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Original Article

Recognition of HLA-DPB1 alleles and their associated HLA haplotypes in 55 randomized unrelated Taiwanese individuals

*Shee-Ping Chen[a], Py-Yu Lin[a], Kuo-Liang Yang[a,b,c]**

[a]Laboratory of Immunogenetics, Tzu Chi Cord Blood Bank, and Buddhist Tzu Chi Bone Marrow Donor Registry, Buddhist Tzu Chi Stem Cells Centre, Hualien Tzu Chi Hospital, Buddhist Tzu Chi Medical Foundation, Hualien, Taiwan, [b]Department of Laboratory Medicine and Biotechnology, Tzu Chi University, Hualien, Taiwan, [c]Institute of Medical Sciences, Tzu Chi University, Hualien, Taiwan

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Abstract

Objectives: Here, we report the distribution of HLA-DPB1 alleles studied in a cohort of 55 randomly collected blood samples from unrelated Taiwanese individuals and the deduced most likely HLA haplotypes associated with the defined DPB1 alleles in the cohort. Our aim is to reveal the unprecedented data on the distribution of HLA-DPB1 alleles in the Taiwanese population and to find out the most probable HLA haplotypes associated with the HLA-DPB1 alleles detected. **Materials and Methods:** The material for this study was blood samples, preserved in K_2EDTA and/or acid citrate dextrose anticoagulants. The blood donors were voluntary individuals of Tzu Chi Bone Marrow Donor Registry, Tzu Chi Stem Cells Center, Hualien Tzu Chi Hospital. Sequence-based typing of the Sanger's sequencing method was performed for the HLA allelic typing. To discern the HLA-DPB1 alleles, exons 2 and 3 of the HLA-DPB1 locus were sequenced. Target exon sequence amplifications were achieved by polymerase chain reaction, and the resulting amplicons were sequenced by BigDye Terminator Cycle Sequencing Ready Reaction Kit according to the manufacturer's protocols. **Results:** In the total number of 55 randomized unrelated Taiwanese individuals studied, we detected 11 different HLA-DPB1 alleles. *DPB1*05:01* (44.54%) was the allele with the highest frequency observed and the next highest frequency allele found was *DPB1*02:01* (17.27%), while *DPB1*38:01* (0.90%) and *DPB1*700:01N* (0.90%) ranked the least observed DPB1 alleles. **Conclusion:** Our findings in this study may be useful in researches reinforcing the comprehensive understanding on the distribution of DPB1 alleles and their associated HLA haplotypes and their clinical applications in Taiwanese.

Keywords: *DPB1, HLA, Taiwanese, Transplantation*

Introduction

The HLA genes are characterized by their extreme polymorphism and their clinical importance in transplantations, especially in hematopoietic stem cell and solid organ transplantations [1-3]. Addressing HLA locus mismatches on clinical outcomes of patients receiving unrelated donor hematopoietic cell transplantation (HCT) as compared to HLA allele-matched control patients, in a meta-analysis conducted by Tie *et al*., [4] found that mismatched HLA-DPB1 was significantly associated with a reduced risk of disease relapse but not with increased risks of transplant-related mortality and the overall mortality. They further concluded that HLA-DPB1 locus mismatches significantly protect against leukemia relapse.

In another published meta-analysis assessing the impact of HLA-DPB1 allele mismatches on the overall survival of patients receiving unrelated donor HCT, Kekre *et al*. [5] stated that there was no significant overall survival difference associated with DPB1 mismatch. On the contrary, de Marco *et al*. [6] indicated that HLA-DPB1 molecular mismatched is a risk factor for acute rejection and has a low 5-year graft function in the first kidney transplants.

Studies in the distribution of HLA-DPB1 alleles in Taiwanese population are scarce. Before addressing the significance of HLA-DPB1 alleles in transplantations in

**Address for correspondence:* Prof. Kuo-Liang Yang, Buddhist Tzu Chi Stem Cells Centre, Hualien Tzu Chi Hospital, Buddhist Tzu Chi Medical Foundation, 707, Section 3, Chung-Yang Road, Hualien, Taiwan.
E-mail: edward@tzuchi.com.tw

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Taiwanese population, therefore, understanding the distribution of HLA-DPB1 alleles in Taiwanese individuals is a necessary prerequisite. We report, here, the HLA-DPB1 alleles studied in a cohort of 55 unrelated Taiwanese individuals and determined their HLA DRB1 and HLA DQB1 haplotypes associated with HLA-DPB1 as well as HLA-A,-B,-C,-DPB1,-DQB1 and-DRB1 associated haplotypes.

The Buddhist Tzu Chi Bone Marrow Donor Registry, Tzu Chi Stem Cells Center, has the biggest database of HLA genes in Taiwan. There are more than 460,000 donors' gene typing of HLA-A,-B,-C,-DQB1, and-DRB1 in its database. Genotypes matching on the alleles of HLA-A,-B,-C,-DRB1,-DQB1 are commonly considered for bone marrow hematopoietic stem cell transplant. It may be beneficial to add HLA-DPB1 typing of the volunteer donors to the database. This study reports the alleles of human leukocyte antigen HLA-DPB1 locus and their associated HLA haplotypes identified in 55 randomized unrelated Taiwanese individuals. The different haplotypes of HLA-A,-B,-C,-DRB1,-DQB1,-DPB1 may offer new perspectives for bone marrow hematopoietic stem cell transplant in Taiwanese population.

Materials and methods

With informed consent, the peripheral whole blood specimens were collected from randomized unrelated Taiwanese individuals. All samples were stored at −80°C until DNA extraction procedure. Employing QIAamp DNA Blood Mini Kit (Lot Number 175027565, QIAGEN GmbH, QIAGEN Strasse 1, 40724 Hilden, Germany), nucleic acid extraction was performed according to the manufacturer's recommendation. The amplicons were then sequenced using sequence-based typing (SBT), Sanger sequencing. Exon 2 and exon 3 of DPB1 locus were sequenced to discern alleles of the HLA-DPB1 locus. According to the manufacturer's protocol, amplicons were sequenced using the BigDye Terminator Cycle Sequencing Ready Reaction Kit. Assignment for the HLA-DPB1 alleles was performed using Sanger sequencing with TBG HLAssure SE SBT Kit and Applied Biosystems 3730 DNA Analyzer. All individuals participating in the study provided written informed consent following the guidelines of the Research Ethics Committee, Buddhist Hualien Tzu Chi Hospital, Buddhist Tzu Chi Medical Foundation, No. IRB106-81-A. This study was conducted in accordance with the Declaration of Helsinki. Haplotype frequencies were estimated by the expectation-maximization algorithm (Arlequin software version 3.5.2.2), which is an integrated software package for population genetics data analysis. Evolutionary Bioinformatics Online 1:47-50: Computational and Molecular Population Genetics Lab, Institute of Ecology and Evolution, University of Berne, Baltzerstrasse 6, 3012 Bern, Switzerland.

