

Table S1: Quantitative analysis study details

First Author, Year	No. of cSCC (IS, IC)	IS Patients	Assay	No. of Genes	Source of Data	Limitations
Bennett, 1997	25 (25, 0)	OTR	DNA sequencing	1	Table 3	No IC subjects
Blockx, 2005	8 (4, 4)	OTR	DNA sequencing	2	Tables 1, 3	Small sample size
Brown, 2004	40 (30, 10)	Receiving immunosuppressive medications	DNA sequencing Genotyping (microsatellite analysis)	1	Table 5	Unequal sample sizes, IS not clearly defined
Chitszadeh, 2016	7 (0, 7)	NA	DNA sequencing	13 ^a	Fig. 2c	No IS subjects
Durinck, 2011	8 (1, 7) ^b	OTR	DNA sequencing	WES	Supp. Table 1	Unequal sample sizes
Inman, 2018	40 (33, 7)	29 OTR, 1 Crohn'sreceiving immunosuppressive medications	DNA sequencing Genotyping (SNP microarray)	WES	Supp. Data 3 (sequencing) Fig. 3b, 7b (genotyping)	Unequal sample sizes
Kacew, 2019	16 (2, 14)	Not specified (may include HIV, hematologic malignancy, or OTR)	DNA sequencing	20 ^c	Fig. 2a	Unequal sample sizes, varying definitions of IS
Lambert, 2012	71 (39, 32) ^d	Not defined	DNA sequencing Genotyping (SNP microarray)	1	Supp. Tables 1, 2	IS not clearly defined

Loeb, 2012	55 (0, 55)	NA	DNA sequencing	1	Table 2	No IS subjects
Maurer, 2011	30 (3, 17)	Not defined	DNA sequencing	4	Table 1	Unequal sample sizes, IS not clearly defined
McGregor, 2002	47 (33, 14)	OTR	DNA sequencing Genotyping (microsatellite analysis)	1	Table 5	Unequal sample sizes
Morris, 2017	21 (4, 17)	Not defined	DNA sequencing	410	Supp. Table 4	Unequal sample sizes, IS not clearly defined
Picard, 2017	31 (15, 16)	Not specified (may include history of steroid use >6 months, OTR, cancer, or diabetes)	DNA sequencing	5	Table 2	IS not clearly defined
Pickering, 2014	39 (1, 38)	Not defined	DNA sequencing	WES	Supp. Table S5	Unequal sample sizes, IS not clearly defined
Ridd, 2010	42 (20, 22)	OTR	DNA sequencing	6	Table 1	
South, 2014	91 (52, 39)	46 OTR, 6 not defined	DNA sequencing	6 ^e	Supp. Table 4	
Wang, 2011	12 (2, 10)	OTR	DNA sequencing	8 ^a	Tables 1, S2	Unequal sample sizes
Yilmaz, 2017	28 (0, 28)	NA	DNA sequencing	WES (n=12) 409 (n=16)	Supp. Tables 4, 6	No IS subjects
a. whole-exome sequencing performed, however dataset not available b. cohort included in Wang et al., 2011 c. sequencing of 447 cancer-related genes performed, results limited to those mutated in >30% of samples						

d. includes Purdie et al., 2009

e. whole-exome sequencing cohort (n=20) included in Inman et al., 2018

Abbreviations: OTR, organ transplant recipient; NA, not applicable; WES, whole-exome sequencing.

