GeneWurx

Newcastle 2011

TamiFlu Resistance

Impressions on FluTrackers thread:
Swine flu cases resistant to Tamiflu are becoming more common, say scientists

The data on file at **GISAID** indicates 17 of 27 **pH1N1** Neuraminidase segments from Newcastle, Australia in 2011 carry **NA 275Y**. That Neuraminidase polymorphism (**NA H275Y**) is considered the primary mechanism behind antiviral drug resistance in **pH1N1** at this time. The **NA 247N** marker is recognised as an alternate / secondary effector, though no **NA 247N** instance occurs within the 2011 Newcastle sequences at **GISAID**.

The related 30 **HA** segments fall onto the most widespread **pH1N1** clade, **Clade2:188T**, according to circulation sampling. **CladeCrossing** from **Clade3:186P** is demonstrated as a mixture on 2 of the sequences that were sampled near the end of the 2011 Southern Hemisphere season. At least **38%** of the distinct **HA** polymorphisms (22 of 58) in this batch also appear on **pH1N1** sequences that carry the alternate **TamiFlu Resistance** marker **NA 247N**.

pH1N1
Newcastle 2011
HA & NA Polymorphisms

pH1N1 Influenza Hemagglutinin & Neuraminidase Segments elucidated at 2013-03-18-23_15_01_089840 by GeneWurx see.PolyDetector v0, Copyright 2007-2013.
Sequences discussed in this analysis are variously stored publicly at GenBank and privately at GISAID. We gratefully acknowledge the authors, originating and submitting laboratories of the sequences from GenBank and from GISAID's EpiFlu™ Database on which this research is based. GISAID Citations are attached as PDF.

440 **HA** Polymorphisms Averaging ~**14.7** per Segment
322 **NA** Polymorphisms Averaging ~**11.9** per Segment
762 **HA** & **NA** Combined Polymorphisms

NA Polymorphisms

. . . . AustraliaNewcastle204_M1_34M_2011_08_14 (
. . . . . GISAID NA EPI349220
. . . . . GISAID Isolate EPI_ISL_101545
. . . . . 10 Polymorphisms (2 Amino and 8 Silent)
. . . . . syn4N (AAt),
. . . . . syn5Q (CAg),
. . . . . syn81V (GTc),
. . . . . syn157T (ACt),
. . . . . syn240T (ACc),

. . . . . 241I,
. . . . . syn331K (AAa),
. . . . . 369K,
. . . . . syn377P (CCa),
. . . . . syn416D (GAc))

. . . . AustraliaNewcastle182_M1_3M_2011_08_09 (
. . . . . GISAID NA EPI349211
. . . . . GISAID Isolate EPI_ISL_101542
. . . . . 10 Polymorphisms (4 Amino and 6 Silent)
. . . . . syn4N (AAt),
. . . . . syn5Q (CAg),
. . . . . 70N,
. . . . . 81G,
. . . . . syn240T (ACc),
. . . . . 241I,
. . . . . 369K,
. . . . . syn377P (CCa),
. . . . . syn416D (GAc),
. . . . . syn444S (TCt))

. . . . AustraliaNewcastle170_M2_61M_2011_08_05_f (
. . . . . GISAID NA EPI349208
. . . . . GISAID Isolate EPI_ISL_101541
. . . . . 12 Polymorphisms (5 Amino and 7 Silent)
. . . . . syn4N (AAt),
. . . . . syn5Q (CAg),
. . . . . 44S,
. . . . . 52N,
. . . . . syn53V (GTt),
. . . . . 82P,
. . . . . syn240T (ACc),
. . . . . 241I,
. . . . . syn319S (AGc),
. . . . . 369K,
. . . . . syn377P (CCa),
. . . . . syn378N (AAt))

. . . . AustraliaNewcastle212_37M_2011_08_02_TmX (
. . . . . GISAID NA EPI349298
. . . . . GISAID Isolate EPI_ISL_101565
. . . . . 13 Polymorphisms (6 Amino and 7 Silent)
. . . . . syn4N (AAt),
. . . . . syn5Q (CAg),
. . . . . 44S,
. . . . . 62I,
. . . . . syn191L (CTg),
. . . . . syn237S (TCa),
. . . . . syn240T (ACc),
. . . . . 241I,
. . . . . 275Y,
. . . . . syn331K (AAa),
. . . . . 369K,
. . . . . syn377P (CCa),
. . . . . 386S)

. . . . AustraliaNewcastle179_M2_1M_2011_07_15_TmX (
. . . . . GISAID NA EPI349296
. . . . . GISAID Isolate EPI_ISL_101564
. . . . . 14 Polymorphisms (7 Amino and 7 Silent)
. . . . . syn4N (AAt),
. . . . . syn5Q (CAg),
. . . . . 44S,
. . . . . 62I,
. . . . . 83A,
. . . . . syn191L (CTg),
. . . . . syn237S (TCa),
. . . . . syn240T (ACc),
. . . . . 241I,
. . . . . 275Y,
. . . . . syn331K (AAa),
. . . . . 369K,
. . . . . syn377P (CCa),
. . . . . 386S)

