

Prediction Quality of European Ancestry

Aug 01, 2012

Table 1: The sensitivity (SEN), specificity (SPE), positive predictive value (PPV) and negative predictive value (NPV) calculated from validation samples for each four-digit HLA allele without call threshold, when Study Data of European ancestry were divided to training and validation parts with equal sizes. The SNP markers in the intersect of Illumina platforms were used.

	Allele	Num. Train	Freq. Train	Num. Valid.	Freq. Valid.	CR ¹ (%)	ACC ¹ (%)	SEN (%)	SPE (%)	PPV (%)	NPV (%)	Miscall ² (%)
<i>HLA-A: Overall accuracy: 98.2%</i>												
1	01:01	270	0.1429	271	0.1486	100.0	100.0	100.0	100.0	100.0	100.0	–
2	01:02	1	0.0005	–	–	–	–	–	–	–	–	–
3	01:25	1	0.0005	–	–	–	–	–	–	–	–	–
4	02:01	503	0.2661	533	0.2922	100.0	99.5	99.8	99.4	98.5	99.9	68:01 (100)
5	02:02	3	0.0016	3	0.0016	100.0	99.9	66.7	100.0	100.0	99.9	02:05 (100)
6	02:05	19	0.0101	19	0.0104	100.0	99.9	100.0	99.9	95.0	100.0	–
7	02:06	5	0.0026	6	0.0033	100.0	99.7	0.0	100.0	–	99.7	02:01 (100)
8	02:17	1	0.0005	–	–	–	–	–	–	–	–	–
9	02:20	1	0.0005	–	–	–	–	–	–	–	–	–
10	02:22	1	0.0005	–	–	–	–	–	–	–	–	–
11	02:35	1	0.0005	–	–	–	–	–	–	–	–	–
12	03:01	252	0.1333	234	0.1283	100.0	99.8	99.6	99.8	98.7	99.9	24:02 (100)
13	03:02	3	0.0016	2	0.0011	100.0	99.9	0.0	100.0	–	99.9	03:01 (100)
14	03:17	1	0.0005	–	–	–	–	–	–	–	–	–
15	11:01	127	0.0672	120	0.0658	100.0	100.0	100.0	100.0	100.0	100.0	–
16	11:02	1	0.0005	–	–	–	–	–	–	–	–	–
17	11:25	1	0.0005	–	–	–	–	–	–	–	–	–
18	23:01	39	0.0206	42	0.0230	100.0	100.0	100.0	100.0	100.0	100.0	–
19	24:02	170	0.0899	141	0.0773	100.0	99.7	100.0	99.6	95.9	100.0	–
20	24:03	5	0.0026	5	0.0027	100.0	99.7	0.0	100.0	–	99.7	24:02 (100)
21	24:32	1	0.0005	–	–	–	–	–	–	–	–	–
22	25:01	55	0.0291	50	0.0274	100.0	99.6	92.0	99.8	92.0	99.8	26:01 (100)
23	26:01	74	0.0392	70	0.0384	100.0	99.4	91.4	99.7	92.8	99.7	25:01 (67)
24	26:08	1	0.0005	–	–	–	–	–	–	–	–	–
25	29:01	10	0.0053	10	0.0055	100.0	99.9	90.0	100.0	100.0	99.9	29:02 (100)
26	29:02	63	0.0333	57	0.0312	100.0	99.9	100.0	99.9	98.3	100.0	–
27	29:10	1	0.0005	–	–	–	–	–	–	–	–	–

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	Allele	Num. Train	Freq. Train	Num. Valid.	Freq. Valid.	CR ¹ (%)	ACC ¹ (%)	SEN (%)	SPE (%)	PPV (%)	NPV (%)	Miscall ² (%)
28	30:01	30	0.0159	27	0.0148	100.0	100.0	100.0	100.0	100.0	100.0	–
29	30:02	19	0.0101	17	0.0093	100.0	100.0	100.0	100.0	100.0	100.0	–
30	30:04	2	0.0011	1	0.0005	100.0	99.9	0.0	100.0	–	99.9	68:01 (100)
31	31:01	46	0.0243	45	0.0247	100.0	99.9	97.8	100.0	100.0	99.9	02:01 (100)
32	31:08	1	0.0005	–	–	–	–	–	–	–	–	–
33	32:01	69	0.0365	66	0.0362	100.0	100.0	100.0	100.0	100.0	100.0	–
34	33:01	13	0.0069	12	0.0066	100.0	100.0	100.0	100.0	100.0	100.0	–
35	33:03	9	0.0048	9	0.0049	100.0	100.0	100.0	100.0	100.0	100.0	–
36	33:05	1	0.0005	–	–	–	–	–	–	–	–	–
37	34:02	2	0.0011	1	0.0005	100.0	100.0	100.0	100.0	100.0	100.0	–
38	36:01	1	0.0005	–	–	–	–	–	–	–	–	–
39	66:01	12	0.0063	11	0.0060	100.0	99.9	90.9	100.0	100.0	99.9	26:01 (100)
40	66:02	1	0.0005	–	–	–	–	–	–	–	–	–
41	68:01	54	0.0286	58	0.0318	100.0	99.8	98.3	99.8	95.0	99.9	69:01 (100)
42	68:02	13	0.0069	11	0.0060	100.0	100.0	100.0	100.0	100.0	100.0	–
43	68:24	1	0.0005	–	–	–	–	–	–	–	–	–
44	68:35	1	0.0005	–	–	–	–	–	–	–	–	–
45	69:01	2	0.0011	2	0.0011	100.0	99.9	50.0	99.9	50.0	99.9	68:01 (100)
46	74:01	1	0.0005	–	–	–	–	–	–	–	–	–
47	74:03	1	0.0005	1	0.0005	100.0	100.0	100.0	100.0	100.0	100.0	–
48	80:01	1	0.0005	–	–	–	–	–	–	–	–	–
<i>HLA-B: Overall accuracy: 96.6%</i>												
1	07:02	319	0.1214	291	0.1157	100.0	99.9	100.0	99.9	99.0	100.0	–
2	07:04	1	0.0004	1	0.0004	100.0	100.0	0.0	100.0	–	100.0	07:02 (100)
3	07:05	8	0.0030	7	0.0028	100.0	100.0	100.0	100.0	87.5	100.0	–
4	07:10	1	0.0004	–	–	–	–	–	–	–	–	–
5	07:17	1	0.0004	–	–	–	–	–	–	–	–	–
6	08:01	239	0.0909	262	0.1041	100.0	100.0	100.0	100.0	99.6	100.0	–
7	13:02	87	0.0331	85	0.0338	100.0	100.0	98.8	100.0	100.0	100.0	07:05 (100)
8	14:01	17	0.0065	17	0.0068	100.0	100.0	94.1	100.0	100.0	100.0	08:01 (100)
9	14:02	61	0.0232	60	0.0238	100.0	100.0	100.0	100.0	98.4	100.0	–
10	15:01	147	0.0559	160	0.0636	100.0	99.7	99.4	99.7	96.4	100.0	56:01 (100)
11	15:02	1	0.0004	1	0.0004	100.0	100.0	100.0	100.0	100.0	100.0	–
12	15:03	2	0.0008	2	0.0008	100.0	100.0	50.0	100.0	100.0	100.0	15:01 (100)
13	15:04	1	0.0004	–	–	–	–	–	–	–	–	–
14	15:07	1	0.0004	–	–	–	–	–	–	–	–	–
15	15:08	1	0.0004	1	0.0004	100.0	100.0	100.0	100.0	100.0	100.0	–
16	15:09	1	0.0004	–	–	–	–	–	–	–	–	–
17	15:10	2	0.0008	2	0.0008	100.0	99.9	0.0	100.0	–	99.9	15:01 (100)
18	15:16	2	0.0008	2	0.0008	100.0	99.9	0.0	100.0	–	99.9	14:02 (50)
19	15:17	10	0.0038	10	0.0040	100.0	100.0	100.0	100.0	100.0	100.0	–
20	15:18	5	0.0019	4	0.0016	100.0	100.0	75.0	100.0	100.0	100.0	15:01 (100)
21	18:01	140	0.0533	152	0.0604	100.0	99.4	96.7	99.6	93.6	99.8	38:01 (60)
22	18:02	1	0.0004	–	–	–	–	–	–	–	–	–
23	18:03	6	0.0023	6	0.0024	100.0	99.8	0.0	100.0	–	99.8	18:01 (100)
24	18:11	1	0.0004	–	–	–	–	–	–	–	–	–

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Table 1 – continued from previous page

