**Virologica Sinica**

**Supplementary Data**

**Development of PREDAC-H1pdm to model the antigenic evolution of influenza A/(H1N1) pdm09 viruses**

**Mi Liua, Jingze Liu b, c, Wenjun Song d, Yousong Peng e, Xiao Ding b, c, Lizong Deng b, c, Taijiao Jiang b, c, d\***

a Jiangsu Institute of Clinical Immunology, The First Affiliated Hospital of Soochow University, Suzhou, 215006, China

b Institute of Systems Medicine, Chinese Academy of Medical Sciences & Peking Union Medical College, Beijing, 100005, China.

c Suzhou Institute of Systems Medicine, Suzhou, 215123, China.

d Guangzhou Laboratory, Guangzhou, 510005, China

e Bioinformatics Center, College of Biology, Hunan Provincial Key Laboratory of Medical Virology, Hunan University, Changsha, 410082, China

\*Corresponding author.

jiang\_taijiao@gzlab.ac.cn (TJ)

ORCID: 0000-0002-6071-0122 (T. Jiang)

****

**Supplementary Figure S1.** Mapping of antigenic clusters on the genetic distance tree of the HA1 region of the H1N1 HA nucleotide sequences. The tree was rooted using A/California/07/2009.

**Supplementary Table S1**. Antigenic relationships for training dataset.

|  |  |  |
| --- | --- | --- |
| virus A | virus B | antigenic relationship(1 for variant, 0 for similar) |
| A/AUSTRIA/397829/2007 | A/BRISBANE/59/2007 | 0 |
| A/BAYERN/7/1995 | A/TEXAS/36/91 | 0 |
| A/BAYERN/7/1995 | A/TAIWAN/1/86 | 0 |
| A/BEIJING/262/1995 | A/WUHAN/371/1995 | 0 |
| A/BEIJING/262/1995 | A/CHILE/9848/2002 | 0 |
| A/BEIJING/262/1995 | A/HAWAII/10/2002 | 0 |
| A/BEIJING/262/1995 | A/KENTUCKY/1/2005 | 0 |
| A/BEIJING/262/1995 | A/SINGAPORE/9/1998 | 0 |
| A/BRATISLAVA/45/2007 | A/SOLOMONISLANDS/3/2006 | 0 |
| A/BRAZIL/11/1978 | A/HONGKONG/2/1982 | 0 |
| A/BRAZIL/11/1978 | A/LACKLAND/7/1978 | 0 |
| A/BRAZIL/11/1978 | A/ENGLAND/333/1980 | 0 |
| A/BRISBANE/193/2004 | A/MALAYSIA/100/2006 | 0 |
| A/BRISBANE/193/2004 | A/SINGAPORE/14/2004 | 0 |
| A/BRISBANE/193/2004 | A/NEWCALEDONIA/9/2004 | 0 |
| A/BRISBANE/193/2004 | A/SHENZHEN/141/2005 | 0 |
| A/BRISBANE/193/2004 | A/VICTORIA/500/2006 | 0 |
| A/BRISBANE/59/2007 | A/SOUTHDAKOTA/6/2007 | 0 |
| A/BRISBANE/59/2007 | A/SOLOMONISLANDS/3/2006 | 0 |
| A/BRISBANE/59/2007 | A/FUKUSHIMA/141/2006 | 0 |
| A/BRISBANE/59/2007 | A/PERTH/200/2008 | 0 |
| A/BRISBANE/59/2007 | A/CAMBODIA/0371/2007 | 0 |
| A/BRISBANE/59/2007 | A/HONGKONG/2652/2006 | 0 |
| A/CAMBODIA/0371/2007 | A/SOUTHDAKOTA/6/2007 | 0 |
| A/CHILE/1/1983 | A/DUNEDIN/27/1983 | 0 |
| A/CHILE/4795/2000 | A/BAYERN/7/1995 | 0 |
| A/CHILE/8885/2002 | A/MADAGASCAR/57794/2000 | 0 |
| A/CHILE/8885/2002 | A/NEWCALEDONIA/20/1999 | 0 |
| A/CHILE/8885/2002 | A/HUNGARY/2/2003 | 0 |
| A/CHILE/8885/2002 | A/EGYPT/96/2002 | 0 |
| A/CHILE/9848/2002 | A/HAWAII/10/2002 | 0 |
| A/CHILE/9848/2002 | A/NEIMENGGU/52/2002 | 0 |
| A/CHRISTCHURCH/1/2003 | A/CHILE/8885/2002 | 0 |
| A/CHRISTCHURCH/1/2003 | A/EGYPT/96/2002 | 0 |
| A/CHRISTCHURCH/5/2000 | A/NEWCALEDONIA/20/1999 | 0 |
| A/CHRISTCHURCH/5/2000 | A/ULANUDE/209/1998 | 0 |
| A/CHRISTCHURCH/5/2000 | A/MADAGASCAR/57794/2000 | 0 |
| A/EGYPT/10/2007 | A/FUKUSHIMA/141/2006 | 0 |
| A/EGYPT/39/2005 | A/NEWCALEDONIA/20/1999 | 0 |
| A/EGYPT/39/2005 | A/NETHERLANDS/128/2004 | 0 |
| A/EGYPT/39/2005 | A/EGYPT/96/2002 | 0 |
| A/EGYPT/39/2005 | A/VICTORIA/500/2006 | 0 |
| A/EGYPT/39/2005 | A/STPETERSBURG/10/2007 | 0 |
| A/EGYPT/39/2005 | A/HONGKONG/2637/2004 | 0 |
| A/EGYPT/70/2007 | A/BRISBANE/59/2007 | 0 |
| A/EGYPT/96/2002 | A/NEWCALEDONIA/20/1999 | 0 |
| A/EGYPT/96/2002 | A/MADAGASCAR/57794/2000 | 0 |
| A/EGYPT/96/2002 | A/HUNGARY/2/2003 | 0 |
| A/ENGLAND/333/1980 | A/HONGKONG/2/1982 | 0 |
| A/ENGLAND/333/1980 | A/CHILE/1/1983 | 0 |
| A/FORTMONMOUTH/1/1947 | A/FORTWARREN/1/1950 | 0 |
| A/FORTWARREN/1/1950 | A/LACKLAND/7/1978 | 0 |
| A/FORTWARREN/1/1950 | A/USSR/90/1977 | 0 |
| A/FUKUSHIMA/141/2006 | A/SOUTHDAKOTA/6/2007 | 0 |
| A/FUKUSHIMA/141/2006 | A/SOLOMONISLANDS/3/2006 | 0 |
| A/FUKUSHIMA/141/2006 | A/FUKUSHIMA/97/2006 | 0 |
| A/FUKUSHIMA/141/2006 | A/PHILIPPINES/673/2006 | 0 |
| A/FUKUSHIMA/141/2006 | A/CAMBODIA/0371/2007 | 0 |
| A/FUKUSHIMA/141/2006 | A/HONGKONG/2652/2006 | 0 |
| A/FUKUSHIMA/97/2006 | A/HONGKONG/2652/2006 | 0 |
| A/GENEVA/3762/2003 | A/NEWCALEDONIA/20/1999 | 0 |
| A/GENEVA/3762/2003 | A/MADAGASCAR/57794/2000 | 0 |
| A/GENEVA/3762/2003 | A/EGYPT/96/2002 | 0 |
| A/HAWAII/10/2002 | A/NEIMENGGU/52/2002 | 0 |
| A/HONGKONG/1856/2008 | A/NETHERLANDS/345/2007 | 0 |
| A/HONGKONG/1856/2008 | A/SOLOMONISLANDS/3/2006 | 0 |
| A/HONGKONG/1870/2008 | A/BRISBANE/59/2007 | 0 |
| A/HONGKONG/1870/2008 | A/STPETERSBURG/12/2008 | 0 |
| A/HONGKONG/1870/2008 | A/PERTH/200/2008 | 0 |
| A/HONGKONG/1870/2008 | A/HONGKONG/2652/2006 | 0 |
| A/HONGKONG/1870/2008 | A/HONGKONG/1856/2008 | 0 |
| A/HONGKONG/1988/2009 | A/STPETERSBURG/12/2008 | 0 |
| A/HONGKONG/1988/2009 | A/HONGKONG/1856/2008 | 0 |
| A/HONGKONG/1988/2009 | A/HONGKONG/2652/2006 | 0 |
| A/HONGKONG/1988/2009 | A/MOSCOW/2/2009 | 0 |
| A/HONGKONG/2/1982 | A/CHILE/1/1983 | 0 |
| A/HONGKONG/2637/2004 | A/CHILE/8885/2002 | 0 |
| A/HONGKONG/2637/2004 | A/NEWCALEDONIA/20/1999 | 0 |
| A/HONGKONG/2637/2004 | A/THESSALONIKI/24/2005 | 0 |
| A/HONGKONG/2637/2004 | A/EGYPT/96/2002 | 0 |
| A/HONGKONG/2637/2004 | A/VICTORIA/500/2006 | 0 |
| A/HONGKONG/2652/2006 | A/SOUTHDAKOTA/6/2007 | 0 |
| A/HONGKONG/2652/2006 | A/PERTH/200/2008 | 0 |
| A/HONGKONG/2652/2006 | A/CAMBODIA/0371/2007 | 0 |
| A/HONGKONG/2652/2006 | A/PHILIPPINES/673/2006 | 0 |
| A/HONGKONG/3148/2008 | A/HONGKONG/1870/2008 | 0 |
| A/HONGKONG/747/2001 | A/NEWCALEDONIA/20/1999 | 0 |
| A/HONGKONG/747/2001 | A/MADAGASCAR/57794/2000 | 0 |
| A/HONGKONG/948/2006 | A/EGYPT/39/2005 | 0 |
| A/ICELAND/123/2003 | A/NEWCALEDONIA/20/1999 | 0 |
| A/ICELAND/123/2003 | A/CHILE/8885/2002 | 0 |
| A/ICELAND/123/2003 | A/EGYPT/96/2002 | 0 |
| A/INDIA/6263/1980 | A/HONGKONG/2/1982 | 0 |
| A/INDIA/6263/1980 | A/DUNEDIN/27/1983 | 0 |
| A/INDIA/6263/1980 | A/CHILE/1/1983 | 0 |
| A/ISRAEL/6/2002 | A/NEWCALEDONIA/20/1999 | 0 |
| A/ISRAEL/6/2002 | A/MADAGASCAR/57794/2000 | 0 |
| A/JIHLAVA/8/2007 | A/NETHERLANDS/345/2007 | 0 |
| A/JIHLAVA/8/2007 | A/SOLOMONISLANDS/3/2006 | 0 |
| A/JOHANNESBURG/159/1997 | A/BEIJING/262/1995 | 0 |
| A/JOHANNESBURG/159/1997 | A/WUHAN/371/1995 | 0 |
| A/JOHANNESBURG/82/1996 | A/BAYERN/7/1995 | 0 |
| A/JOHANNESBURG/82/1996 | A/TEXAS/36/91 | 0 |
| A/JOHANNESBURG/82/1996 | A/TAIWAN/1/86 | 0 |
| A/KANAGAWA/92/1998 | A/ULANUDE/209/1998 | 0 |
| A/KANAGAWA/92/1998 | A/OSTRAVA/801/1998 | 0 |
| A/KENTUCKY/2/2006 | A/VIRGINIA/1/2006 | 0 |
| A/KENTUCKY/2/2006 | A/SAINTPETERSBURG/8/2006 | 0 |
| A/KHABAROVSK/21/2006 | A/EGYPT/39/2005 | 0 |
| A/KHABAROVSK/21/2006 | A/NEWCALEDONIA/20/1999 | 0 |
| A/KHABAROVSK/21/2006 | A/NETHERLANDS/128/2004 | 0 |
| A/KHABAROVSK/21/2006 | A/HONGKONG/2637/2004 | 0 |
| A/LACKLAND/3/1978 | A/DUNEDIN/27/1983 | 0 |
| A/LACKLAND/7/1978 | A/LACKLAND/3/1978 | 0 |
| A/MADAGASCAR/57794/2000 | A/ULANUDE/209/1998 | 0 |
| A/MADAGASCAR/57794/2000 | A/NEWCALEDONIA/20/1999 | 0 |
| A/MADRID/G930/1999 | A/JOHANNESBURG/82/1996 | 0 |
| A/MADRID/G942/1999 | A/NEWCALEDONIA/20/1999 | 0 |
| A/MALAYSIA/100/2006 | A/SOLOMONISLANDS/3/2006 | 0 |
| A/MOSCOW/2/2009 | A/SEYCHELLES/2239/2008 | 0 |
| A/MOSCOW/2/2009 | A/NETHERLANDS/345/2007 | 0 |
| A/MOSCOW/2/2009 | A/HONGKONG/1856/2008 | 0 |
| A/MOSCOW/7/2003 | A/MADAGASCAR/57794/2000 | 0 |
| A/MOSCOW/7/2003 | A/EGYPT/96/2002 | 0 |
| A/NEIMENGGU/52/2002 | A/KENTUCKY/1/2005 | 0 |