. . . . AustraliaNewcastle168_M2_58F_2011_07_12_aU_TmX (
. . . . . GISAID NA EPI349200
. . . . . GISAID Isolate EPI_ISL_101540
. . . . . 12 Polymorphisms (6 Amino and 6 Silent)
. . . . . syn4N (AAt),
. . . . . syn5Q (CAg),
. . . . . 44S,
. . . . . 62I,
. . . . . syn237S (TCa),
. . . . . syn240T (ACc),
. . . . . 241I,
. . . . . 275Y,
. . . . . syn331K (AAa),
. . . . . 369K,
. . . . . syn377P (CCa),
. . . . . 386S)

. . . . AustraliaNewcastle163_M1_57F_2011_07_11 (
. . . . . GISAID NA EPI334787
. . . . . GISAID Isolate EPI_ISL_95604
. . . . . 12 Polymorphisms (6 Amino and 6 Silent)
. . . . . syn4N (AAt),
. . . . . syn5Q (CAg),
. . . . . 44S,
. . . . . 52N,
. . . . . 82P,
. . . . . syn240T (ACc),
. . . . . 241I,
. . . . . 295H,
. . . . . syn319S (AGc),
. . . . . 369K,
. . . . . syn377P (CCa),
. . . . . syn378N (AAt))

. . . . AustraliaNewcastle151_M1_37M_2011_07_11_TmX (
. . . . . GISAID NA EPI334767
. . . . . GISAID Isolate EPI_ISL_95594
. . . . . 13 Polymorphisms (6 Amino and 7 Silent)

. . . . . syn4N (AAt),
. . . . . syn5Q (CAg),
. . . . . syn22L (cTA),
. . . . . 44S,
. . . . . 62I,
. . . . . syn237S (TCa),
. . . . . syn240T (ACc),
. . . . . 241I,
. . . . . 275Y,
. . . . . syn331K (AAa),
. . . . . 369K,
. . . . . syn377P (CCa),
. . . . . 386S)

. . . . AustraliaNewcastle132_M1_31F_2011_07_10_TmX (
. . . . . GISAID NA EPI334765
. . . . . GISAID Isolate EPI_ISL_95593
. . . . . 13 Polymorphisms (6 Amino and 7 Silent)
. . . . . syn4N (AAt),
. . . . . syn5Q (CAg),
. . . . . syn22L (cTA),
. . . . . 44S,
. . . . . 62I,
. . . . . syn237S (TCa),
. . . . . syn240T (ACc),
. . . . . 241I,
. . . . . 275Y,
. . . . . syn331K (AAa),
. . . . . 369K,
. . . . . syn377P (CCa),
. . . . . 386S)

. . . . AustraliaNewcastle84_M2_17F_2011_07_08 (
. . . . . GISAID NA EPI334785
. . . . . GISAID Isolate EPI_ISL_95603
. . . . . 11 Polymorphisms (6 Amino and 5 Silent)
. . . . . syn4N (AAt),
. . . . . syn5Q (CAg),

. . . . . 44S,
. . . . . 62I,
. . . . . syn237S (TCa),
. . . . . syn240T (ACc),
. . . . . 241I,
. . . . . 369K,
. . . . . 373V,
. . . . . syn377P (CCa),
. . . . . 386S)

. . . . AustraliaNewcastle102_37M_2011_07_05_TmX (
. . . . . GISAID NA EPI349157
. . . . . GISAID Isolate EPI_ISL_101525
. . . . . 13 Polymorphisms (6 Amino and 7 Silent)
. . . . . syn4N (AAt),
. . . . . syn5Q (CAg),
. . . . . 44S,
. . . . . 62I,
. . . . . syn86A (GCa) mix wt,
. . . . . syn237S (TCa),
. . . . . syn240T (ACc),
. . . . . 241I,
. . . . . 275Y,
. . . . . syn331K (AAa),
. . . . . 369K,
. . . . . syn377P (CCa),
. . . . . 386S)

. . . . AustraliaNewcastle89_M2_19M_2011_07_04_TmX (
. . . . . GISAID NA EPI334783
. . . . . GISAID Isolate EPI_ISL_95602
. . . . . 13 Polymorphisms (6 Amino and 7 Silent)
. . . . . syn4N (AAt),
. . . . . syn5Q (CAg),
. . . . . 44S,
. . . . . 62I,
. . . . . syn191L (CTg),
. . . . . syn237S (TCa),

. . . . . syn240T (ACc),
. . . . . 241I,
. . . . . 275Y,
. . . . . syn331K (AAa),
. . . . . 369K,
. . . . . syn377P (CCa),
. . . . . 386S)

. . . . AustraliaNewcastle85_M2_21F_2011_07_04_TmX (
. . . . . GISAID NA EPI334781
. . . . . GISAID Isolate EPI_ISL_95601
. . . . . 13 Polymorphisms (6 Amino and 7 Silent)
. . . . . syn4N (AAt),
. . . . . syn5Q (CAg),
. . . . . 44S,
. . . . . 62I,
. . . . . syn191L (CTg),
. . . . . syn237S (TCa),
. . . . . syn240T (ACc),
. . . . . 241I,
. . . . . 275Y,
. . . . . syn331K (AAa),
. . . . . 369K,
. . . . . syn377P (CCa),
. . . . . 386S)