Table S2: Mutation frequencies for the 136 genes reported in four or more studies

Gene	No. of Studies	Immunosuppressed			Immunocompetent			Combined			IS vs. IC
		Mutated	WT	% Mutated	Mutated	WT	% Mutated	Mutated	WT	% Mutated	P-value
TP53	12	79	77	50.64	150	82	64.66	229	159	59.02	0.006
CDKN2A	9	40	87	31.50	65	99	39.63	105	186	36.08	0.152
HRAS	8	20	89	18.35	21	148	12.43	41	237	14.75	0.174
NOTCH1	8	73	21	77.66	93	67	58.13	166	88	65.35	0.002
NOTCH2	8	56	38	59.57	77	83	48.13	133	121	52.36	0.078
EGFR	7	10	64	13.51	12	133	8.28	22	197	10.05	0.223
KRAS	7	9	99	8.33	8	142	5.33	17	241	6.59	0.338
NF1	7	14	27	34.15	37	81	31.36	51	108	32.08	0.742
APC	6	14	27	34.15	24	75	24.24	38	102	27.14	0.230
ARID1A	6	7	34	17.07	23	88	20.72	30	122	19.74	0.616
EP300	6	14	28	33.33	33	80	29.20	47	108	30.32	0.619
FAT1	6	27	13	67.50	46	49	48.42	73	62	54.07	0.042
IGF1R	6	8	41	16.33	12	94	11.32	20	135	12.90	0.387
KDR	6	11	30	26.83	33	78	29.73	44	108	28.95	0.726
MLL2	6	22	18	55.00	63	48	56.76	85	66	56.29	0.848
MLL3	6	18	21	46.15	44	60	42.31	62	81	43.36	0.679
NRAS	6	4	72	5.26	5	129	3.73	9	201	4.29	0.726
ABL1	5	6	33	15.38	16	81	16.49	22	114	16.18	NA
AKT2	5	5	34	12.82	4	81	4.71	9	115	7.26	NA
AKT3	5	1	38	2.56	9	76	10.59	10	114	8.06	NA
ALK	5	9	30	23.08	19	78	19.59	28	108	20.59	NA
ANKRD11	5	10	29	25.64	17	64	20.99	27	93	22.50	NA
AR	5	3	37	7.50	23	81	22.12	26	118	18.06	NA
ARID2	5	10	29	25.64	20	77	20.62	30	106	22.06	NA
ASXL1	5	7	32	17.95	21	76	21.65	28	108	20.59	NA
ATM	5	8	31	20.51	22	75	22.68	30	106	22.06	NA
ATR	5	9	30	23.08	22	75	22.68	31	105	22.79	NA
AXL	5	7	32	17.95	18	79	18.56	25	111	18.38	NA
BLM	5	2	37	5.13	14	83	14.43	16	120	11.76	NA
BRCA2	5	11	29	27.50	18	70	20.45	29	99	22.66	NA
BTK	5	3	36	7.69	7	78	8.24	10	114	8.06	NA
CARD11	5	11	28	28.21	24	73	24.74	35	101	25.74	NA
CASP8	5	6	33	15.38	15	66	18.52	21	99	17.50	NA
CIC	5	6	33	15.38	20	77	20.62	26	110	19.12	NA
CREBBP	5	10	29	25.64	29	68	29.90	39	97	28.68	NA
CTCF	5	0	39	0.00	10	87	10.31	10	126	7.35	NA
CUL3	5	3	36	7.69	7	90	7.22	10	126	7.35	NA
CUX1	5	5	32	13.51	15	79	15.96	20	111	15.27	NA

