

Table S8. Allocation of recombinational SNPs to lineages by virtual outgroup analysis^a

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ExPEC genome site details												Outgroup Strains Details ^j																						
UTI89 ^b	UTI89 site ^c	APEC 01 site ^c	APEC 01 site ^c	S88 ^b	S88 site ^c	type ^d	Event Lineage ^e	Recombinant segment	Inferred ancestral base ^g	Outgroup Analysis ^f						Outgroup Strains Details ^j																		
										Support level ^f	CFT073	ED1a	536	E2348/69	SMS 3-5	IA139	UMN026	K-12	ATCC 8739	HS	D1 Sdt197	CB9615	Sakai	EDL933	IA11	E24377A	SE11	SS Ss046	F2a 301	F5 8401	B4 Sb227	B18 BS512		
c	1277953	g	1215248	g	1218861	s	UTI89/AS	rec5	g	UTI89	++	g	g	c	g	t	g	g	g	c	g	c	g	g	g	c	t	t	t	t	c			
g	1277955	a	1215250	a	1218863	ns	UTI89/AS	rec5	a	UTI89	++	a	a	g	a	a	a	a	a	a	a	a	a	a	a	g	a	a	c	g	c	c	c	c
g	1277956	c	1215251	c	1218864	ns	UTI89/AS	rec5	c	UTI89	++	c	c	c	g	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c		
t	1277986	g	1215281	g	1218894	s	UTI89/AS	rec5	g	UTI89	++	g	g	g	g	g	g	g	g	g	g	g	g	g	g	g	g	g	g	g	g			
c	1277998	t	1215293	t	1218906	s	UTI89/AS	rec5	c	AS	++	t	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c			
g	1278046	a	1215341	a	1218954	s	UTI89/AS	rec5	a	UTI89	++	a	g	a	g	g	g	g	g	g	g	g	g	g	g	g	g	g	g	g	g			
t	1278118	c	1215413	c	1219026	s	UTI89/AS	rec5	t	UTI89	+++	c	c	t	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c				
t	1278166	c	1215461	c	1219074	s	UTI89/AS	rec5	c	UTI89	++++	c	g	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c					
a	1278337	g	1215632	g	1219245	s	UTI89/AS	rec5	g	UTI89	++	g	a	g	a	a	a	a	a	g	g	a	a	a	a	a	a	a	a					
g	1278346	a	1215641	a	1219254	s	UTI89/AS	rec5	a	UTI89	++	a	a	a	a	a	a	a	a	g	g	a	a	a	a	a	a	a	a					
t	1278361	c	1215656	c	1219269	s	UTI89/AS	rec5	c	UTI89	++	c	t	c	c	c	c	c	t	t	t	c	c	c	c	c	c	c	c					
t	1278376	a	1215671	a	1219284	s	UTI89/AS	rec5	a	UTI89	++	a	t	a	c	g	a	a	a	t	t	a	a	t	t	a	a	a	a	g				
c	1278418	t	1215713	t	1219326	s	UTI89/AS	rec5	t	UTI89	++	t	t	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c					
c	1278433	g	1215728	g	1219341	s	UTI89/AS	rec5	g	UTI89	++	g	c	g	c	g	c	c	c	c	c	c	c	c	c	c	c	c	c					
t	1278436	g	1215731	g	1219344	s	UTI89/AS	rec5	g	UTI89	++	g	g	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t						
c	1278444	t	1215739	t	1219352	ns	UTI89/AS	rec5	t	UTI89	++	t	c	c	t	c	c	c	c	c	c	c	c	c	c	c	c	c						
t	1278448	c	1215743	c	1219356	s	UTI89/AS	rec5	c	UTI89	++	c	c	c	t	c	t	c	t	c	t	c	t	t	t	t	t	c						
t	1278451	g	1215746	g	1219359	s	UTI89/AS	rec5	g	UTI89	++	g	a	g	t	g	t	g	t	g	g	g	g	g	g	g	g	g						
g	1278471	a	1215766	a	1219379	ns	UTI89/AS	rec5	g	AS	++++	a	g	g	g	g	g	g	g	g	g	g	g	g	g	g	g	g						
c	1278478	g	1215773	g	1219386	s	UTI89/AS	rec5	g	UTI89	++	g	c	g	c	g	c	c	c	c	c	c	c	c	c	c	c	c						
g	1278484	a	1215779	a	1219392	s	UTI89/AS	rec5	a	UTI89	++	a	c	a	g	g	g	g	g	g	g	g	g	g	g	g	g	g						
t	1278523	c	1215818	c	1219431	s	UTI89/AS	rec5	c	UTI89	++	c	t	c	t	t	t	t	t	t	t	t	t	t	t	t	t	t						
t	1278543	c	1215838	c	1219451	ns	UTI89/AS	rec5	t	AS	++++	c	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t						
t	1278550	a	1215845	a	1219458	s	UTI89/AS	rec5	a	UTI89	++	a	-	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a						
t	1278556	g	1215851	g	1219464	s	UTI89/AS	rec5	g	UTI89	+	g	t	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c						
g	1278604	a	1215899	a	1219512	s	UTI89/AS	rec5	a	UTI89	++	a	a	g	a	a	g	a	a	g	a	a	g	g	g	g	g	g						
c	1278659	t	1215954	t	1219567	s	UTI89/AS	rec5	c	AS	++	t	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c					
g	1278664	a	1215959	a	1219572	s	UTI89/AS	rec5	g	AS	++++	a	g	g	g	g	g	g	g	g	g	g	g	g	g	g	g	g	g					
c	1278668	t	1215963	t	1219576	s	UTI89/AS	rec5	c	AS	++	t	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c					
c	1278691	t	1215986	t	1219599	s	UTI89/AS	rec5	t	UTI89	++	t	t	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c					
c	1278733	t	1216028	t	1219641	s	UTI89/AS	rec5	t	UTI89	++	t	g	c	c	t	c	c	c	c	c	c	c	c	c	c	c	c						
g	1278754	a	1216049	a	1219662	s	UTI89/AS	rec5	a	UTI89	++	a	a	g	a	a	a	a	a	a	a	a	a	a	a	a	a	a						
a	1278760	g	1216055	g	1219668	s	UTI89/AS	rec5	a	AS	++	g	a	a	g	a	g	a	g	a	g	a	g	a	g	a	g	a						
t	1278793	c	1216088	c	1219701	s	UTI89/AS	rec5	t	UTI89	++	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c						
a	1278832	g	1216127	g	1219740	s	UTI89/AS	rec5	a	AS	++	g	a	t	g	g	g	g	g	g	g	g	g	g	g	g	g	g						
c	1278847	t	1216142	t	1219755	s	UTI89/AS	rec5	t	UTI89	++	t	g	t	t	c	t	c	t	c	t	c	t	c	c	c	c	c						
g	1412697	c	1350611	c	1354717	s	UTI89/AS	rec6	g	AS	+	g	c	g	c	g	c	g	g	g	g	g	g	g	g	g	g	g	c					
g	1412698	t	1350612	t	1354718	ns	UTI89/AS	rec6	g	AS	+	g	t	g	t	g	t	g	g	g	g	g	g	g	g	g	g	g	t					
g	1412751	t	1350665	t	1354771	s	UTI89/AS	rec6	t	UTI89	+	g	t	g	t	g	t	g	g	g	g	g	g	g	g	g	g	g						
t	1412787	c	1350701	c	1354807	s	UTI89/AS	rec6	c	UTI89	+	t	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c						
t	1412799	c	1350713	c	1354819	s	UTI89/AS	rec6	c	UTI89	+	t	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c						
c	1412838	t	1350752	t	1354858	s	UTI89/AS	rec6	c	AS	+	c	t	c	t	c	t	c	c	c	c	c	c	c	c	c	c	c						
a	1412883	g	1350797	g	1354903	s	UTI89/AS	rec6	a	AS	+	a	g	a	t	g	g	g	g	g	g	g	g	g	g	g	g	g						
c	1412892	t	1350806	t	1354912	s	UTI89/AS	rec6	t	UTI89	+	c	t	c	t	c	t	c	c	c	c	c	c	c	c	c	c							
g	1412922	a	1350836	a	1354942	s	UTI89/AS	rec6	g	AS	+	g	a	g	g	a	g	a	a	a	a	a	a	a	a	a	a							
c	1412931	a	1350845	a	1354951	s	UTI89/AS	rec6	c	AS	+	c	g	a	c	g	a	c	a	a	a	a	a	a	a	a	a							
c	1412946	t	1350860	t	1354966	s	UTI89/AS	rec6	c	AS	+	c	t	c	t	c	t	c	c	c	c	c	c	c	c	c	c							
a	1412964	g	1350878	g	1354984	s	UTI89/AS	rec6	g	UTI89	++	a	g	g	t	g	g	g	g	g	g	g	g	g	g	g	g							
c	1412976	t	1350890	t	1354996	s	UTI89/AS	rec6	t	UTI89	++	c	t	t	c	t	t	c	t	c	c	c	c	c	c	c	c							
a	1413054	g	1350968	g	1355074	s	UTI89/AS	rec6	g	UTI89	+	a	g	g	t	g																		

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UTI89 ^b	UTI89 site ^c	APEC 01 site ^c		APEC 01 site ^c		type ^d	Event Lineage ^e	Recombinant segment	Inferred ancestral base ^g	Outgroup Analysis ^h												SS Ss046	F2a 301	F5 8401	B4 Sb227	B18 BS512		
		S88 ^b	S88 ^b	S88 ^b	S88 ^b					CFT073	ED1a	536	E2348/69	SMS 3-5	IA139	UMN026	K-12	ATCC 8739	HS	D1 Sdt97	CB9615	Sakai	EDL933	IA11	E24377A	SE11		
g	1416163	g	1354077	t	1358183	s	S88	rec8	g	S88	+	t	g	g	g	t				t	g	g	g	t	t	t	t	g
c	1416169	c	1354083	t	1358189	s	S88	rec8	t	2	-	t	c	t	c	c				t	t	t	t	t	t	t	t	c
c	1416217	c	1354131	t	1358237	s	S88	rec8	t	2	-	t	c	t	c	c				t	t	t	t	t	t	t	t	c
a	1416281	a	1354195	g	1358301	ns	S88	rec8	g	2	-	g	g	g	a	a				g	g	g	g	g	g	g	g	a
c	1416283	c	1354197	t	1358303	ns	S88	rec8	t	2	-	t	t	t	c	c				t	t	t	t	t	t	t	t	c
t	1416301	t	1354215	g	1358321	s	S88	rec8	g	2	-	g	g	g	t	g				g	g	g	g	g	g	g	g	t
c	1416304	c	1354218	t	1358324	s	S88	rec8	t	2	-	t	t	t	c	c				t	t	t	t	t	t	t	t	c
c	1416310	c	1354224	t	1358330	s	S88	rec8	t	2	-	t	c	t	c	t				t	c	c	t	t	t	t	t	c
a	1416331	a	1354245	g	1358351	s	S88	rec8	a	S88	+	g	a	a	a	g				g	a	a	g	g	g	g	g	a
g	1416406	g	1354320	a	1358426	s	S88	rec8	g	S88	+	a	g	g	g	g				a	g	g	g	g	g	g	g	g
g	1416407	g	1354321	t	1358427	ns	S88	rec8	g	S88	+	t	g	g	g	g				t	g	g	g	g	g	g	g	g
g	1416412	g	1354326	a	1358432	s	S88	rec8	g	S88	+	a	g	g	g	g				a	g	g	g	g	g	g	g	g
c	1416418	c	1354332	t	1358438	s	S88	rec8	c	S88	+	t	c	c	c	c				c	c	c	c	c	c	c	c	
c	1416421	c	1354335	t	1358441	s	S88	rec8	c	S88	+	t	c	c	c	c				t	c	c	c	c	c	c	c	
c	1416427	c	1354341	t	1358447	s	S88	rec8	c	S88	+	t	c	c	c	c				t	t	t	t	t	t	t	t	
t	1416433	t	1354347	c	1358453	s	S88	rec8	t	S88	+	c	t	t	t	t				c	t	t	t	t	t	t	t	
c	1416478	c	1354392	g	1358498	s	S88	rec8	c	S88	+	g	c	c	c	c				g	c	c	c	c	c	c	c	
g	1416508	g	1354422	a	1358528	s	S88	rec8	g	S88	+	a	g	g	g	g				a	g	g	g	g	g	g	g	
c	1416514	c	1354428	t	1358534	s	S88	rec8	c	S88	+	t	c	c	c	t				c	c	c	c	c	c	c		
c	1416518	c	1354432	t	1358538	s	S88	rec8	c	S88	+	t	c	c	c	t				c	c	c	c	c	c	c		
g	1416544	g	1354458	a	1358564	s	S88	rec8	a	2	-	a	a	a	a	g				a	g	a	a	g	a	g		
t	1416547	g	1354461	c	1358567	ns	S88	rec8	c	2	-	c	c	c	c	t				c	g	g	g	g	g	g		
t	1417598	t	1355512	c	1359609	s	S88	rec8	c	2	-	c	t	c	t	c				c	t	t	t	t	t	t		
c	1417604	c	1355518	t	1359615	s	S88	rec8	t	2	-	t	c	t	t	t				t	g	g	g	g	g	g	g	
a	1417613	a	1355527	g	1359624	s	S88	rec8	g	2	-	g	g	g	g	g				c	c	c	c	c	c	c		
c	1417625	c	1355539	t	1359636	s	S88	rec8	t	2	-	t	c	t	t	t				t	g	g	g	g	g	g	g	
g	1417640	g	1355554	a	1359651	s	S88	rec8	c	2	-	c	a	c	c	g				c	t	t	t	t	t	t		
c	1417641	c	1355555	a	1359652	ns	S88	rec8	a	2	-	a	c	a	a	a				a	g	g	g	g	g	g	g	
t	1417644	t	1355558	a	1359655	ns	S88	rec8	a	2	-	a	t	a	c	c				a	g	g	g	g	g	g	g	
g	1427249	c	1365163	c	1369260	s	AS	rec9	g	AS	++	g	c	g	c	g				g	c	t	g	g	g	g	g	
t	1427252	c	1365166	c	1369263	s	AS	rec9	t	AS	+	t	g	c	g	t	c	c	c	t	g	g	g	g	g	g	g	
t	1427255	a	1365169	a	1369266	s	AS	rec9	t	AS	++	t	t	a	t	g	a	a	a	a	a	a	a	a	a	a		
c	1427279	t	1365193	t	1369290	s	AS	rec9	c	AS	++	c	t	c	t	g	c	c	c	c	t	t	t	t	t	t		
c	1427285	t	1365199	t	1369296	s	AS	rec9	c	AS	++	c	t	c	c	c	t	c	c	c	t	t	t	t	t	t		
c	1427312	g	1365226	g	1369323	s	AS	rec9	c	AS	++	c	c	g	c	g	c	c	c	c	c	c	c	c	c	c		
t	1427315	g	1365229	g	1369326	s	AS	rec9	t	AS	++	t	g	t	g	t	t	t	t	t	t	t	t	t	t	t		
c	1427323	t	1365237	t	1369334	ns	AS	rec9	c	AS	++	c	c	t	c	c	t	c	c	c	c	c	c	c	c	c		
c	1427324	t	1365238	t	1369335	ns	AS	rec9	c	AS	++++	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c		
t	1427327	c	1365241	c	1369338	s	AS	rec9	c	UTI89	++	t	c	c	c	c	t	c	t	c	c	t	t	t	t	t		
t	1427330	g	1365244	g	1369341	s	AS	rec9	t	AS	+	t	a	g	a	g	t	g	t	a	t	g	t	t	t	t		
c	1543324	t	1533566	c	1485336	s	APEC	rec11	c	APEC	+++	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c		
t	1543585	c	1533827	t	1485597	s	APEC	rec11	c	2	-	c	c	t	t	t	t	t	t	t	t	t	t	t	t	t		
g	1543624	t	1533866	g	1485636	s	APEC	rec11	t	2	-	t	t	t	t	t	t	t	t	t	t	t	t	t	t			
t	1543651	g	1533893	t	1485663	s	APEC	rec11	g	2	-	g	g	g	g	g	g	g	g	g	g	g	g	g	g			
c	1543657	t	1533899	t	1485669	s	APEC	rec11	c	APEC	++	c	t	c	t	c	t	t	t	t	t	t	t	t	t			
c	1543669	t	1533911	t	1485681	s	APEC	rec11	c	APEC	++	c	t	c	t	c	t	c	c	c	c	c	c	c	c			
t	1543675	c	1533917	t	1485687	s	APEC	rec11	c	2	-	t	c	c	c	c	c	c	c	c	c	c	c	c	c			
t	1543690	t	1533932	t	1485702	s	APEC	rec11	t	APEC	++	t	t	c	t	c	t	t	t	t	t	t	t	t	t			
g	1543720	a	1533962	g	1485732	s	APEC	rec11	g	APEC	++	g	g	g	g	g	g	g	g	g	g	g	g	g	g			
g	1543735	c	1533977	g	1485747	ns	APEC	rec11	c	2	-	c	c	c	c	c	c	c	c	c	c	c	c	c	c			
a	1543743	g	1533985	a	1485755	ns	APEC	rec11	a	APEC	++	a	a	a	a	a	a	a	a	a	a	a	a	a	a			
t	1543762	c	1534004	t	1485774	s	APEC	rec11	c	2	-	c	c	c	c	c	c	c	c	c	c	c	c	c	c			
g	1543778	a	1534020	g	1485790	ns	APEC	rec11	g	APEC	++	g	g	g	g	g	g	g	g	g	g	g	g	g	g			
c	1543786	t	1534028	c	1485798	s	APEC	rec11	c	APEC	++	c	c	c	c	c	c	c	c	c	c	c	c	c	c			
c	1543789	t	1534031	c	1485801	s	APEC	rec11	c	APEC	++	c	c	c	c	c	c	c	c	c	c	c	c	c	c			
g	1543801	a	1534043	g	1485813	s	APEC	rec11	a	APEC																		

