**SUPPLEMENTARY INFORMATION**

**1A) MHC Class-II alleles selected for analysis in IEDB MHCII AND NETMHCII 2.3 server**

DRB1\*0101, DRB1\*0301, DRB1\*0401, DRB1\*0405, DRB1\*0701, DRB1\*0901, DRB1\*1101, DRB1\*1201, DRB1\*1302, DRB1\*1501, DRB3\*0101, DRB3\*0202, DRB4\*0101, DRB5\*0101, DRB1\*0802, HLA-DQA1\*0501-DQB1\*0201, HLA-DQA1\*0501-DQB1\*0301, HLA-DQA1\*0301-DQB1\*0302, HLA-DQA1\*0401-DQB1\*0402, HLA-DQA1\*0101-DQB1\*0501, HLA-DQA1\*0102-DQB1\*0602, HLA-DPA1\*0201-DPB1\*0101, HLA-DPA1\*0103-DPB1\*0201, HLA-DPA1\*0103-DPB1\*0401, HLA-DPA1\*0301-DPB1\*0402, HLA-DPA1\*0201-DPB1\*0501, HLA-DPA1\*0201-DPB1\*1401

**1B) MHC Class-I alleles selected for analysis in NETMHC 4.0 server**

HLA\*A0101, HLA\*A0201, HLA\*A0202, HLA\*A0203, HLA\*A0205, HLA\*A0206, HLA\*A0207, HLA\*A0211, HLA\*A0212, HLA\*A0216, HLA\*A0217, HLA\*A0219, HLA\*A0250, HLA\*A0301, HLA\*B0702, HLA\*B5801, HLA\*B5802, HLA\*B3501, HLA\*B3503, HLA\*B2705, HLA\*B2720, HLA\*B3901, HLA\*B1501

**SUPPLEMENTARY FIGURES**

**Supplementary Figure 1:** Population coverage analysis**-** (a) MHC-I epitope coverage (b) MHC-II epitope coverage (C) combined MHC-I and II binding epitopes coverage.

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**Supplementary Figure 2:** The stability and binding of TLR-4 with the vaccine accessed through MD simulations. a)The root mean square fluctuations (RMSF) of TLR-4 bound to the vaccine (Red) and TLR-4 alone (black) indicating improved residue stability upon binding during the course of simulations. b)The distance between the TLR-4 and vaccine remains consistent during the simulation period.