	Allele	Num. Train	Freq. Train	Num. Valid.	Freq. Valid.	CR ¹ (%)	ACC ¹ (%)	SEN (%)	SPE (%)	PPV (%)	NPV (%)	Miscall ² (%)
25	18:18	1	0.0004	–	–	–	–	–	–	–	–	–
26	27:02	24	0.0091	23	0.0091	100.0	99.8	73.9	100.0	100.0	99.8	27:05 (83)
27	27:03	1	0.0004	–	–	–	–	–	–	–	–	–
28	27:05	98	0.0373	95	0.0378	100.0	99.8	100.0	99.8	95.0	100.0	–
29	27:07	1	0.0004	–	–	–	–	–	–	–	–	–
30	27:09	1	0.0004	–	–	–	–	–	–	–	–	–
31	35:01	149	0.0567	125	0.0497	100.0	99.0	91.2	99.5	89.4	99.5	35:08 (36)
32	35:02	24	0.0091	24	0.0095	100.0	99.8	91.7	99.9	88.0	99.9	35:03 (100)
33	35:03	54	0.0205	61	0.0242	100.0	99.3	80.3	99.8	90.7	99.5	35:01 (83)
34	35:08	19	0.0072	18	0.0072	100.0	99.8	94.4	99.8	77.3	100.0	35:01 (100)
35	35:09	1	0.0004	–	–	–	–	–	–	–	–	–
36	35:17	1	0.0004	1	0.0004	100.0	100.0	0.0	100.0	–	100.0	35:01 (100)
37	35:41	1	0.0004	–	–	–	–	–	–	–	–	–
38	35:55	1	0.0004	–	–	–	–	–	–	–	–	–
39	37:01	28	0.0107	26	0.0103	100.0	100.0	100.0	100.0	100.0	100.0	–
40	38:01	70	0.0266	74	0.0294	100.0	99.9	100.0	99.9	96.1	100.0	–
41	39:01	38	0.0145	35	0.0139	100.0	99.6	85.7	99.8	85.7	99.8	18:01 (80)
42	39:06	12	0.0046	11	0.0044	100.0	99.9	81.8	100.0	100.0	99.9	39:01 (100)
43	39:10	1	0.0004	–	–	–	–	–	–	–	–	–
44	39:24	2	0.0008	1	0.0004	100.0	100.0	100.0	100.0	100.0	100.0	–
45	39:29	1	0.0004	–	–	–	–	–	–	–	–	–
46	40:01	105	0.0400	98	0.0390	100.0	100.0	100.0	100.0	100.0	100.0	–
47	40:02	42	0.0160	47	0.0187	100.0	99.9	95.7	100.0	100.0	99.9	–
48	40:06	3	0.0011	3	0.0012	100.0	100.0	100.0	100.0	100.0	100.0	–
49	40:10	1	0.0004	–	–	–	–	–	–	–	–	–
50	40:27	1	0.0004	–	–	–	–	–	–	–	–	–
51	40:32	1	0.0004	–	–	–	–	–	–	–	–	–
52	41:01	12	0.0046	11	0.0044	100.0	100.0	100.0	100.0	100.0	100.0	–
53	41:02	17	0.0065	15	0.0060	100.0	100.0	100.0	100.0	100.0	100.0	–
54	42:01	1	0.0004	–	–	–	–	–	–	–	–	–
55	42:02	1	0.0004	–	–	–	–	–	–	–	–	–
56	44:02	226	0.0860	212	0.0843	100.0	99.9	99.1	100.0	99.5	99.9	44:03 (50)
57	44:03	126	0.0479	126	0.0501	100.0	99.8	100.0	99.8	96.6	100.0	–
58	44:04	1	0.0004	1	0.0004	100.0	100.0	0.0	100.0	–	100.0	44:03 (100)
59	44:05	16	0.0061	13	0.0052	100.0	99.9	100.0	99.9	86.7	100.0	–
60	44:06	1	0.0004	–	–	–	–	–	–	–	–	–
61	44:08	1	0.0004	–	–	–	–	–	–	–	–	–
62	44:27	1	0.0004	–	–	–	–	–	–	–	–	–
63	45:01	13	0.0049	12	0.0048	100.0	100.0	91.7	100.0	100.0	100.0	35:01 (50)
64	46:01	1	0.0004	–	–	–	–	–	–	–	–	–
65	47:01	7	0.0027	7	0.0028	100.0	100.0	100.0	100.0	100.0	100.0	–
66	47:02	1	0.0004	–	–	–	–	–	–	–	–	–
67	48:01	3	0.0011	2	0.0008	100.0	100.0	100.0	100.0	100.0	100.0	–
68	49:01	44	0.0167	44	0.0175	100.0	99.9	93.2	100.0	100.0	99.9	50:01 (67)
69	50:01	37	0.0141	35	0.0139	100.0	99.9	97.1	99.9	94.4	100.0	44:03 (100)
70	50:02	1	0.0004	–	–	–	–	–	–	–	–	–

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	Allele	Num. Train	Freq. Train	Num. Valid.	Freq. Valid.	CR ¹ (%)	ACC ¹ (%)	SEN (%)	SPE (%)	PPV (%)	NPV (%)	Miscall ² (%)
71	51:01	154	0.0586	122	0.0485	100.0	99.7	98.4	99.7	95.2	99.9	35:03 (50)
72	51:05	2	0.0008	1	0.0004	100.0	100.0	0.0	100.0	–	100.0	35:08 (100)
73	51:07	3	0.0011	2	0.0008	100.0	99.9	0.0	100.0	–	99.9	51:01 (100)
74	51:08	2	0.0008	2	0.0008	100.0	100.0	50.0	100.0	100.0	100.0	51:01 (100)
75	51:09	1	0.0004	–	–	–	–	–	–	–	–	–
76	52:01	34	0.0129	31	0.0123	100.0	100.0	96.8	100.0	100.0	100.0	15:01 (100)
77	53:01	7	0.0027	6	0.0024	100.0	100.0	83.3	100.0	100.0	100.0	35:01 (100)
78	54:01	2	0.0008	1	0.0004	100.0	100.0	100.0	100.0	100.0	100.0	–
79	55:01	42	0.0160	44	0.0175	100.0	99.8	93.2	99.9	97.6	99.9	56:01 (100)
80	55:02	2	0.0008	1	0.0004	100.0	100.0	0.0	100.0	–	100.0	56:01 (100)
81	55:05	1	0.0004	–	–	–	–	–	–	–	–	–
82	56:01	25	0.0095	21	0.0083	100.0	99.8	95.2	99.8	80.0	100.0	55:01 (100)
83	57:01	76	0.0289	77	0.0306	100.0	100.0	100.0	100.0	100.0	100.0	–
84	57:03	1	0.0004	–	–	–	–	–	–	–	–	–
85	58:01	25	0.0095	22	0.0087	100.0	99.9	95.5	100.0	95.5	100.0	35:03 (100)
86	70:20	1	0.0004	1	0.0004	100.0	100.0	0.0	100.0	–	100.0	07:02 (100)
87	73:01	3	0.0011	2	0.0008	100.0	100.0	100.0	100.0	100.0	100.0	–
88	81:01	1	0.0004	–	–	–	–	–	–	–	–	–
<i>HLA-C: Overall accuracy: 98.8%</i>												
1	01:02	85	0.0450	72	0.0390	100.0	100.0	100.0	100.0	100.0	100.0	–
2	02:02	115	0.0609	93	0.0504	100.0	99.9	100.0	99.9	98.9	100.0	–
3	02:10	1	0.0005	1	0.0005	100.0	100.0	100.0	100.0	100.0	100.0	–
4	03:02	4	0.0021	4	0.0022	100.0	100.0	100.0	100.0	100.0	100.0	–
5	03:03	90	0.0477	92	0.0499	100.0	99.6	95.7	99.8	95.7	99.8	03:04 (100)
6	03:04	113	0.0599	106	0.0575	100.0	99.5	96.2	99.7	94.4	99.8	03:03 (100)
7	03:05	1	0.0005	1	0.0005	100.0	99.9	0.0	100.0	–	99.9	03:04 (100)
8	03:06	1	0.0005	–	–	–	–	–	–	–	–	–
9	03:10	1	0.0005	–	–	–	–	–	–	–	–	–
10	04:01	221	0.1171	206	0.1117	100.0	100.0	100.0	100.0	100.0	100.0	–
11	04:03	1	0.0005	–	–	–	–	–	–	–	–	–
12	04:09	1	0.0005	–	–	–	–	–	–	–	–	–
13	05:01	143	0.0757	157	0.0851	100.0	99.9	99.4	99.9	99.4	99.9	08:02 (100)
14	06:02	176	0.0932	174	0.0944	100.0	99.9	100.0	99.9	99.4	100.0	–
15	07:01	278	0.1472	273	0.1480	100.0	99.9	99.6	100.0	100.0	99.9	12:03 (100)
16	07:02	228	0.1208	257	0.1394	100.0	99.9	99.6	100.0	100.0	99.9	03:04 (100)
17	07:04	38	0.0201	37	0.0201	100.0	100.0	100.0	100.0	100.0	100.0	–
18	08:01	2	0.0011	1	0.0005	100.0	99.9	0.0	100.0	–	99.9	08:03 (100)
19	08:02	48	0.0254	49	0.0266	100.0	99.9	98.0	99.9	98.0	99.9	05:01 (100)
20	08:03	2	0.0011	1	0.0005	100.0	99.9	100.0	99.9	50.0	100.0	–
21	12:02	26	0.0138	24	0.0130	100.0	100.0	100.0	100.0	100.0	100.0	–
22	12:03	134	0.0710	128	0.0694	100.0	99.9	99.2	99.9	99.2	99.9	06:02 (100)
23	12:05	1	0.0005	–	–	–	–	–	–	–	–	–
24	12:13	1	0.0005	–	–	–	–	–	–	–	–	–
25	14:02	21	0.0111	21	0.0114	100.0	100.0	100.0	100.0	100.0	100.0	–
26	14:03	1	0.0005	1	0.0005	100.0	100.0	100.0	100.0	100.0	100.0	–
27	14:04	1	0.0005	–	–	–	–	–	–	–	–	–

