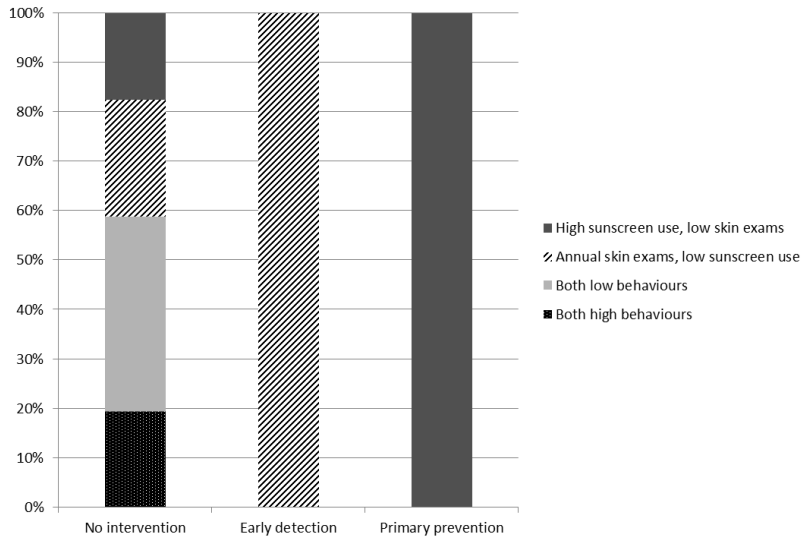
SUPPLEMENTARY FILE

Contents

Figure S1: Proportions of health behaviours for each strategy



Definitions: high sunscreen use = >50% time outdoors, low sunscreen use <50% time outdoors, skin exams – any clinical skin exam within past 3 years
Early detection strategy – skin exams annually + low sunscreen use
Primary prevention strategy – High sunscreen use + low skin exams
No intervention – mix of behaviours according to QSkin analysis of n=38638

In the 'No intervention' strategy, the baseline behaviours of sunscreen use and skin exams were estimated and represent the real-world scenario of current 'no intervention'. Using QSKIN data, the behaviour probabilities were 17% for high sunscreen use and no skin exams, 24% for low sunscreen use and skin exams, 19% for both high behaviours, and 40% for both low behaviours. Under the early detection strategy, 'skin exams and low sunscreen use' was 100% and in the primary prevention scenario, the 'high sunscreen use and low skin exams category probability was 100%. The behaviours were not explicitly modelled as data inputs in the model but rather the consequences from them.

Further details of model inputs

The estimate for solar keratosis incidence was 24% [18] (used for 'benign skin lesions' health state). The effect of increased skin exams was a 50% increase in all skin malignancies as seen in the Skin Awareness Trial [1]. This increase was applied to the age-specific Queensland population incidence of melanoma, KCs and benign lesions [19, 20]. The effect of early detection is through an 18% reduction in thicker melanomas (>1mm) over three years [9].

A weighted average was calculated for thicker melanomas which combined stages II, III and IV. Five year survival for stage I melanoma was 98% versus 32% for stage IIID (the latter was assumed the same for stage IV in our model). This is supported by increasing metastatic mortality rates from pharmacotherapy trial evidence at 4-years for ipilimumab and nivolumab (53% survival). Ten year survival for stage 1 melanoma was 95% versus 24% for stage IIID[7]. We did not apply excess mortality to individuals with multiple melanomas as evidence is unclear and similarly, for KCs, deaths from KCs are uncommon in the general population and are lower than background mortality rates [22]. Background mortality rates were based on life tables for the Queensland population [8] to reflect that individuals may die at any age from any cause

Health Utilities. Utility scores (similar to health-related quality of life scores) were assigned to the health states where appropriate. Scores ranged from 0 (indicating death) to 1 (indicating best possible health) and applied to survival to generate 'quality-adjusted life years' (QALYs). Utility scores for melanoma stages, including patients with advanced melanoma receiving targeted therapies, were obtained from a meta-analysis (Table 1) [13]. Robust evidence on health utilities for patients with KC or benign skin lesions is limited, but there is an appreciable quality of life effect where some individuals face disfiguring, multiple cancers, anxiety and other symptoms [23]. From Seidler *et al.* (2009), we assigned a utility score of 0.984 to patients with KCs (0.95 and 0.99 in sensitivity analysis) and a utility reduction of -0.03 each time an individual had an additional KC [24].