. . . . AustraliaNewcastle129_3M_2011_07_03_TmX (
. . . . . GISAID NA EPI349162
. . . . . GISAID Isolate EPI_ISL_101527
. . . . . 11 Polymorphisms (6 Amino and 5 Silent)
. . . . . NA Truncated before aa9,
. . . . . 44S,
. . . . . 62I,
. . . . . syn237S (TCa),
. . . . . syn240T (ACc),
. . . . . 241I,
. . . . . 275Y,
. . . . . syn324D (GAt),

. . . . . syn331K (AAa),
. . . . . 369K,
. . . . . syn377P (CCa),
. . . . . 386S)

. . . . AustraliaNewcastle86_49M_2011_07_02_TmX (
. . . . . GISAID NA EPI349114
. . . . . GISAID Isolate EPI_ISL_101511
. . . . . 12 Polymorphisms (6 Amino and 6 Silent)
. . . . . syn4N (AAt),
. . . . . syn5Q (CAg),
. . . . . 44S,
. . . . . 62I,
. . . . . syn237S (TCa),
. . . . . syn240T (ACc),
. . . . . 241I,
. . . . . 275Y,
. . . . . syn331K (AAa),
. . . . . 369K,
. . . . . syn377P (CCa),
. . . . . 386S)

. . . . AustraliaNewcastle58_M1_29F_2011_07_02 (
. . . . . GISAID NA EPI333113
. . . . . GISAID Isolate EPI_ISL_95252
. . . . . 12 Polymorphisms (3 Amino and 9 Silent)
. . . . . syn4N (AAt),
. . . . . syn5Q (CAg),
. . . . . syn81V (GTc),
. . . . . syn157T (ACt),
. . . . . syn201G (GGa),
. . . . . syn240T (ACc),
. . . . . 241I,
. . . . . syn331K (AAa),
. . . . . 369K,
. . . . . syn377P (CCa),
. . . . . syn416D (GAc),
. . . . . 432N)

. . . . AustraliaNewcastle82_M1_30F_2011_07_01_TmX (
. . . . . GISAID NA EPI334779
. . . . . GISAID Isolate EPI_ISL_95600
. . . . . 12 Polymorphisms (6 Amino and 6 Silent)
. . . . . syn4N (AAt),
. . . . . syn5Q (CAg),
. . . . . 44G,
. . . . . 62I,
. . . . . syn237S (TCa),
. . . . . syn240T (ACc),
. . . . . 241I,
. . . . . 275Y,
. . . . . syn331K (AAa),
. . . . . 369K,
. . . . . syn377P (CCa),
. . . . . 386S)

. . . . AustraliaNewcastle62_M1_5F_2011_07_01_TmX (
. . . . . GISAID NA EPI334777
. . . . . GISAID Isolate EPI_ISL_95599
. . . . . 12 Polymorphisms (6 Amino and 6 Silent)
. . . . . syn4N (AAt),
. . . . . syn5Q (CAg),
. . . . . 44S,
. . . . . 62I,
. . . . . syn237S (TCa),
. . . . . syn240T (ACc),
. . . . . 241I,
. . . . . 275Y,
. . . . . syn331K (AAa),
. . . . . 369K,
. . . . . syn377P (CCa),
. . . . . 386S)

. . . . AustraliaNewcastle125_8F_2011_06_30_TmX (
. . . . . GISAID NA EPI349159
. . . . . GISAID Isolate EPI_ISL_101526
. . . . . 13 Polymorphisms (7 Amino and 6 Silent)

. . . . . syn4N (AAt),
. . . . . syn5Q (CAg),
. . . . . 44S,
. . . . . 62I,
. . . . . 99M,
. . . . . syn237S (TCa),
. . . . . syn240T (ACc),
. . . . . 241I,
. . . . . 275Y,
. . . . . syn331K (AAa),
. . . . . 369K,
. . . . . syn377P (CCa),
. . . . . 386S)

. . . . AustraliaNewcastle53_M1_13F_2011_06_30_TmX (
. . . . . GISAID NA EPI334775
. . . . . GISAID Isolate EPI_ISL_95598
. . . . . 12 Polymorphisms (6 Amino and 6 Silent)
. . . . . syn4N (AAt),
. . . . . syn5Q (CAg),
. . . . . 44S,
. . . . . 62I,
. . . . . syn237S (TCa),
. . . . . syn240T (ACc),
. . . . . 241I,
. . . . . 275Y,
. . . . . syn331K (AAa),
. . . . . 369K,
. . . . . syn377P (CCa),
. . . . . 386S)

. . . . AustraliaNewcastle37_M2_27F_2011_06_23_TmX (
. . . . . GISAID NA EPI334773
. . . . . GISAID Isolate EPI_ISL_95597
. . . . . 12 Polymorphisms (6 Amino and 6 Silent)
. . . . . syn4N (AAt),
. . . . . syn5Q (CAg),
. . . . . 44S,

. . . . . 62I,
. . . . . syn237S (TCa),
. . . . . syn240T (ACc),
. . . . . 241I,
. . . . . 275Y,
. . . . . syn331K (AAa),
. . . . . 369K,
. . . . . syn377P (CCa),
. . . . . 386S)