Results

Among the 55 unrelated Taiwanese individuals tested, we detected 15 HLA-A alleles, 26 HLA-B alleles, 15 HLA-C alleles, 21 DRB1 alleles, 14 DQB1 alleles, and 11 DPB1 alleles [Figure 1 and Table 1], suggesting that the HLA-DPB1 locus was most likely the least polymorphic classical

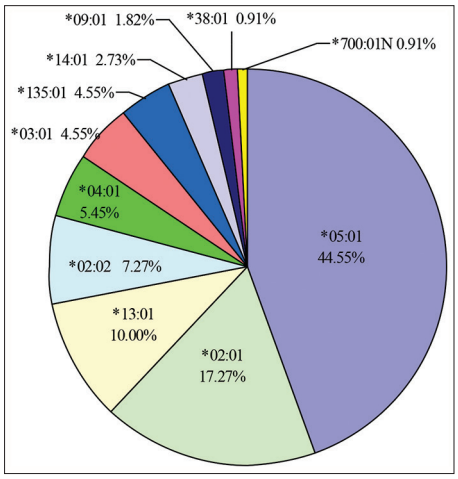

Figure 1: The HLA-DPB1 alleles observed in 55 Taiwanese individuals

Table 1: DPB1 allele frequency

Allele DPB1	Frequency (%)
05:01	44.55
02:01	17.27
13:01	10.00
02:02	7.27
04:01	5.45
03:01	4.55
135:01	4.55
14:01	2.73
09:01	1.82
38:01	0.91
700:01N	0.91

HLA locus in the Taiwanese studied. Among the 11 various distinctive DPB1 alleles [Table 1], we found that the highest frequency allele observed was *DPB1*05:01* (44.54%), followed by *DPB1*02:01* (17.27%), *DPB1*13:01* (10.00%), *DPB1*02:02* (7.27%), *DPB1*04:01* (5.45%), *DPB1*03:01* (4.55%), *DPB1*135:01* (4.55%), *DPB1*14:01* (2.73%), *DPB1*09:01* (1.82%), *DPB1*38:01* (0.91%), and *DPB1*700:01N* (0.91%) [Table 1]. To show the polymorphic property of linkage between HLA-DP alleles with HLA-DRB1 and HLA-DQB1 alleles, we determined the most probable HLA-DPB1-DRB1 haplotypes, HLA-DPB1-DQB1 haplotypes, and HLA-A-B-C-DPB1-DQB1-DRB1 haplotypes on the 55 randomized unrelated Taiwanese individuals. These results are shown in Supplemental Table 1. As illustrated in Supplemental Table 1, using the most prevalent *DPB1*:05:01* as an example, we found that *DPB1**05*:01* is associated with *DRB1*09:01*, *08:03*, *11:01*, *16:02*, *04:03*, *12:01*, *15:01*, *03:01*, *13:12*, *04:05*, *07:01*, *08:02,* and *13:02* [Table 2], while it is associated with *DQB1*06:01*, *03:01*, *03:03*, *05:02*, *02:01*, *04:01*, *05:03*, *02:02*, *04:02,* and *06:09* [Table 3]. These results demonstrate the polymorphic nature of *HLA-DPB1*05:01* in association with HLA-DRB1 alleles and HLA-DQB1 alleles in the Taiwanese individuals studied. Further, the deduced probable *DPB1*05:01*, *DPB1*02:01,* and *DPB1*13:01* associated HLA-A-B-C-DRB1-DQB1-DPB1 haplotypes on the 55 randomized unrelated Taiwanese individuals are shown

Table 2: DRB1-DPB1 haplotype frequency

Haplotype DRB1*-DPB1*	Frequency (%)	Haplotype DRB1*-DPB1*	Frequency (%)	Haplotype DRB1*-DPB1*	Frequency (%)
09:01-05:01	10.30	07:01-13:01	1.82	08:02-05:01	0.91
08:03-05:01	10.00	08:03-03:01	1.82	08:03-02:02	0.91
15:01-02:01	6.00	12:02-13:01	1.82	12:01-02:02	0.91
11:01-05:01	5.64	13:02-09:01	1.82	12:01-700:01N	0.91
03:01-04:01	3.64	13:12-05:01	1.82	12:02-02:02	0.91
16:02-05:01	3.64	14:54-02:01	1.82	12:02-14:01	0.91
04:03-02:01	2.78	14:54-02:02	1.82	13:01-04:01	0.91
09:01-03:01	2.73	11:01-02:01	1.63	13:02-05:01	0.91
09:01-135:01	2.73	09:01-13:01	1.13	13:12-13:01	0.91
12:01-13:01	2.73	12:01-02:01	1.02	14:03-02:02	0.91
04:03-05:01	2.68	03:01-14:01	0.91	14:05-02:02	0.91
12:01-05:01	2.61	04:04-135:01	0.91	14:05 38:01	0.91
09:01-02:01	2.21	04:05-05:01	0.91	15:02-04:01	0.91
15:01-05:01	2.18	04:05-135:01	0.91	16:02-02:02	0.91
03:01-05:01	2.04	04:10-14:01	0.91	16:02-13:01	0.91
04:05-02:01	1.82	07:01-05:01	0.91	03:01-13:01	0.68

Table 3: DQB1-DPB1 haplotype frequency

Haplotype DQB1*-DPB1*	Frequency (%)	Haplotype DQB1*-DPB1*	Frequency (%)
06:01-05:01	12.73	06:01-03:01	1.82
03:01-05:01	11.32	06:09-09:01	1.82
03:03-05:01	6.51	05:03-02:01	1.55
03:01-02:01	6.20	05:02-13:01	1.37
05:02-05:01	4.50	05:03-05:01	1.18
02:01-05:01	3.77	03:03-04:01	1.04
03:02-02:01	3.64	02:02-05:01	0.91
06:02-02:01	3.64	02:02-13:01	0.91
03:01-02:02	3.58	03:02-02:02	0.91
02:01-04:01	3.50	03:03-700:01N	0.91
03:03-13:01	3.36	04:01-13:01	0.91
03:03-03:01	2.73	04:01 38:01	0.91
03:03-135:01	2.73	04:02-05:01	0.91
03:01-13:01	2.54	04:02-14:01	0.91
05:02-02:01	2.25	06:01-02:02	0.91
05:02-02:02	1.87	06:03-04:01	0.91
03:02-135:01	1.82	06:09-05:01	0.91
03:03-14:01	1.82	06:10-13:01	0.91
04:01-05:01	1.82		

in Table 4. The various haplotypes from the above clearly indicate the diversity and polymorphic nature of *DPB1*05:01*, *DPB*02:01,* and *DPB1*13:01* in association with HLA-A-B-C-DRB1-DQB1-DPB1 haplotypes among the 55 unrelated Taiwanese individuals.

An outstanding observation we found among the 55 unrelated individuals was that 10 (18.1%) of them were homozygous for *DPB1*05:01* allele. This phenomenon is possibly due to the higher frequency of the DPB1*05:01 found in the gene pool of the general Taiwanese population and the resulting offspring from couples with DPB1*05:01 allele tend to happen much more likely than the other DPB1 alleles.