Resource Use and Costs. Short-term costs associated with implementing promotional campaigns or intervention programs were excluded. Individuals having any clinical skin exam were assumed to visit their primary physician once per year. Costs were included for resources consumed in the routine diagnosis, treatment and follow-up of skin cancers and skin lesions in Australia [14, 15] and included new therapies for treating advanced melanoma [15] (Table 1).

Model validation

In the 'no intervention' strategy, the model predicted 70.5% were alive at age 80 which aligns to 67.4% of 50-year olds in the general population[8]. The modelled 10-year survival in the no intervention strategy was 96.4% compared with 97.4% survival in Queenslanders with thin melanoma from Green *et al.* 2012.

Figure S2: Tornado Plot: Incremental cost-effectiveness ratio, primary prevention vs early detection

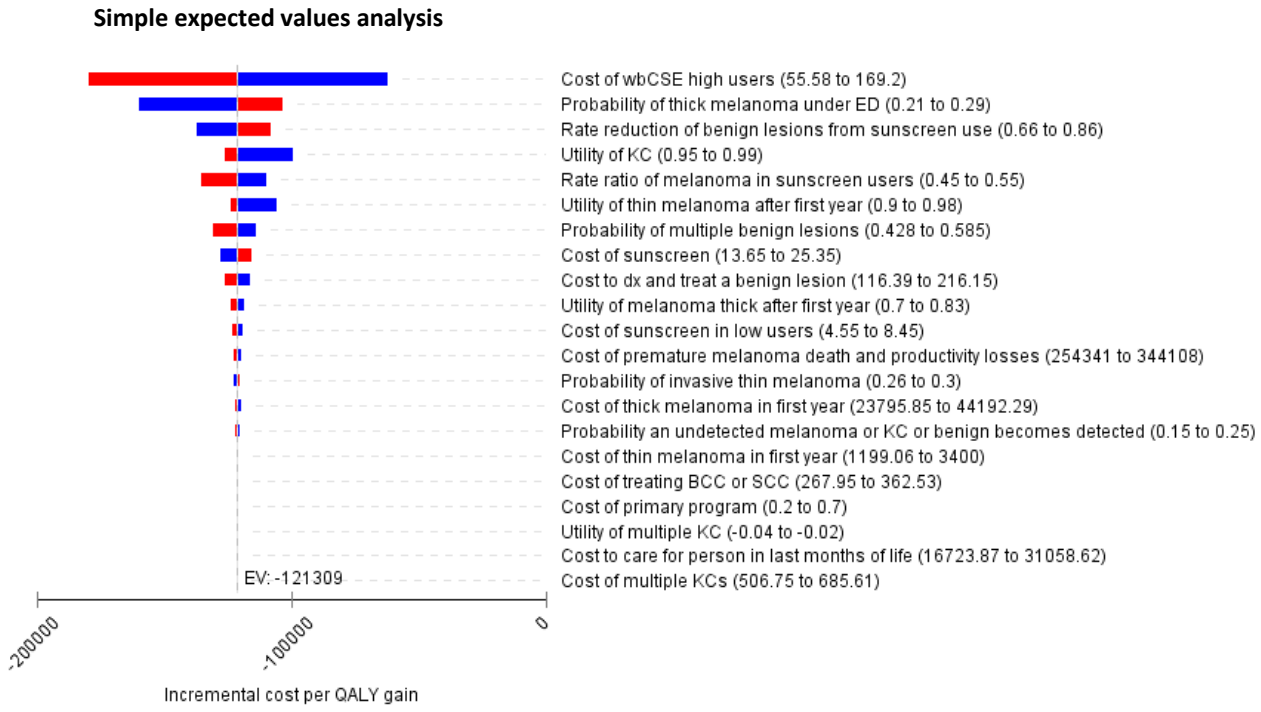
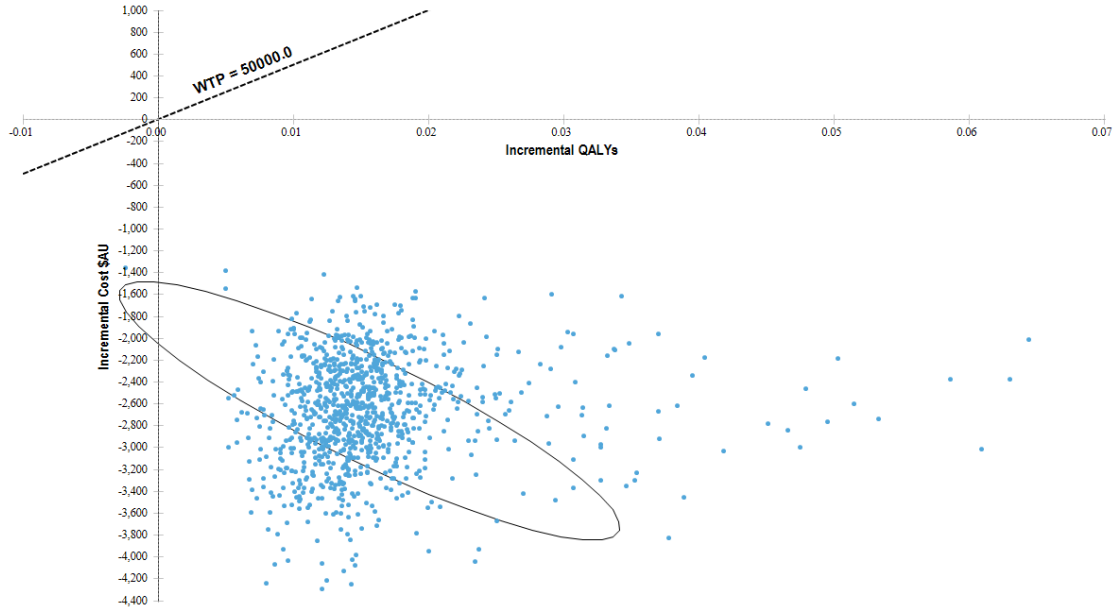