. . . . AustraliaNewcastle47_M1_5M_2011_06_23 (
. . . . . GISAID NA EPI333089
. . . . . GISAID Isolate EPI_ISL_95243
. . . . . 8 Polymorphisms (2 Amino and 6 Silent)
. . . . . syn4N (AAt),
. . . . . syn5Q (CAg),
. . . . . syn81V (GTc),
. . . . . syn240T (ACc),
. . . . . 241I,
. . . . . 369K,
. . . . . syn377P (CCa),
. . . . . syn416D (GAc),
. . . . . NA Truncated after aa465)

. . . . AustraliaNewcastle17_M4_16F_2011_06_20_TmX (
. . . . . GISAID NA EPI334769
. . . . . GISAID Isolate EPI_ISL_95595
. . . . . 12 Polymorphisms (6 Amino and 6 Silent)
. . . . . syn4N (AAt),
. . . . . syn5Q (CAg),
. . . . . 44G,
. . . . . 62I,
. . . . . syn237S (TCa),
. . . . . syn240T (ACc),
. . . . . 241I,
. . . . . 275Y,
. . . . . syn331K (AAa),
. . . . . 369K,

. . . . . syn377P (CCa),
. . . . . 386S)

. . . . AustraliaNewcastle14_M1_35F_2011_06_15 (
. . . . . GISAID NA EPI333075
. . . . . GISAID Isolate EPI_ISL_95237
. . . . . 11 Polymorphisms (3 Amino and 8 Silent)
. . . . . syn4N (AAt),
. . . . . syn5Q (CAg),
. . . . . syn81V (GTc),
. . . . . syn157T (ACt),
. . . . . syn240T (ACc),
. . . . . 241I,
. . . . . syn331K (AAa),
. . . . . 369K,
. . . . . syn377P (CCa),
. . . . . syn416D (GAc),
. . . . . 463F mix wt)

. . . . AustraliaNewcastle25_M3_12M_2011_06_07 (
. . . . . GISAID NA EPI349112
. . . . . GISAID Isolate EPI_ISL_101510
. . . . . 12 Polymorphisms (4 Amino and 8 Silent)
. . . . . syn4N (AAt),
. . . . . syn5Q (CAg),
. . . . . 44S,
. . . . . syn126P (CCa),
. . . . . syn134L (TTa),
. . . . . syn158L (tTA),
. . . . . 199N,
. . . . . syn240T (ACc),
. . . . . 241I,
. . . . . syn313Q (CAa),
. . . . . 369K,
. . . . . syn377P (CCa))

. . . . AustraliaNewcastle2_M2_37M_2011_05_31_TmX (
. . . . . GISAID NA EPI334771
. . . . . GISAID Isolate EPI_ISL_95596
. . . . . 13 Polymorphisms (7 Amino and 6 Silent)
. . . . . syn4N (AAt),
. . . . . syn5Q (CAg),
. . . . . 11S,
. . . . . 44S,
. . . . . 62I,
. . . . . syn237S (TCa),
. . . . . syn240T (ACc),
. . . . . 241I,
. . . . . 275Y,
. . . . . syn331K (AAa),
. . . . . 369K,
. . . . . syn377P (CCa),
. . . . . 386S)

. . . . AustraliaNewcastle1_RMIXM1_37F_2011_04_11 (
. . . . . GISAID NA EPI331557
. . . . . GISAID Isolate EPI_ISL_94873
. . . . . 11 Polymorphisms (3 Amino and 8 Silent)
. . . . . syn4N (AAt),
. . . . . syn5Q (CAg),
. . . . . 44S,
. . . . . syn126P (CCa),
. . . . . syn158L (tTA),
. . . . . syn240T (ACc),
. . . . . 241I,
. . . . . syn291V (GTa),
. . . . . syn313Q (CAa),
. . . . . 369K,
. . . . . syn377P (CCa),
. . . . . NA Truncated after aa465)

HA Polymorphisms

. . . . AustraliaNewcastle204_M1_34M_2011_08_14 (
. . . . . GISAID HA EPI349221
. . . . . GISAID Isolate EPI_ISL_101545
. . . . . 14 Polymorphisms (5 Amino and 9 Silent)
. . . . . syn#5L (CTg),
. . . . . syn#4Y (TAc),
. . . . . 2K,
. . . . . syn46K (AAg),
. . . . . syn65L (tTG),
. . . . . syn81Y (TAt),
. . . . . 100N,
. . . . . syn179L (CTg),
. . . . . 188T,
. . . . . syn288A (GCc),
. . . . . syn338G (GGc),
. . . . . 377K,
. . . . . syn448L (TTg),
. . . . . 454N)

. . . . AustraliaNewcastle182_M1_3M_2011_08_09 (
. . . . . GISAID HA EPI349212
. . . . . GISAID Isolate EPI_ISL_101542
. . . . . 8 Polymorphisms (5 Amino and 3 Silent)
. . . . . 59D,
. . . . . 100N,
. . . . . 188T,
. . . . . syn338G (GGc),
. . . . . syn348V (GTt),
. . . . . 377K,
. . . . . 454N,
. . . . . syn537S (AGc))