Discussion

Increasing evidence showed that there is a significant effect of human leukocyte antigen HLA-DPB1 allelic mismatching on complications following unrelated bone marrow hematopoietic stem cell transplantation. Studies suggest that compatibility on the HLA-DPB1 locus between hematopoietic stem cell donors and their recipients can be relevant for the successful outcome of the transplantation [7,8]. In this study, we attempted to determine the DPB1allelic profile in randomized Taiwanese-unrelated individuals. In a cohort of 55 unrelated Taiwanese, we found that DPB1 locus has the least number of alleles detected in comparison with the alleles detected in HLA-A,-B,-C,-DRB1 and -DQB1 loci on the randomized unrelated individuals. This observation is in agreement with the data presented in the IPD-IMGT/ HLA database [9] which indicates that, in HLA class II loci, the total number of DPB1 alleles listed is 2489 alleles while DRB1 and DQB1 loci were consisted to have 3628 and 2510 alleles, respectively. In addition, we found that *DPB1*05:01* is the most prevalent DPB1 allele detected (44.55%) among the 55 randomized unrelated Taiwanese individuals studied in our hands [Table 1]. This observation is in concordance with the report by Lauterbach *et al*. [10] who in a study of 37 Oriental blood samples, 8 (21.62%) individuals carry *DPB1*05:01* exceeding the other 12 various DPB1 allotypes in their report. Incidentally, Mack *et al*. stated that *DPB1*05:01*, while common in Chinese and Japanese populations, is most frequently observed in the Samoan (62.07%), Malay (24.03%), Hawaiian (26.92%–33.89%), Indonesia Molucca (21.74%), and Indonesia Nusa Tenggara (43.60%) populations [11]. Aside from the afforded mentioned studies and in this current study, unsurprisingly, *DPB1*05:01* is also frequently observed in individuals in Hong Kong and Perth Aboriginal [12]. *DPB1*02:01* was the second most prevalent DPB1 allele (17.27%) found among the 11 DPB1 alleles observed in Taiwanese in this study [Table 1]. It was frequently detected in Papua New Guinea Highlands (35.90%). Coincidentally, it too was the second highest DPB1 allele found in Samoan population (22.41%) as reported by Mack *et al*. [11]. Surprisingly, in a study consisting of a cohort of 2248 healthy

Table 4: A-B-C-DPB1-DRB1-DQB1 haplotype frequency

Haplotype A*-B*-C*-DPB1*-DRB1*-DQB1*	Frequency (%)	Haplotype A*-B*-C*-DPB1*-DRB1*-DQB1*	Frequency (%)
33:03-58:01-03:02-05:01-03:01-02:01	4.09	26:01-35:01-03:03-02:01-11:01-03:01	1.82
11:01-40:01-07:02-05:01-09:01-03:03	3.64	02:01-13:01-03:04-02:01-08:03-06:01	0.91
33:03-58:01-03:02-05:01-13:02-06:09	2.73	02:01-40:01-03:03-02:01-15:01-06:02	0.91
02:03-38:02-07:02-05:01-16:02-05:02	1.82	02:01-51:01-01:02-02:01-12:01-03:01	0.91
11:01-39:01-01:02-05:01-08:03-06:01	1.82	02:07-55:02-01:02-02:01-12:01-03:01	0.91
11:01-40:01-07:02-05:01-08:03-06:01	1.82	11:01-15:02-08:01-02:01-12:02-03:01	0.91
11:01-58:01-03:02-05:01-03:01-02:01	1.82	11:01-48:03-03:03-02:01-11:01-03:01	0.91
24:02-35:01-03:03-05:01-04:03-03:02	1.82	24:02-15:01-07:02-02:01-04:03-06:01	0.91
68:01-40:01-07:02-05:01-11:01-03:01	1.36	24:02-40:01-15:02-02:01-08:03-03:01	0.91
02:01-13:01-01:02-05:01-12:02-03:01	0.91	24:02-40:02-15:02-02:01-08:02-04:02	0.91
02:06-51:01-14:02-02:01-15:01-06:02	1.82	24:02-55:02-03:03-02:01-04:04-03:02	0.91
02:01-15:01-03:03-05:01-09:01-06:01	0.91	24:02-57:01-06:02-02:01-07:01-03:02	0.91
02:01-15:01-15:02-05:01-12:01-03:01	0.91	26:01-39:01-07:02-02:01-04:05-04:01	0.91
02:01-35:01-03:03-05:01-14:54-05:02	0.91	26:01-40:01-03:04-02:01-16:02-05:02	0.91
02:01-40:01-07:02-05:01-11:01-06:01	0.91	31:01-58:01-15:02-02:01-13:01-06:03	0.91
02:01-40:03-03:04-05:01-08:03-04:02	0.91	33:03-55:02-01:02-02:01-04:05-05:03	0.91
02:01-40:06-07:02-05:01-12:01-06:01	0.91		
02:03-40:01-03:04-05:01-15:01-05:02	0.91	11:01-27:04-12:02-13:01-12:02-03:01	1.82
02:06-54:01-01:02-05:01-14:05-05:03	0.91	11:01-40:01-07:02-13:01-12:01-03:01	1.82
02:07-46:01-07:02-05:01-08:03-06:01	0.91	01:01-46:01-03:04-13:01-04:03-03:03	0.91
03:03-40:01-03:04-05:01-04:05-04:01	0.91	02:01-38:02-01:02-13:01-09:01-03:03	0.91
11:01-13:01-03:04-05:01-16:02-05:02	0.91	02:03-38:02-08:01-13:01-08:03-03:01	0.91
11:01-13:01-07:06-05:01-07:01-02:02	0.91	02:07-40:01-01:02-13:01-13:12-03:01	0.91
11:01-18:02-12:02-05:01-11:01-03:01	0.91	02:07-46:01-07:02-13:01-16:02-05:02	0.91
11:01-27:04-07:04-05:01-08:03-06:01	0.91	11:02-46:01-01:02-13:01-09:01-03:03	0.91
11:01-39:01-07:02-05:01-09:01-03:03	0.91	33:03-44:03-07:02-13:01-15:01-06:01	0.91
11:01-40:01-04:01-05:01-15:01-03:02	0.91		
11:01-40:02-07:02-05:01-09:01-03:03	0.91		
11:01-51:02-03:03-05:01-15:01-06:02	0.91		
24:02-13:01-03:04-05:01-15:01-06:10	0.91		
24:02-40:02-08:01-05:01-14:54-05:03	0.91		
24:02-40:06-08:01-05:01-12:01-03:01	0.91		
24:02-40:06-08:22-05:01-08:03-06:01	0.91		
24:02-46:01-01:02-05:01-14:54-05:02	0.91		
26:01-15:03-08:01-05:01-13:12-03:01	0.91		
33:03-46:01-01:02-05:01-09:01-03:03	0.91		

unrelated individuals from the United States of America of self-reported European ancestry, *DPB1*02:01* was found to rank the second most prevalently observed DPB1 allele (13.85%) [13]. *DPB1*13:01* was the third most common DPB1 allele according to our current study (10.00%). It was commonly observed in Malay (14.94%) and in Indonesia Nusa Tenggara (21.51%) and Indonesia Molucca (6.52%) populations. However, in contrast, it was the least observed DPB1 allele in Samoan (1.72%) and Hawaiian (0%–2.63%) populations (11). Taken all together, based on the allele frequencies of *DPB1*05:01*, *DPB1*02:01,* and *DPB1*13:01* from the above data, in comparison, it appears to suggest that different South East Oriental populations and Pacific Islanders show a close degree of HLA-DPB1 relatedness but display a certain degree of unique variations between each other simultaneously. Incidentally, Lauterbach *et al*. [10] detected 19 out of 61 (31.14%) Caucasians carried *DPB1*04:01*. Similarly, they observed that 18 out of 46 (39.13%) Black-origin individuals carry *DPB1*01:01* [10]. Therefore, without surprises, we observed a mere 5.45% and 0% of the 55 Taiwanese unrelated individuals carrying *DPB1*04:01* allele and *DPB1*01:01* allele, respectively. These observations reiterate the fact that variation of HLA allelic distribution in various ethnicities is one of the characteristics of the HLA genetic system in humans.