| A/NETHERLANDS/128/2004 | A/NEWCALEDONIA/20/1999 | 0 |
| A/NETHERLANDS/128/2004 | A/ICELAND/123/2003 | 0 |
| A/NETHERLANDS/128/2004 | A/VICTORIA/500/2006 | 0 |
| A/NETHERLANDS/128/2004 | A/EGYPT/96/2002 | 0 |
| A/NETHERLANDS/128/2004 | A/HONGKONG/2637/2004 | 0 |
| A/NETHERLANDS/345/2007 | A/SOLOMONISLANDS/3/2006 | 0 |
| A/NEWCALEDONIA/18/1999 | A/ULANUDE/209/1998 | 0 |
| A/NEWCALEDONIA/20/1999 | A/ULANUDE/209/1998 | 0 |
| A/NEWCALEDONIA/20/1999 | A/CHILE/9848/2002 | 0 |
| A/NEWCALEDONIA/20/1999 | A/HAWAII/10/2002 | 0 |
| A/NEWCALEDONIA/20/1999 | A/OSTRAVA/801/1998 | 0 |
| A/NEWCALEDONIA/20/1999 | A/VICTORIA/500/2006 | 0 |
| A/NEWCALEDONIA/20/1999 | A/BRISBANE/193/2004 | 0 |
| A/NEWCALEDONIA/20/1999 | A/HONGKONG/4847/1998 | 0 |
| A/NEWCALEDONIA/20/1999 | A/NEWCALEDONIA/9/2004 | 0 |
| A/NEWCALEDONIA/20/1999 | A/SHENZHEN/141/2005 | 0 |
| A/NEWCALEDONIA/20/1999 | A/VIRGINIA/1/2006 | 0 |
| A/NEWCALEDONIA/20/1999 | A/SAINTPETERSBURG/8/2006 | 0 |
| A/NEWCALEDONIA/20/1999 | A/NEIMENGGU/52/2002 | 0 |
| A/NEWCALEDONIA/20/1999 | A/KENTUCKY/1/2005 | 0 |
| A/NEWCALEDONIA/20/1999 | A/KENTUCKY/2/2006 | 0 |
| A/NEWCALEDONIA/20/1999 | A/HUNGARY/2/2003 | 0 |
| A/NEWCALEDONIA/9/2004 | A/MALAYSIA/100/2006 | 0 |
| A/NEWCALEDONIA/9/2004 | A/SOLOMONISLANDS/3/2006 | 0 |
| A/NEWCALEDONIA/9/2004 | A/SINGAPORE/14/2004 | 0 |
| A/NEWCALEDONIA/9/2004 | A/VICTORIA/500/2006 | 0 |
| A/NEWCALEDONIA/9/2004 | A/PHILIPPINES/673/2006 | 0 |
| A/NEWCALEDONIA/9/2004 | A/SHENZHEN/141/2005 | 0 |
| A/NORWAY/1729/2007 | A/BRISBANE/59/2007 | 0 |
| A/NOVISAD/150/2006 | A/NEWCALEDONIA/20/1999 | 0 |
| A/NOVISAD/150/2006 | A/HONGKONG/2637/2004 | 0 |
| A/NOVISAD/150/2006 | A/EGYPT/39/2005 | 0 |
| A/OSTRAVA/79/2008 | A/BRISBANE/59/2007 | 0 |
| A/OSTRAVA/79/2008 | A/JIHLAVA/8/2007 | 0 |
| A/OSTRAVA/79/2008 | A/NETHERLANDS/345/2007 | 0 |
| A/OSTRAVA/801/1998 | A/BEIJING/262/1995 | 0 |
| A/OSTRAVA/801/1998 | A/WUHAN/371/1995 | 0 |
| A/PARIS/0194/2007 | A/BRISBANE/59/2007 | 0 |
| A/PARIS/160/2007 | A/SOLOMONISLANDS/3/2006 | 0 |
| A/PARIS/160/2007 | A/FUKUSHIMA/141/2006 | 0 |
| A/PARIS/160/2007 | A/HONGKONG/2652/2006 | 0 |
| A/PARMA/4/2006 | A/NEWCALEDONIA/20/1999 | 0 |
| A/PARMA/4/2006 | A/EGYPT/39/2005 | 0 |
| A/PARMA/4/2006 | A/HONGKONG/2637/2004 | 0 |
| A/PARMA/4/2006 | A/NETHERLANDS/128/2004 | 0 |
| A/PHILIPPINES/673/2006 | A/SOLOMONISLANDS/3/2006 | 0 |
| A/RHEINLANDPFALZ/64/2007 | A/BRISBANE/59/2007 | 0 |
| A/SERBIA/1721/2006 | A/EGYPT/39/2005 | 0 |
| A/SERBIA/1721/2006 | A/HONGKONG/2637/2004 | 0 |
| A/SERBIA/1721/2006 | A/THESSALONIKI/24/2005 | 0 |
| A/SEYCHELLES/2239/2008 | A/NETHERLANDS/345/2007 | 0 |
| A/SEYCHELLES/2239/2008 | A/HONGKONG/1856/2008 | 0 |
| A/SHENZHEN/141/2005 | A/MALAYSIA/100/2006 | 0 |
| A/SHENZHEN/141/2005 | A/VICTORIA/500/2006 | 0 |
| A/SINGAPORE/14/2004 | A/CHILE/8885/2002 | 0 |
| A/SINGAPORE/14/2004 | A/ICELAND/123/2003 | 0 |
| A/SINGAPORE/14/2004 | A/MALAYSIA/100/2006 | 0 |
| A/SINGAPORE/14/2004 | A/SOLOMONISLANDS/3/2006 | 0 |
| A/SINGAPORE/14/2004 | A/VICTORIA/500/2006 | 0 |
| A/SINGAPORE/14/2004 | A/EGYPT/96/2002 | 0 |
| A/SINGAPORE/14/2004 | A/NEWCALEDONIA/20/1999 | 0 |
| A/SINGAPORE/14/2004 | A/SHENZHEN/141/2005 | 0 |
| A/SINGAPORE/14/2004 | A/PHILIPPINES/673/2006 | 0 |
| A/SINGAPORE/6/1986 | A/BAYERN/7/1995 | 0 |
| A/SINGAPORE/6/1986 | A/TEXAS/36/1991 | 0 |
| A/SINGAPORE/6/1986 | A/SICHUAN/4/1988 | 0 |
| A/SINGAPORE/6/1986 | A/TAIWAN/1/1986 | 0 |
| A/SINGAPORE/9/1998 | A/NEWCALEDONIA/20/1999 | 0 |
| A/SOLOMONISLANDS/3/2006 | A/FUKUSHIMA/97/2006 | 0 |
| A/SOLOMONISLANDS/3/2006 | A/SOUTHDAKOTA/6/2007 | 0 |
| A/SOLOMONISLANDS/3/2006 | A/VICTORIA/500/2006 | 0 |
| A/SOLOMONISLANDS/3/2006 | A/VIRGINIA/1/2006 | 0 |
| A/SOLOMONISLANDS/3/2006 | A/PERTH/200/2008 | 0 |
| A/SOLOMONISLANDS/3/2006 | A/HONGKONG/2652/2006 | 0 |
| A/SOUTHDAKOTA/6/2007 | A/HONGKONG/1870/2008 | 0 |
| A/SOUTHDAKOTA/6/2007 | A/PERTH/200/2008 | 0 |
| A/STPETERSBURG/10/2007 | A/THESSALONIKI/24/2005 | 0 |
| A/STPETERSBURG/12/2008 | A/BRISBANE/59/2007 | 0 |
| A/STPETERSBURG/12/2008 | A/SOLOMONISLANDS/3/2006 | 0 |
| A/STPETERSBURG/12/2008 | A/HONGKONG/2652/2006 | 0 |
| A/STPETERSBURG/12/2008 | A/STPETERSBURG/5/2008 | 0 |
| A/STPETERSBURG/5/2008 | A/BRISBANE/59/2007 | 0 |
| A/STPETERSBURG/5/2008 | A/EGYPT/10/2007 | 0 |
| A/STPETERSBURG/5/2008 | A/SOLOMONISLANDS/3/2006 | 0 |
| A/STPETERSBURG/5/2008 | A/FUKUSHIMA/141/2006 | 0 |
| A/STPETERSBURG/5/2008 | A/HONGKONG/2652/2006 | 0 |
| A/STPETERSBURG/8/2006 | A/EGYPT/39/2005 | 0 |
| A/STPETERSBURG/8/2006 | A/NEWCALEDONIA/20/1999 | 0 |
| A/STPETERSBURG/98/1998 | A/JOHANNESBURG/82/1996 | 0 |
| A/STPETERSBURG/98/1998 | A/BAYERN/7/1995 | 0 |
| A/STPETERSBURG/98/1998 | A/TAIWAN/1/86 | 0 |
| A/SWITZERLAND/7425/2006 | A/NEWCALEDONIA/20/1999 | 0 |
| A/SWITZERLAND/7425/2006 | A/NETHERLANDS/128/2004 | 0 |
| A/SWITZERLAND/7425/2006 | A/EGYPT/39/2005 | 0 |
| A/SWITZERLAND/7425/2006 | A/HONGKONG/2637/2004 | 0 |
| A/TAIWAN/1/1986 | A/BAYERN/7/1995 | 0 |
| A/TAIWAN/1/1986 | A/TEXAS/36/1991 | 0 |
| A/TAIWAN/1/1986 | A/SICHUAN/4/1988 | 0 |
| A/TEXAS/36/1991 | A/JOHANNESBURG/82/1996 | 0 |
| A/TEXAS/36/1991 | A/BAYERN/7/1995 | 0 |
| A/TEXAS/36/91 | A/TAIWAN/1/86 | 0 |
| A/ULANUDE/209/1998 | A/OSTRAVA/801/1998 | 0 |
| A/ULANUDE/209/1998 | A/BEIJING/262/1995 | 0 |
| A/USSR/90/1977 | A/LACKLAND/7/1978 | 0 |
| A/USSR/90/1977 | A/ENGLAND/333/1980 | 0 |
| A/USSR/90/1977 | A/BRAZIL/11/1978 | 0 |
| A/WELLINGTON/8/1997 | A/JOHANNESBURG/82/1996 | 0 |
| A/WELLINGTON/8/1997 | A/BAYERN/7/1995 | 0 |
| A/WELLINGTON/8/1997 | A/TAIWAN/1/86 | 0 |
| A/WELLINGTON/8/1997 | A/TEXAS/36/91 | 0 |
| A/ZAGREB/4622/2006 | A/EGYPT/39/2005 | 0 |
| A/ZAGREB/4622/2006 | A/HONGKONG/2637/2004 | 0 |
| A/ZAGREB/4622/2006 | A/NEWCALEDONIA/20/1999 | 0 |
| A/ZAGREB/4622/2006 | A/NETHERLANDS/128/2004 | 0 |
| A/ARIZONA/14/1978 | A/LACKLAND/3/1978 | 1 |
| A/ARIZONA/14/1978 | A/LACKLAND/7/1978 | 1 |
| A/ARIZONA/14/1978 | A/CALIFORNIA/45/1978 | 1 |
| A/ARIZONA/14/1978 | A/BRAZIL/11/1978 | 1 |
| A/BAYERN/7/1995 | A/SINGAPORE/9/1998 | 1 |
| A/BAYERN/7/1995 | A/CHILE/1/83 | 1 |
| A/BEIJING/262/1995 | A/JOHANNESBURG/82/1996 | 1 |
| A/BEIJING/262/1995 | A/TEXAS/36/91 | 1 |
| A/BEIJING/262/1995 | A/BAYERN/7/1995 | 1 |
| A/BEIJING/262/1995 | A/CHILE/4795/2000 | 1 |
| A/BEIJING/262/1995 | A/WELLINGTON/8/1997 | 1 |
| A/BEIJING/262/1995 | A/TAIWAN/1/86 | 1 |
| A/BEIJING/262/1995 | A/CHILE/1/83 | 1 |
| A/BEIJING/262/1995 | A/PERU/3135/2003 | 1 |
| A/BEIJING/262/1995 | A/NEIMENGGU/52/2002 | 1 |
| A/BEIJING/262/1995 | A/HUNGARY/2/2003 | 1 |
| A/BEIJING/262/1995 | A/JIANGXI/160/2005 | 1 |
| A/BRATISLAVA/45/2007 | A/NEWCALEDONIA/20/1999 | 1 |
| A/BRATISLAVA/45/2007 | A/THESSALONIKI/24/2005 | 1 |
| A/BRATISLAVA/45/2007 | A/STPETERSBURG/10/2007 | 1 |
| A/BRAZIL/11/1978 | A/INDIA/6263/1980 | 1 |
| A/BRAZIL/11/1978 | A/LACKLAND/3/1978 | 1 |
| A/BRAZIL/11/1978 | A/CALIFORNIA/45/1978 | 1 |
| A/BRAZIL/11/1978 | A/BAYERN/7/1995 | 1 |
| A/BRAZIL/11/1978 | A/TEXAS/36/1991 | 1 |
| A/BRAZIL/11/1978 | A/SINGAPORE/6/1986 | 1 |
| A/BRAZIL/11/1978 | A/TAIWAN/1/1986 | 1 |
| A/BRAZIL/11/1978 | A/BEIJING/262/1995 | 1 |
| A/BRAZIL/11/1978 | A/NEWCALEDONIA/20/1999 | 1 |
| A/BRAZIL/11/1978 | A/CHILE/1/1983 | 1 |
| A/BRAZIL/11/1978 | A/DUNEDIN/27/1983 | 1 |
| A/BRAZIL/11/1978 | A/VICTORIA/7/1983 | 1 |
| A/BRISBANE/193/2004 | A/HONGKONG/2652/2006 | 1 |
| A/BRISBANE/193/2004 | A/FUKUSHIMA/141/2006 | 1 |
| A/BRISBANE/193/2004 | A/SOLOMONISLANDS/3/2006 | 1 |