. . . . AustraliaNewcastle170_M2_61M_2011_08_05_f (
. . . . . GISAID HA EPI349209
. . . . . GISAID Isolate EPI_ISL_101541
. . . . . 17 Polymorphisms (6 Amino and 11 Silent)
. . . . . syn34N (AAt),
. . . . . syn120F (TTt),
. . . . . syn122K (AAa),
. . . . . syn138A (GCt),
. . . . . 146G,
. . . . . syn161Y (TAt),
. . . . . 186P mix wt,
. . . . . 188T,
. . . . . 200T,
. . . . . syn258F (TTt),
. . . . . syn327I (ATc),
. . . . . syn338G (GGc),
. . . . . 377K,
. . . . . 454N,
. . . . . syn460A (GCt),
. . . . . syn465N (AAt),
. . . . . syn538F (TTt))

. . . . AustraliaNewcastle212_37M_2011_08_02_TmX (
. . . . . GISAID HA EPI349299
. . . . . GISAID Isolate EPI_ISL_101565
. . . . . 14 Polymorphisms (6 Amino and 8 Silent)
. . . . . syn#6L (tTG),
. . . . . syn34N (AAt),
. . . . . syn53L (TTa),
. . . . . 115K,
. . . . . 146G,
. . . . . 188T,
. . . . . 200T,
. . . . . syn338G (GGc),
. . . . . 377K,
. . . . . syn443S (TCg),
. . . . . 454N,
. . . . . syn465N (AAt),

. . . . . syn514Y (TAt),
. . . . . syn538F (TTt))

. . . . AustraliaNewcastle179_M2_1M_2011_07_15_TmX (
. . . . . GISAID HA EPI349297
. . . . . GISAID Isolate EPI_ISL_101564
. . . . . 14 Polymorphisms (6 Amino and 8 Silent)
. . . . . syn#6L (tTG),
. . . . . syn34N (AAt),
. . . . . syn53L (TTa),
. . . . . 115K,
. . . . . 146G,
. . . . . 188T,
. . . . . 200T,
. . . . . syn338G (GGc),
. . . . . 377K,
. . . . . syn443S (TCg),
. . . . . 454N,
. . . . . syn465N (AAt),
. . . . . syn514Y (TAt),
. . . . . syn538F (TTt))

. . . . AustraliaNewcastle168_M2_58F_2011_07_12_aU_TmX (
. . . . . GISAID HA EPI349201
. . . . . GISAID Isolate EPI_ISL_101540
. . . . . 16 Polymorphisms (7 Amino and 9 Silent)
. . . . . syn#5L (CTg),
. . . . . syn34N (AAt),
. . . . . syn53L (TTa),
. . . . . 115K,
. . . . . 146G,
. . . . . 188T,
. . . . . 194I (aTt) mix,
. . . . . syn194L (cTt) mix,
. . . . . 200T,
. . . . . syn338G (GGc),
. . . . . 377K,
. . . . . syn443S (TCg),
. . . . . 454N,
. . . . . syn465N (AAt),
. . . . . syn514Y (TAt),
. . . . . syn538F (TTt))

. . . . AustraliaNewcastle168_58F_2011_07_12 (
. . . . . GISAID HA EPI349198
. . . . . GISAID Isolate EPI_ISL_101539
. . . . . 16 Polymorphisms (6 Amino and 10 Silent)
. . . . . syn#6L (tTG),
. . . . . syn#5L (CTg),
. . . . . syn34N (AAt),
. . . . . syn53L (TTa),
. . . . . 115K,
. . . . . 146G,
. . . . . 188T,
. . . . . syn194L (CTt),
. . . . . 200T,
. . . . . syn338G (GGc),
. . . . . 377K,
. . . . . syn443S (TCg),
. . . . . 454N,

. . . . . syn465N (AAt),
. . . . . syn514Y (TAt),
. . . . . syn538F (TTt))

. . . . AustraliaNewcastle146_45M_2011_07_11 (
. . . . . GISAID HA EPI349164
. . . . . GISAID Isolate EPI_ISL_101528
. . . . . 15 Polymorphisms (6 Amino and 9 Silent)
. . . . . syn#6L (tTG),
. . . . . syn34N (AAt),
. . . . . syn53L (TTa),
. . . . . 115K,
. . . . . 146G,
. . . . . 188T,
. . . . . 200T,
. . . . . syn304G (GGg),
. . . . . syn338G (GGc),
. . . . . 377K,
. . . . . syn443S (TCg),
. . . . . 454N,
. . . . . syn465N (AAt),
. . . . . syn514Y (TAt),
. . . . . syn538F (TTt))

. . . . AustraliaNewcastle163_M1_57F_2011_07_11 (
. . . . . GISAID HA EPI334788
. . . . . GISAID Isolate EPI_ISL_95604
. . . . . 15 Polymorphisms (6 Amino and 9 Silent)
. . . . . syn34N (AAt),
. . . . . syn122K (AAa),
. . . . . syn138A (GCt),
. . . . . 146G,
. . . . . 188T,
. . . . . 200T,
. . . . . syn258F (TTt),
. . . . . 324I,
. . . . . syn327I (ATc),
. . . . . syn338G (GGc),

. . . . . 377K,
. . . . . 454N,
. . . . . syn460A (GCt),
. . . . . syn465N (AAt),
. . . . . syn538F (TTt))