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UTI89 ^b	UTI89 site ^c	APEC 01 ^b	APEC 01 site ^c	S88 ^b	S88 site ^c	type ^d	Event Lineage ^{e,f}	Recombinant segment	Inferred ancestral base ^g	Outgroup Analysis ^h	Support level ⁱ	CFT073	ED1a	536	E2348/69	SMS 3-5	IA139	UMN026	K-12	ATCC 8739	HS	D1 Sdt197	CB9615	Sakai	EDL933	IA11	E24377A	SE11	SS Ss046	F2a 301	F5 8401	B4 Sb227	B18 BS512	
c	2256069	-	2152225	g	2115491	ns	S88	rec14	c	S88	++	c	g	c									g	g	g			g	g	g	g	g	g	g
c	2256070	-	2152225	t	2115492	ns	S88	rec14	c	S88	++	c	t	c									t	t	t			t	t	t	t	t	t	t
c	2256075	-	2152225	t	2115497	ns	S88	rec14	c	S88	++	c	t	c								c	c	c			c	c	c	c	c	c	c	
c	2256094	-	2152225	t	2115516	ns	S88	rec14	c	S88	++	c	c	c							c	c	c			c	c	c	c	c	c	c		
t	2256098	-	2152225	c	2115520	s	S88	rec14	t	S88	++	t	t	t							t	t	c			c	c	c	c	c	c	c		
c	2256112	-	2152225	t	2115534	ns	S88	rec14	c	S88	++	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c		
c	2256129	-	2152225	a	2115551	nc	S88	rec14	c	S88	++	c	a	c	c	c	c	c	a	a	a	a	a	a	a	a	a	a	a	a	a	a		
t	2256131	-	2152225	c	2115553	nc	S88	rec14	t	S88	++	t	c	t	t	t	t	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c		
g	2256310	-	2152225	a	2115732	ns	S88	rec14	g	S88	++	g	g	g	g	g	g	g	g	g	g	g	g	g	g	g	g	g	g	g	g	g		
g	2256390	-	2152225	a	2115812	s	S88	rec14	g	S88	++	g	a	g	a	g	g	g	g	g	g	g	g	g	g	g	g	g	g	g	g	g	g	
c	2256393	-	2152225	a	2115815	s	S88	rec14	c	S88	++	c	a	c	a	c	c	c	c	a	a	a	a	a	a	a	a	a	a	a	a	a		
a	2256414	-	2152225	g	2115836	s	S88	rec14	a	S88	++	a	g	a	g	a	a	a	g	g	g	g	g	g	g	g	g	g	g	g	g	g		
g	2256417	-	2152225	a	2115839	s	S88	rec14	g	S88	++	g	a	g	a	g	g	g	g	g	g	g	g	g	g	g	g	g	g	g	g	g	g	
g	2256519	-	2152225	t	2115941	s	S88	rec14	g	S88	++	g	t	g	t	g	g	g	t	g	g	g	g	g	g	g	g	g	g	g	g	g		
g	2256597	-	2152225	c	2116019	s	S88	rec14	g	S88	++	g	c	c	a	c	c	c	a	a	a	a	a	a	a	a	a	a	a	a	a	a		
c	2256609	-	2152225	a	2116031	s	S88	rec14	c	S88	++	c	c	c	a	c	c	c	a	a	a	a	a	a	a	a	a	a	a	a	a	a		
g	2256777	-	2152225	a	2116199	s	S88	rec14	g	S88	++	g	g	g	a	g	g	g	g	g	g	g	g	g	g	g	g	g	g	g	g	g	g	
g	2256813	-	2152225	s	2116235	s	S88	rec14	g	S88	++	g	g	g	a	g	g	g	g	g	g	g	g	g	g	g	g	g	g	g	g	g	g	
g	2256933	-	2152225	a	2116355	s	S88	rec14	g	S88	++	g	g	g	a	a	a	g	g	g	g	g	g	g	g	g	g	g	g	g	g	g	g	
c	2256993	-	2152225	a	2116415	s	S88	rec14	c	S88	++	c	c	c	a	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c		
c	2256996	-	2152225	a	2116418	s	S88	rec14	c	S88	++	c	c	c	a	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c		
g	2257020	-	2152225	a	2116442	s	S88	rec14	g	S88	++++	g	g	g	g	g	g	g	g	g	g	g	g	g	g	g	g	g	g	g	g	g		
c	2257065	-	2152225	t	2116487	s	S88	rec14	c	S88	++	c	t	c	c	t	t	t	c	t	t	c	t	t	c	c	c	c	c	c	c	c		
a	2257092	-	2152225	g	2116514	s	S88	rec14	a	S88	++	a	g	a	g	g	g	g	g	g	g	g	g	g	g	g	g	g	g	g	g	g	g	
t	2257134	-	2152225	c	2116556	s	S88	rec14	t	S88	++	t	c	t	t	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c	
t	2257203	-	2152225	s	2116625	s	S88	rec14	t	S88	++	t	c	t	t	c	t	c	t	c	t	c	t	c	c	c	c	c	c	c	c	c	c	
a	2257295	-	2152225	g	2116717	s	S88	rec14	a	S88	++	a	g	a	g	g	g	g	g	g	g	g	g	g	g	g	g	g	g	g	g	g	g	
g	2257305	-	2152225	a	2116727	s	S88	rec14	g	S88	++	g	a	g	a	g	a	g	a	g	a	g	a	g	a	g	a	g	a	g	a	g	a	
a	2257309	-	2152225	g	2116731	ns	S88	rec14	a	S88	++	a	g	a	g	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	
a	2257356	-	2152225	g	2116778	s	S88	rec14	a	S88	++	a	g	a	g	g	a	g	g	a	g	g	a	g	g	a	g	g	a	g	g	a	g	
c	2257530	-	2152225	c	2116952	s	S88	rec14	c	S88	++	c	t	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c		
g	2257560	-	2152225	a	2116982	s	S88	rec14	g	S88	++	g	g	g	g	g	g	g	g	g	g	g	g	g	g	g	g	g	g	g	g	g	g	
c	2257738	-	2152225	t	2117160	s	S88	rec14	c	S88	++	c	c	c	t	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c	
t	2257798	-	2152225	t	2117220	s	S88	rec14	t	S88	++	t	c	t	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c		
c	2257861	-	2152225	t	2117283	s	S88	rec14	c	S88	++	c	t	c	c	t	c	c	t	c	t	c	c	c	c	c	c	c	c	c	c	c		
c	2257867	-	2152225	t	2117289	s	S88	rec14	c	S88	++	c	t	c	c	t	c	t	c	t	c	t	c	t	c	t	c	t	t	t	t			
a	2257917	-	2152225	a	2117339	s	S88	rec14	a	S88	++	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a		
g	2258062	-	2152225	a	2117484	s	S88	rec14	g	S88	++	g	a	g	a	g	g	g	g	g	g	g	g	g	g	g	g	g	g	g	g	g	g	
c	2258092	-	2152225	t	2117514	s	S88	rec14	c	S88	++	c	a	c	t	c	a	t	c	a	t	c	a	t	c	a	t	t	t	t	t	t	t	
g	2258098	-	2152225	a	2117520	s	S88	rec14	g	S88	++	g	a	g	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	
c	2258101	-	2152225	g	2117523	s	S88	rec14	c	S88	++	c	g	c	g	g	g	g	g	g	g	g	g	g	g	g	g	g	g	g	g	g	g	
g	2258122	-	2152225	a	2117544	s	S88	rec14	g	S88	++	g	g	g	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a		
g	2258137	-	2152225	t	2117559	s	S88	rec14	g	S88	++++	g	g	g	g	g	g	g	g	g	g	g	g	g	g	g	g	g	g	g	g	g		
t	2258179	-	2152225	c	2117601	s	S88	rec14	t	S88	++	t	c	t	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c			
g	2258188	-	2152225	t	2117610	s	S88	rec14	g	S88	++	t	g	g	t	t	g	g	t	g	g	t	g	g	t	t	t	t	t	t	t	t		
g	2258259	-	2152225	t	2117681	ns	S88	rec14	g	S88	++	g	g	t	g	t	g	t	g	t	g	t	g	t	g	t	g	t	g	t	t			
t	2258263	-	2152225	g	2117685	s	S88	rec14	t	S88	++	t	t	g	t	t	t	g	t	t	g	t	t	g	t	t	t	t	t	t	t			
g	2258269	-	2152225	a	2117691	s	S88	rec14	g	S88</																								

Table S8. Allocation of recombinational SNPs to lineages by virtual outgroup analysis^a

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ExPEC genome site details												Outgroup Strains Details ^j																				
UTI89 ^b	UTI89 site ^c	APEC 01 site ^c		S88 ^b	S88 site ^c	type ^d	Event Lineage ^e	Recombinant segment	Inferred ancestral base ^g	Outgroup Analysis ^f												SE11	SS Ss046	F2a 301	F5 8401	B4 Sb227	B18 BS512					
		Recombinant	segment							Support level ^f	CFT073	ED1a	536	E2348/69	SMS 3-5	IA139	UMN026	K-12	ATCC 8739	HS	D1 Sdt197	CB9615	Sakai	EDL933	IA11	E24377A						
g	2272588	a	2222093	a	2132011	s	UTI89/AS	rec18	a	UTI89	++++	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	
g	2272666	a	2222171	a	2132089	s	UTI89/AS	rec18	g	AS	++	g	t	g	g	g	g	g	g	g	g	g	g	g	g	g	g	g	g	g	g	g
t	2272719	g	2222224	g	2132142	ns	UTI89/AS	rec18	t	AS	++	t	g	t	g	t	g	t	g	t	g	g	g	g	g	g	g	g	g	g	g	g
t	2272731	c	2222236	c	2132154	ns	UTI89/AS	rec18	c	UTI89	++++	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c	
g	2272801	a	2222306	a	2132224	s	UTI89/AS	rec18	a	UTI89	++	a	a	a	a	a	a	a	a	g	a	a	a	a	a	a	a	a	a	a	a	
g	2272813	a	2222318	a	2132236	s	UTI89/AS	rec18	g	AS	++	g	g	g	g	g	g	g	g	g	g	g	g	g	g	g	g	g	g	g	g	
g	2272825	a	2222330	a	2132248	ns	UTI89/AS	rec18	g	AS	++	g	a	g	a	a	a	a	g	a	a	g	g	g	g	g	g	g	g	g		
t	2272827	c	2222332	c	2132250	ns	UTI89/AS	rec18	t	AS	++	c	t	t	c	c	c	c	c	t	t	c	t	t	c	c	c	t	t	t		
a	2272873	g	2222378	g	2132296	s	UTI89/AS	rec18	g	UTI89	++	g	g	t	g	g	g	g	g	g	g	g	g	g	g	g	g	g	g	g		
a	2272909	g	2222414	g	2132332	s	UTI89/AS	rec18	a	AS	++	a	a	a	a	a	g	g	g	g	g	g	g	g	g	g	g	g	g	g	g	
c	2272966	t	2222471	t	2132389	s	UTI89/AS	rec18	c	AS	++	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c		
a	2272978	g	2222483	g	2132401	s	UTI89/AS	rec18	g	UTI89	++++	g	g	g	g	g	g	g	g	g	g	g	g	g	g	g	g	g	g	g		
g	2273011	a	2222516	a	2132434	s	UTI89/AS	rec18	a	UTI89	++	a	a	g	g	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	
a	2273047	t	2222552	t	2132470	s	UTI89/AS	rec18	a	AS	++	t	a	a	t	a	t	t	a	a	t	t	a	g	g	g	g	g	g	g		
t	2273071	a	2222576	a	2132494	s	UTI89/AS	rec18	a	UTI89	++	a	g	a	t	a	a	a	a	g	a	t	t	a	g	g	g	g	g	g		
g	2273074	a	2222579	a	2132497	s	UTI89/AS	rec18	a	UTI89	++	a	g	a	g	a	a	a	a	a	a	a	g	g	g	g	g	g	g	g		
a	2273077	g	2222582	g	2132500	s	UTI89/AS	rec18	g	UTI89	++	g	a	g	g	g	g	g	g	g	g	g	g	g	g	g	g	g	g	g		
c	2273102	t	2222607	t	2132525	ns	UTI89/AS	rec18	c	AS	++	t	c	c	c	t	t	t	t	t	t	c	c	c	t	t	t	t	t	t		
g	2273131	a	2222636	a	2132554	s	UTI89/AS	rec18	a	UTI89	++++	a	a	g	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a		
a	2273149	g	2222654	g	2132572	s	UTI89/AS	rec18	g	UTI89	++++	g	g	a	g	g	g	g	g	g	g	g	g	g	g	g	g	g	g	g		
g	2273179	a	2222684	a	2132602	s	UTI89/AS	rec18	a	UTI89	++	a	a	a	g	a	a	a	g	a	a	a	a	a	a	a	a	a	a	a		
c	2273200	t	2222705	t	2132623	s	UTI89/AS	rec18	c	AS	++	c	c	c	c	c	t	t	c	c	c	c	c	c	c	c	c	c	c			
g	2273373	t	2222878	t	2132796	s	UTI89/AS	rec18	t	UTI89	++++	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t			
a	2273463	g	2222968	g	2132886	s	UTI89/AS	rec18	a	AS	++	a	a	g	a	a	a	a	c	a	c	c	c	c	c	c	c	c	c			
c	2273496	a	2223001	a	2132919	ns	UTI89/AS	rec18	c	AS	++++	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c		
g	2273535	a	2223040	a	2132958	ns	UTI89/AS	rec18	a	UTI89	++	g	a	a	g	g	g	g	g	g	g	g	g	g	g	g	g	g	g	g	g	
t	2273537	g	2223042	g	2132960	ns	UTI89/AS	rec18	g	UTI89	++++	g	g	g	g	g	g	g	g	g	g	g	g	g	g	g	g	g	g	g		
a	2273550	c	2223055	c	2132973	s	UTI89/AS	rec18	c	UTI89	++	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c			
g	2273553	t	2223058	t	2132976	s	UTI89/AS	rec18	t	UTI89	++	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t			
g	2273604	a	2223109	a	2133027	s	UTI89/AS	rec18	g	AS	++	a	g	g	g	a	a	g	g	g	g	g	g	g	g	g	g	g	g			
a	2273610	g	2223115	g	2133033	s	UTI89/AS	rec18	a	AS	++	-	a	a	g	g	g	g	g	g	g	g	g	g	g	g	g	g	g	g		
c	2273616	g	2223121	g	2133039	s	UTI89/AS	rec18	g	UTI89	++++	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c			
t	2273619	c	2223124	c	2133042	s	UTI89/AS	rec18	c	UTI89	++++	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c			
a	2273703	g	2223208	g	2133126	s	UTI89/AS	rec18	a	AS	++++	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a			
t	2273852	g	2223357	g	2133275	s	UTI89/AS	rec18	g	UTI89	++++	g	g	g	g	g	g	g	g	g	g	g	g	g	g	g	g	g	g			
g	2273960	a	2223465	a	2133383	s	UTI89/AS	rec18	g	AS	++	g	a	g	g	g	g	g	g	g	g	g	g	g	g	g	g	g	g			
t	2274143	c	2223648	c	2133566	s	UTI89/AS	rec18	t	AS	++	t	c	t	c	c	t	c	t	t	t	c	c	c	c	c	c	c	c			
t	2274227	c	2223732	c	2133650	s	UTI89/AS	rec18	c	UTI89	++	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c			
t	2274245	c	2223739	c	2133677	s	UTI89/AS	rec18	c	UTI89	++	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c			
g	2274278	a	2223783	a	2133701	s	UTI89/AS	rec18	g	AS	++++	g	g	g	g	g	g	g	g	g	g	g	g	g	g	g	g	g	g			
t	2274290	c	2223795	c	2133713	s	UTI89/AS	rec18	t	AS	++++	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t			
a	2274332	g	2223837	g	2133755	s	UTI89/AS	rec18	a	AS	++	a	a	g	a	g	g	g	g	g	g	g	g	g	g	g	g	g	g	g		
a	2274344	c	2223849	c	2133767	s	UTI89/AS	rec18	a	AS	++++	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a			
a	2274362	t	2223867	t	2133785	s	UTI89/AS	rec18	a	AS	++	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a			
t	2274377	c	2223882	c	2133800	s	UTI89/AS	rec18	t	AS	++	t	c	t	t	t	c	c	c	c	c	c	c	c	c	c	c	c				
c	2274383	t	2223888	t	2133806	s	UTI89/AS	rec18	c	AS	++	c	t	c	t	c	c	c	c	c	c	c	c	c	c	c	c	c				
a	2274509	g	2224014	g	2133932	s	UTI89/AS	rec18	g	UTI89	++++	g	g	g	g	g	g	g	g	g	g	g	g	g	g	g	g	g	g			
a	2274518	t	2224023	t	2133941	s																										