| A/BRISBANE/193/2004 | A/PHILIPPINES/673/2006 | 1 |
| A/BRISBANE/59/2007 | A/NETHERLANDS/345/2007 | 1 |
| A/BRISBANE/59/2007 | A/FUKUSHIMA/97/2006 | 1 |
| A/BRISBANE/59/2007 | A/NEWCALEDONIA/20/1999 | 1 |
| A/BRISBANE/59/2007 | A/THESSALONIKI/24/2005 | 1 |
| A/BRISBANE/59/2007 | A/STPETERSBURG/10/2007 | 1 |
| A/CALIFORNIA/45/1978 | A/LACKLAND/3/1978 | 1 |
| A/CALIFORNIA/45/1978 | A/LACKLAND/7/1978 | 1 |
| A/CAM/1946 | A/FORTMONMOUTH/1/1947 | 1 |
| A/CAM/1946 | A/FORTWARREN/1/1950 | 1 |
| A/CAM/1946 | A/DENVER/1/1957 | 1 |
| A/CAM/1946 | A/USSR/90/1977 | 1 |
| A/CAM/1946 | A/ARIZONA/14/1978 | 1 |
| A/CAM/1946 | A/BRAZIL/11/1978 | 1 |
| A/CAM/1946 | A/LACKLAND/7/1978 | 1 |
| A/CAM/1946 | A/LACKLAND/3/1978 | 1 |
| A/CHILE/1/1983 | A/VICTORIA/7/1983 | 1 |
| A/CHILE/1/1983 | A/BEIJING/262/1995 | 1 |
| A/CHILE/1/1983 | A/NEWCALEDONIA/20/1999 | 1 |
| A/CHILE/1/1983 | A/BAYERN/7/1995 | 1 |
| A/CHILE/1/1983 | A/TEXAS/36/1991 | 1 |
| A/CHILE/1/1983 | A/SINGAPORE/6/1986 | 1 |
| A/CHILE/1/1983 | A/TAIWAN/1/1986 | 1 |
| A/CHILE/4795/2000 | A/JOHANNESBURG/82/1996 | 1 |
| A/CHILE/8885/2002 | A/BAYERN/7/1995 | 1 |
| A/CHILE/8885/2002 | A/BEIJING/262/1995 | 1 |
| A/CHILE/9848/2002 | A/PERU/3135/2003 | 1 |
| A/CHRISTCHURCH/1/2003 | A/BAYERN/7/1995 | 1 |
| A/CHRISTCHURCH/1/2003 | A/BEIJING/262/1995 | 1 |
| A/CHRISTCHURCH/5/2000 | A/JOHANNESBURG/82/1996 | 1 |
| A/CHRISTCHURCH/5/2000 | A/HONGKONG/1252/2000 | 1 |
| A/CHRISTCHURCH/5/2000 | A/BAYERN/7/1995 | 1 |
| A/CHRISTCHURCH/5/2000 | A/BEIJING/262/1995 | 1 |
| A/DENVER/1/1957 | A/ARIZONA/14/1978 | 1 |
| A/DENVER/1/1957 | A/BRAZIL/11/1978 | 1 |
| A/DENVER/1/1957 | A/LACKLAND/3/1978 | 1 |
| A/DENVER/1/1957 | A/LACKLAND/7/1978 | 1 |
| A/DENVER/1/1957 | A/USSR/90/1977 | 1 |
| A/DUNEDIN/27/1983 | A/VICTORIA/7/1983 | 1 |
| A/EGYPT/10/2007 | A/THESSALONIKI/24/2005 | 1 |
| A/EGYPT/10/2007 | A/STPETERSBURG/10/2007 | 1 |
| A/EGYPT/39/2005 | A/TAIWAN/42/2006 | 1 |
| A/EGYPT/39/2005 | A/BEIJING/262/1995 | 1 |
| A/EGYPT/96/2002 | A/TOKYO/6708/2005 | 1 |
| A/EGYPT/96/2002 | A/TAIWAN/42/2006 | 1 |
| A/EGYPT/96/2002 | A/BAYERN/7/1995 | 1 |
| A/EGYPT/96/2002 | A/BEIJING/262/1995 | 1 |
| A/EGYPT/96/2002 | A/VICTORIA/500/2006 | 1 |
| A/EGYPT/96/2002 | A/HONGKONG/1252/2000 | 1 |
| A/ENGLAND/333/1980 | A/INDIA/6263/1980 | 1 |
| A/ENGLAND/333/1980 | A/VICTORIA/7/1983 | 1 |
| A/ENGLAND/333/1980 | A/DUNEDIN/27/1983 | 1 |
| A/FLORIDA/03/2006 | A/SOUTHDAKOTA/6/2007 | 1 |
| A/FLORIDA/03/2006 | A/BRISBANE/59/2007 | 1 |
| A/FLORIDA/03/2006 | A/SOLOMONISLANDS/3/2006 | 1 |
| A/FLORIDA/03/2006 | A/HONGKONG/1870/2008 | 1 |
| A/FLORIDA/03/2006 | A/HONGKONG/2652/2006 | 1 |
| A/FLORIDA/03/2006 | A/PERTH/200/2008 | 1 |
| A/FORTMONMOUTH/1/1947 | A/DENVER/1/1957 | 1 |
| A/FORTMONMOUTH/1/1947 | A/USSR/90/1977 | 1 |
| A/FORTMONMOUTH/1/1947 | A/ARIZONA/14/1978 | 1 |
| A/FORTMONMOUTH/1/1947 | A/BRAZIL/11/1978 | 1 |
| A/FORTMONMOUTH/1/1947 | A/LACKLAND/7/1978 | 1 |
| A/FORTMONMOUTH/1/1947 | A/LACKLAND/3/1978 | 1 |
| A/FORTWARREN/1/1950 | A/ARIZONA/14/1978 | 1 |
| A/FORTWARREN/1/1950 | A/BRAZIL/11/1978 | 1 |
| A/FORTWARREN/1/1950 | A/LACKLAND/3/1978 | 1 |
| A/FORTWARREN/1/1950 | A/DENVER/1/1957 | 1 |
| A/FUKUOKA/C86/2000 | A/JOHANNESBURG/82/1996 | 1 |
| A/FUKUOKA/C86/2000 | A/MADAGASCAR/57794/2000 | 1 |
| A/FUKUOKA/C86/2000 | A/NEWCALEDONIA/20/1999 | 1 |
| A/FUKUOKA/C86/2000 | A/BAYERN/7/1995 | 1 |
| A/FUKUOKA/C86/2000 | A/BEIJING/262/1995 | 1 |
| A/FUKUSHIMA/141/2006 | A/VICTORIA/500/2006 | 1 |
| A/FUKUSHIMA/141/2006 | A/EGYPT/39/2005 | 1 |
| A/FUKUSHIMA/141/2006 | A/NEWCALEDONIA/20/1999 | 1 |
| A/FUKUSHIMA/141/2006 | A/THESSALONIKI/24/2005 | 1 |
| A/FUKUSHIMA/141/2006 | A/MALAYSIA/100/2006 | 1 |
| A/FUKUSHIMA/97/2006 | A/EGYPT/39/2005 | 1 |
| A/FUKUSHIMA/97/2006 | A/NEWCALEDONIA/20/1999 | 1 |
| A/FUKUSHIMA/97/2006 | A/THESSALONIKI/24/2005 | 1 |
| A/FUKUSHIMA/97/2006 | A/EGYPT/96/2002 | 1 |
| A/FUKUSHIMA/97/2006 | A/HONGKONG/2637/2004 | 1 |
| A/FUKUSHIMA/97/2006 | A/STPETERSBURG/10/2007 | 1 |
| A/GENEVA/3762/2003 | A/CHILE/8885/2002 | 1 |
| A/GENEVA/3762/2003 | A/BAYERN/7/1995 | 1 |
| A/GENEVA/3762/2003 | A/BEIJING/262/1995 | 1 |
| A/HAWAII/10/2002 | A/PERU/3135/2003 | 1 |
| A/HONGKONG/1252/2000 | A/JOHANNESBURG/82/1996 | 1 |
| A/HONGKONG/1252/2000 | A/ULANUDE/209/1998 | 1 |
| A/HONGKONG/1252/2000 | A/NEWCALEDONIA/20/1999 | 1 |
| A/HONGKONG/1252/2000 | A/BAYERN/7/1995 | 1 |
| A/HONGKONG/1252/2000 | A/CHILE/4795/2000 | 1 |
| A/HONGKONG/1252/2000 | A/BEIJING/262/1995 | 1 |
| A/HONGKONG/1856/2008 | A/BRISBANE/59/2007 | 1 |
| A/HONGKONG/1856/2008 | A/STPETERSBURG/12/2008 | 1 |
| A/HONGKONG/1856/2008 | A/HONGKONG/2652/2006 | 1 |
| A/HONGKONG/1856/2008 | A/NEWCALEDONIA/20/1999 | 1 |
| A/HONGKONG/1856/2008 | A/THESSALONIKI/24/2005 | 1 |
| A/HONGKONG/1870/2008 | A/SEYCHELLES/2239/2008 | 1 |
| A/HONGKONG/1870/2008 | A/NETHERLANDS/345/2007 | 1 |
| A/HONGKONG/1870/2008 | A/SOLOMONISLANDS/3/2006 | 1 |
| A/HONGKONG/1870/2008 | A/NEWCALEDONIA/20/1999 | 1 |
| A/HONGKONG/1988/2009 | A/SEYCHELLES/2239/2008 | 1 |
| A/HONGKONG/1988/2009 | A/BRISBANE/59/2007 | 1 |
| A/HONGKONG/1988/2009 | A/SOLOMONISLANDS/3/2006 | 1 |
| A/HONGKONG/1988/2009 | A/NEWCALEDONIA/20/1999 | 1 |
| A/HONGKONG/1988/2009 | A/HONGKONG/1870/2008 | 1 |
| A/HONGKONG/2/1982 | A/DUNEDIN/27/1983 | 1 |
| A/HONGKONG/2/1982 | A/VICTORIA/7/1983 | 1 |
| A/HONGKONG/2637/2004 | A/ICELAND/123/2003 | 1 |
| A/HONGKONG/2637/2004 | A/TAIWAN/42/2006 | 1 |
| A/HONGKONG/2637/2004 | A/BEIJING/262/1995 | 1 |
| A/HONGKONG/2652/2006 | A/STPETERSBURG/10/2007 | 1 |
| A/HONGKONG/2652/2006 | A/HONGKONG/2637/2004 | 1 |
| A/HONGKONG/2652/2006 | A/SAINTPETERSBURG/8/2006 | 1 |
| A/HONGKONG/2652/2006 | A/VIRGINIA/1/2006 | 1 |
| A/HONGKONG/2652/2006 | A/EGYPT/39/2005 | 1 |
| A/HONGKONG/2652/2006 | A/MALAYSIA/100/2006 | 1 |
| A/HONGKONG/2652/2006 | A/NEWCALEDONIA/20/1999 | 1 |
| A/HONGKONG/2652/2006 | A/THESSALONIKI/24/2005 | 1 |
| A/HONGKONG/2652/2006 | A/KENTUCKY/2/2006 | 1 |
| A/HONGKONG/2652/2006 | A/EGYPT/96/2002 | 1 |
| A/HONGKONG/2652/2006 | A/VICTORIA/500/2006 | 1 |
| A/HONGKONG/3176/2008 | A/HONGKONG/1870/2008 | 1 |
| A/HONGKONG/4847/1998 | A/JOHANNESBURG/82/1996 | 1 |
| A/HONGKONG/4847/1998 | A/ULANUDE/209/1998 | 1 |
| A/HONGKONG/4847/1998 | A/BAYERN/7/1995 | 1 |
| A/HONGKONG/4847/1998 | A/OSTRAVA/801/1998 | 1 |
| A/HONGKONG/4847/1998 | A/BEIJING/262/1995 | 1 |
| A/HONGKONG/4847/1998 | A/WUHAN/371/1995 | 1 |
| A/HONGKONG/4847/1998 | A/JOHANNESBURG/159/1997 | 1 |
| A/HONGKONG/747/2001 | A/HONGKONG/1252/2000 | 1 |
| A/HONGKONG/747/2001 | A/BAYERN/7/1995 | 1 |
| A/HONGKONG/747/2001 | A/BEIJING/262/1995 | 1 |
| A/HONGKONG/948/2006 | A/BEIJING/262/1995 | 1 |
| A/ICELAND/123/2003 | A/BEIJING/262/1995 | 1 |
| A/INDIA/6263/1980 | A/VICTORIA/7/1983 | 1 |
| A/ISRAEL/6/2002 | A/BAYERN/7/1995 | 1 |
| A/ISRAEL/6/2002 | A/BEIJING/262/1995 | 1 |
| A/JIANGXI/160/2005 | A/KENTUCKY/1/2005 | 1 |
| A/JOHANNESBURG/159/1997 | A/JOHANNESBURG/82/1996 | 1 |
| A/JOHANNESBURG/159/1997 | A/TEXAS/36/91 | 1 |
| A/JOHANNESBURG/159/1997 | A/BAYERN/7/1995 | 1 |
| A/JOHANNESBURG/159/1997 | A/TAIWAN/1/86 | 1 |
| A/JOHANNESBURG/82/1996 | A/SINGAPORE/9/1998 | 1 |
| A/JOHANNESBURG/82/1996 | A/CHILE/8885/2002 | 1 |
| A/JOHANNESBURG/82/1996 | A/HAWAII/10/2002 | 1 |
| A/JOHANNESBURG/82/1996 | A/NEIMENGGU/52/2002 | 1 |
| A/JOHANNESBURG/82/1996 | A/CHILE/1/83 | 1 |
| A/KANAGAWA/92/1998 | A/JOHANNESBURG/82/1996 | 1 |
| A/KANAGAWA/92/1998 | A/BAYERN/7/1995 | 1 |