It is worthy to note that among the 11 DPB1 alleles, we detected the *DPB1*700:01N* allele in one individual in the 55 randomized unrelated Taiwanese individuals. Its most probable HLA haplotype may be deduced as: *A*24:02-C*01:02-B*56:03-DPB1*700:01N-DRB1*12:01-DQB1*03:01*. From exon 1 to exon 5, the DNA sequence of *DPB1*700:01N* is identical to *DPB1*02:01:02:01* except for the codon 135 of exon 3 where GAG of *DPB1*02:01:02:01* is replacedby TAG in *HLA-DPB1*700:01N*.The nucleotide substitution causes the replacement of glutamic acid (E) in *DPB1*02:01:02:01* at codon 135 with a premature stop codon in *DPB1*700:01N* [14]. We speculate that *DPB1*700:01N* may will be observed in other Oriental populations aside from Taiwanese ethnic group. This speculation warrants a future investigation.

The approach and practice to define HLA-DPB1 alleles in blood donors is well established. However, to our knowledge, characterization and publication about the distribution of DPB1 alleles in Taiwanese is shortcoming. Engagement to increase the number of Taiwanese individuals to be tested on DPB1 locus will be our next imminent endeavor.

Conclusion

The status on the significance of HLA-DPB1 alleles in clinical transplantations is emerging slowly but steadily. To date, report on the HLA-DPB1 locus study in Taiwanese population is scarce. Before addressing the significance of HLA-DPB1 alleles in transplantations in Taiwanese population, revelation on the distribution of HLA-DPB1 alleles in Taiwanese individuals is a necessary prerequisite. We report, here, the HLA-DPB1 locus study in a cohort of 55 randomized unrelated Taiwanese individuals and determined the distribution and frequency of the alleles detected and to tabulate HLA DRB1 and HLA DQB1 haplotypes associated with HLA-DPB1 as well as DPB1 associated HLA-A,-B,-C,-DQB1 and-DRB1 haplotypes in the Taiwanese population. Our findings in this study may be useful for coordinators in bone marrow donor registries in research for HLA-compatible donors for their patients and for researchers pursuing a comprehensive understanding on the clinical implications of HLA-DPB1 alleles in transplantation settings and for anthropological applications in population studies.

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Data availability statement

Data availability is based on request to the authors.

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Conflicts of interest

There are no conflicts of interest.

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Supplemental Table 1: HLA-A, -B, -C, -DRB1, -DPB1 and -DQB1 typing of the 55 Taiwanese

	HLA typing of 55 samples											
Sample No.	**A**	**A**	**B**	**B**	**C**	**C**	**DPB1**	**DPB1**	**DQB1**	**DQB1**	**DRB1**	**DRB1**
1	02:07	33:03	46:01	58:01	01:02	03:02	05:01	14:01	02:01	03:03	03:01	09:01
2	02:03	26:01	40:01	40:01	03:04	03:04	02:01	05:01	05:02	05:02	15:01	16:02
3	02:01	68:01	40:01	46:01	01:02	07:02	03:01	05:01	03:01	03:03	09:01	11:01
4	33:03	68:01	40:01	58:01	03:02	07:02	04:01	05:01	02:01	03:01	03:01	11:01
5	11:01	03:03	40:01	58:01	03:02	03:04	05:01	05:01	02:01	04:01	03:01	04:05
6	02:07	24:02	46:01	55:02	01:02	01:02	02:01	05:01	03:01	05:02	12:01	14:54
7	02:07	11:01	15:02	46:01	01:02	08:01	02:01	14:01	03:01	03:03	09:01	12:02
8	33:03	33:03	40:01	58:01	03:02	07:02	05:01	09:01	03:03	06:09	09:01	13:02
9	11:01	24:02	40:02	48:03	03:03	08:01	02:01	05:01	03:01	05:03	11:01	14:54
10	02:01	33:03	51:01	58:01	01:02	03:02	02:01	04:01	02:01	03:01	03:01	12:01
11	02:07	11:01	39:01	46:01	01:02	07:02	05:01	05:01	06:01	06:01	08:03	08:03
12	02:01	02:07	38:02	46:01	01:02	07:02	13:01	13:01	03:03	05:02	09:01	16:02
13	02:07	24:353	40:01	46:01	01:02	07:02	02:02	13:01	03:01	05:02	13:12	14:54
14	24:02	33:03	55:02	58:01	01:02	03:02	02:01	38:01	04:01	05:03	04:05	14:05
15	11:01	24:02	15:01	40:01	04:01	07:02	02:01	05:01	03:02	06:01	04:03	15:01
16	02:01	02:01	15:01	40:01	03:03	15:02	02:01	05:01	03:01	06:02	12:01	15:01
17	11:01	11:01	15:02	40:01	07:02	08:01	05:01	135:01	03:03	03:03	09:01	09:01
18	11:01	11:01	40:01	40:01	07:02	07:02	03:01	05:01	03:03	03:03	09:01	09:01
19	02:01	02:06	13:01	56:01	01:02	03:04	02:02	05:01	03:01	03:01	12:02	13:12
20	02:01	24:02	40:01	40:01	07:02	15:02	02:01	05:01	03:01	06:01	08:03	11:01
21	11:01	11:01	13:01	40:01	03:04	07:02	05:01	05:01	05:02	06:01	08:03	16:02
22	11:01	26:01	15:03	40:01	07:02	08:01	05:01	05:01	03:01	03:03	09:01	13:12
23	11:01	31:01	35:01	46:01	01:02	04:01	02:02	135:01	03:01	03:03	09:01	14:03
24	11:01	24:02	40:01	56:03	01:02	07:02	700:01N	05:01	03:01	03:03	09:01	12:01
25	02:03	11:01	38:02	58:01	03:02	07:02	05:01	05:01	02:01	05:02	03:01	16:02
26	02:01	11:02	27:04	55:02	12:02	12:03	02:02	135:01	03:01	03:03	09:01	12:01
27	02:01	11:01	15:01	52:01	03:03	12:02	04:01	05:01	03:03	06:01	09:01	15:02
28	24:02	26:01	35:01	35:01	03:03	03:03	02:01	05:01	03:01	03:02	04:03	11:01
29	02:01	24:02	35:01	40:01	03:03	07:02	05:01	135:01	03:02	04:01	04:03	04:05
30	11:01	26:01	35:01	40:02	03:03	07:02	02:01	05:01	03:01	03:03	09:01	11:01
31	24:02	24:02	39:01	55:02	03:03	07:02	02:01	135:01	03:02	03:02	04:03	04:04
32	32:01	33:03	44:03	58:01	03:02	04:01	05:01	09:01	02:02	06:09	07:01	13:02
33	02:06	24:02	54:01	55:02	01:02	01:02	02:02	05:01	03:02	05:03	04:03	14:05
34	11:01	33:03	40:01	58:01	03:02	07:02	05:01	05:01	06:01	06:09	08:03	13:02
35	11:01	33:03	13:01	44:03	07:02	07:06	05:01	13:01	02:02	06:01	07:01	15:01
36	02:01	02:07	13:01	46:01	01:02	03:04	02:01	02:02	03:01	06:01	08:03	09:01
37	11:01	24:02	13:01	27:04	03:04	12:02	05:01	13:01	03:01	06:10	12:02	15:01
38	11:02	33:03	46:01	58:01	01:02	03:02	05:01	13:01	02:01	03:03	03:01	09:01
39	01:01	24:02	46:01	57:01	03:04	06:02	02:01	13:01	03:02	03:03	04:03	07:01
40	11:01	33:03	27:04	46:01	01:02	12:02	05:01	13:01	03:01	03:03	09:01	12:02
41	11:01	33:03	40:06	58:01	03:02	08:01	04:01	05:01	02:01	06:01	03:01	08:03
42	11:01	11:01	18:02	27:04	07:04	12:02	05:01	05:01	03:01	06:01	08:03	11:01
43	31:01	33:03	51:02	58:01	03:02	15:02	02:01	04:01	05:02	06:03	13:01	15:01
44	11:01	26:01	39:01	40:01	07:02	07:02	02:01	13:01	03:01	04:01	04:05	12:01
45	02:01	24:02	15:01	40:03	03:04	07:02	05:01	14:01	04:02	06:01	04:10	08:03
46	02:01	11:02	15:11	35:01	03:03	03:03	02:02	05:01	03:01	05:02	11:01	14:54
47	02:06	11:01	40:01	51:01	07:02	14:02	02:01	13:01	03:01	06:02	12:01	15:01
48	02:06	02:07	27:04	51:01	12:02	14:02	02:01	02:02	05:02	06:02	15:01	16:02
49	02:03	11:01	38:02	39:01	07:02	07:02	05:01	05:01	03:03	05:02	09:01	16:02
50	24:02	24:02	40:06	40:06	08:01	08:22	05:01	05:01	03:01	06:01	08:03	12:01
51	11:01	24:02	39:01	55:02	01:02	07:02	03:01	05:01	06:01	06:01	08:03	08:03
52	02:01	02:03	38:02	40:06	07:02	08:01	05:01	13:01	03:01	06:01	08:03	12:01
53	02:06	33:03	51:01	58:01	03:02	14:02	04:01	05:01	02:01	03:03	03:01	09:01
54	02:07	02:07	40:01	46:01	01:02	03:04	03:01	03:01	03:03	06:01	08:03	09:01
55	11:01	24:02	40:02	51:02	03:03	15:02	02:01	05:01	04:02	06:02	08:02	15:01