DAXX	5	6	33	15.38	6	91	6.19	12	124	8.82	NA
DDR2	5	9	30	23.08	26	71	26.80	35	101	25.74	NA
DIS3	5	3	36	7.69	7	74	8.64	10	110	8.33	NA
DNMT3 A	5	5	34	12.82	11	86	11.34	16	120	11.76	NA
DNMT3 B	5	4	35	10.26	14	67	17.28	18	102	15.00	NA
EPHA3	5	10	29	25.64	26	55	32.10	36	84	30.00	NA
EPHA5	5	10	29	25.64	24	57	29.63	34	86	28.33	NA
EPHA7	5	13	26	33.33	26	71	26.80	39	97	28.68	NA
ERBB2	5	4	44	8.33	19	83	18.63	23	127	15.33	NA
ERBB4	5	14	25	35.90	31	66	31.96	45	91	33.09	NA
EZH2	5	7	32	17.95	8	89	8.25	15	121	11.03	NA
FANCA	5	6	33	15.38	18	79	18.56	24	112	17.65	NA
FANCC	5	1	38	2.56	4	81	4.71	5	119	4.03	NA
FGFR2	5	4	53	7.02	10	102	8.93	14	155	8.28	NA
FGFR3	5	1	57	1.72	14	85	14.14	15	142	9.55	NA
FLT3	5	6	33	15.38	18	79	18.56	24	112	17.65	NA
GLI1	5	5	34	12.82	18	63	22.22	23	97	19.17	NA
HGF	5	6	33	15.38	19	62	23.46	25	95	20.83	NA
HIST1H3 C	5	2	37	5.13	4	77	4.94	6	114	5.00	NA
IGF2	5	0	39	0.00	8	77	9.41	8	116	6.45	NA
IL7R	5	4	35	10.26	9	88	9.28	13	123	9.56	NA
INSRR	5	7	32	17.95	14	67	17.28	21	99	17.50	NA
JAK3	5	5	34	12.82	17	80	17.53	22	114	16.18	NA
KIT	5	2	37	5.13	19	78	19.59	21	115	15.44	NA
MALT1	5	2	37	5.13	6	79	7.06	8	116	6.45	NA
MAP3K1	5	8	31	20.51	10	71	12.35	18	102	15.00	NA
MAPK1	5	2	37	5.13	2	83	2.35	4	120	3.23	NA
MDC1	5	6	33	15.38	18	63	22.22	24	96	20.00	NA
MDM4	5	2	37	5.13	5	80	5.88	7	117	5.65	NA
MED12	5	3	36	7.69	11	70	13.58	14	106	11.67	NA
MET	5	8	49	14.04	12	99	10.81	20	148	11.90	NA
MLH1	5	4	35	10.26	13	84	13.40	17	119	12.50	NA
MLL	5	11	28	28.21	31	66	31.96	42	94	30.88	NA
MSH2	5	2	37	5.13	6	91	6.19	8	128	5.88	NA
MSH6	5	11	28	28.21	9	72	11.11	20	100	16.67	NA
MST1R	5	4	35	10.26	7	74	8.64	11	109	9.17	NA
NCOR1	5	11	28	28.21	16	65	19.75	27	93	22.50	NA
NOTCH3	5	13	27	32.50	29	54	34.94	42	81	34.15	NA
NOTCH4	5	5	35	12.50	21	78	21.21	26	113	18.71	NA
NSD1	5	11	28	28.21	18	79	18.56	29	107	21.32	NA
NTRK1	5	4	35	10.26	17	80	17.53	21	115	15.44	NA
NTRK3	5	11	29	27.50	25	79	24.04	36	108	25.00	NA
NUP93	5	5	34	12.82	7	74	8.64	12	108	10.00	NA
PAK7	5	8	31	20.51	30	51	37.04	38	82	31.67	NA
PARK2	5	7	32	17.95	18	63	22.22	25	95	20.83	NA