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Table 1 – continued from previous page

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28	15:02	43	0.0228	45	0.0244	100.0	99.9	100.0	99.9	95.7	100.0	–
29	15:04	2	0.0011	2	0.0011	100.0	99.9	0.0	100.0	–	99.9	15:02 (100)
30	15:05	8	0.0042	8	0.0043	100.0	100.0	100.0	100.0	100.0	100.0	–
31	15:11	1	0.0005	–	–	–	–	–	–	–	–	–
32	16:01	63	0.0334	62	0.0336	100.0	99.9	98.4	99.9	98.4	99.9	02:02 (100)
33	16:02	6	0.0032	5	0.0027	100.0	99.9	100.0	99.9	83.3	100.0	–
34	16:04	5	0.0026	4	0.0022	100.0	99.9	50.0	100.0	100.0	99.9	16:01 (50)
35	17:01	22	0.0117	18	0.0098	100.0	99.9	100.0	99.9	90.0	100.0	–
36	17:03	3	0.0016	2	0.0011	100.0	99.9	0.0	100.0	–	99.9	17:01 (100)
37	18:01	1	0.0005	–	–	–	–	–	–	–	–	–
<i>HLA-DRB1: Overall accuracy: 92.1%</i>												
1	01:01	198	0.0802	208	0.0865	100.0	99.4	99.5	99.4	93.7	100.0	01:02 (100)
2	01:02	33	0.0134	35	0.0146	100.0	99.9	100.0	99.9	94.6	100.0	–
3	01:03	18	0.0073	18	0.0075	100.0	99.4	22.2	100.0	100.0	99.4	01:01 (100)
4	03:01	277	0.1122	277	0.1152	100.0	99.8	99.3	99.9	98.9	99.9	13:01 (50)
5	03:02	1	0.0004	–	–	–	–	–	–	–	–	–
6	04:01	179	0.0725	198	0.0824	100.0	98.4	93.9	98.8	87.0	99.5	04:07 (58)
7	04:02	29	0.0118	28	0.0116	100.0	99.8	96.4	99.8	87.1	100.0	04:01 (50)
8	04:03	25	0.0101	31	0.0129	100.0	98.8	16.1	99.9	71.4	98.9	04:04 (58)
9	04:04	74	0.0300	64	0.0266	100.0	98.9	90.6	99.1	73.4	99.7	04:01 (83)
10	04:05	17	0.0069	19	0.0079	100.0	99.8	68.4	100.0	100.0	99.7	07:01 (50)
11	04:06	1	0.0004	1	0.0004	100.0	100.0	100.0	100.0	100.0	100.0	–
12	04:07	25	0.0101	28	0.0116	100.0	99.4	75.0	99.7	72.4	99.7	04:01 (57)
13	04:08	9	0.0036	8	0.0033	100.0	99.7	0.0	100.0	–	99.7	04:01 (75)
14	04:09	1	0.0004	–	–	–	–	–	–	–	–	–
15	04:10	1	0.0004	1	0.0004	100.0	100.0	100.0	100.0	100.0	100.0	–
16	04:59	1	0.0004	–	–	–	–	–	–	–	–	–
17	07:01	343	0.1390	300	0.1248	100.0	99.8	99.7	99.8	98.4	100.0	04:01 (100)
18	08:01	65	0.0263	56	0.0233	100.0	99.8	100.0	99.8	92.6	100.0	–
19	08:02	4	0.0016	4	0.0017	100.0	99.8	0.0	100.0	–	99.8	08:01 (100)
20	08:03	4	0.0016	3	0.0012	100.0	100.0	100.0	100.0	100.0	100.0	–
21	08:04	5	0.0020	4	0.0017	100.0	100.0	75.0	100.0	100.0	100.0	04:02 (100)
22	08:10	1	0.0004	1	0.0004	100.0	100.0	100.0	100.0	100.0	100.0	–
23	09:01	26	0.0105	22	0.0092	100.0	99.9	95.5	100.0	100.0	100.0	04:01 (100)
24	10:01	16	0.0065	17	0.0071	100.0	100.0	94.1	100.0	100.0	100.0	13:01 (100)
25	11:01	165	0.0669	177	0.0736	100.0	96.7	93.8	96.9	70.9	99.5	11:04 (45)
26	11:02	6	0.0024	6	0.0025	100.0	99.8	33.3	100.0	100.0	99.8	11:01 (100)
27	11:03	21	0.0085	20	0.0083	100.0	99.2	0.0	100.0	–	99.2	11:01 (100)
28	11:04	110	0.0446	96	0.0399	100.0	98.2	60.4	99.8	92.1	98.4	11:01 (95)
29	11:06	1	0.0004	–	–	–	–	–	–	–	–	–
30	11:08	1	0.0004	–	–	–	–	–	–	–	–	–
31	11:12	1	0.0004	1	0.0004	100.0	100.0	0.0	100.0	–	100.0	11:01 (100)
32	11:15	1	0.0004	–	–	–	–	–	–	–	–	–
33	11:28	1	0.0004	–	–	–	–	–	–	–	–	–
34	11:39	1	0.0004	–	–	–	–	–	–	–	–	–
35	11:43	1	0.0004	–	–	–	–	–	–	–	–	–

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Table 1 – continued from previous page