Contd...

Supplemental Table 1: Contd...

Allele frequency of 55 samples

A	Frequency	B	Frequency	C	Frequency	DPB1	Frequency	DRB1	Frequency	DQB1	Frequency
11:01	0.263636	40:01	0.2	07:02	0.254545	05:01	0.445455	09:01	0.190909	03:01	0.236364
24:02	0.163636	46:01	0.118182	01:02	0.181818	02:01	0.172727	08:03	0.127273	03:03	0.190909
33:03	0.127273	58:01	0.118182	03:02	0.118182	13:01	0.1	12:01	0.081818	06:01	0.154545
02:01	0.127273	35:01	0.054545	03:03	0.1	02:02	0.072727	15:01	0.081818	05:02	0.1
02:07	0.090909	55:02	0.054545	03:04	0.090909	04:01	0.054545	03:01	0.072727	02:01	0.072727
26:01	0.045455	13:01	0.045455	08:01	0.063636	03:01	0.045455	11:01	0.072727	03:02	0.063636
02:06	0.045455	27:04	0.045455	12:02	0.054545	135:01	0.045455	04:03	0.054545	04:01	0.036364
02:03	0.036364	39:01	0.045455	15:02	0.036364	14:01	0.027273	16:02	0.054545	06:02	0.036364
11:02	0.027273	15:01	0.036364	04:01	0.027273	09:01	0.018182	04:05	0.036364	05:03	0.027273
68:01	0.018182	38:02	0.036364	14:02	0.027273	38:01	0.009091	12:02	0.036364	06:09	0.027273
31:01	0.018182	40:06	0.036364	06:02	0.009091	700:01N	0.009091	14:54	0.036364	02:02	0.018182
24:353	0.009091	51:01	0.036364	07:04	0.009091			07:01	0.027273	04:02	0.018182
32:01	0.009091	40:02	0.027273	07:06	0.009091			13:02	0.027273	06:03	0.009091
03:03	0.009091	15:02	0.018182	08:22	0.009091			13:12	0.027273	06:10	0.009091
01:01	0.009091	44:03	0.018182	12:03	0.009091			14:05	0.018182		
		51:02	0.018182					04:04	0.009091		
		15:03	0.009091					04:10	0.009091		
		15:11	0.009091					08:02	0.009091		
		18:02	0.009091					13:01	0.009091		
		40:03	0.009091					14:03	0.009091		
		48:03	0.009091					15:02	0.009091		
		52:01	0.009091								
		54:01	0.009091								
		56:01	0.009091								
		56:03	0.009091								
		57:01	0.009091								