| A/KANAGAWA/92/1998 | A/JOHANNESBURG/159/1997 | 1 |
| A/KENTUCKY/2/2006 | A/SOLOMONISLANDS/3/2006 | 1 |
| A/LACKLAND/3/1978 | A/HONGKONG/2/1982 | 1 |
| A/LACKLAND/3/1978 | A/INDIA/6263/1980 | 1 |
| A/LACKLAND/3/1978 | A/ENGLAND/333/1980 | 1 |
| A/LACKLAND/3/1978 | A/VICTORIA/7/1983 | 1 |
| A/LACKLAND/3/1978 | A/CHILE/1/1983 | 1 |
| A/MADAGASCAR/57794/2000 | A/JOHANNESBURG/82/1996 | 1 |
| A/MADAGASCAR/57794/2000 | A/HONGKONG/1252/2000 | 1 |
| A/MADAGASCAR/57794/2000 | A/BAYERN/7/1995 | 1 |
| A/MADAGASCAR/57794/2000 | A/CHILE/4795/2000 | 1 |
| A/MADAGASCAR/57794/2000 | A/BEIJING/262/1995 | 1 |
| A/MADRID/G930/1999 | A/ULANUDE/209/1998 | 1 |
| A/MADRID/G930/1999 | A/BEIJING/262/1995 | 1 |
| A/MADRID/G930/1999 | A/NEWCALEDONIA/20/1999 | 1 |
| A/MADRID/G930/1999 | A/BAYERN/7/1995 | 1 |
| A/MADRID/G942/1999 | A/JOHANNESBURG/82/1996 | 1 |
| A/MADRID/G942/1999 | A/ULANUDE/209/1998 | 1 |
| A/MADRID/G942/1999 | A/BAYERN/7/1995 | 1 |
| A/MADRID/G942/1999 | A/BEIJING/262/1995 | 1 |
| A/MALAYSIA/100/2006 | A/PHILIPPINES/673/2006 | 1 |
| A/MIYAGI/3/2000 | A/JOHANNESBURG/82/1996 | 1 |
| A/MIYAGI/3/2000 | A/ULANUDE/209/1998 | 1 |
| A/MIYAGI/3/2000 | A/NEWCALEDONIA/20/1999 | 1 |
| A/MIYAGI/3/2000 | A/BAYERN/7/1995 | 1 |
| A/MIYAGI/3/2000 | A/BEIJING/262/1995 | 1 |
| A/MOROCCO/229/2006 | A/HONGKONG/2652/2006 | 1 |
| A/MOSCOW/2/2009 | A/BRISBANE/59/2007 | 1 |
| A/MOSCOW/2/2009 | A/STPETERSBURG/12/2008 | 1 |
| A/MOSCOW/2/2009 | A/SOLOMONISLANDS/3/2006 | 1 |
| A/MOSCOW/2/2009 | A/NEWCALEDONIA/20/1999 | 1 |
| A/MOSCOW/2/2009 | A/HONGKONG/1870/2008 | 1 |
| A/MOSCOW/2/2009 | A/HONGKONG/2652/2006 | 1 |
| A/MOSCOW/7/2003 | A/BAYERN/7/1995 | 1 |
| A/MOSCOW/7/2003 | A/BEIJING/262/1995 | 1 |
| A/NEIMENGGU/52/2002 | A/JIANGXI/160/2005 | 1 |
| A/NEIMENGGU/52/2002 | A/PERU/3135/2003 | 1 |
| A/NETHERLANDS/128/2004 | A/CHILE/8885/2002 | 1 |
| A/NETHERLANDS/128/2004 | A/TAIWAN/42/2006 | 1 |
| A/NETHERLANDS/128/2004 | A/BEIJING/262/1995 | 1 |
| A/NETHERLANDS/345/2007 | A/FUKUSHIMA/141/2006 | 1 |
| A/NETHERLANDS/345/2007 | A/FUKUSHIMA/97/2006 | 1 |
| A/NETHERLANDS/345/2007 | A/NEWCALEDONIA/20/1999 | 1 |
| A/NETHERLANDS/345/2007 | A/THESSALONIKI/24/2005 | 1 |
| A/NETHERLANDS/345/2007 | A/STPETERSBURG/10/2007 | 1 |
| A/NETHERLANDS/345/2007 | A/HONGKONG/2652/2006 | 1 |
| A/NEWCALEDONIA/18/1999 | A/JOHANNESBURG/82/1996 | 1 |
| A/NEWCALEDONIA/18/1999 | A/BAYERN/7/1995 | 1 |
| A/NEWCALEDONIA/18/1999 | A/WUHAN/371/1995 | 1 |
| A/NEWCALEDONIA/18/1999 | A/BEIJING/262/1995 | 1 |
| A/NEWCALEDONIA/18/1999 | A/JOHANNESBURG/159/1997 | 1 |
| A/NEWCALEDONIA/20/1999 | A/SOUTHDAKOTA/6/2007 | 1 |
| A/NEWCALEDONIA/20/1999 | A/JOHANNESBURG/82/1996 | 1 |
| A/NEWCALEDONIA/20/1999 | A/JIANGXI/160/2005 | 1 |
| A/NEWCALEDONIA/20/1999 | A/TAIWAN/42/2006 | 1 |
| A/NEWCALEDONIA/20/1999 | A/BAYERN/7/1995 | 1 |
| A/NEWCALEDONIA/20/1999 | A/CHILE/4795/2000 | 1 |
| A/NEWCALEDONIA/20/1999 | A/WUHAN/371/1995 | 1 |
| A/NEWCALEDONIA/20/1999 | A/BEIJING/262/1995 | 1 |
| A/NEWCALEDONIA/20/1999 | A/JOHANNESBURG/159/1997 | 1 |
| A/NEWCALEDONIA/20/1999 | A/PERU/3135/2003 | 1 |
| A/NEWCALEDONIA/20/1999 | A/CAMBODIA/0371/2007 | 1 |
| A/NEWCALEDONIA/20/1999 | A/PHILIPPINES/673/2006 | 1 |
| A/NEWCALEDONIA/9/2004 | A/FUKUSHIMA/141/2006 | 1 |
| A/NEWCALEDONIA/9/2004 | A/HONGKONG/2652/2006 | 1 |
| A/NOVISAD/150/2006 | A/BEIJING/262/1995 | 1 |
| A/OSTRAVA/79/2008 | A/SOLOMONISLANDS/3/2006 | 1 |
| A/OSTRAVA/79/2008 | A/FUKUSHIMA/141/2006 | 1 |
| A/OSTRAVA/79/2008 | A/NEWCALEDONIA/20/1999 | 1 |
| A/OSTRAVA/79/2008 | A/THESSALONIKI/24/2005 | 1 |
| A/OSTRAVA/801/1998 | A/JOHANNESBURG/82/1996 | 1 |
| A/OSTRAVA/801/1998 | A/BAYERN/7/1995 | 1 |
| A/PARIS/160/2007 | A/EGYPT/39/2005 | 1 |
| A/PARIS/160/2007 | A/NEWCALEDONIA/20/1999 | 1 |
| A/PARIS/160/2007 | A/THESSALONIKI/24/2005 | 1 |
| A/PARMA/4/2006 | A/BEIJING/262/1995 | 1 |
| A/PHILIPPINES/673/2006 | A/VICTORIA/500/2006 | 1 |
| A/SAINTPETERSBURG/8/2006 | A/SOLOMONISLANDS/3/2006 | 1 |
| A/SERBIA/1721/2006 | A/NEWCALEDONIA/20/1999 | 1 |
| A/SEYCHELLES/2239/2008 | A/BRISBANE/59/2007 | 1 |
| A/SEYCHELLES/2239/2008 | A/STPETERSBURG/12/2008 | 1 |
| A/SEYCHELLES/2239/2008 | A/NEWCALEDONIA/20/1999 | 1 |
| A/SEYCHELLES/2239/2008 | A/HONGKONG/2652/2006 | 1 |
| A/SHENZHEN/141/2005 | A/FUKUSHIMA/141/2006 | 1 |
| A/SHENZHEN/141/2005 | A/SOLOMONISLANDS/3/2006 | 1 |
| A/SHENZHEN/141/2005 | A/PHILIPPINES/673/2006 | 1 |
| A/SHENZHEN/141/2005 | A/HONGKONG/2652/2006 | 1 |
| A/SINGAPORE/14/2004 | A/FUKUSHIMA/141/2006 | 1 |
| A/SINGAPORE/14/2004 | A/BEIJING/262/1995 | 1 |
| A/SINGAPORE/14/2004 | A/HONGKONG/2652/2006 | 1 |
| A/SINGAPORE/6/1986 | A/BEIJING/262/1995 | 1 |
| A/SINGAPORE/6/1986 | A/NEWCALEDONIA/20/1999 | 1 |
| A/SOLOMONISLANDS/3/2006 | A/EGYPT/39/2005 | 1 |
| A/SOLOMONISLANDS/3/2006 | A/NEWCALEDONIA/20/1999 | 1 |
| A/SOLOMONISLANDS/3/2006 | A/THESSALONIKI/24/2005 | 1 |
| A/SOLOMONISLANDS/3/2006 | A/STPETERSBURG/8/2006 | 1 |
| A/SOLOMONISLANDS/3/2006 | A/STPETERSBURG/10/2007 | 1 |
| A/STPETERSBURG/10/2007 | A/NEWCALEDONIA/20/1999 | 1 |
| A/STPETERSBURG/12/2008 | A/NETHERLANDS/345/2007 | 1 |
| A/STPETERSBURG/12/2008 | A/NEWCALEDONIA/20/1999 | 1 |
| A/STPETERSBURG/5/2008 | A/NETHERLANDS/345/2007 | 1 |
| A/STPETERSBURG/5/2008 | A/NEWCALEDONIA/20/1999 | 1 |
| A/STPETERSBURG/5/2008 | A/THESSALONIKI/24/2005 | 1 |
| A/STPETERSBURG/5/2008 | A/STPETERSBURG/10/2007 | 1 |
| A/STPETERSBURG/8/2006 | A/THESSALONIKI/24/2005 | 1 |
| A/STPETERSBURG/96/2007 | A/EGYPT/39/2005 | 1 |
| A/STPETERSBURG/96/2007 | A/FUKUSHIMA/97/2006 | 1 |
| A/STPETERSBURG/96/2007 | A/SOLOMONISLANDS/3/2006 | 1 |
| A/STPETERSBURG/96/2007 | A/NEWCALEDONIA/20/1999 | 1 |
| A/STPETERSBURG/96/2007 | A/THESSALONIKI/24/2005 | 1 |
| A/STPETERSBURG/96/2007 | A/HONGKONG/2652/2006 | 1 |
| A/STPETERSBURG/98/1998 | A/WUHAN/371/1995 | 1 |
| A/STPETERSBURG/98/1998 | A/BEIJING/262/1995 | 1 |
| A/STPETERSBURG/98/1998 | A/TEXAS/36/91 | 1 |
| A/SWITZERLAND/7425/2006 | A/BEIJING/262/1995 | 1 |
| A/TAIWAN/1/1986 | A/BEIJING/262/1995 | 1 |
| A/TAIWAN/1/1986 | A/WUHAN/371/1995 | 1 |
| A/TAIWAN/1/1986 | A/NEWCALEDONIA/20/1999 | 1 |
| A/TAIWAN/1/86 | A/CHILE/1/83 | 1 |
| A/TAIWAN/42/2006 | A/VICTORIA/500/2006 | 1 |
| A/TEXAS/36/1991 | A/BEIJING/262/1995 | 1 |
| A/TEXAS/36/1991 | A/WUHAN/371/1995 | 1 |
| A/TEXAS/36/1991 | A/NEWCALEDONIA/20/1999 | 1 |
| A/TEXAS/36/91 | A/CHILE/1/83 | 1 |
| A/ULANUDE/209/1998 | A/JOHANNESBURG/82/1996 | 1 |
| A/ULANUDE/209/1998 | A/BAYERN/7/1995 | 1 |
| A/ULANUDE/209/1998 | A/WUHAN/371/1995 | 1 |
| A/ULANUDE/209/1998 | A/JOHANNESBURG/159/1997 | 1 |
| A/USSR/90/1977 | A/HONGKONG/2/1982 | 1 |
| A/USSR/90/1977 | A/BAYERN/7/1995 | 1 |
| A/USSR/90/1977 | A/TEXAS/36/1991 | 1 |
| A/USSR/90/1977 | A/SINGAPORE/6/1986 | 1 |
| A/USSR/90/1977 | A/TAIWAN/1/1986 | 1 |
| A/USSR/90/1977 | A/ARIZONA/14/1978 | 1 |
| A/USSR/90/1977 | A/LACKLAND/3/1978 | 1 |
| A/USSR/90/1977 | A/INDIA/6263/1980 | 1 |
| A/USSR/90/1977 | A/CALIFORNIA/45/1978 | 1 |
| A/USSR/90/1977 | A/BEIJING/262/1995 | 1 |
| A/USSR/90/1977 | A/NEWCALEDONIA/20/1999 | 1 |
| A/USSR/90/1977 | A/DUNEDIN/27/1983 | 1 |
| A/USSR/90/1977 | A/VICTORIA/7/1983 | 1 |
| A/USSR/90/1977 | A/CHILE/1/1983 | 1 |
| A/WUHAN/371/1995 | A/JOHANNESBURG/82/1996 | 1 |
| A/WUHAN/371/1995 | A/TEXAS/36/91 | 1 |
| A/WUHAN/371/1995 | A/BAYERN/7/1995 | 1 |
| A/WUHAN/371/1995 | A/WELLINGTON/8/1997 | 1 |
| A/WUHAN/371/1995 | A/TAIWAN/1/86 | 1 |
| A/WUHAN/371/1995 | A/CHILE/1/83 | 1 |
| A/ZAGREB/4622/2006 | A/BEIJING/262/1995 | 1 |

