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Economic Evaluation of the SunSmart Program: Achievement in the past and prospect for the future

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The difference is Deakin University
Acknowledgement

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  - Cancer Education Unit, The Cancer Council Victoria

> **Prof. Theo Vos**
  - School of Population Health, University of Queensland
Background

> Australia has the highest skin cancer in the world:
  - Malignant Melanoma
  - Non-Melanomic Skin Cancer (NMSC)
    - Basal cell carcinoma (BCC)
    - Squamous cell carcinoma (SCC)
> Most common cancer: 2 in 3 Australians can expect to have NMSC treated by the age of 70
> Most expensive cancer in Australia: more than $294 million spent annually on the diagnosis and treatment of skin cancer
> Most significant component of skin cancer: preventable
Public Health Campaigns

- Existence for decades
- “Slip Slop Slap” Campaign in Victoria in early 1980s
- Rolled into a multi-faceted skin cancer prevention program: SunSmart
- National initiative delivered primarily through Cancer Councils across Australia under the brand name
Investment in SunSmart (I)

> Varied considerable over the years and between states
> Often well below the level for a comprehensive program
> Reflecting fiscal constraints in the State/Territories
> The Australian Government for the first time in 2006/2007 invested $5m; no commitment made beyond the initial period.
Investment in SunSmart (II)

Table 1: Historical expenditures ($ per capita) on sun protection programs in each current year value and in reference year (2003) values, in Victoria (Vic), New South Wales (NSW) and Queensland (Qld)

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<tbody>
<tr>
<td>VIC</td>
<td>0.26</td>
<td>0.27</td>
<td>0.24</td>
<td>0.28</td>
<td>0.09</td>
<td>0.22</td>
<td>0.22</td>
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<td>0.15</td>
<td>0.13</td>
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<td>0.02</td>
<td>0.13</td>
<td>0.15</td>
<td>0.15</td>
<td>0.16</td>
<td>0.13</td>
<td>0.14</td>
<td>0.20</td>
<td>0.24</td>
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<tr>
<td>QLD</td>
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<td>-</td>
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<td>-</td>
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<td>0.01</td>
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<td>0.07</td>
<td>0.02</td>
<td>0.01</td>
<td>0.02</td>
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<tr>
<td>Australia</td>
<td>0.25</td>
<td>0.26</td>
<td>0.23</td>
<td>0.28</td>
<td>0.10</td>
<td>0.22</td>
<td>0.22</td>
<td>0.22</td>
<td>0.26</td>
<td>0.26</td>
<td>0.10</td>
<td>0.15</td>
<td>0.12</td>
<td>0.11</td>
<td>0.13</td>
<td>0.14</td>
<td>0.13</td>
<td>0.15</td>
<td>0.17</td>
</tr>
</tbody>
</table>

*In Reference Year (2003) Value*

| VIC  | 0.41 | 0.40 | 0.35 | 0.39 | 0.12 | 0.29 | 0.29 | 0.28 | 0.33 | 0.32 | 0.31 | 0.29 | 0.16 | 0.14 | 0.12 | 0.20 | 0.19 | 0.19 | 0.18 |
| NSW  | 0.02 | 0.08 | 0.10 | 0.10 | 0.10 | 0.08 | 0.08 | 0.12 | 0.14 |    |    |    |    |    |    |    |    |    |    |    |
| QLD  | 0.03 | 0.02 | 0.03 | 0.01 | 0.09 | 0.07 | 0.02 | 0.02 | 0.01 | 0.02 |    |    |    |    |    |    |    |    |    |    |
| Australia | 0.41 | 0.40 | 0.35 | 0.39 | 0.12 | 0.29 | 0.29 | 0.28 | 0.33 | 0.32 | 0.11 | 0.14 | 0.10 | 0.09 | 0.10 | 0.12 | 0.10 | 0.12 | 0.12 |

*Source: provided by the Australian Cancer Council based on information collected from the three State SunSmart programs.*
Previous Study

> Carter et al (1999) conducted an economic study to determine the potential cost-effectiveness of a national sun protection program of $5 million investment per annum for 20 years

> Sunburn incidence was used as a proxy for outcome measurement in relation to reduction in cancer incidence

> The study found the intervention would potentially be excellent value-for-money, from the Australian Government perspective
Study Objective

> Undertake an economic evaluation of the SunSmart program, from the government as a “third-party funder” perspective to make up-to-date informed policy.
> To demonstrate the C/E of the past SunSmart program
> To determine the potential C/E of an on-going national upgraded SunSmart program for the next 20 years
> A broader “health sector” perspective is taken
  - as per ACE-Prevention Project to compare across 100 preventive intervention using the same methodology
  - to recognize the role of individuals in compliance of the SunSmart message and ensuring the success of the program
Definition of intervention