PARP1	5	7	32	17.95	18	79	18.56	25	111	18.38	NA
PBRM1	5	6	33	15.38	19	78	19.59	25	111	18.38	NA
PDGFR A	5	8	31	20.51	16	81	16.49	24	112	17.65	NA
PDGFRB	5	8	31	20.51	21	76	21.65	29	107	21.32	NA
PIK3C2 B	5	8	29	21.62	20	74	21.28	28	103	21.37	NA
PIK3CA	5	10	29	25.64	14	83	14.43	24	112	17.65	NA
PIK3CG	5	9	30	23.08	30	67	30.93	39	97	28.68	NA
PIK3R1	5	7	32	17.95	7	90	7.22	14	122	10.29	NA
POLE	5	8	31	20.51	11	70	13.58	19	101	15.83	NA
PPM1D	5	5	34	12.82	9	72	11.11	14	106	11.67	NA
PRDM1	5	12	27	30.77	12	69	14.81	24	96	20.00	NA
PTCH1	5	9	30	23.08	18	79	18.56	27	109	19.85	NA
PTPRD	5	33	44	42.86	59	63	48.36	92	107	46.23	NA
PTPRS	5	8	31	20.51	14	67	17.28	22	98	18.33	NA
PTPRT	5	15	24	38.46	36	61	37.11	51	85	37.50	NA
RAD50	5	1	38	2.56	11	86	11.34	12	124	8.82	NA
REL	5	2	37	5.13	6	91	6.19	8	128	5.88	NA
RNF43	5	6	33	15.38	11	70	13.58	17	103	14.17	NA
ROS1	5	15	24	38.46	41	56	42.27	56	80	41.18	NA
SETD2	5	12	27	30.77	20	77	20.62	32	104	23.53	NA
SHQ1	5	1	38	2.56	6	75	7.41	7	113	5.83	NA
SMARC B1	5	1	38	2.56	6	91	6.19	7	129	5.15	NA
SMO	5	3	36	7.69	8	77	9.41	11	113	8.87	NA
SPEN	5	15	24	38.46	30	51	37.04	45	75	37.50	NA
STK40	5	2	37	5.13	11	70	13.58	13	107	10.83	NA
TCF3	5	3	36	7.69	10	75	11.76	13	111	10.48	NA
TMPRSS 2	5	3	36	7.69	12	69	14.81	15	105	12.50	NA
TP63	5	3	36	7.69	11	70	13.58	14	106	11.67	NA
TSC2	5	5	34	12.82	19	78	19.59	24	112	17.65	NA
TYK2	5	5	34	12.82	13	68	16.05	18	102	15.00	NA
WT1	5	2	37	5.13	5	92	5.15	7	129	5.15	NA
XPO1	5	4	35	10.26	2	83	2.35	6	118	4.84	NA
BARD1	4	3	36	7.69	2	67	2.90	5	103	4.63	NA
CSF3R	4	1	38	2.56	12	57	17.39	13	95	12.04	NA
DNMT1	4	5	34	12.82	15	54	21.74	20	88	18.52	NA
ERRFI1	4	3	36	7.69	4	65	5.80	7	101	6.48	NA
ETV6	4	3	36	7.69	8	61	11.59	11	97	10.19	NA
FAM175 A	4	2	37	5.13	3	66	4.35	5	103	4.63	NA
FH	4	1	38	2.56	5	64	7.25	6	102	5.56	NA
HIST1H3 B	4	3	36	7.69	4	65	5.80	7	101	6.48	NA
HIST1H3 G	4	2	37	5.13	5	64	7.25	7	101	6.48	NA
HIST3H3	4	1	38	2.56	4	65	5.80	5	103	4.63	NA

INHA	4	4	35	10.26	5	64	7.25	9	99	8.33	NA
INPP4B	4	6	33	15.38	10	59	14.49	16	92	14.81	NA
MAP2K4	4	1	38	2.56	3	66	4.35	4	104	3.70	NA
MST1	4	5	34	12.82	4	65	5.80	9	99	8.33	NA
NEGR1	4	3	36	7.69	5	64	7.25	8	100	7.41	NA
NTRK2	4	0	39	0.00	7	62	10.14	7	101	6.48	NA
RAC1	4	3	36	7.69	5	64	7.25	8	100	7.41	NA
RAD54L	4	3	36	7.69	9	60	13.04	12	96	11.11	NA
RBM10	4	3	36	7.69	6	63	8.70	9	99	8.33	NA
TERT	4	7	31	18.42	20	54	27.03	27	85	24.11	NA
TRAF7	4	3	36	7.69	6	63	8.70	9	99	8.33	NA