|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Analysis** | **Alignments between haplotypes** | **Number of SNPs per section (manual count)/SR or SP region or mix with a XO in blocks A to E**  | **Xover** | **SNP or** | **Nearest** | **Nearest** | **Breakpoint** |  |
| **Number** | **Lab ID numbers precede haplotypes** | **HLA-A to** | **HLA-J to** | **HLA-E to** | **MUC21 to** | **PSORS to** | **Location** | **indel** | **repeat** | **gene** |  **nt distance to** | **HLA-C** |
|  | **Haplotype 1** | **Haplotype 2** | **HLA-J (97k)** | **HLA-E (486k)** | **MUC21 (490k)** | **PSORS (203k)** | **HLA-C (88k)** | **bp/section** | **at XO** | **at XO** | **to XO** | **3'end of HLA-C**  | **exon 8 - 3'end** |
|  |  |  | **A** | **B** | **C** | **D** | **E** |  |  |  |  |  |  |
|  | **Different HLA-A allele and same HLA-C allele**  |  |  |  |  |  |  |  |  |  |  |  |
| 1 | 95\_A02-C07 | 8\_A\*02:05-C\*07:18 | SR | SR | SR | SR | **SR (505) XO SP** | 84011/E | A/G | L2/L1 | HLA-C | (-)1345 | 82666 |
| 2 | 11\_A\*01-C\*07 | 8\_A\*02:05-C\*07:18 | SR | SR | SR | SR | **SR XO SP** | 83442/E | A/G | L2/L1 | HLA-C | -1345 | 82097 |
| 3 | 30\_A\*02-C\*07 | 8\_A\*02:05-C\*07:18 | SR | SR | SR | SR | **SR XO SP** | 81822/E | A/G | L2/L1 | HLA-C | -1335 | 80487 |
| 4 | 8\_A\*02:05-C\*07:18 | 4\_A\*03-C\*07 | SR | SR | SR | SR | **SR XO SP** | 83408/E | G/A | L2/L1 | HLA-C | -749 | 82659 |
| 5 | 95\_A\*02-C\*07 | 4\_A\*03-C\*07 | SR | SR | SR | SR | **SR XO SP** | 83138/E | C/T | L2/L1 | HLA-C | -572 | 82666 |
| 6 | 11\_A\*01-C\*07 | 4\_A\*03-C\*07 | SR (193) | SR | SR | SR | **SR XO SP** | 82425/E | T/C | L2/L1 | HLA-C | -329 | 82096 |
| 7 | 23\_A\*01-C\*04 | 35\_A\*31-C\*04 | SR | SR | SR | SR | **SR (>200\*) XO SP** | 81483/E | A/G | L2/L1 | HLA-C | -162 | 81321 |
| 8 | 39\_A\*02-C\*01 | 89\_A\*24-C\*01:02 | SR | SR | SR | SR | **SR XO SP** | 80722/E | T/C | L2/L1 | 3'NCR HLA-C | 276 | 80998-81421 |
| 9 | 73\_A\*31-C\*01 | 89\_A\*24-C\*01:02 | SR | SR | SR | SR | **SR (327) XO SP** | 81303/E | C/T | L2/L1 | 3'NCR HLA-C | 276 | 81579 |
| 10 | 10\_A\*02-C\*12 | 53\_A\*01-C\*12 | SR | SR | SR | SR | **SR XO SP** | 81653/E | G/A | L2/L1 | 3'NCR HLA-C | 363 | 82016 |
| 11 | 11\_A\*01-C\*07 | 30\_A\*02-C\*07 | SR | SR | SR | SR | **SR XO SP** | 81605/E | T/C | L2/L1 | 3'NCR HLA-C | 491 | 82096 |
| 12 | 92\_A\*02:12-C\*01 | 89\_A\*24-C01:02 | SR | SR | SR | SR | **SR XO SP** | 80344/E | A/G | L2/L1 | 3'NCR HLA-C | 654 | 80998 |
| 13 | 30\_A\*02-C\*07 | 4\_A\*03-C\*07 | SR | SR | SR | SR | **SR XO SP** | 79103/E | C/T | L2 | 3'NCR HLA-C | 1384 | 80487 |