Table S8. Allocation of recombinational SNPs to lineages by virtual outgroup analysis^a

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ExPEC genome site details										Outgroup Strains Details ^j																							
UTI89 ^b	UTI89 site ^c	APEC 01 ^b	APEC 01 site ^c	S88 ^b	S88 site ^c	type ^d	Event Lineage ^e	Recombinant segment	Inferred ancestral base ^g	Outgroup Analysis ^h	Support level ⁱ	CFT073	ED1a	536	E2348/69	SMS 3-5	IA139	UMN026	K-12	ATCC 8739	HS	D1 Sdt97	CB9615	Sakai	EDL933	IA11	E24377A	SE11	SS Ss046	F2a 301	F5 8401	B4 Sb227	B18 BS512
-	2309751	a	2259648	t	2169567	nc	APEC/S88	rec19	-	A/S	+-	-	c	a	t	c	a	t	c	a	t	c	c	a	t	a	t	a	a	t	c		
-	2309751	t	2259649	a	2169568	nc	APEC/S88	rec19	a	APEC	++	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a		
-	2309751	a	2259652	t	2169571	nc	APEC/S88	rec19	c	S88	+++	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a		
-	2309751	a	2259653	t	2169572	nc	APEC/S88	rec19	a	S88	+++	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a		
-	2309751	c	2259711	t	2169630	nc	APEC/S88	rec19	t	APEC	+++	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t			
-	2309751	c	2259801	t	2169720	nc	APEC/S88	rec19	c	S88	+++	c	g	g	c	c	t	t	t	t	t	t	t	t	c	c	c	c	c	c			
-	2309751	t	2259831	a	2169750	nc	APEC/S88	rec19	a	APEC	++	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a			
-	2309751	c	2259834	a	2169753	nc	APEC/S88	rec19	a	APEC	++	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a			
-	2309751	c	2259882	t	2169801	nc	APEC/S88	rec19	t	APEC	+++	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t				
-	2309751	g	2259906	a	2169825	nc	APEC/S88	rec19	g	S88	++	g	g	g	g	g	g	g	g	g	g	g	g	g	g	g	g	g	g				
-	2309751	c	2259918	t	2169837	nc	APEC/S88	rec19	c	S88	+++	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c				
-	2309751	c	2259938	t	2169857	nc	APEC/S88	rec19	t	APEC	+++	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t					
-	2309751	a	2259954	g	2169873	nc	APEC/S88	rec19	g	APEC	+++	g	g	g	g	g	g	g	g	g	g	g	g	g	g	g	g	g	g				
-	2309751	t	2259969	g	2169888	nc	APEC/S88	rec19	g	APEC	+++	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t					
-	2309751	t	2260003	c	2169922	nc	APEC/S88	rec19	t	S88	+++	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t					
-	2309751	g	2260021	c	2169940	nc	APEC/S88	rec19	g	S88	++	g	g	g	g	g	g	g	g	g	g	g	g	g	g	g	g	g	g				
-	2309751	t	2260026	c	2169945	nc	APEC/S88	rec19	t	S88	+++	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t					
-	2309751	c	2260032	t	2169951	nc	APEC/S88	rec19	c	S88	+++	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c					
-	2309751	c	2260065	t	2169984	nc	APEC/S88	rec19	c	S88	+++	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c						
-	2309751	t	2260104	c	2170023	nc	APEC/S88	rec19	c	APEC	+++	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c						
-	2309751	a	2260209	g	2170128	nc	APEC/S88	rec19	g	APEC	++	g	g	g	g	g	g	g	g	g	g	g	g	g	g	g	g	g					
-	2309751	t	2260211	c	2170130	nc	APEC/S88	rec19	c	APEC	++	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c						
-	2309751	c	2260254	t	2170173	nc	APEC/S88	rec19	t	APEC	+++	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t						
-	2309751	a	2260265	g	2170184	nc	APEC/S88	rec19	a	S88	++	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a					
-	2309751	a	2260308	t	2170227	nc	APEC/S88	rec19	t	APEC	++	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t						
-	2309751	g	2260314	a	2170233	nc	APEC/S88	rec19	a	APEC	++	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a					
-	2309751	t	2260329	c	2170248	nc	APEC/S88	rec19	c	APEC	++	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c					
-	2309751	g	2260362	a	2170281	nc	APEC/S88	rec19	g	S88	+++	g	g	g	g	g	g	g	g	g	g	g	g	g	g	g	g	g					
-	2309751	c	2260391	t	2170310	nc	APEC/S88	rec19	c	S88	+++	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c					
-	2309751	t	2260419	a	2170338	nc	APEC/S88	rec19	t	S88	+++	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t						
-	2309751	c	2260425	c	2170344	nc	APEC/S88	rec19	c	APEC	+++	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c						
-	2309751	a	2260467	c	2170386	nc	APEC/S88	rec19	a	S88	+++	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a					
-	2309751	t	2260530	c	2170449	nc	APEC/S88	rec19	t	S88	++	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t						
-	2309751	t	2260753	a	2170672	nc	APEC/S88	rec19	c	APEC	+++	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c						
-	2309751	t	2260809	c	2170728	nc	APEC/S88	rec19	c	APEC	++	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c						
-	2309751	t	2260839	c	2170758	nc	APEC/S88	rec19	c	APEC	++	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c						
-	2309751	t	2260886	c	2170805	nc	APEC/S88	rec19	c	APEC	+++	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c						
-	2309751	c	2260964	t	2170883	nc	APEC/S88	rec19	c	S88	++	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c						
-	2309751	a	2261078	t	2170997	nc	APEC/S88	rec19	t	APEC	+++	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t						
-	2309751	c	2261087	t	2171006	nc	APEC/S88	rec19	c	S88	++	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c						
-	2309751	g	2261111	t	2171030	nc	APEC/S88	rec19	a	A/S	+-	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c						
-	2309751	g	2261126	t	2171045	nc	APEC/S88	rec19	g	S88	++	g	g	g	g	g	g	g	g	g	g	g	g	g	g	g	g	g					
-	2309751	c	2261150	c	2171069	nc	APEC/S88	rec19	g	S88	++	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c						
-	2309751	a	2261153	g	2171072	nc	APEC/S88	rec19	g	APEC	+++	g	g	g	g	g	g	g	g	g	g	g	g	g	g	g	g						
-	2309751	g	2261162	a	2171081	nc	APEC/S88	rec19	a	APEC	+++	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a						
-	2309751	c	2261165	c	2171084	nc	APEC/S88	rec19	c	APEC	+++	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c						
-	2309751	a	2261180	g	2171099	nc	APEC/S88	rec19	a	S88	+++	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a						
-	2309751	t	2261181	t	2171100	nc	APEC/S88	rec19	a	S88	+++	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t						
-	2309751	c	2261215	c	2171134	nc	APEC/S88	rec19	g	APEC	+++	g	g	g	g	g	g	g	g	g	g	g	g	g	g	g	g						
-	2309751	c	2261503	t	2171422	nc	APEC/S88	rec19	c	S88	+++	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c						
-	2309751	t	2261611	g	2171530	nc	APEC/S88	rec19	g	APEC	++	g	g	g	g	g	g	g	g	g	g	g	g	g	g	g	g						
-	2309751	c	2261614	c	2171533	nc	APEC/S88	rec19	c	APEC	++	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c						
-	2309751	t	2261641	g	2171560	nc	APEC/S88	rec19	a	S88	+++	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a						
-	2309751	c	2261744	t	2171663	nc	APEC/S88	rec1																									

Table S8. Allocation of recombinational SNPs to lineages by virtual outgroup analysis^a

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ExPEC genome site details										Outgroup Strains Details ^j										
UTI89 ^b	UTI89 site ^c	APEC 01 site ^c		S88 ^b	S88 site ^c	type ^d	Event Lineage ^e	Recombinant segment	Inferred ancestral base ^g	Outgroup Analysis ^f										
		APEC	01							Support level ^f										
t	2613373	c	2586599	c	2509696	s	UTI89/AS	rec21	c	UTI89	+									c
a	2613391	c	2586617	c	2509714	s	UTI89/AS	rec21	c	UTI89	+									c
c	2613637	t	2586863	t	2509960	ns	UTI89/AS	rec21	t	UTI89	+									t
a	2613659	g	2586885	g	2509982	s	UTI89/AS	rec21	a	AS	+									a
a	2613677	t	2586903	t	2510000	s	UTI89/AS	rec21	a	AS	+									a
g	2613754	a	2586980	a	2510077	s	UTI89/AS	rec21	g	AS	+									g
a	2613784	c	2587010	c	2510107	s	UTI89/AS	rec21	a	AS	+									a
a	2613817	c	2587043	c	2510140	s	UTI89/AS	rec21	c	UTI89	+									c
c	2613849	a	2587075	a	2510172	ns	UTI89/AS	rec21	c	AS	+									c
a	2613850	g	2587076	g	2510173	s	UTI89/AS	rec21	g	UTI89	+									g
t	2613913	a	2587139	a	2510236	s	UTI89/AS	rec21	a	UTI89	+									a
c	2613916	t	2587142	t	2510239	s	UTI89/AS	rec21	c	AS	+									c
t	2613922	U	2587148	c	2510245	s	UTI89/AS	rec21	c	UTI89	+									c
c	2613943	t	2587169	t	2510266	s	UTI89/AS	rec21	t	UTI89	+									t
g	2613967	c	2587193	c	2510290	s	UTI89/AS	rec21	c	UTI89	+									c
g	2614372	a	2587598	a	2510695	s	UTI89/AS	rec21	g	AS	+									g
c	2614378	a	2587604	a	2510701	s	UTI89/AS	rec21	c	AS	+									c
t	2614393	c	2587619	c	2510716	s	UTI89/AS	rec21	t	AS	+									t
a	2614432	g	2587658	g	2510755	s	UTI89/AS	rec21	a	AS	+									a
a	2614438	t	2587664	t	2510761	s	UTI89/AS	rec21	a	AS	+									a
g	2614486	a	2587712	a	2510809	s	UTI89/AS	rec21	g	AS	+									g
a	2614495	g	2587721	g	2510818	s	UTI89/AS	rec21	a	AS	+									a
a	2614510	t	2587736	t	2510833	s	UTI89/AS	rec21	a	AS	+									a
t	2614513	c	2587739	c	2510836	s	UTI89/AS	rec21	t	AS	+									t
t	2614578	a	2587804	a	2510901	ns	UTI89/AS	rec21	a	UTI89	+									a
t	2614582	a	2587808	a	2510905	ns	UTI89/AS	rec21	t	AS	+									t
c	2614584	t	2587810	t	2510907	ns	UTI89/AS	rec21	t	UTI89	+									t
c	2614600	t	2587826	t	2510923	s	UTI89/AS	rec21	c	AS	+									c
t	2614702	c	2587928	c	2511025	s	UTI89/AS	rec21	t	AS	+									t
c	2614705	a	2587931	a	2511028	s	UTI89/AS	rec21	c	AS	+									c
a	2614708	g	2587934	g	2511031	s	UTI89/AS	rec21	g	UTI89	+									g
a	2614831	g	2588057	g	2511154	s	UTI89/AS	rec21	g	UTI89	+									g
g	2614994	t	2588220	t	2511317	ns	UTI89/AS	rec21	g	AS	+									g
a	2615011	g	2588237	g	2511334	nc	UTI89/AS	rec21	g	UTI89	+									g
g	2625355	a	2598581	a	2521678	nc	UTI89/AS	rec22	g	AS	+									g
g	2625357	c	2598583	c	2521680	nc	UTI89/AS	rec22	g	AS	+									g
c	2625358	g	2598584	g	2521681	nc	UTI89/AS	rec22	c	AS	+									c
t	2625359	g	2598585	g	2521682	nc	UTI89/AS	rec22	t	AS	+									t
c	2625360	a	2598586	a	2521683	nc	UTI89/AS	rec22	c	AS	+									c
a	2625361	g	2598587	g	2521684	nc	UTI89/AS	rec22	a	AS	+									a
t	2625366	c	2598592	c	2521689	nc	UTI89/AS	rec22	c	UTI89	+									c
c	2625376	a	2598602	a	2521699	nc	UTI89/AS	rec22	c	AS	+								c	
a	2625415	t	2598641	t	2521738	nc	UTI89/AS	rec22	a	AS	+								t	
t	2625418	c	2598644	c	2521741	nc	UTI89/AS	rec22	t	AS	+								t	
c	2625440	t	2598666	t	2521763	nc	UTI89/AS	rec22	t	UTI89	+									
g	2625494	t	2598720	t	2521817	ns	UTI89/AS	rec22	?	UTI89/AS	+-									
-	2625515	t	2600125	g	2523222	ns	UTI89/AS	rec22	?	A/S	+-									
t	2626678	c	2600580	c	2523677	ns	UTI89/AS	rec22	t	AS	+									t
t	2626679	a	2600581	a	2523678	s	UTI89/AS	rec22	t	AS	+									t
c	2626690	t	2600592	t	2523689	ns	UTI89/AS	rec22	t	UTI89	+									c
c	2626708	a	2600610	a	2523707	s	UTI89/AS	rec22	c	AS	+									c
c	2626744	t	2600646	t	2523743	s	UTI89/AS	rec22	t	UTI89	+									t
a	2626858	g	2600760	g	2523857	s	UTI89/AS	rec22	g	UTI89	+									g
t	2627023	c	2600925	c	2524022	s	UTI89/AS	rec22	c	UTI89	+									c
g	2627029	a	2600931	a	2524028	s	UTI89/AS	rec22	g	AS	+									g
a	2627035	c	2600937	c	2524034	s	UTI89/AS	rec22	a	AS	+									a
c	2627038	t	2600940	t	2524037	s	UTI89/AS	rec22	c	AS	+									c
a	2627065	c	2600967	c	2524064	s	UTI89/AS	rec22	c	UTI89	+									c
t	2627074	g	2600976	g	2524073	s	UTI89/AS	rec22	g	UTI89	+									g
g	2627083	a	2600985	a	2524082	s	UTI89/AS	rec22	a	UTI89	+									a
a	2627104	g	2601006	g	2524103	s	UTI89/AS	rec22	g	UTI89	+									g
c	2627155	t	2601057	t	2524154	s	UTI89/AS	rec22	c	AS	+									c
t	2627179	c	2601081	c	2524178	s	UTI89/AS	rec22	t	UTI89	+									t
c	2627215	t	2601117	t	2524214	s	UTI89/AS	rec22	c	AS	+									c
c	2627278	t	2601180	t	2524277	s	UTI89/AS	rec22	c	AS	+									c
t	2627287	c	2601189	c	2524286	s	UTI89/AS	rec22	t	AS	+									t
c	2627447	t	2601369	t	2524466	s	UTI89/AS	rec22	t	UTI89	+									t
t	2627515	c	2601417	c	2524514	s	UTI89/AS	rec22	c	UTI89	+									c
a	2627620	g	2601522	g	2524619	s	UTI89/AS	rec22	a	AS	+									a
a	2627623	g	2601525	g	2524622	s	UTI89/AS	rec22	a	AS	+									a
a	2627680	g	2601582	g	2524679	s	UTI89/AS	rec22	g	UTI89	+									g
c	2627686	t	2601588	t	2524685	s	UTI89/AS	rec22	c	AS	+									c
c	2627695	t	2601597	t	2524694	s	UTI89/AS	rec22	t	UTI89	+									t
c	2627734	t	2601636	t	2524733	s	UTI89/AS	rec22	c	AS	+									c