Figure S3: Scatterplot of incremental costs and QALYs for Primary prevention versus Early detection.



Note: Each dot represents an incremental cost and incremental QALY pairing, using the assigned distributions around each model parameter, selected randomly during 5000 iterations. Dots falling below the diagonal line (the willingness-to-pay threshold of AU$50,000 per QALY) are considered cost-effective. The proportion of simulations considered cost-effective is 100%. The oval is the 95% ellipse.

Figure S4: Scatterplot of mean costs and QALYs for all three strategies

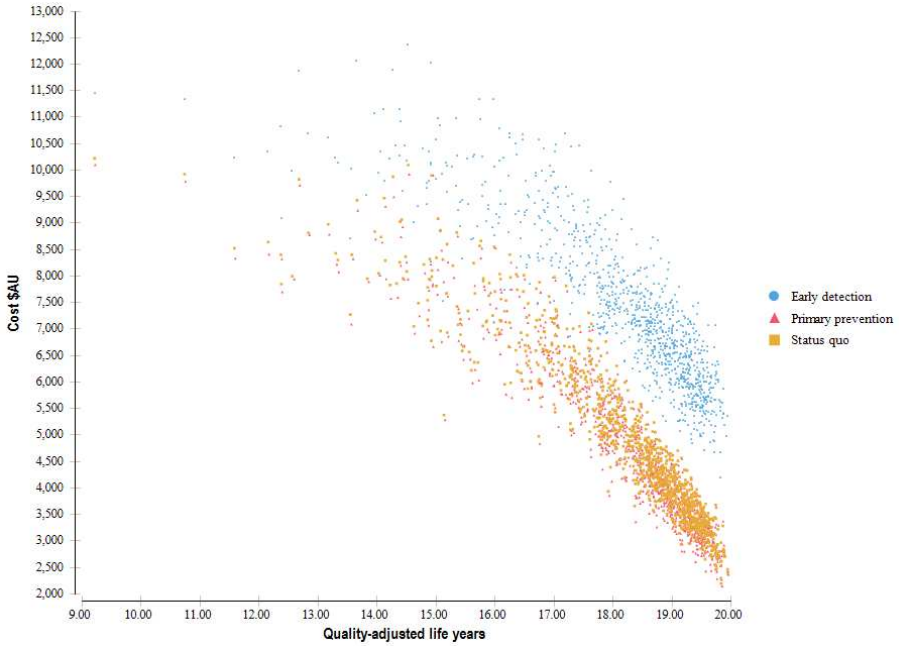
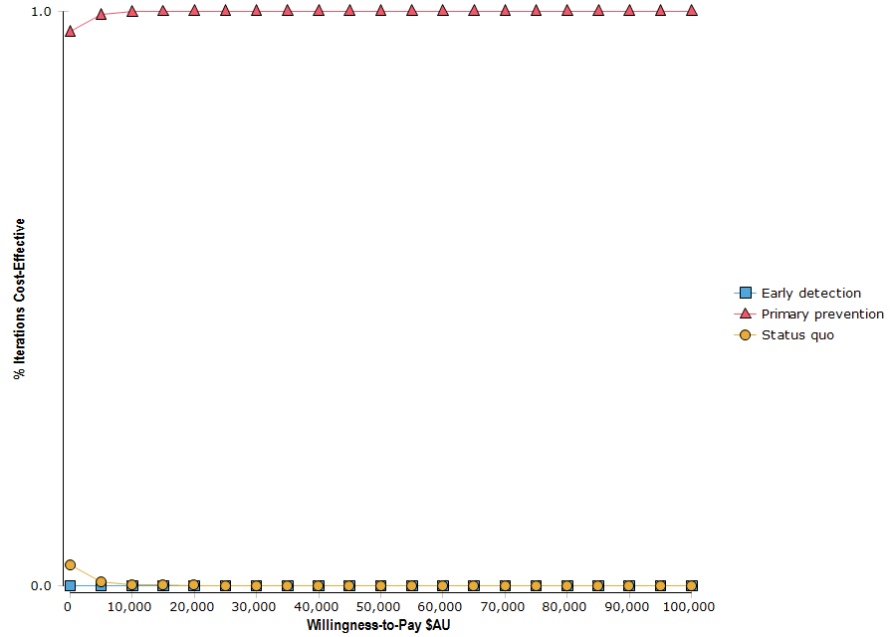
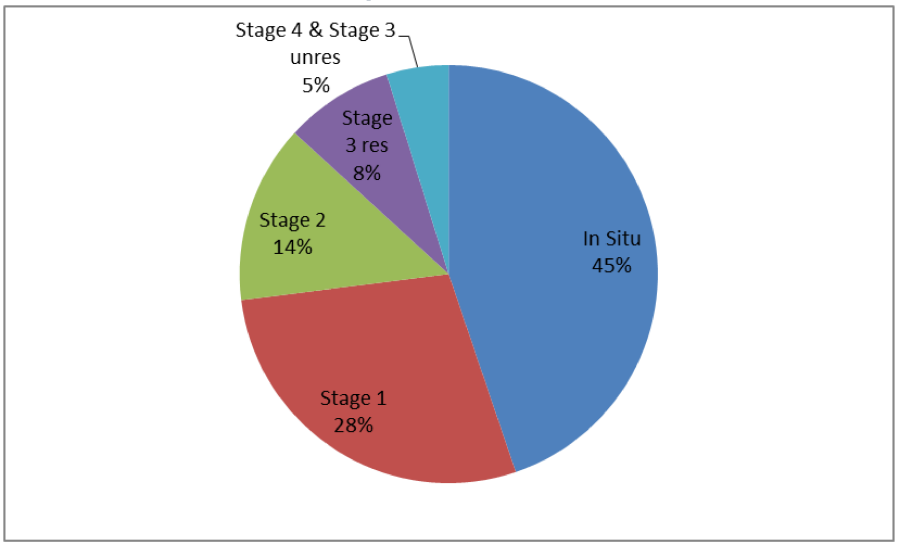