. . . . AustraliaNewcastle151_M1_37M_2011_07_11_TmX (
. . . . . GISAID HA EPI334768
. . . . . GISAID Isolate EPI_ISL_95594
. . . . . 15 Polymorphisms (6 Amino and 9 Silent)
. . . . . syn#6L (tTG),
. . . . . syn#5L (CTg),
. . . . . syn34N (AAt),
. . . . . syn53L (TTa),
. . . . . 115K,
. . . . . 146G,
. . . . . 188T,
. . . . . 200T,
. . . . . syn338G (GGc),
. . . . . 377K,
. . . . . syn443S (TCg),
. . . . . 454N,
. . . . . syn465N (AAt),
. . . . . syn514Y (TAt),
. . . . . syn538F (TTt))

. . . . AustraliaNewcastle132_M1_31F_2011_07_10_TmX (
. . . . . GISAID HA EPI334766
. . . . . GISAID Isolate EPI_ISL_95593
. . . . . 15 Polymorphisms (6 Amino and 9 Silent)
. . . . . syn#6L (tTG),
. . . . . syn#5L (CTg),
. . . . . syn34N (AAt),
. . . . . syn53L (TTa),
. . . . . 115K,
. . . . . 146G,
. . . . . 188T,
. . . . . 200T,

. . . . . syn338G (GGc),
. . . . . 377K,
. . . . . syn443S (TCg),
. . . . . 454N,
. . . . . syn465N (AAt),
. . . . . syn514Y (TAt),
. . . . . syn538F (TTt))

. . . . AustraliaNewcastle84_M2_17F_2011_07_08 (
. . . . . GISAID HA EPI334786
. . . . . GISAID Isolate EPI_ISL_95603
. . . . . 15 Polymorphisms (6 Amino and 9 Silent)
. . . . . syn#5L (CTg),
. . . . . syn34N (AAt),
. . . . . syn53L (TTa),
. . . . . 115K,
. . . . . 146G,
. . . . . 188T,
. . . . . 200T,
. . . . . syn338G (GGc),
. . . . . 377K,
. . . . . syn443S (TCg),
. . . . . 454N,
. . . . . syn465N (AAt),
. . . . . syn514Y (TAt),
. . . . . syn533L (CTa),
. . . . . syn538F (TTt))

. . . . AustraliaNewcastle97_39F_2011_07_06 (
. . . . . GISAID HA EPI349156
. . . . . GISAID Isolate EPI_ISL_101524
. . . . . 15 Polymorphisms (7 Amino and 8 Silent)
. . . . . syn#6L (tTG),
. . . . . syn34N (AAt),
. . . . . syn53L (TTa),
. . . . . 115K,
. . . . . 146G,
. . . . . 188T,

. . . . . 200T,
. . . . . syn338G (GGc),
. . . . . 377K,
. . . . . syn443S (TCg),
. . . . . 454N,
. . . . . syn465N (AAt),
. . . . . syn514Y (TAt),
. . . . . 536T,
. . . . . syn538F (TTt))

. . . . AustraliaNewcastle102_37M_2011_07_05_TmX (
. . . . . GISAID HA EPI349158
. . . . . GISAID Isolate EPI_ISL_101525
. . . . . 14 Polymorphisms (6 Amino and 8 Silent)
. . . . . syn#6L (tTG),
. . . . . syn34N (AAt),
. . . . . syn53L (TTa),
. . . . . 115K,
. . . . . 146G,
. . . . . 188T,
. . . . . 200T,
. . . . . syn338G (GGc),
. . . . . 377K,
. . . . . syn443S (TCg),
. . . . . 454N,
. . . . . syn465N (AAt),
. . . . . syn514Y (TAt),
. . . . . syn538F (TTt))

. . . . AustraliaNewcastle89_M2_19M_2011_07_04_TmX (
. . . . . GISAID HA EPI334784
. . . . . GISAID Isolate EPI_ISL_95602
. . . . . 15 Polymorphisms (7 Amino and 8 Silent)
. . . . . syn34N (AAt),
. . . . . syn53L (TTa),
. . . . . 115K,
. . . . . 146G,
. . . . . 186P mix wt,

. . . . . 188T,
. . . . . 200T,
. . . . . syn258F (TTt),
. . . . . syn338G (GGc),
. . . . . 377K,
. . . . . syn443S (TCg),
. . . . . 454N,
. . . . . syn465N (AAt),
. . . . . syn514Y (TAt),
. . . . . syn538F (TTt))

. . . . AustraliaNewcastle85_M2_21F_2011_07_04_TmX (
. . . . . GISAID HA EPI334782
. . . . . GISAID Isolate EPI_ISL_95601
. . . . . 14 Polymorphisms (6 Amino and 8 Silent)
. . . . . syn#6L (tTG),
. . . . . syn34N (AAt),
. . . . . syn53L (TTa),
. . . . . 115K,
. . . . . 146G,
. . . . . 188T,
. . . . . 200T,
. . . . . syn338G (GGc),
. . . . . 377K,
. . . . . syn443S (TCg),
. . . . . 454N,
. . . . . syn465N (AAt),
. . . . . syn514Y (TAt),
. . . . . syn538F (TTt))