Estimated haplotype frequency of 55 samples

A-B-DRB1-DPB1	Frequency	A-B-DRB1	Frequency	A-B-C	Frequency	B-C	Frequency
33:03 58:01 03:01 05:01	0.0455	33:03 58:01 03:01	0.0545	33:03 58:01 03:02	0.0998	40:01 07:02	0.1449
11:01 40:01 09:01 05:01	0.0364	02:07 46:01 09:01	0.0455	11:01 40:01 07:02	0.0907	58:01 03:02	0.1182
33:03 58:01 13:02 05:01	0.0273	11:01 40:01 09:01	0.0455	02:07 46:01 01:02	0.0727	46:01 01:02	0.1091
02:01 40:01 11:01 05:01	0.0182	33:03 58:01 13:02	0.0273	24:02 55:02 01:02	0.0364	27:04 12:02	0.0455
02:03 38:02 16:02 05:01	0.0182	02:03 38:02 16:02	0.0182	02:03 38:02 07:02	0.0273	35:01 03:03	0.0455
02:06 51:01 15:01 02:01	0.0182	02:06 51:01 15:01	0.0182	02:06 51:01 14:02	0.0273	39:01 07:02	0.0455
02:07 46:01 09:01 02:01	0.0182	02:07 46:01 14:54	0.0182	11:01 27:04 12:02	0.0273	40:01 03:04	0.0370
11:01 27:04 12:02 05:01	0.0182	11:01 13:01 15:01	0.0182	11:01 39:01 07:02	0.0273	38:02 07:02	0.0364
11:01 39:01 08:03 05:01	0.0182	11:01 39:01 08:03	0.0182	11:01 40:02 03:03	0.0273	55:02 01:02	0.0364
11:01 40:01 08:03 05:01	0.0182	11:01 40:01 08:03	0.0182	11:01 58:01 03:02	0.0183	13:01 03:04	0.0358
11:01 40:01 12:01 13:01	0.0182	11:01 40:01 12:01	0.0182	02:01 13:01 03:04	0.0182	40:06 08:01	0.0273
11:01 58:01 03:01 05:01	0.0182	11:01 46:01 09:01	0.0182	02:01 15:01 03:03	0.0182	51:01 14:02	0.0273
24:02 35:01 04:03 05:01	0.0182	11:01 58:01 03:01	0.0182	02:01 35:01 03:03	0.0182	15:01 03:03	0.0182
26:01 35:01 11:01 02:01	0.0182	24:02 35:01 04:03	0.0182	02:01 40:01 15:02	0.0182	15:02 08:01	0.0182
01:01 57:01 04:03 02:01	0.0091	24:02 55:02 04:03	0.0182	11:01 15:02 08:01	0.0182	40:01 15:02	0.0182
02:01 13:01 08:03 02:02	0.0091	26:01 35:01 11:01	0.0182	24:02 40:01 07:02	0.0182	40:02 03:03	0.0182
02:01 15:01 09:01 05:01	0.0091	68:01 40:01 11:01	0.0182	68:01 40:01 07:02	0.0182	51:02 15:02	0.0182
02:01 15:01 15:01 02:01	0.0091	01:01 57:01 07:01	0.0091	33:03 40:01 07:02	0.0093	13:01 07:02	0.0097
02:01 15:11 11:01 05:01	0.0091	02:01 13:01 08:03	0.0091	01:01 57:01 03:04	0.0091	15:01 04:01	0.0091
02:01 27:04 12:01 02:02	0.0091	02:01 15:01 12:01	0.0091	02:01 15:01 03:04	0.0091	15:01 07:02	0.0091
02:01 40:01 04:05 135:01	0.0091	02:01 15:01 15:02	0.0091	02:01 38:02 07:02	0.0091	15:03 08:01	0.0091
02:01 40:01 12:01 05:01	0.0091	02:01 15:11 14:54	0.0091	02:01 40:06 08:01	0.0091	15:11 03:03	0.0091
02:01 40:03 04:10 14:01	0.0091	02:01 27:04 12:01	0.0091	02:01 46:01 01:02	0.0091	18:02 07:04	0.0091
02:01 40:06 12:01 13:01	0.0091	02:01 38:02 12:01	0.0091	02:01 51:01 01:02	0.0091	35:01 04:01	0.0091
02:01 46:01 09:01 13:01	0.0091	02:01 38:02 16:02	0.0091	02:01 55:02 12:02	0.0091	40:02 07:02	0.0091
02:01 56:01 13:12 02:02	0.0091	02:01 40:01 04:05	0.0091	02:03 40:01 03:04	0.0091	40:03 03:04	0.0091
02:01 58:01 03:01 04:01	0.0091	02:01 40:01 08:03	0.0091	02:06 54:01 01:02	0.0091	40:06 08:22	0.0091

Contd...

Supplemental Table 1: Contd...

Estimated haplotype frequency of 55 samples							
A-B-DRB1-DPB1	**Frequency**	**A-B-DRB1**	**Frequency**	**A-B-C**	**Frequency**	**B-C**	**Frequency**
02:03 38:02 08:03 05:01	0.0091	02:01 40:01 15:01	0.0091	02:06 56:01 01:02	0.0091	44:03 04:01	0.0091
02:03 40:01 15:01 05:01	0.0091	02:01 40:03 08:03	0.0091	02:07 27:04 12:02	0.0091	44:03 07:06	0.0091
02:06 13:01 12:02 05:01	0.0091	02:01 46:01 09:01	0.0091	02:07 40:01 03:04	0.0091	46:01 03:04	0.0091
02:06 51:01 09:01 04:01	0.0091	02:01 51:01 12:01	0.0091	03:03 40:01 03:04	0.0091	48:03 08:01	0.0091
02:06 54:01 14:05 05:01	0.0091	02:01 56:01 12:02	0.0091	11:01 13:01 03:04	0.0091	51:01 01:02	0.0091
02:07 27:04 16:02 02:02	0.0091	02:03 40:01 16:02	0.0091	11:01 18:02 07:04	0.0091	52:01 12:02	0.0091
02:07 38:02 16:02 13:01	0.0091	02:03 40:06 08:03	0.0091	11:01 40:06 08:01	0.0091	54:01 01:02	0.0091
02:07 40:01 09:01 03:01	0.0091	02:06 13:01 13:12	0.0091	11:01 44:03 07:06	0.0091	55:02 03:03	0.0091
02:07 40:01 13:12 13:01	0.0091	02:06 51:01 09:01	0.0091	11:01 46:01 04:01	0.0091	55:02 12:03	0.0091
02:07 46:01 08:03 03:01	0.0091	02:06 54:01 14:05	0.0091	11:01 52:01 12:02	0.0091	56:01 01:02	0.0091
02:07 46:01 08:03 05:01	0.0091	02:07 27:04 16:02	0.0091	11:02 15:11 03:03	0.0091	56:03 01:02	0.0091
02:07 46:01 09:01 14:01	0.0091	02:07 40:01 08:03	0.0091	11:02 27:04 12:03	0.0091	57:01 06:02	0.0091
02:07 46:01 12:01 02:01	0.0091	02:07 46:01 08:03	0.0091	11:02 46:01 01:02	0.0091		
03:03 40:01 04:05 05:01	0.0091	03:03 40:01 04:05	0.0091	24:02 13:01 03:04	0.0091		
11:01 13:01 16:02 05:01	0.0091	11:01 13:01 16:02	0.0091	24:02 15:01 04:01	0.0091		
11:01 15:01 15:01 05:01	0.0091	11:01 15:01 15:01	0.0091	24:02 35:01 03:03	0.0091		
11:01 15:02 09:01 135:01	0.0091	11:01 15:02 09:01	0.0091	24:02 39:01 07:02	0.0091		
11:01 15:02 12:02 14:01	0.0091	11:01 15:02 12:02	0.0091	24:02 40:03 07:02	0.0091		
11:01 18:02 08:03 05:01	0.0091	11:01 18:02 11:01	0.0091	24:02 40:06 08:01	0.0091		
11:01 27:04 11:01 05:01	0.0091	11:01 27:04 08:03	0.0091	24:02 40:06 08:22	0.0091		
11:01 39:01 09:01 05:01	0.0091	11:01 39:01 09:01	0.0091	24:02 46:01 06:02	0.0091		
11:01 40:01 09:01 03:01	0.0091	11:01 40:02 09:01	0.0091	24:02 48:03 08:01	0.0091		
11:01 40:02 09:01 05:01	0.0091	11:01 40:02 15:01	0.0091	24:02 51:02 15:02	0.0091		
11:01 40:02 11:01 02:01	0.0091	11:01 40:06 08:03	0.0091	24:02 55:02 03:03	0.0091		
11:01 40:06 08:03 04:01	0.0091	11:01 48:03 11:01	0.0091	24:02 56:03 01:02	0.0091		
11:01 44:03 15:01 13:01	0.0091	11:01 52:01 09:01	0.0091	24:353 40:01 07:02	0.0091		
11:01 46:01 14:03 135:01	0.0091	11:02 35:01 11:01	0.0091	26:01 15:03 08:01	0.0091		
11:01 51:02 08:02 05:01	0.0091	11:02 46:01 09:01	0.0091	26:01 35:01 03:03	0.0091		
11:01 52:01 15:02 04:01	0.0091	11:02 55:02 09:01	0.0091	26:01 35:01 07:02	0.0091		
11:02 35:01 14:54 02:02	0.0091	24:02 15:01 04:10	0.0091	26:01 39:01 07:02	0.0091		
11:02 46:01 09:01 13:01	0.0091	24:02 27:04 12:02	0.0091	26:01 40:01 03:04	0.0091		
11:02 55:02 09:01 135:01	0.0091	24:02 39:01 04:04	0.0091	31:01 35:01 01:02	0.0091		
24:02 13:01 15:01 13:01	0.0091	24:02 40:01 04:03	0.0091	31:01 51:02 15:02	0.0091		
24:02 15:01 08:03 05:01	0.0091	24:02 40:01 11:01	0.0091	32:01 44:03 04:01	0.0091		
24:02 39:01 04:03 135:01	0.0091	24:02 40:02 14:54	0.0091	33:03 13:01 07:02	0.0091		
24:02 40:01 04:03 02:01	0.0091	24:02 40:06 08:03	0.0091	33:03 46:01 01:02	0.0091		
24:02 40:01 08:03 02:01	0.0091	24:02 40:06 12:01	0.0091				
24:02 40:02 15:01 02:01	0.0091	24:02 46:01 04:03	0.0091				
24:02 40:06 08:03 05:01	0.0091	24:02 51:02 08:02	0.0091				
24:02 40:06 12:01 05:01	0.0091	24:02 55:02 08:03	0.0091				
24:02 46:01 07:01 13:01	0.0091	24:02 55:02 12:01	0.0091				
24:02 48:03 14:54 05:01	0.0091	24:02 56:03 12:01	0.0091				
24:02 55:02 04:03 02:02	0.0091	24:02 58:01 04:05	0.0091				
24:02 55:02 04:04 02:01	0.0091	24:353 40:01 13:12	0.0091				
24:02 55:02 08:03 03:01	0.0091	26:01 15:03 13:12	0.0091				
24:02 55:02 14:54 05:01	0.0091	26:01 39:01 04:05	0.0091				
24:02 56:03 12:01 700:01N	0.0091	26:01 40:01 15:01	0.0091				
24:02 58:01 04:05 02:01	0.0091	31:01 35:01 14:03	0.0091				
24:353 46:01 14:54 02:02	0.0091	31:01 58:01 13:01	0.0091				
26:01 15:03 13:12 05:01	0.0091	32:01 44:03 07:01	0.0091				
26:01 39:01 04:05 02:01	0.0091	33:03 27:04 12:02	0.0091				
26:01 40:01 16:02 02:01	0.0091	33:03 40:01 09:01	0.0091				
31:01 35:01 09:01 02:02	0.0091	33:03 44:03 07:01	0.0091				
31:01 58:01 15:01 04:01	0.0091	33:03 51:02 15:01	0.0091				
32:01 44:03 07:01 09:01	0.0091	33:03 55:02 14:05	0.0091				
33:03 13:01 07:01 05:01	0.0091						