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ExPEC genome site details											Outgroup Strains Details ^j																									
UTI89 ^b	UTI89 site ^c	APEC 01 ^b	APEC 01 site ^c	S88 ^b	S88 site ^c	type ^d	Event Lineage ^e	Recombinant segment	Inferred ancestral base ^g	Outgroup Analysis ^h	Support level ⁱ	CFT073	ED1a	536	E2348/69	SMS 3-5	IA139	UMN026	K-12	ATCC 8739	HS	D1 Sdt97	CB9615	Sakai	EDL933	IA11	E24377A	SE11	SS Ss046	F2a 301	F5 8401	B4 Sb227	B18 BS512			
-	4456561	1	4488585	1	4403235	ins	AS	rec33	-	AS	++++	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
-	4456652	1	4488668	-	4403317	ins	APEC	rec33	-	APEC	++++	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
g	4456760	c	4488776	g	4403425	nc	APEC	rec33	g	APEC	++++	g	g	g	g	g	g	g	g	g	g	g	g	g	g	g	g	g	g	g	g	g	g	g	g	
g	4456768	c	4488784	g	4403433	nc	APEC	rec33	g	APEC	++++	g	g	g	g	g	g	g	g	g	g	g	g	g	g	g	g	g	g	g	g	g	g	g	g	
-	4456788	1	4488805	-	4403453	ins	APEC	rec33	-	APEC	++++	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
-	4456805	1	4488823	-	4403470	ins	APEC	rec33	-	APEC	++++	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
g	4456808	a	4488826	g	4403473	nc	APEC	rec33	g	APEC	++++	g	g	g	g	g	g	g	g	g	g	g	g	g	g	g	g	g	g	g	g	g	g	g	g	
-	4456813	1	4488832	-	4403478	ins	APEC	rec33	-	APEC	++++	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
-	4456821	1	4488841	-	4403486	ins	APEC	rec33	-	APEC	++++	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
1	4457618	-	4489637	1	4404283	del	APEC	rec33	1	APEC	++++	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1			
-	4457633	1	4489653	-	4404298	ins	APEC	rec33	1	2	-	1	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
a	4457672	g	4489692	a	4404337	s	APEC	rec33	a	APEC	++	t	a	t	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a		
-	4457672	2	4489693	-	4404337	ins	APEC	rec33	2	2	-	2	-	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
-	4457696	1	4489719	-	4404361	ins	APEC	rec33	1	2	-	1	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
g	4457709	c	4489732	g	4404374	s	APEC	rec33	c	2	-	c	g	c	g	g	g	g	g	g	g	g	g	g	g	g	g	g	g	g	g	g	g	g	g	
-	4457713	1	4489737	-	4404378	ins	APEC	rec33	1	2	-	1	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
-	4457735	2	4489760	-	4404400	ins	APEC	rec33	2	2	-	2	-	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
-	4457741	1	4489768	-	4404406	ins	APEC	rec33	1	2	-	1	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
1	4457753	-	4489779	1	4404418	del	APEC	rec33	1	APEC	++++	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1			
a	4457762	c	4489788	a	4404427	ns	APEC	rec33	c	2	-	c	a	c	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a			
c	4457929	t	4489955	c	4404594	nc	APEC	rec33	t	2	-	t	a	t	c	a	c	c	t	a	c	c	c	c	c	c	c	c	c	c	c	c	c			
t	4791161	c	3318053	c	3232837	ns	UTI89/AS	rec34	t	AS	+++	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t		
a	4791163	g	3318055	g	3232839	s	UTI89/AS	rec34	a	AS	+++	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	
g	4791179	a	3318071	a	3232855	ns	UTI89/AS	rec34	g	AS	+++	g	g	g	g	g	g	g	g	g	g	g	g	g	g	g	g	g	g	g	g	g	g	g	g	
c	4791421	t	3318313	t	3233097	ns	UTI89/AS	rec34	c	AS	+++	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c		
a	4791459	g	3318351	g	3233135	s	UTI89/AS	rec34	g	UTI89	+	g	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a		
g	4791663	c	3318555	c	3233339	s	UTI89/AS	rec34	c	UTI89	+++	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c			
c	4791756	t	3318648	t	3233432	ns	UTI89/AS	rec34	t	UTI89	+	t	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c			
c	4791765	t	3318657	t	3233441	s	UTI89/AS	rec34	t	UTI89	+	t	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c			
a	4791780	g	3318672	g	3233456	s	UTI89/AS	rec34	g	UTI89	+	g	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t			
a	4791788	g	3318680	g	3233464	s	UTI89/AS	rec34	g	UTI89	+	g	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	
c	4791821	t	3318713	t	3233497	nc	UTI89/AS	rec34	t	UTI89	+++	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	
t	4795844	c	3322736	c	3237520	s	UTI89	rec35	c	UTI89	+++	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c		
a	4795847	g	3322739	g	3237523	s	UTI89	rec35	g	UTI89	+++	g	g	g	g	g	g	g	g	g	g	g	g	g	g	g	g	g	g	g	g	g	g	g		
t	4795952	c	3322844	c	3237628	s	UTI89	rec35	c	UTI89	+++	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c			
t	4795970	c	3322862	c	3237646	s	UTI89	rec35	t	AS	+++	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t		
a	4795977	g	3322869	g	3237653	ns	UTI89	rec35	g	UTI89	+++	g	g	g	g	g	g	g	g	g	g	g	g	g	g	g	g	g	g	g	g	g	g	g		
a	4796117	g	3323009	g	3237793	s	UTI89	rec35	g	UTI89	+++	g	g	g	g	g	g	g	g	g	g	g	g	g	g	g	g	g	g	g	g	g	g	g		
g	4796156	a	3323048	a	3237832	s	UTI89	rec35	a	UTI89	+++	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a		
t	4796177	t	3323069	t	3237853	s	UTI89	rec35	t	UTI89	+	a	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t		
c	4796184	g	3323076	g	3237860	s	UTI89	rec35	g	UTI89	+++	g	g	g	g	g	g	g	g	g	g	g	g	g	g	g	g	g	g	g	g	g	g			
a	4796198	g	3323090	g	3237874	s	UTI89	rec35	g	UTI89	+++	g	g	g	g	g	g	g	g	g	g	g	g	g	g	g	g	g	g	g	g	g	g			
a	4796314	t	3323206	t	3237990	ns	UTI89	rec35	a	AS	+++	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a		
g	4796494	a	3323386	a	3238170	nc	UTI89	rec35	a	UTI89	+	a	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t			
c	4796512	t	3323404	t	3238188	nc	UTI89	rec35	t	UTI89	+	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t		
c	4900894	c	4917123	a	4879115	ns	S88																													

Table S8. Allocation of recombinational SNPs to lineages by virtual outgroup analysis^a

ExPEC genome site details												Outgroup Strains Details ^j																							
UTI89 ^b	UTI89 site ^c	APEC 01 ^b	APEC 01 site ^c	S88 ^b	S88 site ^c	type ^d	Event Lineage ^e	Recombinant segment	Inferred ancestral base ^g	Outgroup Analysis ^h	Support level ⁱ	CFT073	ED1a	536	E2348/69	SMS-3-5	IAT39	UMN026	K-12	ATCC-8739	HS	D1	Sd197	CB8615	Sakai	EDL933	IA11	E24377A	SE11	SS-S6046	F2a-301	F2a-2457T	F5-3401	B4 Sb227	B18 Sb5512
t	4901959	t	4918188	c	4880047	s	S88	rec36	t	S88	++	c	t	t	c	c	c	c	c	c	a	c	c	c	c	c	c	c	c	c	c	c	c	c	
g	4901986	g	4918215	a	4880074	s	S88	rec36	g	S88	++	g	g	g	g	g	g	g	g	g	a	g	g	g	g	g	g	g	g	g	g	g	g	g	
c	4901991	c	4918220	t	4880079	ns	S88	rec36	c	S88	++	c	c	c	c	c	c	c	c	c	a	c	c	c	c	c	c	c	c	c	c	c	c		
a	4902010	a	4918239	g	4880098	s	S88	rec36	a	S88	++	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a			
t	4902031	t	4918260	a	4880119	s	S88	rec36	t	S88	++	t	t	t	t	t	t	t	t	t	a	a	a	a	a	a	a	a	a	a	a	a			
a	4902162	a	4918391	g	4880250	ns	S88	rec36	a	S88	++	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a			
t	4902178	t	4918407	c	4880266	s	S88	rec36	t	S88	++	c	t	t	c	c	c	c	c	c	a	c	c	c	c	c	c	c	c	c	c	c			
g	4902213	g	4918442	a	4880301	ns	S88	rec36	g	S88	++	g	g	g	g	a	g	g	g	g	g	g	g	g	g	g	g	g	g	g	g	g			
t	4902230	t	4918459	c	4880318	ns	S88	rec36	t	S88	++	t	t	t	t	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c			
c	4902244	c	4918473	c	4880332	s	S88	rec36	t	S88	++	t	t	t	t	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c				
c	4902431	c	4918660	t	4880519	s	S88	rec36	c	S88	++	c	c	c	c	c	t	c	c	c	c	c	c	c	c	c	c	c	c	c					
g	4902539	g	4918768	a	4880627	s	S88	rec36	g	S88	++	g	g	g	g	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a				
c	4902583	c	4918812	t	4880671	ns	S88	rec36	c	S88	++	c	c	c	c	c	t	t	t	t	t	a	t	t	t	t	t	t	t	t	t	t			
t	4902680	t	4918909	a	4880768	s	S88	rec36	t	S88	++	t	t	t	t	t	t	a	a	a	a	a	a	a	a	a	a	a	a	a					
g	4902683	g	4918912	a	4880771	s	S88	rec36	g	S88	++	g	g	g	g	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a				
c	4902692	c	4918921	t	4880780	ns	S88	rec36	c	S88	++	c	c	c	c	c	t	t	t	t	t	t	t	t	t	t	t	t	t	t					
g	4902695	g	4918924	c	4880783	s	S88	rec36	g	S88	++	g	g	g	g	g	c	c	c	c	c	c	c	c	c	c	c	c	c	c					
t	4902698	t	4918927	c	4880786	s	S88	rec36	t	S88	++	t	t	t	t	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c					
c	4902730	c	4918959	a	4880818	ns	S88	rec36	c	S88	++	c	c	c	c	t	t	t	t	t	t	t	t	t	t	t	t	t	t						
g	4902738	g	4918967	t	4880826	s	S88	rec36	g	S88	++	g	g	g	g	t	g	g	g	g	g	g	g	g	g	g	g	g	g						
a	4902884	a	4919113	t	4880972	s	S88	rec36	a	S88	++	a	a	a	a	a	c	c	c	c	c	a	a	a	a	a	a	a	a	a					
a	4902914	a	4919143	t	4881002	s	S88	rec36	a	S88	++	a	a	a	a	a	t	t	t	t	t	t	a	a	a	a	a	a	a	a					
t	4902929	t	4919158	c	4881017	s	S88	rec36	c	2	-	c	c	t	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c					
t	4903000	t	4919229	c	4881088	ns	S88	rec36	c	2	-	c	c	t	t	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c					
g	4903019	g	4919248	c	4881107	s	S88	rec36	t	S88	++	t	t	t	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c					
g	4903181	g	4919410	a	4881269	s	S88	rec36	g	S88	++	g	g	g	g	g	g	g	g	g	g	g	g	g	g	g	g	g	g	g					
c	4903277	c	4919506	t	4881365	s	S88	rec36	c	S88	++	c	c	c	c	c	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t				
c	4903304	c	4919533	t	4881392	s	S88	rec36	t	2	-	t	t	c	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t					
c	4903367	c	4919596	a	4881455	s	S88	rec36	a	2	-	a	a	c	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a				
t	4903450	t	4919679	c	4881538	ns	S88	rec36	c	2	-	c	c	t	c	t	c	c	c	c	c	c	c	c	c	c	c	c	c	c					
t	4903466	t	4919695	c	4881554	ns	S88	rec36	t	S88	++	t	t	t	t	c	c	c	c	c	c	c	c	c	c	c	c	c	c						
t	4903474	t	4919703	c	4881562	ns	S88	rec36	c	2	-	c	c	t	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c						
a	4903614	a	4919843	g	4881702	s	S88	rec36	g	S88	++	a	a	a	a	a	t	t	t	t	t	t	a	a	a	a	a	a	a	a					
c	4903722	c	4919951	g	4881810	s	S88	rec36	c	S88	++++	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c						
g	4904180	g	4920409	a	4882268	s	S88	rec36	g	S88	++	g	g	g	g	g	g	g	g	g	g	g	g	g	g	g	g	g	g	g					
g	4904236	t	4920465	a	4882324	ns	S88	rec36	t	S88	++	t	t	t	t	t	t	t	t	t	a	a	a	a	a	a	a	a	a	a					
g	4904342	g	4920571	c	4882431	nc	S88	rec36	g	S88	++	g	g	g	g	g	g	g	g	g	c	c	c	c	c	c	c	c	c	c					
a	4904434	a	4920572	g	4882432	nc	S88	rec36	a	S88	++	a	a	a	a	a	g	g	g	g	g	g	g	g	g	g	g	g	g	g					
t	4904357	t	4920586	c	4882446	nc	S88	rec36	t	S88	++	-	t	-	-	-	-	t	-	-	-	-	t	-	-	-	-	t	-	-	-				
a	4904358	a	4920587	t	4882447	nc	S88	rec36	a	S88	++++	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a					
a	4904360	a	4920589	t	4882449	ns	S88	rec36	a	S88	++	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a						
g	4904373	g	4920602	t	4882462	nc	S88	rec36	g	S88	++	g	g	g	g	g	g	g	g	g	g	g	g	g	g	g	g	g	g						
t	4904388	t	4920617	c	4882477	nc	S88	rec36	t	S88	++	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t						
a	4904449	a	4920678	a	4882538	ns	S88	rec36	c	S88	++	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c						
a	4904512	a	4920740	t	4882601	nc	S88	rec36	a	S88	++	a	a	a	a	a	g	g	g	g	g	g	g	g	g	g	g	g	g						
t	4904838	t	4921067	a	4882927	nc	S88	rec36	a	2	-	g	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a						
g	4904849	g	4921078	a	4882938	nc	S88	rec36	g	S88	++	g	g	g	g	g	a	a	a	a	a	a	a	a	a	a	a	a	a						
g	4904889	g	4921118	t	4882977	ns	S88	rec36	g	S88	++	g	g	g	g	t	t	t	t	t	t	t	t	t	t	t	t	t	t						
a	4904900	a	4921129	c	4882988	nc	S88	rec36	a	S88	++	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a							
t	4904925	t	4921154	g	4883013	nc	S88	rec36	t	S88	++	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t							
t	4904960	t	4921189	g	4883048	ns	S88	rec36	t	S88	++	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t							
g	4904971	g	4921200	c	4883059	nc	S88	rec36	g	S88	++	g	g	g	g	c	c	c	c	c	c	c	c	c	c	c	c	c							
c	4904979	c	4921208	t	4883067	nc	S88	rec36	c	S88	++	c	c	c	c	c	t	t	t	t	t	t	t	t	t	t	t	t	t						
a	4904911	a	4921209	c	4883068	ns	S88	rec36	c	S88	++	c	c	c	c	c	t	t	t	t	t	t	t	t	t	t	t	t							
t	4904915	t	4921226	g	4883085	nc	S88	rec36	a	S88	++	a	a	a	a	g	g	g	g	g	g	g	g	g	g	g	g	g	g	g					
a	4905006	a	4921235	t	4883094	nc	S88	rec36	a	S88	++	a	a	a	a	a	t	t	t	t	t	t	t	t	t	t	t	t	t						
g	4905036	g	4921265	c	4883124	s	S88	rec36	g	S88	++	g	g	g	g	c	c	c	c	c	c	c	c	c	c	c	c	c							
a	4905037	a	4921266	s	4883125	s	S88	rec36	a	S88	++	a	a																						