**Supplementary Table S2**. Antigenic relationships for testing dataset.

|  |  |  |
| --- | --- | --- |
| Virus A | Virus B | Antigenic relationship (1 for variant, 0 for similar) |
| A/Alabama/27/2019 | A/Michigan/45/2015 | 1 |
| A/Alabama/27/2019 | A/Idaho/07/2018 | 0 |
| A/Alabama/27/2019 | A/Maine/38/2018 | 1 |
| A/Arkansas/28/2019 | A/Michigan/45/2015 | 1 |
| A/Arkansas/28/2019 | A/Idaho/07/2018 | 0 |
| A/Arkansas/28/2019 | A/Maine/38/2018 | 1 |
| A/Bolivia/559/2013 | A/California/07/2009 | 0 |
| A/Bolivia/559/2013 | A/Maryland/13/2012 | 0 |
| A/Bolivia/559/2013 | A/Dominican\_Rep/7293/2012 | 0 |
| A/Brisbane/02/2018 | A/California/07/2009 | 0 |
| A/Brisbane/9/2020 | A/California/07/2009 | 1 |
| A/Brisbane/9/2020 | A/Brisbane/02/2018 | 1 |
| A/Brisbane/9/2020 | A/Guangdong-Maonan/SWL1536/2019 | 1 |
| A/Brisbane/9/2020 | A/Victoria/2454/2019 | 1 |
| A/Brisbane/9/2020 | A/Victoria/2570/2019 | 0 |
| A/Brisbane/9/2020 | A/Canberra/337/2019 | 1 |
| A/California/76/2018 | A/Michigan/45/2015 | 1 |
| A/Canberra/337/2019 | A/California/07/2009 | 0 |
| A/Canberra/337/2019 | A/Brisbane/02/2018 | 0 |
| A/Canberra/337/2019 | A/Guangdong-Maonan/SWL1536/2019 | 0 |
| A/Canberra/337/2019 | A/Victoria/2454/2019 | 0 |
| A/Canberra/337/2019 | A/Victoria/2570/2019 | 1 |
| A/Dominican\_Rep/7293/2012 | A/California/07/2009 | 0 |
| A/Dominican\_Rep/7293/2012 | A/Maryland/13/2012 | 0 |
| A/El\_Salvador/589/2018 | A/Michigan/45/2015 | 0 |
| A/El\_Salvador/630/2018 | A/Michigan/45/2015 | 0 |
| A/Guangdong-Maonan/SWL1536/2019 | A/California/07/2009 | 0 |
| A/Guangdong-Maonan/SWL1536/2019 | A/Brisbane/02/2018 | 0 |
| A/Hawaii/56/2018 | A/Michigan/45/2015 | 0 |
| A/Idaho/07/2018 | A/California/07/2009 | 0 |
| A/Idaho/07/2018 | A/Michigan/45/2015 | 0 |
| A/Iowa/33/2019 | A/California/07/2009 | 0 |
| A/Iowa/33/2019 | A/Idaho/07/2018 | 0 |
| A/Iowa/33/2019 | A/Maine/38/2018 | 1 |
| A/Iowa/53/2015 | A/California/07/2009 | 0 |
| A/Iowa/53/2015 | A/Maryland/13/2012 | 0 |
| A/Iowa/53/2015 | A/Dominican\_Rep/7293/2012 | 0 |
| A/Iowa/53/2015 | A/Bolivia/559/2013 | 0 |
| A/Iowa/53/2015 | A/Michigan/45/2015 | 0 |
| A/Iowa/59/2018 | A/Michigan/45/2015 | 0 |
| A/Louisiana/18/2018 | A/Michigan/45/2015 | 0 |
| A/Maine/38/2018 | A/California/07/2009 | 1 |
| A/Maine/38/2018 | A/Michigan/45/2015 | 1 |
| A/Maine/38/2018 | A/Idaho/07/2018 | 1 |
| A/Malaysia/RP0567/2020 | A/California/07/2009 | 0 |
| A/Malaysia/RP0567/2020 | A/Brisbane/02/2018 | 0 |
| A/Malaysia/RP0567/2020 | A/Guangdong-Maonan/SWL1536/2019 | 0 |
| A/Malaysia/RP0567/2020 | A/Victoria/2454/2019 | 0 |
| A/Malaysia/RP0567/2020 | A/Victoria/2570/2019 | 1 |
| A/Malaysia/RP0567/2020 | A/Canberra/337/2019 | 0 |
| A/Malaysia/RP0568/2020 | A/California/07/2009 | 0 |
| A/Malaysia/RP0568/2020 | A/Brisbane/02/2018 | 0 |
| A/Malaysia/RP0568/2020 | A/Guangdong-Maonan/SWL1536/2019 | 0 |
| A/Malaysia/RP0568/2020 | A/Victoria/2454/2019 | 0 |
| A/Malaysia/RP0568/2020 | A/Victoria/2570/2019 | 1 |
| A/Malaysia/RP0568/2020 | A/Canberra/337/2019 | 0 |
| A/Malaysia/RP0625/2020 | A/California/07/2009 | 1 |
| A/Malaysia/RP0625/2020 | A/Brisbane/02/2018 | 1 |
| A/Malaysia/RP0625/2020 | A/Guangdong-Maonan/SWL1536/2019 | 1 |
| A/Malaysia/RP0625/2020 | A/Victoria/2454/2019 | 1 |
| A/Malaysia/RP0625/2020 | A/Victoria/2570/2019 | 0 |
| A/Malaysia/RP0625/2020 | A/Canberra/337/2019 | 1 |
| A/Maryland/13/2012 | A/California/07/2009 | 0 |
| A/Maryland/46/2018 | A/Michigan/45/2015 | 0 |
| A/Michigan/45/2015 | A/California/07/2009 | 0 |
| A/Michigan/45/2015 | A/Maryland/13/2012 | 0 |
| A/Michigan/45/2015 | A/Dominican\_Rep/7293/2012 | 0 |
| A/Michigan/45/2015 | A/Bolivia/559/2013 | 0 |
| A/Minnesota/32/2015 | A/California/07/2009 | 1 |
| A/Minnesota/32/2015 | A/Maryland/13/2012 | 0 |
| A/Minnesota/32/2015 | A/Dominican\_Rep/7293/2012 | 0 |
| A/Minnesota/32/2015 | A/Michigan/45/2015 | 1 |
| A/Minnesota/60/2019 | A/Michigan/45/2015 | 1 |
| A/Minnesota/60/2019 | A/Idaho/07/2018 | 0 |
| A/Minnesota/60/2019 | A/Maine/38/2018 | 1 |
| A/Montana/35/2018 | A/Michigan/45/2015 | 0 |
| A/Nebraska/14/2019 | A/Michigan/45/2015 | 1 |
| A/Nebraska/14/2019 | A/Idaho/07/2018 | 0 |
| A/Nebraska/14/2019 | A/Maine/38/2018 | 1 |
| A/Nebraska/15/2018 | A/California/07/2009 | 0 |
| A/Nebraska/15/2018 | A/Michigan/45/2015 | 0 |
| A/Nebraska/15/2018 | A/Idaho/07/2018 | 0 |
| A/Nebraska/15/2018 | A/Maine/38/2018 | 1 |
| A/New\_Jersey/13/2018 | A/Michigan/45/2015 | 0 |
| A/North\_Dakota/31/2018 | A/Michigan/45/2015 | 0 |
| A/Panama/318595/2016 | A/California/07/2009 | 0 |
| A/Panama/318595/2016 | A/Maryland/13/2012 | 0 |
| A/Panama/318595/2016 | A/Dominican\_Rep/7293/2012 | 0 |
| A/Panama/318595/2016 | A/Bolivia/559/2013 | 0 |
| A/Panama/318595/2016 | A/Michigan/45/2015 | 0 |
| A/Pennsylvania/511/2018 | A/Michigan/45/2015 | 1 |
| A/Philippines/11/2020 | A/California/07/2009 | 0 |
| A/Philippines/11/2020 | A/Brisbane/02/2018 | 0 |
| A/Philippines/11/2020 | A/Guangdong-Maonan/SWL1536/2019 | 0 |
| A/Philippines/11/2020 | A/Victoria/2454/2019 | 0 |
| A/Philippines/11/2020 | A/Victoria/2570/2019 | 1 |
| A/Philippines/11/2020 | A/Canberra/337/2019 | 0 |
| A/Philippines/14/2020 | A/California/07/2009 | 0 |
| A/Philippines/14/2020 | A/Brisbane/02/2018 | 0 |
| A/Philippines/14/2020 | A/Guangdong-Maonan/SWL1536/2019 | 0 |
| A/Philippines/14/2020 | A/Victoria/2454/2019 | 0 |
| A/Philippines/14/2020 | A/Victoria/2570/2019 | 1 |
| A/Philippines/14/2020 | A/Canberra/337/2019 | 0 |
| A/Philippines/22/2020 | A/California/07/2009 | 1 |
| A/Philippines/22/2020 | A/Brisbane/02/2018 | 1 |
| A/Philippines/22/2020 | A/Guangdong-Maonan/SWL1536/2019 | 1 |
| A/Philippines/22/2020 | A/Victoria/2454/2019 | 1 |
| A/Philippines/22/2020 | A/Canberra/337/2019 | 1 |
| A/Philippines/23/2020 | A/California/07/2009 | 1 |
| A/Philippines/23/2020 | A/Brisbane/02/2018 | 1 |
| A/Philippines/23/2020 | A/Guangdong-Maonan/SWL1536/2019 | 1 |
| A/Philippines/23/2020 | A/Victoria/2454/2019 | 1 |
| A/Philippines/23/2020 | A/Victoria/2570/2019 | 0 |
| A/Philippines/23/2020 | A/Canberra/337/2019 | 1 |
| A/Philippines/6/2020 | A/California/07/2009 | 1 |
| A/Philippines/6/2020 | A/Brisbane/02/2018 | 1 |
| A/Philippines/6/2020 | A/Guangdong-Maonan/SWL1536/2019 | 1 |
| A/Philippines/6/2020 | A/Victoria/2454/2019 | 1 |
| A/Philippines/6/2020 | A/Canberra/337/2019 | 1 |
| A/Philippines/7/2020 | A/California/07/2009 | 0 |
| A/Philippines/7/2020 | A/Brisbane/02/2018 | 0 |
| A/Philippines/7/2020 | A/Guangdong-Maonan/SWL1536/2019 | 0 |
| A/Philippines/7/2020 | A/Victoria/2454/2019 | 0 |
| A/Philippines/7/2020 | A/Victoria/2570/2019 | 1 |
| A/Philippines/7/2020 | A/Canberra/337/2019 | 0 |
| A/South\_Africa/1191/2020 | A/California/07/2009 | 0 |
| A/South\_Africa/1191/2020 | A/Brisbane/02/2018 | 0 |
| A/South\_Africa/1191/2020 | A/Guangdong-Maonan/SWL1536/2019 | 0 |
| A/South\_Africa/1191/2020 | A/Victoria/2454/2019 | 0 |
| A/South\_Africa/1191/2020 | A/Victoria/2570/2019 | 1 |
| A/South\_Africa/1191/2020 | A/Canberra/337/2019 | 0 |
| A/South\_Africa/2501/2020 | A/California/07/2009 | 1 |
| A/South\_Africa/2501/2020 | A/Brisbane/02/2018 | 1 |
| A/South\_Africa/2501/2020 | A/Guangdong-Maonan/SWL1536/2019 | 1 |
| A/South\_Africa/2501/2020 | A/Victoria/2454/2019 | 1 |