Contd...

Supplemental Table 1: Contd...

Estimated haplotype frequency of 55 samples									
A-B-DRB1-DPB1	**Frequency**	**A-B-DRB1**	**Frequency**	**A-B-C**	**Frequency**	**B-C**	**Frequency**		
33:03 40:01 09:01 09:01	0.0091								
33:03 46:01 09:01 13:01	0.0091								
33:03 51:01 12:01 02:01	0.0091								
33:03 51:02 13:01 02:01	0.0091								
33:03 55:02 14:05 38:01	0.0091								
68:01 40:01 11:01 04:01	0.0091								
68:01 46:01 09:01 03:01	0.0091								
DRB1-DPB1	**Frequency**	**DRB1-DQB1**	**Frequency**	**DQB1-DPB1**	**Frequency**	**A-B-C-DPB1-DRB1-DQB1**			**Frequency**
09:01 05:01	0.1030	09:01 03:03	0.1818	06:01 05:01	0.1273	33:03 58:01 03:02 05:01 03:01 02:01			0.0409
08:03 05:01	0.1000	08:03 06:01	0.1273	03:01 05:01	0.1132	11:01 40:01 07:02 05:01 09:01 03:03			0.0364
15:01 02:01	0.0600	12:01 03:01	0.0818	03:03 05:01	0.0651	33:03 58:01 03:02 05:01 13:02 06:09			0.0273
11:01 05:01	0.0564	03:01 02:01	0.0727	03:01 02:01	0.0620	02:03 38:02 07:02 05:01 16:02 05:02			0.0182
03:01 04:01	0.0364	11:01 03:01	0.0727	05:02 05:01	0.0450	02:06 51:01 14:02 02:01 15:01 06:02			0.0182
16:02 05:01	0.0364	04:03 03:02	0.0545	02:01 05:01	0.0377	02:07 46:01 01:02 14:01 09:01 03:03			0.0182
04:03 02:01	0.0278	16:02 05:02	0.0545	03:02 02:01	0.0364	11:01 27:04 12:02 13:01 12:02 03:01			0.0182
09:01 03:01	0.0273	04:05 04:01	0.0364	06:02 02:01	0.0364	11:01 39:01 01:02 05:01 08:03 06:01			0.0182
09:01 135:01	0.0273	12:02 03:01	0.0364	03:01 02:02	0.0358	11:01 40:01 07:02 05:01 08:03 06:01			0.0182
12:01 13:01	0.0273	15:01 06:02	0.0364	02:01 04:01	0.0350	11:01 40:01 07:02 13:01 12:01 03:01			0.0182
04:03 05:01	0.0268	13:02 06:09	0.0273	03:03 13:01	0.0336	11:01 58:01 03:02 05:01 03:01 02:01			0.0182
12:01 05:01	0.0261	13:12 03:01	0.0273	03:03 03:01	0.0273	24:02 35:01 03:03 05:01 04:03 03:02			0.0182
09:01 02:01	0.0221	14:54 05:02	0.0273	03:03 135:01	0.0273	26:01 35:01 03:03 02:01 11:01 03:01			0.0182
15:01 05:01	0.0218	07:01 02:02	0.0182	03:01 13:01	0.0254	33:03 58:01 03:02 04:01 03:01 02:01			0.0136
03:01 05:01	0.0204	14:05 05:03	0.0182	05:02 02:01	0.0225	68:01 40:01 07:02 05:01 11:01 03:01			0.0136
04:05 02:01	0.0182	15:01 05:02	0.0182	05:02 02:02	0.0187	01:01 46:01 03:04 13:01 04:03 03:03			0.0091
07:01 13:01	0.0182	15:01 06:01	0.0182	03:02 135:01	0.0182	02:01 13:01 01:02 05:01 12:02 03:01			0.0091
08:03 03:01	0.0182	04:04 03:02	0.0091	03:03 14:01	0.0182	02:01 13:01 03:04 02:01 08:03 06:01			0.0091
12:02 13:01	0.0182	04:10 04:02	0.0091	04:01 05:01	0.0182	02:01 15:01 03:03 05:01 09:01 06:01			0.0091
13:02 09:01	0.0182	07:01 03:03	0.0091	06:01 03:01	0.0182	02:01 15:01 15:02 05:01 12:01 03:01			0.0091
13:12 05:01	0.0182	08:02 04:02	0.0091	06:09 09:01	0.0182	02:01 27:04 12:03 135:01 09:01 03:03			0.0091
14:54 02:01	0.0182	09:01 03:01	0.0091	05:03 02:01	0.0155	02:01 35:01 03:03 05:01 14:54 05:02			0.0091
14:54 02:02	0.0182	13:01 06:03	0.0091	05:02 13:01	0.0137	02:01 38:02 01:02 13:01 09:01 03:03			0.0091
11:01 02:01	0.0163	14:03 03:01	0.0091	05:03 05:01	0.0118	02:01 40:01 03:03 02:01 15:01 06:02			0.0091
09:01 13:01	0.0113	14:54 05:03	0.0091	03:03 04:01	0.0104	02:01 40:01 07:02 05:01 11:01 06:01			0.0091
12:01 02:01	0.0102	15:01 06:10	0.0091	02:02 05:01	0.0091	02:01 40:01 07:02 135:01 04:05 04:01			0.0091
03:01 14:01	0.0091	15:02 06:01	0.0091	02:02 13:01	0.0091	02:01 40:03 03:04 05:01 08:03 04:02			0.0091
04:04 135:01	0.0091			03:02 02:02	0.0091	02:01 40:06 07:02 05:01 12:01 06:01			0.0091
04:05 05:01	0.0091			03:03 700:01N	0.0091	02:01 46:01 01:02 03:01 09:01 03:03			0.0091
04:05 135:01	0.0091			04:01 13:01	0.0091	02:01 51:01 01:02 02:01 12:01 03:01			0.0091
04:10 14:01	0.0091			04:01 38:01	0.0091	02:03 38:02 08:01 13:01 08:03 03:01			0.0091
07:01 05:01	0.0091			04:02 05:01	0.0091	02:03 40:01 03:04 05:01 15:01 05:02			0.0091
08:02 05:01	0.0091			04:02 14:01	0.0091	02:06 51:01 14:02 04:01 09:01 03:03			0.0091
08:03 02:02	0.0091			06:01 02:02	0.0091	02:06 54:01 01:02 05:01 14:05 05:03			0.0091
12:01 02:02	0.0091			06:03 04:01	0.0091	02:06 56:01 03:04 02:02 13:12 03:01			0.0091
12:01 700:01N	0.0091			06:09 05:01	0.0091	02:07 27:04 12:02 02:02 16:02 05:02			0.0091
12:02 02:02	0.0091			06:10 13:01	0.0091	02:07 40:01 01:02 13:01 13:12 03:01			0.0091
12:02 14:01	0.0091					02:07 40:01 03:04 03:01 08:03 06:01			0.0091
13:01 04:01	0.0091					02:07 46:01 01:02 02:02 09:01 03:01			0.0091
13:02 05:01	0.0091					02:07 46:01 01:02 03:01 09:01 03:03			0.0091
13:12 13:01	0.0091					02:07 46:01 07:02 05:01 08:03 06:01			0.0091
14:03 02:02	0.0091					02:07 46:01 07:02 13:01 16:02 05:02			0.0091
14:05 02:02	0.0091					02:07 55:02 01:02 02:01 12:01 03:01			0.0091
14:05 38:01	0.0091					03:03 40:01 03:04 05:01 04:05 04:01			0.0091
15:02 04:01	0.0091					11:01 13:01 03:04 05:01 16:02 05:02			0.0091
16:02 02:02	0.0091					11:01 13:01 07:06 05:01 07:01 02:02			0.0091
16:02 13:01	0.0091					11:01 15:02 08:01 02:01 12:02 03:01			0.0091