	Allele	Num. Train	Freq. Train	Num. Valid.	Freq. Valid.	CR ¹ (%)	ACC ¹ (%)	SEN (%)	SPE (%)	PPV (%)	NPV (%)	Miscall ² (%)
36	12:01	35	0.0142	39	0.0162	100.0	99.6	87.2	99.8	90.7	99.8	11:01 (75)
37	12:02	2	0.0008	1	0.0004	100.0	100.0	100.0	100.0	100.0	100.0	–
38	13:01	170	0.0689	142	0.0591	100.0	99.6	98.6	99.6	94.6	99.9	13:02 (50)
39	13:02	89	0.0361	87	0.0362	100.0	99.9	98.9	100.0	98.9	100.0	13:01 (100)
40	13:03	30	0.0122	31	0.0129	100.0	99.9	100.0	99.9	93.9	100.0	–
41	13:05	4	0.0016	3	0.0012	100.0	99.9	0.0	100.0	–	99.9	11:01 (100)
42	13:10	1	0.0004	–	–	–	–	–	–	–	–	–
43	13:15	1	0.0004	–	–	–	–	–	–	–	–	–
44	13:17	1	0.0004	–	–	–	–	–	–	–	–	–
45	13:18	1	0.0004	–	–	–	–	–	–	–	–	–
46	14:01	68	0.0276	67	0.0279	100.0	99.8	98.5	99.8	93.0	100.0	15:01 (100)
47	14:02	1	0.0004	1	0.0004	100.0	100.0	0.0	100.0	–	100.0	11:01 (50)
48	14:04	3	0.0012	4	0.0017	100.0	99.8	0.0	100.0	–	99.8	14:01 (100)
49	14:06	1	0.0004	1	0.0004	100.0	100.0	0.0	100.0	–	100.0	12:01 (100)
50	15:01	294	0.1191	300	0.1248	100.0	99.7	99.0	99.8	98.7	99.9	03:01 (67)
51	15:02	28	0.0113	28	0.0116	100.0	100.0	100.0	100.0	100.0	100.0	–
52	15:03	1	0.0004	1	0.0004	100.0	100.0	0.0	100.0	–	100.0	13:01 (100)
53	16:01	68	0.0276	68	0.0283	100.0	99.9	98.5	99.9	97.1	100.0	01:02 (100)
54	16:02	7	0.0028	7	0.0029	100.0	100.0	85.7	100.0	100.0	100.0	16:01 (100)
55	16:05	1	0.0004	1	0.0004	100.0	100.0	0.0	100.0	–	100.0	16:01 (100)
<i>HLA-DQA1: Overall accuracy: 97.3%</i>												
1	01:01	202	0.1156	185	0.1068	100.0	99.7	97.3	99.9	99.4	99.7	01:04 (80)
2	01:02	351	0.2008	355	0.2050	100.0	99.7	99.2	99.8	99.2	99.8	01:03 (67)
3	01:03	147	0.0841	138	0.0797	100.0	99.6	97.1	99.8	97.8	99.7	01:02 (75)
4	01:04	30	0.0172	29	0.0167	100.0	99.7	100.0	99.6	82.9	100.0	–
5	01:05	6	0.0034	6	0.0035	100.0	99.9	83.3	99.9	90.9	99.9	01:03 (100)
6	01:06	1	0.0006	–	–	–	–	–	–	–	–	–
7	02:01	237	0.1356	263	0.1518	100.0	100.0	100.0	100.0	100.0	100.0	–
8	03:01	164	0.0938	159	0.0918	100.0	98.6	93.7	99.0	90.9	99.4	03:03 (90)
9	03:02	14	0.0080	14	0.0081	100.0	99.9	92.9	100.0	100.0	99.9	05:05 (100)
10	03:03	108	0.0618	108	0.0624	100.0	98.6	86.1	99.4	90.7	99.1	03:01 (100)
11	04:01	54	0.0309	52	0.0300	100.0	99.8	100.0	99.8	94.5	100.0	–
12	04:02	2	0.0011	1	0.0006	100.0	99.9	0.0	100.0	–	99.9	04:01 (100)
13	05:01	194	0.1110	183	0.1057	100.0	100.0	100.0	100.0	100.0	100.0	–
14	05:03	2	0.0011	2	0.0012	100.0	99.9	0.0	100.0	–	99.9	05:05 (100)
15	05:05	227	0.1299	228	0.1316	100.0	99.7	100.0	99.6	97.4	100.0	–
16	05:09	4	0.0023	4	0.0023	100.0	99.8	25.0	100.0	100.0	99.8	05:05 (100)
17	06:01	5	0.0029	5	0.0029	100.0	99.9	60.0	100.0	100.0	99.9	04:01 (100)
<i>HLA-DQB1 Overall accuracy: 98.8%</i>												
1	02:01	220	0.1136	204	0.1067	100.0	99.9	100.0	99.9	99.0	100.0	–
2	02:02	200	0.1033	200	0.1046	100.0	99.9	99.5	99.9	99.5	99.9	03:01 (100)
3	02:04	1	0.0005	–	–	–	–	–	–	–	–	–
4	03:01	393	0.2030	384	0.2008	100.0	99.5	99.7	99.5	97.8	99.9	02:02 (100)
5	03:02	187	0.0966	187	0.0978	100.0	99.9	100.0	99.9	98.9	100.0	–
6	03:03	84	0.0434	83	0.0434	100.0	99.9	97.6	100.0	100.0	99.9	03:01 (100)
7	03:04	5	0.0026	5	0.0026	100.0	99.8	20.0	100.0	100.0	99.8	03:01 (100)

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Table 1 – continued from previous page

	Allele	Num. Train	Freq. Train	Num. Valid.	Freq. Valid.	CR ¹ (%)	ACC ¹ (%)	SEN (%)	SPE (%)	PPV (%)	NPV (%)	Miscall ² (%)
8	03:05	2	0.0010	2	0.0010	100.0	99.9	0.0	100.0	–	99.9	03:02 (100)
9	03:19	2	0.0010	2	0.0010	100.0	99.9	50.0	100.0	100.0	99.9	03:01 (100)
10	04:02	61	0.0315	60	0.0314	100.0	100.0	100.0	100.0	100.0	100.0	–
11	05:01	220	0.1136	213	0.1114	100.0	99.9	99.1	100.0	100.0	99.9	05:03 (100)
12	05:02	67	0.0346	65	0.0340	100.0	100.0	100.0	100.0	100.0	100.0	–
13	05:03	55	0.0284	56	0.0293	100.0	99.9	100.0	99.9	96.6	100.0	–
14	05:04	1	0.0005	1	0.0005	100.0	100.0	100.0	100.0	100.0	100.0	–
15	06:01	24	0.0124	22	0.0115	100.0	99.9	95.5	100.0	100.0	99.9	06:03 (100)
16	06:02	234	0.1209	228	0.1192	100.0	99.6	98.7	99.8	98.5	99.8	02:01 (67)
17	06:03	112	0.0579	132	0.0690	100.0	99.8	97.7	99.9	99.2	99.8	06:02 (100)
18	06:04	52	0.0269	55	0.0288	100.0	99.8	98.2	99.9	96.4	99.9	03:01 (50)
19	06:09	14	0.0072	13	0.0068	100.0	99.9	92.3	100.0	100.0	99.9	06:04 (100)
20	06:14	1	0.0005	–	–	–	–	–	–	–	–	–
21	06:16	1	0.0005	–	–	–	–	–	–	–	–	–
<i>HLA-DPB1: Overall accuracy: 93.8%</i>												
1	01:01	74	0.0451	77	0.0479	100.0	99.9	98.7	100.0	100.0	99.9	04:01 (100)
2	02:01	201	0.1226	233	0.1449	100.0	97.8	89.3	99.3	95.4	98.2	04:01 (88)
3	02:02	7	0.0043	6	0.0037	100.0	99.6	0.0	100.0	–	99.6	02:01 (100)
4	03:01	133	0.0811	131	0.0815	100.0	98.0	99.2	97.9	80.7	99.9	104:01 (100)
5	04:01	713	0.4348	678	0.4216	100.0	97.6	99.7	96.0	94.7	99.8	02:01 (100)
6	04:02	212	0.1293	201	0.1250	100.0	99.4	100.0	99.4	95.9	100.0	–
7	05:01	33	0.0201	32	0.0199	100.0	100.0	100.0	100.0	100.0	100.0	–
8	06:01	29	0.0177	24	0.0149	100.0	98.5	0.0	100.0	–	98.5	03:01 (100)
9	06:02	9	0.0055	9	0.0056	100.0	99.4	0.0	100.0	–	99.4	04:02 (56)
10	09:01	12	0.0073	10	0.0062	100.0	99.6	90.0	99.7	64.3	99.9	14:01 (100)
11	10:01	22	0.0134	24	0.0149	100.0	99.8	91.7	99.9	95.7	99.9	104:01 (50)
12	11:01	29	0.0177	25	0.0155	100.0	99.9	92.0	100.0	100.0	99.9	17:01 (100)
13	13:01	38	0.0232	33	0.0205	100.0	100.0	100.0	100.0	100.0	100.0	–
14	14:01	20	0.0122	21	0.0131	100.0	99.7	81.0	99.9	94.4	99.7	09:01 (100)
15	15:01	16	0.0098	15	0.0093	100.0	100.0	100.0	100.0	100.0	100.0	–
16	16:01	7	0.0043	6	0.0037	100.0	100.0	100.0	100.0	100.0	100.0	–
17	17:01	29	0.0177	31	0.0193	100.0	99.8	96.8	99.9	93.8	99.9	04:01 (100)
18	19:01	8	0.0049	8	0.0050	100.0	100.0	100.0	100.0	100.0	100.0	–
19	20:01	7	0.0043	6	0.0037	100.0	99.6	0.0	100.0	–	99.6	03:01 (100)
20	23:01	11	0.0067	12	0.0075	100.0	99.3	0.0	100.0	–	99.3	04:01 (92)
21	35:01	1	0.0006	–	–	–	–	–	–	–	–	–
22	36:01	2	0.0012	1	0.0006	100.0	99.9	0.0	100.0	–	99.9	104:01 (100)
23	50:01	1	0.0006	–	–	–	–	–	–	–	–	–
24	51:01	1	0.0006	1	0.0006	100.0	99.9	0.0	100.0	–	99.9	04:01 (50)
25	91:01	1	0.0006	–	–	–	–	–	–	–	–	–
26	104:01	24	0.0146	24	0.0149	100.0	99.6	91.7	99.7	84.6	99.9	03:01 (50)

¹: CR – call rate; ACC – allele accuracy.²: the most likely miscalled allele and the proportion of the most likely miscalled allele in all miscalled alleles.