Table S8. Allocation of recombinational SNPs to lineages by virtual outgroup analysis^a

Table S8. Allocation of recombinational SNPs to lineages by virtual outgroup analysis^a

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ExPEC genome site details												Outgroup Strains Details ^j																		
UTI89 ^b	UTI89 site ^c	APEC 01 site ^c		S88 ^b	S88 site ^c	type ^d	Event Lineage ^e	Recombinant segment	Inferred ancestral base ^g	Outgroup Analysis ^h												SS Ss046	F2a 301	F5 8401	B4 Sb227	B18 BS512				
		APEC 01 site	APEC 01 site							Support level ⁱ			CFT073	ED1a	536	E2348/69	SMS 3-5	IA139	UMN026	K-12	ATCC 8739	HS	D1 Sdt197	CB9615	Sakai	EDL933	IA11	E24377A	SE11	
t	4908357	t	4924586	g	4886432	ns	S88	rec36	g	2	-	c	g	g	t	c	g	c	c	c	g	g	g	c	c	g	g	g	g	c
a	4908366	a	4924595	g	4886441	s	S88	rec36	g	2	-	t	g	g	g	a	g	g	g	g	g	g	g	g	g	g	g	g	t	
g	4908499	g	4924728	a	4886574	s	S88	rec36	g	S88	++	g	g	g	g	a	a	a	a	a	a	a	a	a	a	a	a	a		
t	4908547	t	4924776	c	4886622	s	S88	rec36	t	S88	+++	t	t	t	t	c	t	t	t	t	t	t	t	t	t	t	t	t		
t	4908583	t	4924812	c	4886658	s	S88	rec36	c	2	-	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c		
g	4908599	g	4924828	a	4886674	ns	S88	rec36	g	S88	++	g	g	g	g	g	a	a	a	a	a	a	a	a	a	a	a			
t	4908689	t	4924918	g	4886764	ns	S88	rec36	t	S88	++	t	g	t	g	g	g	g	g	g	g	g	g	g	g	g	g	g		
a	4908805	a	4925034	t	4886880	s	S88	rec36	a	S88	+++	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a			
c	4908877	c	4925106	t	4886952	s	S88	rec36	c	S88	++	t	c	c	c	t	t	t	t	t	t	t	t	t	t	t				
g	4909136	g	4925365	a	4887211	ns	S88	rec36	a	2	-	g	a	a	g	g	a	a	a	a	a	a	a	a	a	a	a			
t	4909153	t	4925382	c	4887228	s	S88	rec36	t	S88	+++	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t				
a	4909270	a	4925499	g	4887345	s	S88	rec36	a	S88	++	g	a	a	g	g	g	g	g	g	g	g	g	g	g	g				
c	4909297	c	4925526	t	4887372	s	S88	rec36	c	S88	++	t	c	c	c	t	t	t	t	t	t	t	t	t	t					
g	4909354	g	4925583	a	4887429	s	S88	rec36	g	S88	++	g	g	g	g	g	a	a	a	a	a	a	a	a	a	a				
t	4909417	t	4925646	c	4887492	s	S88	rec36	t	S88	++	t	t	c	c	c	c	c	c	c	c	c	c	c	c	c				
c	4909476	c	4925705	t	4887551	ns	S88	rec36	c	S88	+++	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c				
t	4909507	t	4925736	c	4887582	s	S88	rec36	t	S88	++	t	t	t	t	c	t	c	c	t	t	t	c	c	c					
g	4909582	g	4925811	t	4887657	s	S88	rec36	g	S88	+++	g	g	g	t	g	g	g	g	g	g	g	g	g	g					
t	4909636	t	4925865	c	4887711	s	S88	rec36	t	S88	++	t	t	c	c	c	c	c	c	c	c	c	c	c	c					
g	4909640	g	4925869	a	4887715	ns	S88	rec36	g	S88	+++	g	g	g	g	g	g	g	g	g	g	g	g	g	g					
g	4909679	g	4925908	a	4887754	ns	S88	rec36	g	S88	++	g	g	g	a	a	a	a	a	a	a	a	a	a	a					
t	4909788	t	4926017	a	4887863	nc	S88	rec36	t	S88	++	t	t	t	a	a	a	a	a	a	a	a	a	a	a					
t	4909938	t	4926167	c	4888014	s	S88	rec36	t	S88	++	t	t	t	c	t	c	c	t	c	c	c	c	c						
c	4909992	c	4926221	t	4888068	s	S88	rec36	c	S88	++	c	c	c	c	c	c	c	c	t	t	t	t	t						
t	4909998	t	4926227	c	4888074	s	S88	rec36	t	S88	++	t	t	t	c	t	c	c	c	t	c	c	c	c						
t	4910028	t	4926257	c	4888104	s	S88	rec36	t	S88	++	t	t	t	c	t	c	c	c	t	c	c	c	c						
t	4910082	t	4926311	c	4888158	s	S88	rec36	t	S88	++	c	t	c	c	c	c	c	c	c	c	c	c	c						
c	4910145	c	4926374	t	4888221	s	S88	rec36	c	S88	++	c	c	c	c	t	t	t	t	t	t	t	t	t						
c	4910184	c	4926413	t	4888260	s	S88	rec36	t	2	-	t	t	t	c	t	c	c	c	t	c	c	c	c						
c	4910187	c	4926416	a	4888263	s	S88	rec36	c	S88	+++	c	c	c	c	c	c	c	c	c	c	c	c	c						
a	4910286	a	4926515	t	4888362	ns	S88	rec36	t	2	-	t	t	a	t	a	t	t	t	t	t	t	t	t						
g	4910295	g	4926524	t	4888371	s	S88	rec36	t	2	-	t	t	g	t	t	t	t	t	t	t	t	t	t						
c	4910382	c	4926611	t	4888458	s	S88	rec36	c	S88	+++	c	c	c	c	c	c	c	c	c	c	c	c	c						
a	4910439	a	4926668	g	4888515	s	S88	rec36	a	S88	++	a	a	g	g	g	g	g	g	g	g	g	g	g						
c	4910493	c	4926722	t	4888569	s	S88	rec36	t	2	-	t	t	t	t	t	t	t	t	t	t	t	t	t						
t	4910646	t	4926875	c	4888722	s	S88	rec36	t	S88	++	t	t	c	t	t	t	t	t	t	t	t	c	c						
a	4910820	a	4927049	g	4888896	s	S88	rec36	a	S88	++	a	a	a	a	a	a	a	a	g	g	g	a	a	a					
t	4910904	t	4927133	c	4888980	s	S88	rec36	t	S88	++	t	t	c	c	c	c	c	c	c	c	c	c	c						
t	4910913	t	4927142	c	4888989	s	S88	rec36	t	S88	+++	t	t	t	t	t	t	t	t	t	t	t	t	t						
g	4910949	g	4927178	a	4889025	s	S88	rec36	g	S88	++	g	a	a	a	a	a	a	a	a	a	a	a	a						
a	4910964	a	4927193	t	4889040	s	S88	rec36	a	S88	++	a	a	a	t	t	t	t	t	t	t	t	t							
a	4911009	a	4927238	g	4889085	s	S88	rec36	a	S88	++	a	a	a	g	g	g	g	g	g	g	g	g							
g	4911069	g	4927298	a	4889145	s	S88	rec36	a	S88	++	a	a	a	a	a	a	a	a	a	a	a	a	a						
t	4911132	t	4927361	c	4889208	s	S88	rec36	c	S88	++	c	t	c	c	c	c	c	c	c	c	c	c	c						
t	4911228	t	4927457	c	4889304	s	S88	rec36	c	S88	++	c	c	c	c	c	c	c	c	c	c	c	c	c						
g	4911249	g	4927478	a	4889325	s	S88	rec36	g	S88	++	g	g	g	g	g	g	g	g	g	g	g	g	g						
t	4911255	t	4927484	c	4889331	s	S88	rec36	t	2	-	c	c	c	c	c	c	c	c	c	c	c	c	c						
t	4911294	t	4927523	c	4889370	s	S88	rec36	t	S88	++	t	c	t	c	c	c	c	c	c	c	c	c	c						
g	4911297	g	4927526	a	4889373	s	S88	rec36	g	S88	++	g	a	g	a	a	a	a	a	a	a	a	a	a						
a	4911363	a	4927592	t	4889439	s	S88	rec36	a	S88	++	a	t	a	a	a	a	a	a	a	a	a	a	a						
a	4911537	a	4927766	t	4889613	s	S88	rec36	a	S88	++	a	a	t	a	a	a	a	a	a	a	a	a	a						
g	4911549	g	4927778	a	4889625	s	S88	rec36	g	S88	++	g	g	g	a	g	g	g	g	g	g	g	g							
t	4911560	t	4927789	g	4889636	ns	S88	rec36	t	S88	+++	t	t	t	t	t	t	t	t	t	t	t	t	t						
t	4911561	t	4927790	c	4889637	ns	S88	rec36	t	S88	++	t	t	c	c	c	c	c	c	c	c	c	c	c						
t	4911627	t	4927856	g	4889703	s	S88	rec36	g	2	-	g	t	g	g	g	g	g	g	g	g	g	g	g						
a	4911642	a	4927871	t	4889718	s	S88	rec36	t	S88	++	t	t	t	t	t	t	t	t	t	t	t	t	t						
t	4911654	t	4927883	c	4889730	s	S88	rec36	c	S88	++	c	c	c	c</															

Table S8. Allocation of recombinational SNPs to lineages by virtual outgroup analysis^a