| 14 | 23\_A\*01-C\*04 | 61\_A\*68-C\*04 | SR | SR | SR | SR | **SR XO SP** | 74139/E | C/A | MLT1A1 | 7kb-3' HLA-C | 7128 | 81321 |
| 15 | 39\_A\*02-C\*01 | 92\_A\*02:12-C\*01:02 | SP (0) | **SP XO SR** | SR | SR | **SR XO SP** | 69544/E | A/G | AluY | 11.4kb-3' HLA-C | 11454 | 80998 |
| 16 | 39\_A\*02-C\*01 | 59\_A\*24-C\*01:02 | SR | SR | SR | SR | **SR XO SP** | 69544/E | A/G | AluY | 11.4kb-3' HLA-C | 11454 | 80998 |
| 17 | 39\_A\*02-C\*01 | 73\_A\*31-C\*01:02 | SR | SR | SR | SR | **SR XO SP** | 69544/E | A/G | AluY | 11.4kb-3' HLA-C | 11454 | 80998 |
| 18 | 73\_A\*31-C\*01 | 39\_A\*02-C\*01:02 | SR | SR | SR | SR | **SR XO SP** | 69544/E | G/A | AluY | 11.4kb-3' HLA-C | 11454 | 81579 |
| 19 | 65\_A\*23-C\*08 | 49\_A\*33-C\*08 | SR | SR | SR | SR | **SR XO SP** | 70523/E | G/C | MER21-int | 11.5kb-3' HLA-C | 11493 | 81607-82029 |
| 20 | 5\_A\*02-C\*05 | 9\_A\*32-C\*05 | SR | SR | SR | SR | **SR (474) XO SP** | 69150/E | G/A | MER21-int | 12kb-3' HLA-C | 12093 | 81243 |
| 21 | 88\_A\*02-C\*14 | 50\_A\*33-C\*14 | SR | SR | SR | SR | **SR (29) XO SP** | 65401/E | C/T | L1PA13 | 9kb-3'HLA-C | 8896 | 74297-74720 |
| 22 | 28\_A\*01-C\*03:03 | 17\_A\*02:17-C\*03:03 | SR | SR | SR | **SR XO SP** | SP (18) | 192386/D | A/C | MIR3/AluSx | PSORS1C3 | ~95000 | 81322 |
| 23 | 28\_A\*01-C\*03:03 | 13\_A\*02-C\*03:04 | SR | SR | SR | **SR XO SP** | SP (21) | 192386/D | A/C | MIR3/AluSx | PSORS1C3 | ~95000 | 81322 |
| 24 | 28\_A\*01-C\*03:03 | 34\_A\*24-C\*03:04 | SR | SR | SR | **SR XO SP** | SP (21) | 192386/D | A/C | MIR3/AluSx | PSORS1C3 | ~95000 | 81322 |
| 25 | 13\_A\*02-C\*03:04 | 34\_A\*24-C\*03:04 | SR | SR | SR | **SR XO SP** | SP (0) | 192386/D | A/C | MIR3/AluSx | PSORS1C3 | ~95000 | 81322 |
| 26 | 17\_A\*02:17-C\*03:03 | 28\_A\*01-C\*03:03 | SR | SR | SR | **SR XO SP** | SP (8) | 188587/D | C/A | MIR3/AluSx | PSORS1C3 | ~95000 | 82943 |
| 27 | 29\_A\*01-C\*17 | 14\_A\*30-C\*17 | SR | SR | SR | **SR XO SP (0)** | SP (6) | 185258/D | G/A | AluJb/MIR3 | NCR of PSORS1C3 | ~100000 | 73508 |
| 28 | 92\_A\*02:12-C\*01:02 | 73\_A\*31-C\*01:02 | SR | SR | SR | **SR XO SP (6)** | SP (0) | 126710/D | T/A | MLT1D/L1M | NCR of C6orf15 | ~156200 | 80998 |
| 29 | 73\_A\*31-C\*01:02 | 92\_A\*02:12-C\*01:02 | SR | SR | SR | **SR XO SP 4)** | SP (0) | 129587/D | T/C | MLT1D | NCR of C6orf15 | ~156200 | 81579 |
| 30 | 73\_A\*31-C\*01:02 | 59\_A\*24-C\*01:02 | SR | SR | SR | **SR XO SP (7)** | SP (0) | 129916/D | C/T | MLT1D/L1M | NCR of C6orf15 | ~156200 | 81579 |
| 31 | 11\_A\*01-C\*07-B\*08 | 95\_A\*02-C\*07-B\*57 | SR | SR | SR | **SR (102) XO SP (3)** | SP (4) | 70836/D | C/T | THE1A/AluJ | HCG22 | ~215000 | 82097 |