Table 2: The sensitivity (SEN), specificity (SPE), positive predictive value (PPV) and negative predictive value (NPV) calculated from validation samples for each four-digit HLA allele with call threshold 0.5, when Study Data of European ancestry were divided to training and validation parts with equal sizes. The SNP markers in the intersect of Illumina platforms were used.

	Allele	Num. Train	Freq. Train	Num. Valid.	Freq. Valid.	CR ¹ (%)	ACC ¹ (%)	SEN (%)	SPE (%)	PPV (%)	NPV (%)	Miscall ² (%)
<i>HLA-A: Overall accuracy: 98.7%, Call rate: 98.8%</i>												
1	01:01	270	0.1429	271	0.1486	99.6	100.0	100.0	100.0	100.0	100.0	-
2	01:02	1	0.0005	-	-	-	-	-	-	-	-	-
3	01:25	1	0.0005	-	-	-	-	-	-	-	-	-
4	02:01	503	0.2661	533	0.2922	99.2	99.7	100.0	99.5	98.9	100.0	-
5	02:02	3	0.0016	3	0.0016	100.0	99.9	66.7	100.0	100.0	99.9	02:05 (100)
6	02:05	19	0.0101	19	0.0104	100.0	99.9	100.0	99.9	95.0	100.0	-
7	02:06	5	0.0026	6	0.0033	100.0	99.7	0.0	100.0	-	99.7	02:01 (100)
8	02:17	1	0.0005	-	-	-	-	-	-	-	-	-
9	02:20	1	0.0005	-	-	-	-	-	-	-	-	-
10	02:22	1	0.0005	-	-	-	-	-	-	-	-	-
11	02:35	1	0.0005	-	-	-	-	-	-	-	-	-
12	03:01	252	0.1333	234	0.1283	99.6	99.8	100.0	99.8	98.7	100.0	-
13	03:02	3	0.0016	2	0.0011	100.0	99.9	0.0	100.0	-	99.9	03:01 (100)
14	03:17	1	0.0005	-	-	-	-	-	-	-	-	-
15	11:01	127	0.0672	120	0.0658	99.2	100.0	100.0	100.0	100.0	100.0	-
16	11:02	1	0.0005	-	-	-	-	-	-	-	-	-
17	11:25	1	0.0005	-	-	-	-	-	-	-	-	-
18	23:01	39	0.0206	42	0.0230	100.0	100.0	100.0	100.0	100.0	100.0	-
19	24:02	170	0.0899	141	0.0773	97.9	99.7	100.0	99.7	96.5	100.0	-
20	24:03	5	0.0026	5	0.0027	100.0	99.7	0.0	100.0	-	99.7	24:02 (100)
21	24:32	1	0.0005	-	-	-	-	-	-	-	-	-
22	25:01	55	0.0291	50	0.0274	98.0	99.6	91.8	99.8	91.8	99.8	26:01 (100)
23	26:01	74	0.0392	70	0.0384	98.6	99.4	92.8	99.7	92.8	99.7	25:01 (80)
24	26:08	1	0.0005	-	-	-	-	-	-	-	-	-
25	29:01	10	0.0053	10	0.0055	80.0	100.0	100.0	100.0	100.0	100.0	-
26	29:02	63	0.0333	57	0.0312	98.2	100.0	100.0	100.0	100.0	100.0	-
27	29:10	1	0.0005	-	-	-	-	-	-	-	-	-
28	30:01	30	0.0159	27	0.0148	100.0	100.0	100.0	100.0	100.0	100.0	-
29	30:02	19	0.0101	17	0.0093	100.0	100.0	100.0	100.0	100.0	100.0	-
30	30:04	2	0.0011	1	0.0005	0.0	-	-	-	-	-	-
31	31:01	46	0.0243	45	0.0247	93.3	100.0	100.0	100.0	100.0	100.0	-
32	31:08	1	0.0005	-	-	-	-	-	-	-	-	-
33	32:01	69	0.0365	66	0.0362	100.0	100.0	100.0	100.0	100.0	100.0	-
34	33:01	13	0.0069	12	0.0066	100.0	100.0	100.0	100.0	100.0	100.0	-
35	33:03	9	0.0048	9	0.0049	100.0	100.0	100.0	100.0	100.0	100.0	-
36	33:05	1	0.0005	-	-	-	-	-	-	-	-	-
37	34:02	2	0.0011	1	0.0005	100.0	100.0	100.0	100.0	100.0	100.0	-
38	36:01	1	0.0005	-	-	-	-	-	-	-	-	-
39	66:01	12	0.0063	11	0.0060	100.0	99.9	90.9	100.0	100.0	99.9	26:01 (100)
40	66:02	1	0.0005	-	-	-	-	-	-	-	-	-

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Table 2 – continued from previous page

	Allele	Num. Train	Freq. Train	Num. Valid.	Freq. Valid.	CR ¹ (%)	ACC ¹ (%)	SEN (%)	SPE (%)	PPV (%)	NPV (%)	Miscall ² (%)
41	68:01	54	0.0286	58	0.0318	96.6	100.0	100.0	100.0	100.0	100.0	–
42	68:02	13	0.0069	11	0.0060	100.0	100.0	100.0	100.0	100.0	100.0	–
43	68:24	1	0.0005	–	–	–	–	–	–	–	–	–
44	68:35	1	0.0005	–	–	–	–	–	–	–	–	–
45	69:01	2	0.0011	2	0.0011	50.0	100.0	100.0	100.0	100.0	100.0	–
46	74:01	1	0.0005	–	–	–	–	–	–	–	–	–
47	74:03	1	0.0005	1	0.0005	100.0	100.0	100.0	100.0	100.0	100.0	–
48	80:01	1	0.0005	–	–	–	–	–	–	–	–	–
<i>HLA-B: Overall accuracy: 97.8%, Call rate: 94.2%</i>												
1	07:02	319	0.1214	291	0.1157	97.3	99.9	100.0	99.9	99.3	100.0	–
2	07:04	1	0.0004	1	0.0004	100.0	100.0	0.0	100.0	–	100.0	07:02 (100)
3	07:05	8	0.0030	7	0.0028	100.0	100.0	100.0	100.0	100.0	100.0	–
4	07:10	1	0.0004	–	–	–	–	–	–	–	–	–
5	07:17	1	0.0004	–	–	–	–	–	–	–	–	–
6	08:01	239	0.0909	262	0.1041	97.3	100.0	100.0	100.0	100.0	100.0	–
7	13:02	87	0.0331	85	0.0338	94.1	100.0	100.0	100.0	100.0	100.0	–
8	14:01	17	0.0065	17	0.0068	82.4	100.0	100.0	100.0	100.0	100.0	–
9	14:02	61	0.0232	60	0.0238	96.7	100.0	100.0	100.0	100.0	100.0	–
10	15:01	147	0.0559	160	0.0636	98.1	99.8	100.0	99.8	97.5	100.0	–
11	15:02	1	0.0004	1	0.0004	0.0	–	–	–	–	–	–
12	15:03	2	0.0008	2	0.0008	0.0	–	–	–	–	–	–
13	15:04	1	0.0004	–	–	–	–	–	–	–	–	–
14	15:07	1	0.0004	–	–	–	–	–	–	–	–	–
15	15:08	1	0.0004	1	0.0004	100.0	100.0	100.0	100.0	100.0	100.0	–
16	15:09	1	0.0004	–	–	–	–	–	–	–	–	–
17	15:10	2	0.0008	2	0.0008	100.0	99.9	0.0	100.0	–	99.9	15:01 (100)
18	15:16	2	0.0008	2	0.0008	0.0	–	–	–	–	–	–
19	15:17	10	0.0038	10	0.0040	100.0	100.0	100.0	100.0	100.0	100.0	–
20	15:18	5	0.0019	4	0.0016	100.0	100.0	75.0	100.0	100.0	100.0	15:01 (100)
21	18:01	140	0.0533	152	0.0604	93.4	99.6	99.3	99.6	94.6	100.0	38:01 (100)
22	18:02	1	0.0004	–	–	–	–	–	–	–	–	–
23	18:03	6	0.0023	6	0.0024	100.0	99.7	0.0	100.0	–	99.8	18:01 (100)
24	18:11	1	0.0004	–	–	–	–	–	–	–	–	–
25	18:18	1	0.0004	–	–	–	–	–	–	–	–	–
26	27:02	24	0.0091	23	0.0091	95.7	99.7	72.7	100.0	100.0	99.8	27:05 (83)
27	27:03	1	0.0004	–	–	–	–	–	–	–	–	–
28	27:05	98	0.0373	95	0.0378	96.8	99.8	100.0	99.8	94.8	100.0	–
29	27:07	1	0.0004	–	–	–	–	–	–	–	–	–
30	27:09	1	0.0004	–	–	–	–	–	–	–	–	–
31	35:01	149	0.0567	125	0.0497	88.0	99.4	95.5	99.6	91.3	99.8	35:02 (60)
32	35:02	24	0.0091	24	0.0095	83.3	99.9	100.0	99.9	87.0	100.0	–
33	35:03	54	0.0205	61	0.0242	91.8	99.6	82.1	100.0	100.0	99.6	35:01 (80)
34	35:08	19	0.0072	18	0.0072	55.6	99.9	90.0	99.9	81.8	100.0	35:01 (100)
35	35:09	1	0.0004	–	–	–	–	–	–	–	–	–
36	35:17	1	0.0004	1	0.0004	0.0	–	–	–	–	–	–
37	35:41	1	0.0004	–	–	–	–	–	–	–	–	–