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ExPEC genome site details												Outgroup Strains Details ^b																				
UTI89 ^b	UTI89 site ^c	APEC 01 ^b	APEC 01 site ^c	S88 ^b	S88 site ^c	type ^d	Event Lineage ^{e,f}	Recombinant segment	Inferred ancestral base ^g	Outgroup Analysis ^h																						
										Support level ⁱ	CFT073	ED1a	536	E2348/69	SMS 3-5	IA139	UMN026	K-12	ATCC 8739	HS	D1 Sdt197	CB9615	Sakai	EDL933	IA11	E24377A	SE11	SS Ss046	F2a 301	F5 8401	B4 Sb227	B18 BS512
c	4943743	c	4959972	t	4903867	nc	S88	rec36	c	S88	++	c	c	c	c	c	t	t	t	c	c	c	t	t	t	c	c	c	c	c	c	
c	4943764	c	4959993	t	4903888	nc	S88	rec36	c	S88	++	c	c	c	c	c	t	t	t	c	t	t	t	t	t	t	t	t	t	t	t	
c	4943787	c	4960016	g	4903911	nc	S88	rec36	c	S88	++	c	c	c	c	c	g	g	g	g	g	g	g	g	g	g	g	g	g	g	g	
t	4943791	t	4960020	c	4903915	nc	S88	rec36	t	S88	++	t	t	t	c	t	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c	
t	4943794	t	4960023	c	4903918	nc	S88	rec36	t	S88	++	t	t	t	c	t	c	c	c	c	c	c	c	c	c	c	c	c	c	c		
c	4943800	c	4960029	g	4903924	nc	S88	rec36	c	S88	++	c	c	c	g	c	g	g	g	g	g	g	g	g	g	g	g	g	g	g		
t	4943814	t	4960043	c	4903938	nc	S88	rec36	c	2	-	c	c	c	c	c	t	c	c	c	c	c	c	c	c	c	c	c	c			
c	4943830	c	4960059	t	4903954	nc	S88	rec36	c	S88	++	c	c	c	c	c	t	c	t	c	t	t	t	t	t	t	t	t				
g	4943834	g	4960063	t	4903958	nc	S88	rec36	g	S88	++	g	g	g	t	g	t	t	t	t	t	t	t	t	t	t	t					
g	4943835	g	4960064	c	4903959	nc	S88	rec36	g	S88	++	g	c	c	c	g	c	c	c	c	c	c	c	c	c	c	c					
c	4943839	c	4960068	t	4903963	nc	S88	rec36	c	S88	++	c	c	c	c	t	c	t	t	t	t	t	t	t	t	t						
a	4943840	a	4960069	g	4903964	nc	S88	rec36	a	S88	++	a	a	a	g	a	g	g	g	g	g	g	g	g	g	g	g	g				
t	4943841	t	4960070	c	4903965	nc	S88	rec36	t	S88	++	t	t	c	t	c	c	c	c	c	c	c	c	c	c	c	c					
a	4943860	a	4960089	g	4903984	nc	S88	rec36	a	S88	++	a	a	a	g	a	g	g	g	g	g	g	g	g	g	g	g					
t	4943890	t	4960119	c	4904014	nc	S88	rec36	c	2	-	c	t	c	c	t	c	c	c	c	c	c	c	c	c	c	c					
a	4943910	a	4960139	g	4904035	nc	S88	rec36	g	2	-	g	a	g	g	a	g	g	g	g	g	g	g	g	g	g	g					
g	4943925	g	4960154	t	4904050	nc	S88	rec36	g	S88	++	g	g	g	t	g	t	t	g	g	g	g	g	g	g	g	g					
c	4943931	c	4960160	t	4904056	nc	S88	rec36	c	S88	++	c	c	c	c	t	c	t	t	t	t	t	t	t	t	t						
t	4943934	t	4960163	c	4904059	nc	S88	rec36	t	S88	++	t	t	c	t	c	c	t	t	t	t	t	t	t	t	t						
g	4943940	g	4960169	a	4904065	nc	S88	rec36	g	S88	++	g	g	g	a	a	g	t	g	g	g	g	g	g	g	g						
a	4943976	a	4960205	g	4904101	nc	S88	rec36	c	S88	++	c	g	c	c	g	a	g	g	g	g	g	g	g	g	g	g					
c	4943986	c	4960215	t	4904111	nc	S88	rec36	c	S88	++++	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c					
a	4943997	a	4960226	g	4904122	nc	S88	rec36	g	2	-	g	g	g	g	a	g	g	g	g	g	g	g	g	g	g						
t	4944003	t	4960232	c	4904128	nc	S88	rec36	c	2	-	c	c	c	c	t	t	c	t	c	c	c	c	c	c	c						
t	4944048	t	4960277	c	4904173	nc	S88	rec36	c	2	-	c	t	c	t	c	c	c	c	c	c	c	c	c	c							
g	4944090	g	4960319	t	4904215	nc	S88	rec36	g	S88	++	g	g	g	t	g	g	g	t	g	t	t	t	t	t	t						
c	4944193	c	4960422	t	4909907	s	S88	rec36	c	S88	++	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c					
a	4944205	a	4960434	a	4909919	s	S88	rec36	a	S88	++	a	a	a	c	a	a	a	a	a	a	a	a	a	a	a	a					
g	4944211	g	4960440	a	4909925	s	S88	rec36	g	S88	++++	g	g	g	a	g	g	g	g	g	g	g	g	g	g	g						
a	4944217	a	4960446	g	4909931	s	S88	rec36	a	S88	++	a	a	a	g	a	a	a	a	g	g	g	g	g	g	g	g					
c	4944220	c	4960449	g	4909934	s	S88	rec36	c	S88	++++	c	c	c	g	c	c	c	c	c	c	c	c	c	c	c						
t	4944226	t	4960455	c	4909940	s	S88	rec36	t	S88	++	t	t	c	t	t	t	t	t	c	c	c	t	t	t	t						
a	4944232	a	4960461	g	4909946	s	S88	rec36	a	S88	++	a	a	a	g	a	a	a	a	g	g	g	a	a	a	a						
a	4944238	a	4960467	g	4909952	s	S88	rec36	a	S88	++	a	g	g	a	g	g	g	g	g	g	g	g	g	g	g						
t	4944250	t	4960479	c	4909964	s	S88	rec36	c	2	-	c	c	c	c	t	c	c	c	c	c	c	c	c	c							
g	4944262	g	4960491	a	4909976	s	S88	rec36	a	2	-	a	g	a	a	g	g	g	g	a	a	a	g	g	g							
g	4944265	g	4960494	a	4909979	s	S88	rec36	a	2	-	a	g	a	g	g	g	g	g	a	a	a	g	g	g							
a	4944274	a	4960503	g	4909988	s	S88	rec36	a	S88	++	a	a	a	g	a	a	a	a	g	g	g	a	a	a	a						
g	4944277	g	4960506	a	4909991	s	S88	rec36	g	S88	++	g	g	g	g	g	g	g	g	g	g	g	g	g	g							
g	4944280	g	4960509	s	4909994	s	S88	rec36	g	S88	++	g	g	g	g	g	g	g	g	g	g	g	g	g	g							
t	4944301	t	4960530	c	4910015	s	S88	rec36	t	S88	++	t	t	c	t	t	t	t	t	c	c	c	t	t	t							
a	4944307	a	4960536	g	4910021	s	S88	rec36	a	S88	++	a	a	a	g	a	a	a	a	g	g	g	a	a	a							
g	4944310	g	4960539	a	4910024	s	S88	rec36	g	S88	++	g	g	g	g	g	g	g	g	g	g	g	g	g	g							
t	4944322	t	4960551	c	4910036	s	S88	rec36	t	S88	++	t	t	c	t	t	t	t	t	c	c	c	a	a	a							
c	4944328	c	4960557	a	4910042	s	S88	rec36	c	S88	++	c	c	c	c	c	c	c	c	c	c	c	c	c	c							
t	4944331	t	4960560	c	4910045	s	S88	rec36	t	S88	++	t	t	c	t	t	t	t	t	c	c	c	t	t								
a	4944343	a	4960572	g	4910057	s	S88	rec36	a	S88	++	a	a	a	g	a	a	a	a	g	g	g	a	a	a							
a	4944355	a	4960584	c	4910069	s	S88	rec36	a	S88	++	a	a	a	c	a	a	a	a	c	c	c	a	a	a							
t	4944358	t	4960587	g	4910072	s	S88	rec36	t	S88	++	t	t	g	t	t	t	t	t	g	g	g	t	t								
g	4944364	g	4960593	c	4910078	s	S88	rec36	g	S88	++	g	g	g	t	g	g	g	g	g	g	g	g	g								
a	4944376	a	4960605	g	4910090	s	S88	rec36	a	S88	++	a	a	a	g	a	a	a	a	g	g	g	a	a	a							
g	4944390	g	4960619	t	4910104	ns	S88	rec36	g	S88	++	g	t	t	g	g	t	t	t	g	g	g	a	t								
a	4944403	a	4960632	g	4910117	s	S88	rec36	a	S88	++	a	a	a	g	a	a	a	a	g	g	g	a	a	a							
c	4944406	c	4960635	t	4910120	s	S88	rec36	c	S88	++	c	c	c	t	c	c	c	c	t	t	t	c	c	c							
g	4944409	g	4960638	s	4910123	s	S88	rec36	g	S88	++	g	g	g	t	g	g	g	g													

Table S8. Allocation of recombinational SNPs to lineages by virtual outgroup analysis^a

Table S8. Allocation of recombinational SNPs to lineages by virtual outgroup analysis^a

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ExPEC genome site details												Outgroup Strains Details ^b																				
UTI89 ^b	UTI89 site ^c	APEC 01 ^b	APEC 01 site ^c	S88 ^b	S88 site ^c	type ^d	Event Lineage ^e	Recombinant segment	Inferred ancestral base ^f	Outgroup Analysis ^g	Support level ^h	CFT073	ED1a	E2348/69	SMS 3-5	IA139	UMN026	K-12	ATCC8739	HS	D1 Sdt197	CB9615	Sakai	EDL933	IA11	E24377A	SE11	SS Ss046	F2a 301	F5 8401	B4 Sb227	B18 BS512
c	4944979	c	4961208	a	4910693	s	S88	rec36	c	S88	++	c	c	c	a	c	c	c	c	c	c	a	a	a	c	c	c	c	c	c	c	c
t	4944987	t	4961216	a	4910701	ns	S88	rec36	t	S88	++	t	t	t	g	t	t	t	t	t	t	g	g	g	t	t	t	t	t	t	t	
t	4944991	t	4961220	c	4910705	s	S88	rec36	t	S88	++	t	t	t	c	t	t	t	t	t	t	g	c	c	t	t	t	t	t	t	t	
a	4944995	a	4961224	g	4910709	ns	S88	rec36	g	2	-	g	a	g	g	g	g	g	g	g	g	g	g	g	g	g	g	g	g	g	g	
c	4944997	c	4961226	t	4910711	s	S88	rec36	c	S88	++++	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c			
a	4944999	a	4961228	g	4910713	s	S88	rec36	a	S88	++	a	a	a	g	a	a	a	a	a	a	g	g	g	a	a	a	a	a	a		
t	4945003	t	4961232	c	4910717	s	S88	rec36	t	S88	++	t	t	t	c	t	t	t	t	t	t	c	c	c	t	t	t	t	t	t		
t	4945009	t	4961238	c	4910723	s	S88	rec36	t	S88	++	t	t	g	c	t	t	t	t	t	t	c	c	c	t	t	t	t	t	t		
c	4945018	c	4961247	t	4910732	s	S88	rec36	c	S88	++	c	c	c	t	c	c	c	c	c	c	t	t	t	c	c	c	c	c			
c	4945021	c	4961250	t	4910735	s	S88	rec36	c	S88	++	c	c	c	t	c	c	c	c	c	c	t	t	t	c	c	c	c				
c	4945024	c	4961253	t	4910738	s	S88	rec36	c	S88	++	c	c	c	t	c	c	c	c	c	c	t	t	t	c	c	c	c				
c	4945028	c	4961257	g	4910742	ns	S88	rec36	c	S88	++	c	c	c	g	c	c	c	c	c	c	g	g	g	c	c	c	c				
c	4945030	c	4961259	t	4910744	s	S88	rec36	c	S88	++	c	c	c	t	c	c	c	c	c	c	g	g	g	t	c	c	c				
c	4945033	c	4961262	g	4910747	s	S88	rec36	c	S88	++	c	c	c	g	c	c	c	c	c	c	g	g	g	c	c	c	c				
a	4945039	a	4961268	g	4910753	s	S88	rec36	a	S88	++	a	a	a	g	a	a	a	a	a	a	g	g	g	a	a	a	a	a			
c	4945045	c	4961274	t	4910759	s	S88	rec36	c	S88	++	c	c	c	t	c	c	c	c	c	c	t	t	t	c	c	c	c				
a	4945051	a	4961280	g	4910765	s	S88	rec36	a	S88	++	a	a	a	g	a	a	a	a	a	a	g	g	g	t	a	a	a				
t	4945054	t	4961283	c	4910768	s	S88	rec36	t	S88	++	t	t	t	c	t	t	t	t	t	t	c	c	c	t	t	t					
c	4945066	c	4961295	t	4910780	s	S88	rec36	c	S88	++	c	c	c	t	c	c	c	c	c	c	t	t	t	c	c	c					
t	4945069	t	4961298	g	4910783	s	S88	rec36	t	S88	++	t	t	g	t	t	c	c	c	c	c	c	g	g	g	c	c	c				
c	4945072	c	4961301	t	4910786	ns	S88	rec36	c	S88	++	c	c	c	t	c	c	c	c	c	c	g	g	g	t	c	c	c				
t	4945073	t	4961302	a	4910787	ns	S88	rec36	t	S88	++	t	t	t	a	t	t	t	t	t	t	a	a	a	t	t	t					
g	4945074	g	4961303	a	4910788	ns	S88	rec36	g	S88	++	g	g	g	g	g	g	g	g	g	g	a	a	a	g	g	g					
g	4945075	g	4961304	a	4910789	s	S88	rec36	g	S88	++	g	g	g	g	g	g	g	g	g	g	a	a	a	g	g	g					
t	4945081	t	4961310	c	4910795	s	S88	rec36	t	S88	++	t	t	c	t	t	t	t	t	t	t	c	c	c	t	t	t					
a	4945087	a	4961316	g	4910801	s	S88	rec36	a	S88	++	a	a	a	g	a	a	a	a	a	a	g	g	g	a	a	a	a				
c	4945090	c	4961319	t	4910804	s	S88	rec36	c	S88	++	a	c	c	t	a	a	c	c	c	c	t	t	t	c	c	c	c				
t	4945096	t	4961325	c	4910810	s	S88	rec36	t	S88	++	t	t	t	c	t	t	t	t	t	t	c	c	c	t	t	t					
a	4945102	a	4961331	g	4910816	s	S88	rec36	a	S88	++	a	a	a	g	a	a	a	a	a	a	g	g	g	a	a	a					
g	4945105	g	4961334	c	4910819	s	S88	rec36	g	S88	++	g	g	g	c	g	g	g	g	g	g	a	a	a	g	g	g					
a	4945108	a	4961337	c	4910822	s	S88	rec36	a	S88	++	a	a	a	c	a	a	a	a	a	a	c	c	c	a	a	a					
c	4945120	c	4961349	g	4910834	s	S88	rec36	c	S88	++	c	c	c	g	c	c	c	c	c	c	g	g	g	c	c	c					
g	4945129	g	4961358	a	4910843	s	S88	rec36	g	S88	++	g	g	g	a	g	g	g	g	g	g	a	a	a	g	g	g					
g	4945132	g	4961361	a	4910846	ns	S88	rec36	g	S88	++	g	g	g	a	g	g	g	g	g	g	a	a	a	g	g	g					
c	4945133	c	4961362	g	4910847	ns	S88	rec36	c	S88	++++	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c					
a	4945138	a	4961367	g	4910852	s	S88	rec36	a	S88	++	a	a	a	g	a	a	a	a	a	a	g	g	g	a	a	a					
c	4945144	c	4961373	t	4910858	s	S88	rec36	c	S88	++	c	c	c	t	c	c	c	c	c	c	t	t	t	c	c	c					
c	4945150	c	4961379	t	4910864	s	S88	rec36	c	S88	++	c	c	c	t	c	c	c	c	c	c	t	t	t	c	c	c					
g	4945152	g	4961381	c	4910866	ns	S88	rec36	g	S88	++	g	g	g	c	g	g	g	g	g	g	c	c	c	g	g	g					
t	4945159	t	4961388	g	4910873	s	S88	rec36	t	S88	++	t	t	t	g	t	t	t	t	t	t	t	t	t	t	t	t					
c	4945165	c	4961394	t	4910879	ns	S88	rec36	c	S88	++	c	c	c	t	c	c	c	c	c	c	c	c	c	c	c						
g	4945166	g	4961395	t	4910880	ns	S88	rec36	g	S88	++	g	g	g	t	g	g	g	g	g	g	t	t	t	g	g	g					
a	4945167	a	4961396	t	4910881	ns	S88	rec36	a	S88	++	a	a	a	c	a	a	a	a	a	a	c	c	c	a	c	c					
t	4945168	t	4961397	g	4910882	s	S88	rec36	t	S88	++	t	t	t	g	t	t	t	t	t	t	g	g	g	t	c	c					
t	4945179	t	4961408	g	4910893	ns	S88	rec36	t	S88	++	t	t	t	g	t	t	t	t	t	t	g	g	g	t	t	t					
g	4945186	g	4961415	t	4910900	s	S88	rec36	g	S88	++	g	g	g	t	g	g	g	g	g	g	t	t	t	g	g	g					
a	4945191	a	4961420	g	4910905	s	S88	rec36	a	S88	++	a	a	a	g	a	a	a	a	a	a	g	g	g	a	a	a					
a	4945195	a	4961424	c	4910909	s	S88	rec36	a	S88	++	a	a	a	c	a	a	a	a	a	a	g	g	g	a	a	a					
a	4945204	a	4961433	g	4910918	s	S88	rec36	a	S88	++	a	a	a	g	a	a	a	a	a	a	g	g	g	a	a	a					
g	4945207	g	4961436	a	4910921	s	S88	rec36	g	S88	++	g	g	g	a	g	g	g	g	g	g	a	a	a	g	g	g					
a	4945252	a	4961481	t	4910966	s	S88	rec36	a	S88	++	a	a	a	t	a	a	a	a	a	a	t	t	t	a	a	a					
g	4945254	g	4961483	a	4910968	s	S88	rec36	g	S88	++	g	g	g	t	g	g	g	g	g	g	a	a	a	g	g	g					
g	4945273	g	4961502	a	4910987	s	S88	rec36	g	S88	++	g	g	g	t	g	g	g	g	g	g	a	a	a	g	g	g					
g	4945291	g	4961520	t	4911005	ns	S88	rec36	g	S88	++	g	g	g	t	g	g	g	g	g	g	t	t	t	g	g	g					
g	4945293	g																														