| A/South\_Africa/2501/2020 | A/Victoria/2570/2019 | 0 |
| A/South\_Africa/2501/2020 | A/Canberra/337/2019 | 1 |
| A/South\_Africa/3944/2020 | A/California/07/2009 | 0 |
| A/South\_Africa/3944/2020 | A/Brisbane/02/2018 | 0 |
| A/South\_Africa/3944/2020 | A/Guangdong-Maonan/SWL1536/2019 | 0 |
| A/South\_Africa/3944/2020 | A/Victoria/2454/2019 | 0 |
| A/South\_Africa/3944/2020 | A/Victoria/2570/2019 | 1 |
| A/South\_Africa/3944/2020 | A/Canberra/337/2019 | 0 |
| A/South\_Africa/6098/2020 | A/California/07/2009 | 0 |
| A/South\_Africa/6098/2020 | A/Brisbane/02/2018 | 0 |
| A/South\_Africa/6098/2020 | A/Guangdong-Maonan/SWL1536/2019 | 0 |
| A/South\_Africa/6098/2020 | A/Victoria/2454/2019 | 0 |
| A/South\_Africa/6098/2020 | A/Victoria/2570/2019 | 1 |
| A/South\_Africa/6098/2020 | A/Canberra/337/2019 | 0 |
| A/South\_Africa/6169/2020 | A/California/07/2009 | 1 |
| A/South\_Africa/6169/2020 | A/Brisbane/02/2018 | 1 |
| A/South\_Africa/6169/2020 | A/Guangdong-Maonan/SWL1536/2019 | 1 |
| A/South\_Africa/6169/2020 | A/Victoria/2454/2019 | 1 |
| A/South\_Africa/6169/2020 | A/Victoria/2570/2019 | 0 |
| A/South\_Africa/6169/2020 | A/Canberra/337/2019 | 1 |
| A/South\_Africa/6187/2020 | A/California/07/2009 | 1 |
| A/South\_Africa/6187/2020 | A/Brisbane/02/2018 | 1 |
| A/South\_Africa/6187/2020 | A/Guangdong-Maonan/SWL1536/2019 | 1 |
| A/South\_Africa/6187/2020 | A/Victoria/2454/2019 | 1 |
| A/South\_Africa/6187/2020 | A/Victoria/2570/2019 | 0 |
| A/South\_Africa/6187/2020 | A/Canberra/337/2019 | 1 |
| A/South\_Dakota/45/2018 | A/Michigan/45/2015 | 0 |
| A/Townsville/6/2020 | A/California/07/2009 | 1 |
| A/Townsville/6/2020 | A/Brisbane/02/2018 | 1 |
| A/Townsville/6/2020 | A/Guangdong-Maonan/SWL1536/2019 | 1 |
| A/Townsville/6/2020 | A/Victoria/2454/2019 | 1 |
| A/Townsville/6/2020 | A/Victoria/2570/2019 | 0 |
| A/Townsville/6/2020 | A/Canberra/337/2019 | 1 |
| A/Utah/46/2018 | A/Michigan/45/2015 | 0 |
| A/Victoria/2454/2019 | A/California/07/2009 | 0 |
| A/Victoria/2454/2019 | A/Brisbane/02/2018 | 0 |
| A/Victoria/2454/2019 | A/Guangdong-Maonan/SWL1536/2019 | 0 |
| A/Victoria/2570/2019 | A/California/07/2009 | 1 |
| A/Victoria/2570/2019 | A/Brisbane/02/2018 | 1 |
| A/Victoria/2570/2019 | A/Guangdong-Maonan/SWL1536/2019 | 1 |
| A/Victoria/2570/2019 | A/Victoria/2454/2019 | 1 |
| A/Virginia/41/2019 | A/Idaho/07/2018 | 0 |
| A/Virginia/41/2019 | A/Maine/38/2018 | 1 |
| A/Washington/182/2018 | A/Michigan/45/2015 | 0 |
| A/Wisconsin/496/2018 | A/Michigan/45/2015 | 0 |
| A/Wisconsin/505/2018 | A/Michigan/45/2015 | 0 |
| A/Wisconsin/516/2018 | A/Michigan/45/2015 | 0 |
| A/Wisconsin/588/2019 | A/California/07/2009 | 1 |
| A/Wisconsin/588/2019 | A/Michigan/45/2015 | 1 |
| A/Wisconsin/588/2019 | A/Idaho/07/2018 | 1 |
| A/Wisconsin/588/2019 | A/Maine/38/2018 | 0 |
| A/Guangdong-Maonan/SWL1536/2019 | A/Victoria/2455/2019 | 0 |
| A/Guangdong-Maonan/SWL1536/2019 | A/Togo/881/2020 | 0 |
| A/Victoria/2455/2019 | A/Togo/881/2020 | 0 |
| A/Victoria/2455/2019 | A/Sydney/5/2021 | 1 |
| A/Victoria/2570/2019 | A/Victoria/2570/2019 | 0 |
| A/Victoria/2570/2019 | A/Sydney/5/2021 | 0 |
| A/Guangdong-Maonan/SWL1536/2019 | A/Victoria/2570/2019 | 1 |
| A/Guangdong-Maonan/SWL1536/2019 | A/Sydney/5/2021 | 1 |
| A/Victoria/2455/2019 | A/Victoria/2570/2019 | 1 |
| A/Togo/881/2020 | A/Victoria/2570/2019 | 1 |
| A/Togo/881/2020 | A/Sydney/5/2021 | 1 |
| A/Guangdong-Maonan/SWL1536/2019 | A/Sydney/877/2022 | 0 |
| A/Guangdong-Maonan/SWL1536/2019 | A/Sydney/866/2022 | 0 |
| A/Guangdong-Maonan/SWL1536/2019 | A/Sydney/869/2022 | 0 |
| A/Guangdong-Maonan/SWL1536/2019 | A/South\_Africa/R05655/2022 | 0 |
| A/Guangdong-Maonan/SWL1536/2019 | A/South\_Africa/R05558/2022 | 0 |
| A/Guangdong-Maonan/SWL1536/2019 | A/South\_Africa/R05539/2022 | 0 |
| A/Guangdong-Maonan/SWL1536/2019 | A/Sydney/894/2022 | 1 |
| A/Guangdong-Maonan/SWL1536/2019 | A/Perth/184/2022 | 1 |
| A/Guangdong-Maonan/SWL1536/2019 | A/Canberra/222/2022 | 1 |
| A/Guangdong-Maonan/SWL1536/2019 | A/Darwin/488/2022 | 1 |
| A/Guangdong-Maonan/SWL1536/2019 | A/South\_Africa/R05765/2022 | 1 |
| A/Guangdong-Maonan/SWL1536/2019 | A/South\_Africa/R05258/2022 | 1 |
| A/Guangdong-Maonan/SWL1536/2019 | A/South\_Africa/R04994/2022 | 1 |
| A/Guangdong-Maonan/SWL1536/2019 | A/South\_Africa/R03645/2022 | 1 |
| A/Sydney/5/2021 | A/Sydney/894/2022 | 0 |
| A/Sydney/5/2021 | A/Perth/184/2022 | 0 |
| A/Sydney/5/2021 | A/Canberra/222/2022 | 0 |
| A/Sydney/5/2021 | A/Darwin/488/2022 | 0 |
| A/Sydney/5/2021 | A/South\_Africa/R05765/2022 | 1 |
| A/Sydney/5/2021 | A/South\_Africa/R05258/2022 | 0 |
| A/Sydney/5/2021 | A/South\_Africa/R04994/2022 | 0 |
| A/Sydney/5/2021 | A/South\_Africa/R03645/2022 | 0 |
| A/Sydney/5/2021 | A/Sydney/877/2022 | 1 |
| A/Sydney/5/2021 | A/Sydney/866/2022 | 1 |
| A/Sydney/5/2021 | A/Sydney/869/2022 | 1 |
| A/Sydney/5/2021 | A/South\_Africa/R05765/2022 | 1 |
| A/Sydney/5/2021 | A/South\_Africa/R05558/2022 | 1 |
| A/Sydney/5/2021 | A/South\_Africa/R05539/2022 | 1 |
| A/Togo/881/2020 | A/Sydney/877/2022 | 0 |
| A/Togo/881/2020 | A/Sydney/866/2022 | 0 |
| A/Togo/881/2020 | A/Sydney/869/2022 | 0 |
| A/Togo/881/2020 | A/South\_Africa/R05655/2022 | 0 |
| A/Togo/881/2020 | A/South\_Africa/R05558/2022 | 0 |
| A/Togo/881/2020 | A/South\_Africa/R05539/2022 | 0 |
| A/Togo/881/2020 | A/Sydney/894/2022 | 1 |
| A/Togo/881/2020 | A/Perth/184/2022 | 1 |
| A/Togo/881/2020 | A/Canberra/222/2022 | 1 |
| A/Togo/881/2020 | A/Darwin/488/2022 | 1 |
| A/Togo/881/2020 | A/South\_Africa/R05765/2022 | 1 |
| A/Togo/881/2020 | A/South\_Africa/R05258/2022 | 1 |
| A/Togo/881/2020 | A/South\_Africa/R04994/2022 | 1 |
| A/Togo/881/2020 | A/South\_Africa/R03645/2022 | 1 |
| A/Victoria/2455/2019 | A/Sydney/877/2022 | 0 |
| A/Victoria/2455/2019 | A/Sydney/866/2022 | 0 |
| A/Victoria/2455/2019 | A/Sydney/869/2022 | 0 |
| A/Victoria/2455/2019 | A/South\_Africa/R05655/2022 | 0 |
| A/Victoria/2455/2019 | A/South\_Africa/R05558/2022 | 0 |
| A/Victoria/2455/2019 | A/South\_Africa/R05539/2022 | 0 |
| A/Victoria/2455/2019 | A/Sydney/894/2022 | 1 |
| A/Victoria/2455/2019 | A/Perth/184/2022 | 1 |
| A/Victoria/2455/2019 | A/Canberra/222/2022 | 1 |
| A/Victoria/2455/2019 | A/Darwin/488/2022 | 1 |
| A/Victoria/2455/2019 | A/South\_Africa/R05765/2022 | 1 |
| A/Victoria/2455/2019 | A/South\_Africa/R05258/2022 | 1 |
| A/Victoria/2455/2019 | A/South\_Africa/R04994/2022 | 1 |
| A/Victoria/2455/2019 | A/South\_Africa/R03645/2022 | 1 |
| A/Victoria/2570/2019 | A/Sydney/877/2022 | 1 |
| A/Victoria/2570/2019 | A/Sydney/866/2022 | 1 |
| A/Victoria/2570/2019 | A/Sydney/869/2022 | 1 |
| A/Victoria/2570/2019 | A/South\_Africa/R05655/2022 | 1 |
| A/Victoria/2570/2019 | A/South\_Africa/R05558/2022 | 1 |
| A/Victoria/2570/2019 | A/South\_Africa/R05539/2022 | 1 |
| A/Victoria/2570/2019 | A/Sydney/894/2022 | 0 |
| A/Victoria/2570/2019 | A/Perth/184/2022 | 0 |
| A/Victoria/2570/2019 | A/Canberra/222/2022 | 0 |
| A/Victoria/2570/2019 | A/Darwin/488/2022 | 0 |
| A/Victoria/2570/2019 | A/South\_Africa/R05765/2022 | 0 |
| A/Victoria/2570/2019 | A/South\_Africa/R05258/2022 | 0 |
| A/Victoria/2570/2019 | A/South\_Africa/R04994/2022 | 0 |
| A/Victoria/2570/2019 | A/South\_Africa/R03645/2022 | 0 |