| 32 | 2\_A\*01-C\*06-B\*57 | 91\_A\*30-C\*06--B\*13:02 | SR | SR | SR | **SR (173) XO SP (24)** | SP (5) | 70835/D | G/C | THE1A/AluJb | HCG22 | ~215000 | 82906 |
| 33 | 2\_A\*01-C\*06-B\*57 | 77\_A\*03-C\*06-B\*47 | SR | SR | SR | **SR XO SP (20)** | SP (7) | 70053/D | G/A | THE1A | HCG22 | ~215000 | 82906 |
| 34 | 2\_A\*01-C\*06-B\*57 | 55\_A\*02-C\*06-B\*13:02 | SR | SR | SR | **SR XO SP (26)** | SP (5) | 70835/D | G/C | THE1A/AluJb | HCG22 | ~215000 | 82906 |
| 35 | 17\_A\*02:17-C\*03:03 | 13\_A\*02-C\*03:04 | SP (0) | **SP XO SR** | SR | **SRXO SP (8)** | SP (2) | 49319/D | T/C | MIRb/MIRb | MUC22 | ~215000 | 82943 |
| 36 | 10\_A\*02-C\*12:03 | 94\_A\*24-C\*12 | SR | SR | SR | **SR (227) XO SP (4)** | SP (0) | 42687/D | T/C | L2b/AluY | MUC22 | ~215000 | 82016-82400 |
| 37 | 80\_A\*02-C\*16 | 78\_A\*29-C\*16 | SR | SR | **SP XO SR XO SP** | SP (13) | SP (1) | 470123/C | A/G | AluSx/HERVL-int | NCR of MUC21 | ~279000 | 86743 |
| 38 | 67\_A\*02:04-C\*15 | 46\_A\*31-C\*15 | SR | SR | **SR XO SP** | SP (9) | SP (0) | 469599/C | A/C | AluSx/HERVL-int | NCR of MUC21 | ~279000 |  |
| 39 | 23\_A\*01-C\*04 | 1\_A\*11-C\*04 | SR | SR | **SR XO SP** | SP (16) | SP (9) | 467180/C | T/C | AluSx/HERVL-int | NCR of MUC21 | ~279000 | 81321-81745 |
| 40 | 23\_A\*01-C\*04 | 54\_A\*02-C\*04 | SR (389) | SR | **SP XO SR XO SP** | SP (5) | SP (7) | 467104/C | A/G | AluSx/HERVL-int | NCR of MUC21 | ~279000 | 81321-81745 |
| 41 | 2\_A\*01-C\*06 | 36\_A\*02-C\*06 | SR | SR | **SR XO SP** | SP (0) | SP (0) | 466251/C | A/C | AluSx/HERVL-int | NCR of MUC21 | ~279000 | 82906 |
| 42 | 92\_A\*02:12-C\*01:02 | 59\_A\*24-C\*01 | SR | SR | **SR XO SP** | SP (9) | SP (1) | 464610/C | C/T | AluSx/HERVL-int | NCR of MUC21 | ~279000 | 80998 |
| 43 | 17\_A\*02:17-C\*03:03 | 34\_A\*24-C\*03:04 | SR | SR | **SP XO SR XO** | SP (14) | SP (0) | 463976/C | G/A | AluSx/HERVL-int | NCR of MUC21 | ~279000 | 82943 |
| 44 | 10\_A\*02-C\*12:03 | 22\_A\*32-C\*12:03 | SP (0) | SR | **SR (25) + XO + SP (27)** | SP (2) | SP (0) | 36880/C | A/G | MLT2D/L2 | LINC02569/GNL1 | ~730000 | 82016-82400 |
| 45 | 2\_A\*01-C\*06-B\*57 | 31\_A\*01-C\*06-B\*40 | SP (0) | SP (6) | SP (2) | SP (12) | SP ( 0) | SNP poor across alpha block and no XO detected |  |  | 82906 |
| SR is SNP rich region estimated to be >100 SNP/100k, SP is SNP poor region ( (<10 SNP/100k). XO is crossover and numbers in brackets are the number of SNPs after the crossover. NCR is non coding region. |  |  |  |  |  |

**Supplementary Table S10.** SNP variations and crossover (XO) loci between *HLA-A* and *HLA-C* within different haplotype DNA sequence pairs with the same *HLA-C* alleles, but different *HLA-A* alleles.