. . . . AustraliaNewcastle129_3M_2011_07_03_TmX (
. . . . . GISAID HA EPI349163
. . . . . GISAID Isolate EPI_ISL_101527
. . . . . 15 Polymorphisms (6 Amino and 9 Silent)
. . . . . syn#6L (tTG),
. . . . . syn34N (AAt),
. . . . . syn53L (TTa),
. . . . . 115K,

. . . . . 146G,
. . . . . 188T,
. . . . . 200T,
. . . . . syn241D (GAt),
. . . . . syn338G (GGc),
. . . . . 377K,
. . . . . syn443S (TCg),
. . . . . 454N,
. . . . . syn465N (AAt),
. . . . . syn514Y (TAt),
. . . . . syn538F (TTt))

. . . . AustraliaNewcastle86_49M_2011_07_02_TmX (
. . . . . GISAID HA EPI349115
. . . . . GISAID Isolate EPI_ISL_101511
. . . . . 15 Polymorphisms (6 Amino and 9 Silent)
. . . . . syn#6L (tTG),
. . . . . syn#5L (CTg),
. . . . . syn34N (AAt),
. . . . . syn53L (TTa),
. . . . . 115K,
. . . . . 146G,
. . . . . 188T,
. . . . . 200T,
. . . . . syn338G (GGc),
. . . . . 377K,
. . . . . syn443S (TCg),
. . . . . 454N,
. . . . . syn465N (AAt),
. . . . . syn514Y (TAt),
. . . . . syn538F (TTt))

. . . . AustraliaNewcastle58_M1_29F_2011_07_02 (
. . . . . GISAID HA EPI333114
. . . . . GISAID Isolate EPI_ISL_95252
. . . . . 12 Polymorphisms (5 Amino and 7 Silent)
. . . . . syn#4Y (TAc),
. . . . . 2K,

. . . . . syn46K (AAg),
. . . . . syn65L (tTG),
. . . . . 100N,
. . . . . syn179L (CTg),
. . . . . 188T,
. . . . . syn288A (GCc),
. . . . . syn338G (GGc),
. . . . . 377K,
. . . . . syn448L (TTg),
. . . . . 454N)

. . . . AustraliaNewcastle82_M1_30F_2011_07_01_TmX (
. . . . . GISAID HA EPI334780
. . . . . GISAID Isolate EPI_ISL_95600
. . . . . 14 Polymorphisms (6 Amino and 8 Silent)
. . . . . syn#5L (CTg),
. . . . . syn34N (AAt),
. . . . . syn53L (TTa),
. . . . . 115K,
. . . . . 146G,
. . . . . 188T,
. . . . . 200T,
. . . . . syn338G (GGc),
. . . . . 377K,
. . . . . syn443S (TCg),
. . . . . 454N,
. . . . . syn465N (AAt),
. . . . . syn514Y (TAt),
. . . . . syn538F (TTt))

. . . . AustraliaNewcastle62_M1_5F_2011_07_01_TmX (
. . . . . GISAID HA EPI334778
. . . . . GISAID Isolate EPI_ISL_95599
. . . . . 14 Polymorphisms (6 Amino and 8 Silent)
. . . . . syn#5L (CTg),
. . . . . syn34N (AAt),
. . . . . syn53L (TTa),
. . . . . 115K,

. . . . . 146G,
. . . . . 188T,
. . . . . 200T,
. . . . . syn338G (GGc),
. . . . . 377K,
. . . . . syn443S (TCg),
. . . . . 454N,
. . . . . syn465N (AAt),
. . . . . syn514Y (TAt),
. . . . . syn538F (TTt))

. . . . AustraliaNewcastle125_8F_2011_06_30_TmX (
. . . . . GISAID HA EPI349160
. . . . . GISAID Isolate EPI_ISL_101526
. . . . . 14 Polymorphisms (6 Amino and 8 Silent)
. . . . . syn#6L (tTG),
. . . . . syn34N (AAt),
. . . . . syn53L (TTa),
. . . . . 115K,
. . . . . 146G,
. . . . . 188T,
. . . . . 200T,
. . . . . syn338G (GGc),
. . . . . 377K,
. . . . . syn443S (TCg),
. . . . . 454N,
. . . . . syn465N (AAt),
. . . . . syn514Y (TAt),
. . . . . syn538F (TTt))

. . . . AustraliaNewcastle53_M1_13F_2011_06_30_TmX (
. . . . . GISAID HA EPI334776
. . . . . GISAID Isolate EPI_ISL_95598
. . . . . 15 Polymorphisms (6 Amino and 9 Silent)
. . . . . syn#6L (tTG),
. . . . . syn#5L (CTg),
. . . . . syn34N (AAt),
. . . . . syn53L (TTa),

. . . . . 115K,
. . . . . 146G,
. . . . . 188T,
. . . . . 200T,
. . . . . syn338G (GGc),
. . . . . 377K,
. . . . . syn443S (TCg),
. . . . . 454N,
. . . . . syn465N (AAt),
. . . . . syn514Y (TAt),
. . . . . syn538F (TTt))