> For the past –
  - Intervention: a well-resourced SunSmart in Victoria
  - Comparator: under-invested states (NSW/Qld)

> For the future 20 years –
  - Intervention: an upgraded on-going national SunSmart program with an “optimal” investment level as at the historical average of Vic.
  - Comparator: a SunSmart program operating at a much lower level of investment as at the average of NSW/Qld, reflecting current practice
Assessing Program Effectiveness (I)


> Doubt emerging as to its validity, based on a divergent trends in observed sunburn incidence and skin cancer incidence
Assessing Program Effectiveness (II)

> By analyzing the empirical data on skin cancer incidence

> Assess separately for melanoma and NMSC due to data availability issues.

> Melanoma -
  - Case numbers by age and gender from 1982 to 2004 from three states, i.e. Vic, NSW and Qld
  - representative for three latitude zones of different ambient UVR exposures (risk factor of skin cancer)

> NMSC –
  - national survey results
Assessing Program Effectiveness (III)

> Age-specific incidence rates are calculated for these three zones.
> Compare the melanoma incidence rates pre and post the program
> Projected incidence based on the trend of pre-SunSmart from 1982 to 1987 was assumed to be the melanoma incidence without SunSmart
> Effectiveness expressed as rate ratio (RR) of observed over projected incidence
Assessing Program Effectiveness (IV)

> Incidence reduction in Victoria less than the other two states
> Due to lower UVR level??
> Adjust for the ‘Slip, Slop, Slap’ effect,
  ▪ assume that the trend in melanoma incidence (slope of increase) in NSW/Qld is indicative of the trend in Victoria if they had not had this campaign.
  ▪ Adjusted rate ratios of observed to the expected incidence are then calculated for Victoria
  ▪ May over-estimate the effectiveness if the lower UVR level in Vic plays a role.
Assessing Program Effectiveness (V)

- More realistic illustration of the past SunSmart in Victoria over “do nothing”
- Enabled the comparison between optimal SunSmart state (Victoria) and under-invested SunSmart state (NSW/QLD) over the period 1988 to 2003
- Incremental effectiveness of the Victorian program compared to NSW/Qld, provides a realistic (albeit conservative) estimate of the incremental benefit that a sustained investment in SunSmart in the future could achieve compared to current practice

Rate ratio (RR) of observed over predicted melanoma incidence, male

![Graph showing rate ratio (RR) of observed over predicted melanoma incidence, male from 1988 to 2004. The graph compares Victoria (VIC) and NSW/QLD, with Victoria consistently showing a lower rate ratio.]
Assessing Program Effectiveness (VI)

> NMSC

- Not routinely collected by Cancer Registries
- NMSC incidence has been estimated from a population survey every 5 to 7 years since 1985
- Staples (1998) reported the incidence of BCC has fallen in the younger age groups less than 50 years old
- Appears to be no impact on SCC
Modeling to health outcomes

> Assumption –
  - the reduction in melanoma incidence that has occurred in the past in Victoria could be re-produced by the optimal SunSmart program for Australia as a whole in the next 20 years

> Outcomes –
  - Incidence reduction
  - Death averted
  - Life Years Saved (LYS)
  - Disability Adjusted Life Years (DALY): health loss due to
    - mortality component (HALY)
    - morbidity component (YLD)
    - using the Australian Burden of Disease (BoD) results
Cost of intervention and potential offsets

> For the past –
  ▪ Actual expenditures spent
> For the future –
  ▪ Intervention: $0.28 per capita, historical average of the Vic SunSmart expenditure
  ▪ Comparator: $0.07 per capita, average level of investment in NSW/Qld over the last decade (1998-2006),
> Cost offsets refers to the savings in the costs of management and treatment for skin cancer
  ▪ Melanoma: $3341 per case
  ▪ NMSC: $700 per case (2001 value, AIHW 2005)
> Cost to individuals: $3 per capita per year
> Reference year: 2003
> All costs and outcomes are discounted at 3% p.a.
Sensitivity/Uncertainty Analyses

> Main source of the uncertainty would be around the assumptions we make for assessing the effectiveness

> One-way sensitivity analysis on

  - Program effectiveness on melanoma: 50% and 100%.
  - Discount rate, where the base rate of 3% is varied to 0%, 5%, 7%.
  - Decay rate of program effectiveness on NMSC: 0%, 10%, 20% per annum.

