17457
---
Signif. codes:  0 *** 0.001 ** 0.01 * 0.05 . 0.1   1
```