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Table 2 – continued from previous page

	Allele	Num. Train	Freq. Train	Num. Valid.	Freq. Valid.	CR ¹ (%)	ACC ¹ (%)	SEN (%)	SPE (%)	PPV (%)	NPV (%)	Miscall ² (%)
38	35:55	1	0.0004	–	–	–	–	–	–	–	–	–
39	37:01	28	0.0107	26	0.0103	100.0	100.0	100.0	100.0	100.0	100.0	–
40	38:01	70	0.0266	74	0.0294	82.4	100.0	100.0	100.0	98.4	100.0	–
41	39:01	38	0.0145	35	0.0139	80.0	99.9	89.3	100.0	100.0	99.9	18:01 (67)
42	39:06	12	0.0046	11	0.0044	63.6	100.0	100.0	100.0	100.0	100.0	–
43	39:10	1	0.0004	–	–	–	–	–	–	–	–	–
44	39:24	2	0.0008	1	0.0004	100.0	100.0	100.0	100.0	100.0	100.0	–
45	39:29	1	0.0004	–	–	–	–	–	–	–	–	–
46	40:01	105	0.0400	98	0.0390	98.0	100.0	100.0	100.0	100.0	100.0	–
47	40:02	42	0.0160	47	0.0187	87.2	100.0	100.0	100.0	100.0	100.0	–
48	40:06	3	0.0011	3	0.0012	66.7	100.0	100.0	100.0	100.0	100.0	–
49	40:10	1	0.0004	–	–	–	–	–	–	–	–	–
50	40:27	1	0.0004	–	–	–	–	–	–	–	–	–
51	40:32	1	0.0004	–	–	–	–	–	–	–	–	–
52	41:01	12	0.0046	11	0.0044	90.9	100.0	100.0	100.0	100.0	100.0	–
53	41:02	17	0.0065	15	0.0060	93.3	100.0	100.0	100.0	100.0	100.0	–
54	42:01	1	0.0004	–	–	–	–	–	–	–	–	–
55	42:02	1	0.0004	–	–	–	–	–	–	–	–	–
56	44:02	226	0.0860	212	0.0843	99.1	99.9	99.0	100.0	99.5	99.9	44:03 (50)
57	44:03	126	0.0479	126	0.0501	96.8	99.9	100.0	99.9	98.4	100.0	–
58	44:04	1	0.0004	1	0.0004	0.0	–	–	–	–	–	–
59	44:05	16	0.0061	13	0.0052	84.6	99.9	100.0	99.9	84.6	100.0	–
60	44:06	1	0.0004	–	–	–	–	–	–	–	–	–
61	44:08	1	0.0004	–	–	–	–	–	–	–	–	–
62	44:27	1	0.0004	–	–	–	–	–	–	–	–	–
63	45:01	13	0.0049	12	0.0048	83.3	100.0	100.0	100.0	100.0	100.0	–
64	46:01	1	0.0004	–	–	–	–	–	–	–	–	–
65	47:01	7	0.0027	7	0.0028	100.0	100.0	100.0	100.0	100.0	100.0	–
66	47:02	1	0.0004	–	–	–	–	–	–	–	–	–
67	48:01	3	0.0011	2	0.0008	100.0	100.0	100.0	100.0	100.0	100.0	–
68	49:01	44	0.0167	44	0.0175	95.5	99.9	95.2	100.0	100.0	99.9	44:03 (50)
69	50:01	37	0.0141	35	0.0139	91.4	100.0	100.0	100.0	97.0	100.0	–
70	50:02	1	0.0004	–	–	–	–	–	–	–	–	–
71	51:01	154	0.0586	122	0.0485	97.5	99.7	99.2	99.7	95.2	100.0	44:05 (100)
72	51:05	2	0.0008	1	0.0004	100.0	100.0	0.0	100.0	–	100.0	35:08 (100)
73	51:07	3	0.0011	2	0.0008	100.0	99.9	0.0	100.0	–	99.9	51:01 (100)
74	51:08	2	0.0008	2	0.0008	50.0	100.0	0.0	100.0	–	100.0	51:01 (100)
75	51:09	1	0.0004	–	–	–	–	–	–	–	–	–
76	52:01	34	0.0129	31	0.0123	87.1	100.0	100.0	100.0	100.0	100.0	–
77	53:01	7	0.0027	6	0.0024	100.0	100.0	83.3	100.0	100.0	100.0	35:01 (100)
78	54:01	2	0.0008	1	0.0004	0.0	–	–	–	–	–	–
79	55:01	42	0.0160	44	0.0175	95.5	99.8	92.9	100.0	97.5	99.9	56:01 (100)
80	55:02	2	0.0008	1	0.0004	100.0	100.0	0.0	100.0	–	100.0	56:01 (100)
81	55:05	1	0.0004	–	–	–	–	–	–	–	–	–
82	56:01	25	0.0095	21	0.0083	95.2	99.8	95.0	99.8	82.6	100.0	55:01 (100)
83	57:01	76	0.0289	77	0.0306	97.4	100.0	100.0	100.0	100.0	100.0	–

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Table 2 – continued from previous page