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ExPEC genome site details												Outgroup Strains Details ^j																						
UTI89 ^b	UTI89 site ^c			APEC 01 site ^c			APEC 01 site ^c			Event Lineage ^{e,f}			Recombinant segment	Inferred ancestral base ^g	Outgroup Analysis ^h			Support level ⁱ	Outgroup Strains Details ^j															
	UTI89	APEC 01	S88 ^b	S88	S88 ^b	S88 ^c	S88	S88	S88	type ^d	Event Lineage ^{e,f}	Inferred ancestral base ^g	CFT073	ED1a	536	E238/69	SMS-3-5	IAB9	UMN026	K-12	ATCC 8739	HS	D ^l Sd197	CB9615	Sakai	EDL933	IAI1	E24377A	SE11	SSS046	F2a301	F2a2457T	F58401	B45227
t	4983811	t	5000040	a	4949984	nc	S88	rec36	t	S88	++	t	t	t	t	t	t	t	a	a	a	a	a	a	a	a	a	c	c	c	a	a	a	
a	4983815	a	5000044	t	4949988	nc	S88	rec36	a	S88	++	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	g	g	g	g	g	g
g	4983818	g	5000047	a	4949991	nc	S88	rec36	g	S88	++	g	g	g	g	g	g	g	g	a	a	a	a	a	a	a	a	g	g	g	g	g	g	
t	4983819	t	5000048	g	4949992	nc	S88	rec36	t	S88	++	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	g	g	g	g	g	g
c	4983822	c	5000051	a	4949995	nc	S88	rec36	a	2	-	c	a	a	a	c	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a
g	4983825	g	5000054	a	4949998	nc	S88	rec36	g	S88	++	g	g	g	g	g	g	g	g	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a
a	4983834	a	5000063	g	4950007	nc	S88	rec36	a	S88	++	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	
a	4984279	a	5000509	g	4950452	ns	S88	rec36	a	S88	++	a	a	a	g	g	g	g	g	a	a	a	a	a	a	a	a	a	a	a	a	a	a	
c	4984311	c	5000541	a	4950561	ns	S88	rec36	c	S88	++	c	c	c	a	a	a	a	a	c	a	c	c	a	a	a	a	a	a	a	a	a	a	
a	4984316	a	5000546	g	4950566	ns	S88	rec36	a	S88	++	a	a	a	g	g	g	g	g	a	g	g	g	g	g	g	g	g	g	g	g	g		
g	4984327	g	5000557	t	4950577	ns	S88	rec36	g	S88	++	g	g	g	g	g	g	g	g	t	t	t	t	t	t	t	t	t	t	t	t	t		
t	4984328	t	5000558	c	4950578	ns	S88	rec36	t	S88	++	t	t	t	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c	
g	4984350	g	5000580	t	4950600	ns	S88	rec36	g	S88	++	g	g	g	g	g	g	g	g	t	t	t	t	t	t	t	t	t	t	t	t	t		
g	4984370	g	5000600	a	4950611	nc	S88	rec36	c	S88	++	c	c	c	c	c	c	c	c	a	a	a	a	a	a	a	a	a	c	c	c	c		
c	4984372	c	5000602	t	4950613	s	S88	rec36	c	S88	++	c	c	c	c	c	c	c	t	t	t	c	t	t	t	t	t	c	c	c	t	t	t	
g	4984425	g	5000655	t	4950666	s	S88	rec36	g	S88	++	g	g	g	g	g	g	g	g	t	g	g	g	t	t	t	t	g	g	g	g	g	g	
a	4984443	a	5000673	g	4950684	s	S88	rec36	g	2	-	g	g	g	g	g	g	g	g	a	a	g	g	g	g	g	g	g	g	g	g	g		
g	4984476	g	5000706	t	4950717	s	S88	rec36	g	S88	++	g	g	g	g	g	g	g	g	a	g	g	g	g	g	g	g	g	g	g	g	g		
a	4984508	a	5000738	g	4950749	s	S88	rec36	a	S88	++	a	a	a	g	g	g	g	g	g	g	g	g	g	g	g	g	g	g	g	g	g		
g	4984521	g	5000751	a	4950762	s	S88	rec36	g	S88	++	g	g	g	g	g	g	g	g	a	a	a	a	a	a	a	a	a	a	a	a			
c	4984524	c	5000754	a	4950765	s	S88	rec36	c	S88	++	c	c	c	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a		
g	4984539	g	5000769	a	4950780	s	S88	rec36	g	S88	++	g	g	g	g	g	g	g	g	a	g	g	g	g	g	g	g	g	g	g	g			
t	4984608	t	5000838	g	4950849	s	S88	rec36	t	S88	++	t	t	t	g	g	g	g	g	t	g	g	g	g	g	g	g	g	g	g	g	g		
g	4984620	g	5000850	a	4950861	s	S88	rec36	g	S88	++	g	g	g	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a		
t	4984679	t	5000909	c	4950920	ns	S88	rec36	t	S88	++	c	t	t	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c		
t	4984710	t	5000940	c	4950951	s	S88	rec36	t	S88	++	t	t	t	t	t	t	t	t	c	c	c	c	c	c	c	c	c	c	c	c			
t	4984713	t	5000943	g	4950954	s	S88	rec36	t	S88	++	t	t	t	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c			
a	4984719	a	5000949	g	4950960	s	S88	rec36	a	S88	++	g	a	a	g	a	a	a	a	g	g	g	g	g	g	g	g	g	g	g	g			
a	4984725	a	5000955	g	4950966	s	S88	rec36	a	S88	++	g	a	a	g	g	a	a	a	a	g	g	g	g	g	g	g	g	g	g	g			
g	4984730	g	5000960	a	4950971	s	S88	rec36	g	S88	++	g	g	g	g	g	g	g	g	a	g	g	g	g	g	g	g	g	g	g	g			
a	4984731	a	5000961	g	4950972	s	S88	rec36	a	S88	++	a	a	a	c	a	a	a	a	g	g	g	g	g	g	g	g	g	g	g	g			
g	4984737	g	5000967	a	4950978	s	S88	rec36	g	S88	++	a	g	g	a	a	a	a	a	g	g	g	g	g	g	g	g	g	g	g	g			
g	4984740	g	5000970	t	4950981	s	S88	rec36	g	S88	++	a	g	g	a	a	a	a	a	g	g	g	g	g	g	g	g	g	g	g	g			
c	4984743	c	5000973	t	4950984	s	S88	rec36	c	S88	++	t	c	c	t	c	c	t	t	t	c	c	c	c	c	c	c	c	c	c	c			
t	4984749	t	5000979	c	4950990	s	S88	rec36	t	S88	++	c	t	t	t	t	t	t	t	c	c	c	c	c	c	c	c	c	c	c				
a	4984764	a	5000994	g	4951005	s	S88	rec36	a	S88	++	g	a	a	g	g	g	g	g	a	g	g	g	g	g	g	g	g	g	g	g			
g	4984770	g	5001000	t	4951011	s	S88	rec36	g	S88	++	c	g	g	c	c	g	g	g	t	t	t	t	t	t	t	t	t	t	t	t			
t	4984779	t	5001009	c	4951020	s	S88	rec36	g	S88	++	g	g	g	t	g	g	g	t	a	c	g	g	g	g	g	g	g	g	g	g			
g	4984788	g	5001018	a	4951029	s	S88	rec36	g	S88	++	a	g	g	g	a	g	a	a	a	a	a	a	a	a	a	a	a	a	a	a			
t	4984821	t	5001051	c	4951062	s	S88	rec36	t	S88	++	t	t	t	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c			
g	4984829	g	5001059	a	4951070	s	S88	rec36	g	S88	++	g	g	g	a	a	a	a	a	g	g	g	g	g	g	g	g	g	g	g	g			
a	4984848	a	5001078	g	4951089	s	S88	rec36	a	S88	++	a	a	a	g	g	g	g	g	g	g	g	g	g	g	g	g	g	g	g	g			
g	4984851	g	5001081	t	4951092	s	S88	rec36	g	S88	++	g	g	g	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a			
c	4984884	c	5001114	a	4951125	s	S88	rec36	c	S88	++	c	c	c	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a			
t	4984890	t	5001120	c	4951131	s	S88	rec36	c	S88	2	-	t	c	c	c	t	c	c	c	c	c	c	c	c	c	c	c	c	c	c			
a	4984904	a	5001134	g	4951145	s	S88	rec36	a	S88	++	a	a	a	g	g	g	g	g	g	g	g	g	g	g	g	g	g	g	g	g	g		
a	4984935	a	5001165	c	4951176	ns	S88	rec36	a	S88	++	a	a	a	c	a	a	a	a	g	g	g	g	g	g	g	g	g	g	g	g			
t	4984937	t	5001167	c	4951178	ns	S88	rec36	t	S88	++	t	t	t	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c		
g	4984938	g	5001168	s	4951179	s	S88	rec36	g	S88	++	g	g	g	g	g	g	g	g	g	g	g	g	g	g	g	g	g	g	g	g	g		
c	4984956	c	5001186	t	4951197	s	S88	rec36	c	S88	++	c	c	c	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t			
g	4984983	g	5001213	a	4951224	s	S88	rec36	g	S88	++	g	g	g	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t			
t	4985001	t	5001231	g	49512																													

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ExPEC genome site details												Outgroup Strains Details ^j																						
UTI89 ^b	UTI89 site ^c	APEC 01 ^b	APEC 01 site ^c	S88 ^b	S88 site ^c	type ^d	Event Lineage ^e	Recombinant segment	Inferred ancestral base ^g	Outgroup Analysis ^h	Support level ^h	CFT073	ED1a	536	E2348/69	SMS-3-5	I439	UMN026	K-12	ATCC8739	HS	D1 Sdf197	CB615	Sakai	EDL933	IA1	E2437TA	SE11	SS Ss046	F2a-301	F2a-2457T	F5 8401	B4 Sb227	B18 BS512
a	5020622	g	5037917	g	4987927	s	UTI89/AS	rec38	g	UTI89	+	t	c	g	g	g	g	g	g	g	t	c	g	g	g	g	g	g	a	a	a	a	a	a
a	5020623	t	5037918	t	4987928	ns	UTI89/AS	rec38	t	UTI89	+	t	a	g	g	t	t	t	t	c	t	c	t	t	t	t	t	t	t	t	t	t	t	t
t	5020644	c	5037959	c	4987969	s	UTI89/AS	rec38	c	UTI89	+	c	g	c	c	t	t	t	t	c	t	c	t	t	t	t	t	t	t	t	t	t	t	
a	5020731	t	5038026	t	4988036	ns	UTI89/AS	rec38	t	UTI89	+	t	t	t	t	t	t	t	t	c	t	t	t	t	t	t	t	t	t	t	t	t		
a	5020813	g	5038108	g	4988118	s	UTI89/AS	rec38	a	AS	++++	c	a	a	a	a	a	a	a	c	c	c	c	c	c	c	c	c	c	c	c	c		
g	5020868	a	5038163	a	4988173	ns	UTI89/AS	rec38	c	U/AS	+-	g	g	g	g	g	g	g	g	g	g	g	g	g	g	g	g	g	g	g	g	g	g	
g	5020869	t	5038164	t	4988174	ns	UTI89/AS	rec38	g	AS	++	g	g	g	g	g	g	g	g	g	g	g	g	g	g	g	g	g	g	g	g	g		
g	5020929	a	5038224	a	4988234	s	UTI89/AS	rec38	g	AS	++	g	a	g	g	g	g	g	g	g	g	g	g	g	g	g	g	g	g	g	g	g		
t	5020935	c	5038230	c	4988240	s	UTI89/AS	rec38	c	UTI89	++++	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c		
c	5020941	t	5038236	t	4988246	s	UTI89/AS	rec38	t	UTI89	+	t	t	t	t	t	t	t	t	c	t	t	t	t	t	t	t	t	t	t	t			
c	5020944	t	5038239	t	4988249	s	UTI89/AS	rec38	t	UTI89	+	t	t	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c		
c	5020974	t	5038269	t	4988279	s	UTI89/AS	rec38	c	AS	+	c	t	c	t	t	t	t	c	c	c	c	c	c	c	c	c	c	c	c	c			
t	5020984	c	5038279	c	4988289	s	UTI89/AS	rec38	c	UTI89	++++	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c			
c	5021025	g	5038320	g	4988330	s	UTI89/AS	rec38	g	UTI89	++++	g	g	g	g	g	g	g	g	g	g	g	g	g	g	g	g	g	g	g	g	g		
t	5021037	c	5038332	c	4988342	s	UTI89/AS	rec38	t	AS	+	t	c	t	t	c	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t		
c	5021115	t	5038410	t	4988420	s	UTI89/AS	rec38	t	UTI89	+	c	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t		
c	5021211	t	5038416	t	4988426	s	UTI89/AS	rec38	c	AS	+	c	c	t	t	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c		
a	5021159	g	5038454	g	4988464	s	UTI89/AS	rec38	a	AS	++	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a			
c	5021230	g	5038525	g	4988535	ns	UTI89/AS	rec38	c	AS	++	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c			
g	5021239	t	5038534	t	4988544	ns	UTI89/AS	rec38	t	UTI89	+	g	t	t	g	g	g	g	g	g	g	g	g	g	g	g	g	g	g	g	g	g		
g	5021241	a	5038536	a	4988546	ns	UTI89/AS	rec38	a	UTI89	++	g	a	a	a	g	g	g	g	g	g	g	g	g	g	g	g	g	g	g	g			
g	5021244	a	5038539	a	4988549	s	UTI89/AS	rec38	a	UTI89	++	g	a	a	a	g	g	g	g	g	g	g	g	g	g	g	g	g	g	g	g			
c	5021247	t	5038542	t	4988552	s	UTI89/AS	rec38	a	UTI89	++	g	a	a	g	g	g	g	g	g	g	g	g	g	g	g	g	g	g	g	g			
c	5021271	t	5038566	t	4988576	s	UTI89/AS	rec38	t	UTI89	+	c	t	c	t	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c			
c	5021319	t	5038614	t	4988624	s	UTI89/AS	rec38	c	AS	+	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c			
t	5021326	c	5038621	c	4988631	s	UTI89/AS	rec38	c	UTI89	++++	c	c	c	t	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c		
c	5021352	t	5038647	t	4988657	s	UTI89/AS	rec38	t	UTI89	+	t	t	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c		
t	5021474	a	5038769	a	4988779	ns	UTI89/AS	rec38	t	AS	+	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t		
g	5021487	t	5038782	t	4988792	s	UTI89/AS	rec38	g	AS	++++	g	g	g	g	g	g	g	g	g	g	g	g	g	g	g	g	g	g	g	g	g		
c	5021489	t	5038784	t	4988794	ns	UTI89/AS	rec38	t	UTI89	+	t	g	t	t	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c		
c	5021512	t	5038807	t	4988817	ns	UTI89/AS	rec38	c	AS	+	c	t	c	c	t	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c		
c	5021517	a	5038812	a	4988822	ns	UTI89/AS	rec38	c	UTI89	++	c	a	c	c	a	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c		
t	5021519	c	5038814	c	4988824	s	UTI89/AS	rec38	c	UTI89	++++	c	g	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c		
t	5021523	g	5038818	g	4988828	ns	UTI89/AS	rec38	g	UTI89	++++	g	g	g	g	g	g	g	g	g	g	g	g	g	g	g	g	g	g	g	g	g		
c	5021531	t	5038826	t	4988836	s	UTI89/AS	rec38	t	UTI89	+	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t			
a	5021542	g	5038837	g	4988847	s	UTI89/AS	rec38	g	UTI89	++	g	a	g	a	g	a	g	a	g	a	g	a	g	a	g	a	g	a	g	a			
t	5021543	c	5038838	c	4988848	ns	UTI89/AS	rec38	c	UTI89	++	c	c	c	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t		
g	5021546	c	5038841	c	4988851	s	UTI89/AS	rec38	c	UTI89	++	c	a	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c			
t	5021555	c	5038850	c	4988860	s	UTI89/AS	rec38	t	AS	+	t	c	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t			
g	5021561	a	5038856	a	4988866	s	UTI89/AS	rec38	a	UTI89	++	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a			
c	5021585	t	5038880	t	4988890	s	UTI89/AS	rec38	t	UTI89	+	t	g	t	t	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c		
a	5021590	g	5038885	g	4988895	s	UTI89/AS	rec38	c	UTI89	++	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c			
t	5021591	c	5038886	c	4988896	ns	UTI89/AS	rec38	c	UTI89	+	c	g	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c			
a	5021597	g	5038892	g	4988902	s	UTI89/AS	rec38	a	AS	+	a	g	a	g	a	g	a	g	a	g	a	g	a	g	a	g	a	g	a	g			
t	5021645	c	5038940	c	4989144	ns	UTI89/AS	rec38	t	UTI89	+	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t			
c	5021840	g	5039135	g	4989146	ns	UTI89/AS	rec38	a	AS	++	a	t	a	g	g	g	g	g	g	g	g	g	g	g	g	g	g	g	g	g			
c	5021844	g	5039139	g	4989149	ns	UTI89/AS	rec38	c	AS	++	c	c	a	g	g	g	g	g	g	g	g	g	g	g	g	g	g	g	g	g			
a	5021845	c	5039140	c	4989150	ns	UTI89/AS	rec38	a	AS	++	a	a	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c			
g	5021846	c	5039141	c	4989151	s	UTI89/AS	rec38	g	AS	++	g	g	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c			
c	5021848	g	5039143	g	4989153	ns	UTI89/AS	rec38	c	AS	++	c	c	g	g	g	g	g	g	g	g	g	g	g	g	g	g	g	g	g	g			
a	5021849	t	5039144	t	4989154	ns	UTI89/AS	rec38	a	AS	+	a	a	c	c	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t			
g	5021852	c	5039147	c	4989157	s	UTI89/AS	rec38	g	AS	++	g	g	g	g	g	g	g	g	g	g	g	g	g	g	g	g	g	g	g	g			
t	5021861	c	5039156	c	4989166	s	UTI89/AS	rec38	c	UTI89	+	c	t	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c			
g	5021864	a	5039159	a	4989169	s	UTI89/AS	rec38	a	UTI89	++	a	a	g	a	a	a	a																