Figure S5: Cost-effectiveness acceptability curve for 3 strategies



Data inputs

Distribution of melanoma stage



Sources: Aitken 2018[5] & NSW data

Melanoma mortality

a) For invasive melanomas, thin melanomas were Stage I, thicker melanomas were Stages II-IV and weighted by stage II (60%), III (22%), IV (18%). Mortality rate was the complement of survival and rate to probability calculations applied. Stage IIID in Gershenwald 2017 was assumed to be the same for Stage IV.

Year since diagnosis	Thin (0<1mm)	Thicker (>1mm)
5	0.02	0.233
10	0.05	0.301

Source: Gershenwald 2017 [7]

b) For in situ melanomas – no mortality possible, background mortality rates applied

Incidence of melanoma

-in Queenslanders by Age, all persons, rate to prob calculation

Age	Prob of mel
4	0.00000100
9	0.00000100
14	0.00000900
19	0.00005000
24	0.00011799

29	0.00025897
34	0.00035594
39	0.00047189
44	0.00060582
49	0.00077770
54	0.00098551
59	0.00118829
64	0.00170255
69	0.00210877
74	0.00243503
79	0.00278013
84	0.00308822
100	0.00297856

Source: Queensland Cancer Statistics On-Line, 2017. Viertel Cancer Research Centre, Cancer Council Queensland (qcsol.cancerqld.org.au). Based on data released by the Queensland Cancer Registry (1982-2014; released January 2017).[3]

Incidence of Keratinocyte cancers

-in Queenslanders by Age, all persons, rate to prob calculation

Age	**Incid KC**
19	0.0027
39	0.0180
59	0.0565
79	0.0709
99	0.0900

Source: Pandeya 2017[2], Age 99 was estimated

Incidence of Multiple keratinocyte cancers

-in Queenslanders by Age, all persons, rate to prob calculation

Index	**Incid multiple KC**
20	0.0007
40	0.0057
60	0.0246
80	0.0342

Source: Pandeya 2017[2]

Background mortality

These were for Queenslanders as reported in government life tables for 2015-2017.

Index	All
0	0.004008
1	0.000289
2	0.000180
3	0.000150
4	0.000125
5	0.000105
6	0.000090
7	0.000080
8	0.000075
9	0.000075
10	0.000075
11	0.000080
12	0.000100
13	0.000125
14	0.000160
15	0.000210
16	0.000264
17	0.000329
18	0.000373
19	0.000413
20	0.000442
21	0.000462
22	0.000477
23	0.000497
24	0.000512
25	0.000527
26	0.000542
27	0.000566
28	0.000591
29	0.000621
30	0.000661
31	0.000706
32	0.000746
33	0.000801
34	0.000850
35	0.000910
36	0.000960
37	0.001015
38	0.001074
39	0.001144
40	0.001224
41	0.001313
42	0.001408
43	0.001508
44	0.001612
45	0.001717
46	0.001831
47	0.001966
48	0.002105
49	0.002255
50	0.002434
51	0.002623
52	0.002837
53	0.003080
54	0.003343
55	0.003626
56	0.003924
57	0.004256
58	0.004623
59	0.005020
60	0.005441
61	0.005876
62	0.006356
63	0.006886
64	0.007489
65	0.008167
66	0.008949
67	0.009823
68	0.010806
69	0.011895
70	0.013126
71	0.014517
72	0.016088
73	0.017877
74	0.019853
75	0.022084
76	0.024636
77	0.027555
78	0.030891
79	0.034707
80	0.039141
81	0.044251
82	0.050041
83	0.056585
84	0.064097
85	0.074709
86	0.084204
87	0.094600
88	0.105923
89	0.118217
90	0.131459
91	0.145525
92	0.160324
93	0.175518
94	0.190727
95	0.203434
96	0.217400
97	0.231974
98	0.246855
99	0.264965
100	0.281137

Source: Life Tables Queensland[8]

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