	Allele	Num. Train	Freq. Train	Num. Valid.	Freq. Valid.	CR ¹ (%)	ACC ¹ (%)	SEN (%)	SPE (%)	PPV (%)	NPV (%)	Miscall ² (%)
84	57:03	1	0.0004	–	–	–	–	–	–	–	–	–
85	58:01	25	0.0095	22	0.0087	95.5	100.0	100.0	100.0	100.0	100.0	–
86	70:20	1	0.0004	1	0.0004	100.0	100.0	0.0	100.0	–	100.0	07:02 (100)
87	73:01	3	0.0011	2	0.0008	100.0	100.0	100.0	100.0	100.0	100.0	–
88	81:01	1	0.0004	–	–	–	–	–	–	–	–	–
<i>HLA-C: Overall accuracy: 99.2%, Call rate: 98.0%</i>												
1	01:02	85	0.0450	72	0.0390	98.6	100.0	100.0	100.0	100.0	100.0	–
2	02:02	115	0.0609	93	0.0504	100.0	100.0	100.0	100.0	100.0	100.0	–
3	02:10	1	0.0005	1	0.0005	100.0	100.0	100.0	100.0	100.0	100.0	–
4	03:02	4	0.0021	4	0.0022	100.0	100.0	100.0	100.0	100.0	100.0	–
5	03:03	90	0.0477	92	0.0499	91.3	99.7	97.6	99.8	95.3	99.9	03:04 (100)
6	03:04	113	0.0599	106	0.0575	97.2	99.7	96.1	99.9	98.0	99.8	03:03 (100)
7	03:05	1	0.0005	1	0.0005	0.0	–	–	–	–	–	–
8	03:06	1	0.0005	–	–	–	–	–	–	–	–	–
9	03:10	1	0.0005	–	–	–	–	–	–	–	–	–
10	04:01	221	0.1171	206	0.1117	99.5	100.0	100.0	100.0	100.0	100.0	–
11	04:03	1	0.0005	–	–	–	–	–	–	–	–	–
12	04:09	1	0.0005	–	–	–	–	–	–	–	–	–
13	05:01	143	0.0757	157	0.0851	99.4	99.9	99.4	99.9	99.4	99.9	08:02 (100)
14	06:02	176	0.0932	174	0.0944	99.4	99.9	100.0	99.9	99.4	100.0	–
15	07:01	278	0.1472	273	0.1480	97.8	100.0	100.0	100.0	100.0	100.0	–
16	07:02	228	0.1208	257	0.1394	99.2	100.0	100.0	100.0	100.0	100.0	–
17	07:04	38	0.0201	37	0.0201	100.0	100.0	100.0	100.0	100.0	100.0	–
18	08:01	2	0.0011	1	0.0005	0.0	–	–	–	–	–	–
19	08:02	48	0.0254	49	0.0266	98.0	99.9	97.9	99.9	97.9	99.9	05:01 (100)
20	08:03	2	0.0011	1	0.0005	100.0	100.0	100.0	100.0	100.0	100.0	–
21	12:02	26	0.0138	24	0.0130	95.8	100.0	100.0	100.0	100.0	100.0	–
22	12:03	134	0.0710	128	0.0694	99.2	99.9	99.2	100.0	100.0	99.9	06:02 (100)
23	12:05	1	0.0005	–	–	–	–	–	–	–	–	–
24	12:13	1	0.0005	–	–	–	–	–	–	–	–	–
25	14:02	21	0.0111	21	0.0114	100.0	100.0	100.0	100.0	100.0	100.0	–
26	14:03	1	0.0005	1	0.0005	0.0	–	–	–	–	–	–
27	14:04	1	0.0005	–	–	–	–	–	–	–	–	–
28	15:02	43	0.0228	45	0.0244	93.3	99.9	100.0	99.9	95.5	100.0	–
29	15:04	2	0.0011	2	0.0011	100.0	99.9	0.0	100.0	–	99.9	15:02 (100)
30	15:05	8	0.0042	8	0.0043	100.0	100.0	100.0	100.0	100.0	100.0	–
31	15:11	1	0.0005	–	–	–	–	–	–	–	–	–
32	16:01	63	0.0334	62	0.0336	96.8	99.9	100.0	99.9	98.4	100.0	–
33	16:02	6	0.0032	5	0.0027	100.0	100.0	100.0	100.0	100.0	100.0	–
34	16:04	5	0.0026	4	0.0022	75.0	99.9	66.7	100.0	100.0	99.9	16:01 (100)
35	17:01	22	0.0117	18	0.0098	94.4	99.9	100.0	99.9	89.5	100.0	–
36	17:03	3	0.0016	2	0.0011	100.0	99.9	0.0	100.0	–	99.9	17:01 (100)
37	18:01	1	0.0005	–	–	–	–	–	–	–	–	–
<i>HLA-DRB1: Overall accuracy: 94.9%, Call rate: 90.1%</i>												
1	01:01	198	0.0802	208	0.0865	97.6	99.4	99.5	99.4	94.4	100.0	01:02 (100)
2	01:02	33	0.0134	35	0.0146	97.1	100.0	100.0	100.0	97.1	100.0	–

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Table 2 – continued from previous page

	Allele	Num. Train	Freq. Train	Num. Valid.	Freq. Valid.	CR ¹ (%)	ACC ¹ (%)	SEN (%)	SPE (%)	PPV (%)	NPV (%)	Miscall ² (%)
3	01:03	18	0.0073	18	0.0075	83.3	99.4	20.0	100.0	100.0	99.5	01:01 (100)
4	03:01	277	0.1122	277	0.1152	94.9	99.9	99.6	99.9	99.6	100.0	15:01 (100)
5	03:02	1	0.0004	–	–	–	–	–	–	–	–	–
6	04:01	179	0.0725	198	0.0824	91.9	99.2	97.3	99.3	93.2	99.8	04:07 (80)
7	04:02	29	0.0118	28	0.0116	82.1	99.9	100.0	99.9	92.0	100.0	–
8	04:03	25	0.0101	31	0.0129	64.5	99.2	15.0	100.0	100.0	99.3	04:04 (65)
9	04:04	74	0.0300	64	0.0266	85.9	99.2	94.5	99.3	78.2	99.9	04:01 (100)
10	04:05	17	0.0069	19	0.0079	57.9	100.0	90.9	100.0	100.0	100.0	04:01 (100)
11	04:06	1	0.0004	1	0.0004	0.0	–	–	–	–	–	–
12	04:07	25	0.0101	28	0.0116	71.4	99.5	70.0	99.8	77.8	99.7	04:01 (67)
13	04:08	9	0.0036	8	0.0033	12.5	100.0	0.0	100.0	–	100.0	07:01 (100)
14	04:09	1	0.0004	–	–	–	–	–	–	–	–	–
15	04:10	1	0.0004	1	0.0004	0.0	–	–	–	–	–	–
16	04:59	1	0.0004	–	–	–	–	–	–	–	–	–
17	07:01	343	0.1390	300	0.1248	94.7	99.9	99.6	99.9	99.6	100.0	04:01 (100)
18	08:01	65	0.0263	56	0.0233	98.2	100.0	100.0	100.0	99.1	100.0	–
19	08:02	4	0.0016	4	0.0017	25.0	100.0	0.0	100.0	–	100.0	04:04 (50)
20	08:03	4	0.0016	3	0.0012	66.7	100.0	100.0	100.0	100.0	100.0	–
21	08:04	5	0.0020	4	0.0017	50.0	100.0	100.0	100.0	100.0	100.0	–
22	08:10	1	0.0004	1	0.0004	0.0	–	–	–	–	–	–
23	09:01	26	0.0105	22	0.0092	90.9	100.0	100.0	100.0	100.0	100.0	–
24	10:01	16	0.0065	17	0.0071	82.4	100.0	100.0	100.0	100.0	100.0	–
25	11:01	165	0.0669	177	0.0736	75.7	97.7	99.3	97.6	73.5	100.0	12:01 (100)
26	11:02	6	0.0024	6	0.0025	50.0	100.0	66.7	100.0	100.0	100.0	11:01 (100)
27	11:03	21	0.0085	20	0.0083	75.0	99.3	0.0	100.0	–	99.4	11:01 (100)
28	11:04	110	0.0446	96	0.0399	78.1	98.7	62.7	100.0	100.0	98.8	11:01 (93)
29	11:06	1	0.0004	–	–	–	–	–	–	–	–	–
30	11:08	1	0.0004	–	–	–	–	–	–	–	–	–
31	11:12	1	0.0004	1	0.0004	100.0	100.0	0.0	100.0	–	100.0	11:01 (100)
32	11:15	1	0.0004	–	–	–	–	–	–	–	–	–
33	11:28	1	0.0004	–	–	–	–	–	–	–	–	–
34	11:39	1	0.0004	–	–	–	–	–	–	–	–	–
35	11:43	1	0.0004	–	–	–	–	–	–	–	–	–
36	12:01	35	0.0142	39	0.0162	87.2	99.9	94.1	100.0	97.0	99.9	11:01 (100)
37	12:02	2	0.0008	1	0.0004	100.0	100.0	100.0	100.0	100.0	100.0	–
38	13:01	170	0.0689	142	0.0591	95.1	99.8	98.5	99.9	98.5	99.9	13:02 (50)
39	13:02	89	0.0361	87	0.0362	90.8	100.0	100.0	100.0	98.8	100.0	–
40	13:03	30	0.0122	31	0.0129	93.5	100.0	100.0	100.0	100.0	100.0	–
41	13:05	4	0.0016	3	0.0012	100.0	99.9	0.0	100.0	–	99.9	11:01 (100)
42	13:10	1	0.0004	–	–	–	–	–	–	–	–	–
43	13:15	1	0.0004	–	–	–	–	–	–	–	–	–
44	13:17	1	0.0004	–	–	–	–	–	–	–	–	–
45	13:18	1	0.0004	–	–	–	–	–	–	–	–	–
46	14:01	68	0.0276	67	0.0279	94.0	99.8	98.4	99.8	93.9	100.0	15:01 (100)
47	14:02	1	0.0004	1	0.0004	0.0	–	–	–	–	–	–
48	14:04	3	0.0012	4	0.0017	100.0	99.8	0.0	100.0	–	99.8	14:01 (100)

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Table 2 – continued from previous page