**Supplementary Table S3**. Detailed epitope sites for former seasonal H1N1 and H1N1pdm.

|  |  |  |
| --- | --- | --- |
| **epitope** | **Former seasonal H1N1** | **H1N1 pdm** |
| **Ca1** | 166,170,179,204,237,271 | 166,167,168,169,170,203,204,205,235,236,237 |
| **Ca2** | 137,140,142,221,222 | 137,138,139,140,141,142,221,222 |
| **Cb** | 70,71,73,74,75,115 | 70,71,73,74,75 |
| **Sa** | 124,125,155,157,159,160,162,163,164 | 124,125,153,154,155,156,157,159,160,161,162,163,164 |
| **Sb** | 153,156,189,190,193,195 | 184,185,186,187,188,189,190,191,192,193,194,195 |

**Supplementary Table S4**. Predicted antigenic relationships between vaccine strains. CA09 is short for A/California/7/2009, MI15 is short for A/Michigan/45/2015, BR18 is short for A/Brisbane/02/2018, GD19 is short for A/Guangdong-Maonan/SWL1536/2019 and VI19 is short for A/Victoria/2570/2019 (2020/2 to 2022/9).

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| strain 1 | strain 2 | Ferret HI | Predicted | mutations |
| MI15 | CA09 | < 4 | 0 | S83P N84S N97D N162S Q163K T185S T203S T216I T256A E283K V321I |
| BR18 | CA09 | < 4 | 1 | G45R R74S S83P N84S N97D N162S Q163K T164S **P183S** T185S T203S T216I R223Q T256A A282P E283K V295I V298I V321I |
| GD19 | CA09 | < 4 | 1 | R74S S83P N84S N97D D129N N162S Q163K T164S **P183**S I185S A187D E189Q T203S T216I T256A D260N E283K V295I V321I |
| VI19 | CA09 | >= 4 | 1 | R74S S83P N84S N97D D129N N130K **K156N** I161L N162S Q163K T164S P183S I185S T203S T216I R223Q A250V T256A D260N E283K V295I V321I |
| GD19 | BR18 | < 4 | 1 | R45G D129N I185T **A187D E189Q** Q223R D260N P282A I298V |
| VI19 | BR18 | >= 4 | 1 | R45G D129N N130K **K156N** I161L I185T A250V D260N P282A I298V  |
| VI19 | GD19 | >= 4 | 1 | N130K K156N I161L **D187A Q189E** R223Q A250V |