Table S8. Allocation of recombinational SNPs to lineages by virtual outgroup analysis^a

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ExPEC genome site details												Outgroup Strains Details ^j												
UTI89 ^b	UTI89 site ^c	APEC 01 ^b	APEC 01 site ^c	S88 ^b	S88 site ^c	type ^d	Recombinant segment ^e	Event Lineage ^f	Inferred ancestral base ^g	Outgroup Analysis ^h														
										Support level ⁱ														
c	5025350	t	5042645	t	4992655	s	UTI89/AS	rec38	t	UTI89	+	t	t	t	t	t	a	t	t	t	t	t	t	t
a	5025351	c	5042646	c	4992656	ns	UTI89/AS	rec38	c	UTI89	++++	c	c	c	c	c	c	c	c	c	c	c	c	
g	5025352	a	5042647	a	4992657	ns	UTI89/AS	rec38	a	UTI89	++	a	a	a	a	a	a	a	a	a	a	a	a	
t	5025353	c	5042648	c	4992658	ns	UTI89/AS	rec38	c	UTI89	++++	c	c	c	c	c	c	g	c	c	c	c	c	
g	5025357	c	5042652	c	4992662	ns	UTI89/AS	rec38	c	UTI89	++++	c	c	c	c	c	c	a	c	c	c	c	c	
t	5025358	a	5042653	a	4992663	ns	UTI89/AS	rec38	a	UTI89	++++	a	a	a	a	a	a	c	a	a	a	a	a	
a	5025359	c	5042654	c	4992664	ns	UTI89/AS	rec38	c	UTI89	++++	c	c	c	c	c	c	g	c	c	c	c	c	
a	5025365	g	5042660	g	4992670	s	UTI89/AS	rec38	a	AS	++	g	a	a	g	g	g	g	g	g	g	g	g	
t	5025377	g	5042672	g	4992682	s	UTI89/AS	rec38	g	UTI89	+	g	g	g	g	g	g	g	g	g	g	g	g	
a	5025380	g	5042675	g	4992685	s	UTI89/AS	rec38	g	UTI89	++	g	g	g	g	g	g	a	g	g	g	g	g	
t	5025390	c	5042685	c	4992695	ns	UTI89/AS	rec38	c	UTI89	++++	c	c	c	c	c	c	c	c	c	c	c	c	
g	5025391	t	5042686	t	4992696	ns	UTI89/AS	rec38	t	UTI89	+	t	t	t	t	t	t	t	t	t	t	t	t	
g	5025400	a	5042695	a	4992705	ns	UTI89/AS	rec38	a	UTI89	++	a	a	a	a	a	a	a	a	a	a	a	a	
t	5025401	c	5042696	c	4992706	ns	UTI89/AS	rec38	c	UTI89	++++	c	c	c	c	c	c	c	c	c	c	c	c	
t	5025440	g	5042735	g	4992745	s	UTI89/AS	rec38	g	UTI89	+	g	g	g	g	g	g	g	g	g	g	g	g	
t	5025458	c	5042753	c	4992763	s	UTI89/AS	rec38	c	UTI89	+	c	t	c	c	c	t	a	c	c	a	t	c	
c	5025492	a	5042787	a	4992797	ns	UTI89/AS	rec38	a	UTI89	++	c	a	a	c	c	c	a	a	a	a	a	a	
a	5025493	t	5042788	t	4992798	ns	UTI89/AS	rec38	a	AS	+	a	g	t	a	a	g	t	t	t	t	g	g	
t	5025503	c	5042798	c	4992808	s	UTI89/AS	rec38	c	UTI89	+	t	c	c	t	t	t	c	c	c	c	c	c	
a	5025512	g	5042807	g	4992817	ns	UTI89/AS	rec38	g	UTI89	+	a	g	g	a	a	a	g	g	g	g	g	g	
t	5025556	g	5042851	g	4992861	ns	UTI89/AS	rec38	g	UTI89	+	t	g	t	t	c	g	g	c	c	c	g	g	
a	5025558	t	5042853	t	4992863	ns	UTI89/AS	rec38	t	UTI89	+	a	t	t	a	t	t	t	t	t	t	t	t	
t	5025564	a	5042859	a	4992869	ns	UTI89/AS	rec38	a	UTI89	+	t	a	t	t	c	a	a	c	c	c	c	c	
t	5025566	c	5042861	c	4992871	ns	UTI89/AS	rec38	c	UTI89	+	t	c	c	t	c	c	c	c	c	c	c	c	
t	5025567	c	5042862	c	4992872	ns	UTI89/AS	rec38	c	UTI89	+	t	c	c	t	c	c	c	c	c	c	c	c	
c	5025571	t	5042866	t	4992876	ns	UTI89/AS	rec38	t	UTI89	+	c	t	t	c	c	t	t	t	t	t	t	t	
c	5029997	t	5046927	t	4996937	nc	UTI89/AS	rec38	t	UTI89	+	t	t	t	t	t	t	t	t	t	t	t	t	
t	5030011	c	5046941	c	4996951	nc	UTI89/AS	rec38	c	UTI89	+++	c	c	c	c	c	c	c	c	c	c	c	c	
c	5030055	t	5046985	t	4996995	ns	UTI89/AS	rec38	c	AS	+++	c	c	c	c	c	c	c	c	c	c	c	c	
c	5030079	t	5047009	t	4997019	ns	UTI89/AS	rec38	t	UTI89	+	t	t	t	t	t	t	t	t	t	t	t	t	
t	5030085	c	5047015	c	4997025	ns	UTI89/AS	rec38	t	AS	+	c	t	t	t	t	c	c	c	c	c	c	c	
t	5030133	a	5047063	a	4997073	ns	UTI89/AS	rec38	a	UTI89	++	g	a	a	a	a	a	a	a	a	a	a	a	
t	5030166	g	5047096	g	4997106	ns	UTI89/AS	rec38	g	UTI89	++	g	g	g	g	g	g	g	g	g	g	g	g	
t	5030169	c	5047099	c	4997109	ns	UTI89/AS	rec38	t	AS	+	c	t	t	t	t	c	c	c	c	c	c	c	
a	5030172	g	5047102	g	4997112	ns	UTI89/AS	rec38	g	UTI89	+	g	t	t	t	t	g	a	a	a	a	a	a	
t	5030200	g	5047130	g	4997140	ns	UTI89/AS	rec38	g	UTI89	++	g	g	g	g	g	g	g	g	g	g	g	g	
t	5030332	c	5047262	c	4997272	ns	UTI89/AS	rec38	c	UTI89	+++	c	c	c	c	c	c	c	c	c	c	c	c	
c	5030335	t	5047265	t	4997275	ns	UTI89/AS	rec38	t	UTI89	+	t	t	t	t	t	t	t	t	t	t	t	t	
g	5032799	a	5049064	a	4999074	ns	UTI89/AS	rec39	a	UTI89	++++	a	a	a	a	a	a	a	a	a	a	a	a	
c	5032827	t	5049092	t	4999102	s	UTI89/AS	rec39	t	UTI89	+	t	t	t	t	t	t	t	t	t	t	t	t	
a	5032879	c	5049144	c	4999154	nc	UTI89/AS	rec39	c	UTI89	+	c	t	t	t	t	t	t	t	t	t	t	t	
c	5032891	t	5049156	t	4999166	nc	UTI89/AS	rec39	t	UTI89	+	t	t	t	t	t	t	t	t	t	t	t	t	
t	5032963	c	5049228	c	4999238	ns	UTI89/AS	rec39	c	UTI89	++++	c	c	c	c	c	c	c	c	c	c	c	c	
t	5032996	g	5049261	g	4999271	ns	UTI89/AS	rec39	g	UTI89	++++	g	g	g	g	g	g	g	g	g	g	g	g	
c	5032997	g	5049262	g	4999272	s	UTI89/AS	rec39	g	UTI89	++++	g	g	g	g	g	g	g	g	g	g	g	g	
a	5033003	g	5049268	g	4999278	s	UTI89/AS	rec39	g	UTI89	++++	g	g	g	g	g	g	g	g	g	g	g	g	
t	5033027	t	5049292	t	4999302	s	UTI89/AS	rec39	c	UTI89	++++	c	c	c	c	c	c	c	c	c	c	c	c	
c	5033057	t	5049322	t	4999332	s	UTI89/AS	rec39	t	UTI89	+	t	t	t	t	t	t	t	t	t	t	t	t	
g	5033105	a	5049370	a	4999380	ns	UTI89/AS	rec39	g	AS	++++	g	g	g	g	g	g	g	g	g	g	g	g	
t	5033106	g	5049371	g	4999381	ns	UTI89/AS	rec39	g	UTI89	++++	g	g	g	g	g	g	g	g	g	g	g	g	
t	5033148	a	5049413	a	4999423	nc	UTI89/AS	rec39	c	UTI89	+/	c	t	t	t	t	t	t	t	t	t	t	t	
t	5033157	c	5049422	c	4999432	nc	UTI89/AS	rec39	t	AS	+	t	t	t	t	t	t	t	t	t	t	t	t	
a	5033176	g	5049441	g	4999451	nc	UTI89/AS	rec39	a	AS	++	a	t	t	t	t	t	t	t	t	t	t	t	
g	5033191	t	5049456	t	4999466	nc	UTI89/AS	rec39	g	AS	++	g	t	t	t	t	t	t	t	t	t	t	t	
g	5033213	a	5049478	a	4999488	nc	UTI89/AS	rec39	a	UTI89	+	t	t	t	t	t	t	t	t	t	t	t	t	
t	5033214	c	5049479	c	4999489	nc	UTI89/AS	rec39	c	UTI89	+	c	t	t	t	t	t	t	t	t	t	t	t	
g	5033348	a	5049613	a	4999623	nc	UTI89/AS	rec39	a	UTI89	+	a	t	t	t	t	t	t	t	t	t	t	t	
c	5033413	t	5049678	t	4999688	s	UTI89/AS	rec39	t	UTI89	+	t	t	t	t	t	t	t	t	t	t	t	t	
c	5033509	c	5049774	c	4999784	s	S88	rec40	c	S88	+++	c	c	c	t	t	t	t	t	t	t	t	t	
t	5033512	t	5049777	t	4999787	s	S88	rec40	t	S88	+++	t	t	t	c	c	c	t	t	t	t	t	t	
c	5033569	c	5049834	c	4999844	s	S88	rec40	c	S88	+++	c	c	c	t	t								

Table S8. Allocation of recombinational SNPs to lineages by virtual outgroup analysis^a

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^a color in the table: white: the snps in unallocated blocks; green: the snps that supported the allocation of block; red: the snps that conflicted with the allocation of block; yellow: the unallocated snps or the snps that implies 2 mutations at that site - eg in the ancestor of O55 and O157 strains before isolation and again in one of the lineages in the allocated blocks.

^b Numbers in place of bases indicates number of bases where >2 bases inserted or deleted. In these cases "-" indicates absence of these bases.

^c For indels the base indicated is the base before the insertion or deletion in the strain.

^d s: synonymous; ns: non-synonymous; nc: in non-coding gene; i: intergenic; ins: small insert; del: small deletion; indel: the small indels that can't be allocated.

^e AS: allocated to the lineage to the common ancestor of APEC 01 and S88; UTI89/AS: allocated to the divergence between UTI89 and the common ancestor of APEC 01 and S88 (strain not specified); APEC/S88: allocated to the divergence between APEC 01 and S88 lineages (lineage not specified).

^f The recombinational block was allocated if more than 80% of the snps in it can be allocated into the same lineage.

⁹ The base in the common ancestor of the 3 ExPEC strains as inferred from outgroup analysis.

^b Level of support for allocation of mutation as given in previous column

++++ agreement is high - 8 or more outgroup strains with expected base and at most 1 with an alternative base, and at least 2 of the CFT073, ED1a and 536 support the expected base)

+++ agreement good - 4 or more outgroup strains with expected base and at most 1 with an alternative base
the expected base)

++ supported by at least 2 of the CFT073, ED1a and 536 regardless of situation with other outgroup strains

+ no conflict but very limited support as either site absent or conflict in all of CF-1073, ED1a and 536, or conflict among them, and/or support is less than required any of the higher levels of support.

4/- no conflict but no support (base not present in any outgroup OR base when present is not that in any of the ExEPEC strains OR both alternative lineages supported equally).

- conflict data implies 2 mutations at that site - eg in the ancestor of 3 ExEPEC strains before isolation and again in one of the lineages.