. . . . AustraliaNewcastle37_M2_27F_2011_06_23_TmX (
. . . . . GISAID HA EPI334774
. . . . . GISAID Isolate EPI_ISL_95597
. . . . . 18 Polymorphisms (7 Amino and 11 Silent)
. . . . . syn#6L (tTG),
. . . . . syn#5L (CTg),
. . . . . #2S,
. . . . . syn34N (AAt),
. . . . . syn40H (CAc),
. . . . . syn53L (TTa),
. . . . . 115K,
. . . . . 146G,
. . . . . 188T,
. . . . . syn194L (CTt),
. . . . . 200T,
. . . . . syn338G (GGc),
. . . . . 377K,
. . . . . syn443S (TCg),
. . . . . 454N,
. . . . . syn465N (AAt),
. . . . . syn514Y (TAt),
. . . . . syn538F (TTt))

. . . . AustraliaNewcastle47_M1_5M_2011_06_23 (
. . . . . GISAID HA EPI333090
. . . . . GISAID Isolate EPI_ISL_95243

. . . . . 12 Polymorphisms (5 Amino and 7 Silent)
. . . . . syn#4Y (TAc),
. . . . . 2K,
. . . . . syn46K (AAg),
. . . . . syn65L (tTG),
. . . . . 100N,
. . . . . syn179L (CTg),
. . . . . 188T,
. . . . . syn288A (GCc),
. . . . . syn338G (GGc),
. . . . . 377K,
. . . . . syn448L (TTg),
. . . . . 454N)

. . . . AustraliaNewcastle17_M4_16F_2011_06_20_TmX (
. . . . . GISAID HA EPI334770
. . . . . GISAID Isolate EPI_ISL_95595
. . . . . 14 Polymorphisms (6 Amino and 8 Silent)
. . . . . syn#6L (tTG),
. . . . . syn34N (AAt),
. . . . . syn53L (TTa),
. . . . . 115K,
. . . . . 146G,
. . . . . 188T,
. . . . . 200T,
. . . . . syn338G (GGc),
. . . . . 377K,
. . . . . syn443S (TCg),
. . . . . 454N,
. . . . . syn465N (AAt),
. . . . . syn514Y (TAt),
. . . . . syn538F (TTt))

. . . . AustraliaNewcastle14_M1_35F_2011_06_15 (
. . . . . GISAID HA EPI333076
. . . . . GISAID Isolate EPI_ISL_95237
. . . . . 12 Polymorphisms (5 Amino and 7 Silent)
. . . . . syn#4Y (TAc),

. . . . . 2K,
. . . . . syn46K (AAg),
. . . . . syn65L (tTG),
. . . . . 100N,
. . . . . syn179L (CTg),
. . . . . 188T,
. . . . . syn288A (GCc),
. . . . . syn338G (GGc),
. . . . . 377K,
. . . . . syn448L (TTg),
. . . . . 454N)

. . . . AustraliaNewcastle25_M3_12M_2011_06_07 (
. . . . . GISAID HA EPI349113
. . . . . GISAID Isolate EPI_ISL_101510
. . . . . 18 Polymorphisms (6 Amino and 12 Silent)
. . . . . syn10Y (TAc),
. . . . . syn33V (GTc),
. . . . . syn34N (AAt),
. . . . . syn99I (ATt),
. . . . . syn115E (GAg),
. . . . . 146G,
. . . . . 188T,
. . . . . 200T,
. . . . . syn338G (GGc),
. . . . . syn346G (GGa),
. . . . . 377K,
. . . . . syn413K (AAg),
. . . . . 454N,
. . . . . syn456L (TTg),
. . . . . syn465N (AAt),
. . . . . syn508L (tTG),
. . . . . 523A,
. . . . . syn538F (TTt))

. . . . AustraliaNewcastle2_M2_37M_2011_05_31_TmX (
. . . . . GISAID HA EPI334772
. . . . . GISAID Isolate EPI_ISL_95596
. . . . . 14 Polymorphisms (6 Amino and 8 Silent)
. . . . . syn#6L (tTG),
. . . . . syn34N (AAt),
. . . . . syn53L (TTa),
. . . . . 115K,
. . . . . 146G,
. . . . . 188T,
. . . . . 200T,
. . . . . syn338G (GGc),
. . . . . 377K,
. . . . . syn443S (TCg),
. . . . . 454N,
. . . . . syn465N (AAt),
. . . . . syn514Y (TAt),
. . . . . syn538F (TTt))

. . . . AustraliaNewcastle1_RMIXM1_37F_2011_04_11 (
. . . . . GISAID HA EPI331558
. . . . . GISAID Isolate EPI_ISL_94873
. . . . . 21 Polymorphisms (9 Amino and 12 Silent)
. . . . . syn10Y (TAc),
. . . . . syn33V (GTc),
. . . . . syn34N (AAt),
. . . . . 77R,
. . . . . syn99I (ATt),
. . . . . syn115E (GAg),
. . . . . 146G,
. . . . . 157Q mix wt,
. . . . . 188T,
. . . . . 200T,
. . . . . syn338G (GGc),
. . . . . syn346G (GGa),
. . . . . 377K,
. . . . . syn413K (AAg),
. . . . . 454N,

. . . . . syn465N (AAt),
. . . . . syn508L (tTG),
. . . . . 523A,
. . . . . syn538F (TTt),
. . . . . syn549R (AGg),
. . . . . 550S,
. . . . . HA Truncated after aa550)

Source: GISAID