**Supplementary Table S5.** All false-positive pairs of viruses with predicted scores

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| strain A | strain B | HI data | Predicted ratio | substitutions |
| A/Brisbane/02/2018 | A/California/07/2009 | 0 | 24.50  | G45R R74S S83P N84S N97D N162S Q163K T164S P183S T185S T203S T216I R223Q T256A A282P E283K V295I V298I V321I  |
| A/Canberra/337/2019 | A/California/07/2009 | 0 | 58.55  | R74S S83P N84S N97D N130K L138H M160K N162S Q163K T164S P183S T185S T203S K205R K216I D235E T256A D260N E283K S294N V295I N296H V321I |
| A/Canberra/337/2019 | A/Brisbane/02/2018 | 0 | 7.03  | R45G N130K L138H M160K K205R K216T Q223R D235E D260N P282A S294N N296H I298V  |
| A/Canberra/337/2019 | A/Guangdong-Maonan/SWL1536/2019 | 0 | 7.70  | N129D N130K L138H M160K T185I D187A Q189E K205R K216T D235E S294N N296H  |
| A/Canberra/337/2019 | A/Victoria/2454/2019 | 0 | 7.70  | D127E N129D N130K L138H M160K T185I D187V Q189E K205R K216T D235E S294N N296H  |
| A/Guangdong-Maonan/SWL1536/2019 | A/California/07/2009 | 0 | 47.18  | R74S S83P N84S N97D D129N N162S Q163K T164S P183S I185S A187D E189Q T203S T216I T256A D260N E283K V295I V321I  |
| A/Guangdong-Maonan/SWL1536/2019 | A/Brisbane/02/2018 | 0 | 7.04  | R45G D129N I185T A187D E189Q Q223R D260N P282A I298V  |
| A/Idaho/07/2018 | A/California/07/2009 | 0 | 1.24  | R74S S83P N84S N97D N162S Q163K T164S P183S T185S T203S T216I T256A E283K V295I V321I  |
| A/Iowa/33/2019 | A/California/07/2009 | 0 | 58.55  | R74S S83P N84S N97D N130K M160K N162S Q163K T164S P183S T185S T203S K216I D235E T256A D260N E283K V295I N296H V321I  |
| A/Iowa/59/2018 | A/Michigan/45/2015 | 0 | 1.24  | R74S E127D D129N T164S P183S I185T K224E D260N V295I  |
| A/Malaysia/RP0567/2020 | A/California/07/2009 | 0 | 88.88  | R74S S83P N84S N97D A120T D129N N162S Q163K T164S P183S I185S A187D E189Q T203S T216I N222D T256A D260N E283K V295I V321I  |
| A/Malaysia/RP0567/2020 | A/Brisbane/02/2018 | 0 | 13.26  | R45G A120T D129N I185T A187D E189Q N222D Q223R D260N P282A I298V  |
| A/Malaysia/RP0567/2020 | A/Canberra/337/2019 | 0 | 14.50  | A120T D129N K130N H138L K160M I185T A187D E189Q R205K T216K N222D E235D N294S H296N  |
| A/Malaysia/RP0568/2020 | A/California/07/2009 | 0 | 47.18  | R74S S83P N84S N97D A120T D129N N162S Q163K T164S P183S I185S A187D E189Q T203S T216I T256A D260N E283K V295I V321I  |
| A/Malaysia/RP0568/2020 | A/Brisbane/02/2018 | 0 | 7.04  | R45G A120T D129N I185T A187D E189Q Q223R D260N P282A I298V  |
| A/Malaysia/RP0568/2020 | A/Canberra/337/2019 | 0 | 7.70  | A120T D129N K130N H138L K160M I185T A187D E189Q R205K T216K E235D N294S H296N  |
| A/Nebraska/15/2018 | A/California/07/2009 | 0 | 19.73  | R74S S83P N84S N97D D129N N162S Q163K T164S P183S I185S T203S T216I T256A D260N E283K V295I V321I  |
| A/Philippines/11/2020 | A/California/07/2009 | 0 | 47.18  | R74S S83P N84S N97D D129N N162S Q163K T164S P183S I185S A187D E189Q T203S T216I T256A D260N E283K V295I V321I  |
| A/Philippines/11/2020 | A/Brisbane/02/2018 | 0 | 7.04  | R45G D129N I185T A187D E189Q Q223R D260N P282A I298V  |
| A/Philippines/11/2020 | A/Canberra/337/2019 | 0 | 7.70  | D129N K130N H138L K160M I185T A187D E189Q R205K T216K E235D N294S H296N  |
| A/Philippines/14/2020 | A/California/07/2009 | 0 | 47.18  | R74S S83P N84S N97D D129N N162S Q163K T164S P183S I185S A187D E189Q T203S T216I T256A D260N E283K V295I V321I  |
| A/Philippines/14/2020 | A/Brisbane/02/2018 | 0 | 7.04  | R45G D129N I185T A187D E189Q Q223R D260N P282A I298V  |
| A/Philippines/14/2020 | A/Canberra/337/2019 | 0 | 7.70  | D129N K130N H138L K160M I185T A187D E189Q R205K T216K E235D N294S H296N  |
| A/Philippines/23/2020 | A/Victoria/2570/2019 | 0 | 2.94  | G143S E202G M209K Q223R K224E  |
| A/Philippines/7/2020 | A/California/07/2009 | 0 | 140.04  | R74S S83P N84S N97D D129N I152V N162S Q163K T164S P183S I185S A187D E189Q T203S T216I T256A D260N E283K V295I N302K V321I  |
| A/Philippines/7/2020 | A/Brisbane/02/2018 | 0 | 7.04  | R45G D129N I152V I185T A187D E189Q Q223R D260N P282A I298V N302K  |
| A/Philippines/7/2020 | A/Canberra/337/2019 | 0 | 7.70  | D129N K130N H138L I152V K160M I185T A187D E189Q R205K T216K E235D N294S H296N N302K  |
| A/South\_Africa/1191/2020 | A/California/07/2009 | 0 | 47.18  | R74S S83P N84S N97D A120T D129N Q138H N162S Q163K T164S P183S I185S A187D E189Q T203S T216I T256A D260N E283K V295I V321I  |
| A/South\_Africa/1191/2020 | A/Brisbane/02/2018 | 0 | 7.04  | R45G A120T D129N Q138H I185T A187D E189Q Q223R D260N P282A I298V  |
| A/South\_Africa/1191/2020 | A/Canberra/337/2019 | 0 | 7.70  | A120T D129N K130N Q138L K160M I185T A187D E189Q R205K T216K E235D N294S H296N  |
| A/South\_Africa/3944/2020 | A/California/07/2009 | 0 | 47.18  | R74S S83P N84S N97D A120T D129N Q138H N162S Q163K T164S P183S I185S A187D E189Q T203S T216I T256A D260N E283K V295I V321I  |
| A/South\_Africa/3944/2020 | A/Brisbane/02/2018 | 0 | 7.04  | R45G A120T D129N Q138H I185T A187D E189Q Q223R D260N P282A I298V  |
| A/South\_Africa/3944/2020 | A/Canberra/337/2019 | 0 | 7.70  | A120T D129N K130N Q138L K160M I185T A187D E189Q R205K T216K E235D N294S H296N  |
| A/South\_Africa/6098/2020 | A/California/07/2009 | 0 | 47.18  | R74S S83P N84S N97D D129N N162S Q163K T164S P183S I185S A187D E189Q T203S T216I T256A D260N E283K V295I V321I  |
| A/South\_Africa/6098/2020 | A/Brisbane/02/2018 | 0 | 7.04  | R45G D129N I185T A187D E189Q Q223R D260N P282A I298V  |
| A/South\_Africa/6098/2020 | A/Canberra/337/2019 | 0 | 7.70  | D129N K130N H138L K160M I185T A187D E189Q R205K T216K E235D N294S H296N  |
| A/Victoria/2454/2019 | A/California/07/2009 | 0 | 140.04  | R74S S83P N84S N97D E127D D129N N162S Q163K T164S P183S I185S V187D E189Q T203S T216I T256A D260N E283K V295I V321I  |
| A/Victoria/2454/2019 | A/Brisbane/02/2018 | 0 | 16.82  | R45G E127D D129N I185T V187D E189Q Q223R D260N P282A I298V  |
| A/Victoria/2570/2019 | A/Darwin/488/2022 | 0 | 1.08  | K54Q K171R A186T Q189E R223Q E224A R259K I265T K308R  |
| A/Victoria/2570/2019 | A/South\_Africa/R04994/2022 | 0 | 4.47  | D14G K54Q P137S K142R A186T Q189E R223Q E224A R259K D260E T277A K308R  |
| A/Wisconsin/516/2018 | A/Michigan/45/2015 | 0 | 1.24  | R74S D129N T164S P183S I185T T186A D260N V295I  |

**Supplementary Table S6**. The antigenic-specific substitutions of former seasonal H1N1 antigenic clusters were listed. The sites in the receptor-binding domain were bolded.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | Sa | Sb | Ca1/Ca2 | Cb | RBD | other |
| CH83-SI86 | (89.4%)K125N(94.4%) | (84.2%)**E186G(83.3%)** (84.2%)**T190A**(100%) (100%)R193H(94.4%) (100%)K194T(100%) | (100%)K141R(88.9%) |  | (100%)**N127T**(94.4%) | (89.4%)K54N(100%) |
| SI86-BA95 |  |  | (88.9%)K139N(97.1%) (88.9%)R141K(100%) | (100%)K74E(100%) |  | (100%)I57V(97.1%) (88.9%)S85P(97.1%) (100%)N207S(100%) |
| BA95-BE95 |  |  |  | (91.4%)F71I(98.7%) |  | (100%)R43L(100%) (97.1%)A80V(100%) (97.1%)S271P(100%) (85.7%)T310A(79.2%) |
| BE95-NE99 | (81.8%)**E153G**(99.3%) | (98.7%)**I191L**(99.3%) | (98.7%)V166A(97.3%) |  | (94.8%)**S183P**(99.3%) |  |
| NE99-SO06 |  | (97.3%)**R189M**(96.8%)(98.0%)**A190T**(99.2%) (100%)T194K(86.3%) |  |  |  | (98.6%)S36N(92.7%) |
| SO06-BR07 |  | (96.8%)**M189K**(98.5%) (86.3%)K194T(100%) |  |  |  | (98.4%)D35N(98.5%) (92.7%)N36S(100%) (97.6%)K146R(98.5%) (97.6%)E274K(98.5%)  |

**Supplementary Table S7**. Recommended vaccine strains by WHO, and the predicted antigenic clusters they belonged to.

|  |  |  |
| --- | --- | --- |
| **Influenza Season** | **Recommended vaccine strain** | **Antigenic cluster** |
| 2009.2-2009.9 | A/California/7/2009 | CA09 |
| 2009.9-2010.1 | A/California/7/2009 | CA09 |
| 2010.2-2010.9 | A/California/7/2009 | CA09 |
| 2010.9-2011.1 | A/California/7/2009 | CA09 |
| 2011.2-2011.9 | A/California/7/2009 | CA09 |
| 2011.9-2012.1 | A/California/7/2009 | CA09 |
| 2012.2-2012.9 | A/California/7/2009 | CA09 |
| 2012.9-2013.1 | A/California/7/2009 | CA09 |
| 2013.2-2013.9 | A/California/7/2009 | CA09 |
| 2013.9-2014.1 | A/California/7/2009 | CA09 |
| 2014.2-2014.9 | A/California/7/2009 | CA09 |
| 2014.9-2015.1 | A/California/7/2009 | CA09 |
| 2015.2-2015.9 | A/California/7/2009 | CA09 |
| 2015.9-2016.1 | A/California/7/2009 | CA09 |
| 2016.2-2016.9 | A/Michigan/45/2015 | CA09 |
| 2016.9-2017.1 | A/Michigan/45/2015 | CA09 |
| 2017.2-2017.9 | A/Michigan/45/2015 | CA09 |
| 2017.9-2018.1 | A/Michigan/45/2015 | CA09 |
| 2018.2-2018.9 | A/Michigan/45/2015 | CA09 |
| 2018.9-2019.1 | A/Brisbane/02/2018 | BR18 |
| 2019.2-2019.9 | A/Brisbane/02/2018 | BR18 |
| 2019.9-2020.1 | A/Guangdong-Maonan/SWL1536/2019 | GD19 |
| 2020.2-2020.9 | A/Victoria/2570/2019 | VI19 |
| 2020.9-2021.1 | A/Victoria/2570/2019 | VI19 |
| 2021.2-2021.9 | A/Victoria/2570/2019 | VI19 |
| 2021.9-2022.1 | A/Victoria/2570/2019 | VI19 |
| 2022.2-2022.9 | A/Sydney/5/2021 | VI19 |