Contd...

Supplemental Table 1: Contd...

DRB1-DPB1	Frequency	DRB1-DQB1	Frequency	DQB1-DPB1	Frequency	A-B-C-DPB1-DRB1-DQB1	Frequency
03:01 13:01	0.0068					11:01 15:02 08:01 135:01 09:01 03:03	0.0091
						11:01 18:02 12:02 05:01 11:01 03:01	0.0091
						11:01 27:04 07:04 05:01 08:03 06:01	0.0091
						11:01 39:01 07:02 05:01 09:01 03:03	0.0091
						11:01 40:01 04:01 05:01 15:01 03:02	0.0091
						11:01 40:01 07:02 03:01 09:01 03:03	0.0091
						11:01 40:02 07:02 05:01 09:01 03:03	0.0091
						11:01 40:06 08:01 04:01 08:03 06:01	0.0091
						11:01 46:01 01:02 02:02 14:03 03:03	0.0091
						11:01 48:03 03:03 02:01 11:01 03:01	0.0091
						11:01 51:02 03:03 05:01 15:01 06:02	0.0091
						11:01 52:01 12:02 04:01 15:02 03:03	0.0091
						11:02 15:11 03:03 02:02 11:01 03:01	0.0091
						11:02 46:01 01:02 13:01 09:01 03:03	0.0091
						11:02 55:02 12:02 02:02 12:01 03:01	0.0091
						24:02 13:01 03:04 05:01 15:01 06:10	0.0091
						24:02 15:01 07:02 02:01 04:03 06:01	0.0091
						24:02 15:01 07:02 14:01 04:10 06:01	0.0091
						24:02 39:01 07:02 135:01 04:03 03:02	0.0091
						24:02 40:01 15:02 02:01 08:03 03:01	0.0091
						24:02 40:02 08:01 05:01 14:54 05:03	0.0091
						24:02 40:02 15:02 02:01 08:02 04:02	0.0091
						24:02 40:06 08:01 05:01 12:01 03:01	0.0091
						24:02 40:06 08:22 05:01 08:03 06:01	0.0091
						24:02 46:01 01:02 05:01 14:54 05:02	0.0091
						24:02 55:02 01:02 02:02 04:03 03:02	0.0091
						24:02 55:02 03:03 02:01 04:04 03:02	0.0091
						24:02 55:02 07:02 03:01 08:03 06:01	0.0091
						24:02 56:03 01:02 700:01N 12:01 03:01	0.0091
						24:02 57:01 06:02 02:01 07:01 03:02	0.0091
						24:02 58:01 03:02 38:01 14:05 04:01	0.0091
						24:353 46:01 07:02 02:02 14:54 05:02	0.0091
						26:01 15:03 08:01 05:01 13:12 03:01	0.0091
						26:01 39:01 07:02 02:01 04:05 04:01	0.0091
						26:01 40:01 03:04 02:01 16:02 05:02	0.0091
						31:01 35:01 04:01 135:01 09:01 03:01	0.0091
						31:01 58:01 15:02 02:01 13:01 06:03	0.0091
						32:01 44:03 04:01 09:01 07:01 02:02	0.0091
						33:03 40:01 07:02 09:01 09:01 03:03	0.0091
						33:03 44:03 07:02 13:01 15:01 06:01	0.0091
						33:03 46:01 01:02 05:01 09:01 03:03	0.0091
						33:03 51:02 03:02 04:01 15:01 05:02	0.0091
						33:03 55:02 01:02 02:01 04:05 05:03	0.0091
						68:01 40:01 07:02 04:01 11:01 03:01	0.0045