	Allele	Num. Train	Freq. Train	Num. Valid.	Freq. Valid.	CR ¹ (%)	ACC ¹ (%)	SEN (%)	SPE (%)	PPV (%)	NPV (%)	Miscall ² (%)
49	14:06	1	0.0004	1	0.0004	0.0	–	–	–	–	–	–
50	15:01	294	0.1191	300	0.1248	96.0	99.8	99.7	99.8	99.0	100.0	03:01 (100)
51	15:02	28	0.0113	28	0.0116	96.4	100.0	100.0	100.0	100.0	100.0	–
52	15:03	1	0.0004	1	0.0004	0.0	–	–	–	–	–	–
53	16:01	68	0.0276	68	0.0283	92.6	99.9	100.0	99.9	96.9	100.0	–
54	16:02	7	0.0028	7	0.0029	85.7	100.0	83.3	100.0	100.0	100.0	16:01 (100)
55	16:05	1	0.0004	1	0.0004	100.0	100.0	0.0	100.0	–	100.0	16:01 (100)
<i>HLA-DQA1: Overall accuracy: 97.8%, Call rate: 97.9%</i>												
1	01:01	202	0.1156	185	0.1068	99.5	99.7	97.3	100.0	100.0	99.7	01:04 (80)
2	01:02	351	0.2008	355	0.2050	98.0	99.8	99.7	99.9	99.4	99.9	01:03 (100)
3	01:03	147	0.0841	138	0.0797	95.7	99.8	98.5	99.9	99.2	99.9	01:02 (100)
4	01:04	30	0.0172	29	0.0167	96.6	99.7	100.0	99.7	84.8	100.0	–
5	01:05	6	0.0034	6	0.0035	66.7	99.9	100.0	99.9	88.9	100.0	–
6	01:06	1	0.0006	–	–	–	–	–	–	–	–	–
7	02:01	237	0.1356	263	0.1518	98.9	100.0	100.0	100.0	100.0	100.0	–
8	03:01	164	0.0938	159	0.0918	98.1	98.6	94.2	99.1	91.3	99.4	03:03 (89)
9	03:02	14	0.0080	14	0.0081	85.7	100.0	100.0	100.0	100.0	100.0	–
10	03:03	108	0.0618	108	0.0624	98.1	98.7	86.8	99.5	91.5	99.1	03:01 (100)
11	04:01	54	0.0309	52	0.0300	94.2	99.8	100.0	99.8	94.2	100.0	–
12	04:02	2	0.0011	1	0.0006	100.0	99.9	0.0	100.0	–	99.9	04:01 (100)
13	05:01	194	0.1110	183	0.1057	100.0	100.0	100.0	100.0	100.0	100.0	–
14	05:03	2	0.0011	2	0.0012	100.0	99.9	0.0	100.0	–	99.9	05:05 (100)
15	05:05	227	0.1299	228	0.1316	98.7	99.8	100.0	99.7	98.3	100.0	–
16	05:09	4	0.0023	4	0.0023	50.0	99.9	0.0	100.0	–	99.9	05:05 (100)
17	06:01	5	0.0029	5	0.0029	80.0	99.9	50.0	100.0	100.0	99.9	04:01 (100)
<i>HLA-DQB1 Overall accuracy: 99.2%, Call rate: 97.9%</i>												
1	02:01	220	0.1136	204	0.1067	99.0	100.0	100.0	100.0	100.0	100.0	–
2	02:02	200	0.1033	200	0.1046	98.0	99.9	100.0	99.9	99.5	100.0	–
3	02:04	1	0.0005	–	–	–	–	–	–	–	–	–
4	03:01	393	0.2030	384	0.2008	98.7	99.7	99.7	99.7	98.8	99.9	02:02 (100)
5	03:02	187	0.0966	187	0.0978	98.9	99.9	100.0	99.9	98.9	100.0	–
6	03:03	84	0.0434	83	0.0434	94.0	99.9	98.7	100.0	100.0	99.9	03:01 (100)
7	03:04	5	0.0026	5	0.0026	60.0	99.9	33.3	100.0	100.0	99.9	03:01 (100)
8	03:05	2	0.0010	2	0.0010	100.0	99.9	0.0	100.0	–	99.9	03:02 (100)
9	03:19	2	0.0010	2	0.0010	100.0	99.9	50.0	100.0	100.0	99.9	03:01 (100)
10	04:02	61	0.0315	60	0.0314	98.3	100.0	100.0	100.0	100.0	100.0	–
11	05:01	220	0.1136	213	0.1114	98.6	99.9	99.0	100.0	100.0	99.9	05:03 (100)
12	05:02	67	0.0346	65	0.0340	98.5	100.0	100.0	100.0	100.0	100.0	–
13	05:03	55	0.0284	56	0.0293	100.0	99.9	100.0	99.9	96.6	100.0	–
14	05:04	1	0.0005	1	0.0005	0.0	–	–	–	–	–	–
15	06:01	24	0.0124	22	0.0115	95.5	100.0	100.0	100.0	100.0	100.0	–
16	06:02	234	0.1209	228	0.1192	97.8	99.7	99.6	99.8	98.4	99.9	06:04 (100)
17	06:03	112	0.0579	132	0.0690	97.0	99.8	97.7	100.0	100.0	99.8	06:02 (100)
18	06:04	52	0.0269	55	0.0288	94.5	99.8	98.1	99.9	96.2	99.9	03:01 (50)
19	06:09	14	0.0072	13	0.0068	92.3	99.9	91.7	100.0	100.0	99.9	06:04 (100)
20	06:14	1	0.0005	–	–	–	–	–	–	–	–	–

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Table 2 – continued from previous page

	Allele	Num. Train	Freq. Train	Num. Valid.	Freq. Valid.	CR ¹ (%)	ACC ¹ (%)	SEN (%)	SPE (%)	PPV (%)	NPV (%)	Miscall ² (%)
21	06:16	1	0.0005	–	–	–	–	–	–	–	–	–
<i>HLA-DPB1: Overall accuracy: 94.8%, Call rate: 96.0%</i>												
1	01:01	74	0.0451	77	0.0479	96.1	100.0	100.0	100.0	100.0	100.0	–
2	02:01	201	0.1226	233	0.1449	96.6	98.0	90.7	99.2	95.3	98.5	04:01 (95)
3	02:02	7	0.0043	6	0.0037	100.0	99.6	0.0	100.0	–	99.6	02:01 (100)
4	03:01	133	0.0811	131	0.0815	93.9	98.1	99.2	98.0	80.8	99.9	104:01 (100)
5	04:01	713	0.4348	678	0.4216	98.5	97.8	99.7	96.3	95.3	99.8	02:01 (100)
6	04:02	212	0.1293	201	0.1250	97.0	99.5	100.0	99.5	96.8	100.0	–
7	05:01	33	0.0201	32	0.0199	100.0	100.0	100.0	100.0	100.0	100.0	–
8	06:01	29	0.0177	24	0.0149	100.0	98.4	0.0	100.0	–	98.5	03:01 (100)
9	06:02	9	0.0055	9	0.0056	88.9	99.5	0.0	100.0	–	99.5	04:02 (62)
10	09:01	12	0.0073	10	0.0062	50.0	99.9	100.0	99.9	83.3	100.0	–
11	10:01	22	0.0134	24	0.0149	91.7	99.9	95.5	100.0	100.0	99.9	09:01 (100)
12	11:01	29	0.0177	25	0.0155	88.0	100.0	100.0	100.0	100.0	100.0	–
13	13:01	38	0.0232	33	0.0205	87.9	100.0	100.0	100.0	100.0	100.0	–
14	14:01	20	0.0122	21	0.0131	66.7	100.0	100.0	100.0	100.0	100.0	–
15	15:01	16	0.0098	15	0.0093	100.0	100.0	100.0	100.0	100.0	100.0	–
16	16:01	7	0.0043	6	0.0037	100.0	100.0	100.0	100.0	100.0	100.0	–
17	17:01	29	0.0177	31	0.0193	93.5	100.0	100.0	100.0	100.0	100.0	–
18	19:01	8	0.0049	8	0.0050	100.0	100.0	100.0	100.0	100.0	100.0	–
19	20:01	7	0.0043	6	0.0037	83.3	99.7	0.0	100.0	–	99.7	03:01 (100)
20	23:01	11	0.0067	12	0.0075	100.0	99.2	0.0	100.0	–	99.3	04:01 (92)
21	35:01	1	0.0006	–	–	–	–	–	–	–	–	–
22	36:01	2	0.0012	1	0.0006	0.0	–	–	–	–	–	–
23	50:01	1	0.0006	–	–	–	–	–	–	–	–	–
24	51:01	1	0.0006	1	0.0006	100.0	99.9	0.0	100.0	–	99.9	04:01 (50)
25	91:01	1	0.0006	–	–	–	–	–	–	–	–	–
26	104:01	24	0.0146	24	0.0149	87.5	99.9	100.0	99.9	91.3	100.0	–

¹: CR – call rate; ACC – allele accuracy.

²: the most likely miscalled allele and the proportion of the most likely miscalled allele in all miscalled alleles.