> Threshold analysis to determine the proportion of health gain that would need to be attributed to SunSmart for the program to no longer be dominant or reach a threshold

> Multiple-probabilistic uncertainty analysis around costs using @Risk software

Uncertainty analysis parameters and distribution

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Base case value (range)</th>
<th>Distribution</th>
</tr>
</thead>
<tbody>
<tr>
<td>Program cost of intervention</td>
<td>$0.28 per capita (0.28 – 0.55)</td>
<td>Triangular</td>
</tr>
<tr>
<td>Program cost of comparator</td>
<td>$0.07 per capita (0.07-0.14)</td>
<td>Triangular</td>
</tr>
<tr>
<td>Cost offset of Melanoma</td>
<td>$3747 per case (+/-10%)</td>
<td>Uniform</td>
</tr>
<tr>
<td>Cost offset of NMSC</td>
<td>$785 per case (+/-10%)</td>
<td>Uniform</td>
</tr>
</tbody>
</table>
Results (I): past

> The past SunSmart program in Victoria since it was introduced in 1988 to 2003 achieves dominance: achieves health gains and saves money, from the Government perspective.

> Excluding cost-offset:
  - $680 per LYS
  - $540 per DALY averted
Results (II): future

The median value and 95% uncertainty interval of ICER results in the base case analysis (d=3%) for both perspectives.

<table>
<thead>
<tr>
<th>Health gains</th>
<th>Government Perspective</th>
<th>Health Sector Perspective</th>
</tr>
</thead>
<tbody>
<tr>
<td>Incidence case prevented</td>
<td>median value (95% UI)</td>
<td>median value (95% UI)</td>
</tr>
<tr>
<td>Life years saved (LYS)</td>
<td>191,000</td>
<td>191,000</td>
</tr>
<tr>
<td>DALYs averted</td>
<td>91,000</td>
<td>91,000</td>
</tr>
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<table>
<thead>
<tr>
<th>Incremental cost</th>
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<tbody>
<tr>
<td>Incremental net costs</td>
<td>$-180m ($-220m, $-120m)</td>
<td>$770m ($730m, $830m)</td>
</tr>
<tr>
<td>Incremental program cost</td>
<td>$85m ($57m,$140m)</td>
<td>$1,000m ($1,000m, $1,100m)</td>
</tr>
<tr>
<td>Incremental cost offsets</td>
<td>$270m ($240m, $290m)</td>
<td>$270m ($240m, $290m)</td>
</tr>
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</table>

<table>
<thead>
<tr>
<th>ICER per LYS</th>
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</thead>
<tbody>
<tr>
<td>ICER (with cost-offset)</td>
<td>dominant</td>
<td>$8,500 ($8,000, $9,100)</td>
</tr>
<tr>
<td>ICER (without cost-offset)</td>
<td>$940($610,$1500)</td>
<td>$11,400 ($11,100, $12,000)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>ICER per DALY averted</th>
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</thead>
<tbody>
<tr>
<td>ICER (with cost-offset)</td>
<td>dominant</td>
<td>$6,349 ($5,971, $6,821)</td>
</tr>
<tr>
<td>ICER (without cost-offset)</td>
<td>$700 ($470,$1100)</td>
<td>$8,500 ($8,300, $8,900)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Investment return</th>
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<tbody>
<tr>
<td>Program cost</td>
<td>$115m ($90m, $160m)</td>
<td>$1,070m ($1,040m, $1,120m)</td>
</tr>
<tr>
<td>Investment return for every dollar invested by government</td>
<td>$2.30 ($1.60, $3.00)</td>
<td></td>
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</tbody>
</table>
Results (III): Sensitivity Analysis

> From Government perspective, all ICER of the sensitivity result are dominant with cost-offsets

> Worse case scenario where we assume the future national SunSmart:
  - only achieves 50% of the effectiveness in melanoma incidence reduction
  - with double the program cost as the past SunSmart in Victoria
  - together with a greater decay rate of 20% in the ability of the program to reduce the rate of NMSC
  - ICER: 129/DALY averted with cost-offsets

> Threshold analysis
  - <2% of the reduction attributed to SunSmart in order for dominance to be maintained (Govt perspective, including cost-offsets)
  - 17% of the reduction attributed to SunSmart for ICER< 50,000/DALY (health sector perspective, including cost-offsets)
Results (IV): Acceptability Curve

Acceptability curve of 2000 iterations uncertainty analysis for ICER with cost-offsets from the health sector perspective.
Discussion

- Provide evidence to support a recommendation for a national comprehensive SunSmart program.
- Results are similar in nature and magnitude to the previous Australian work evaluating the cost-effectiveness of SunSmart (Carter, Marks et al. 1999).
- Quality of evidence is not perfect but it is considered the best we could obtain - threshold analysis
- Allocative efficiency vs. Technical efficiency
- Unnecessary cost in removal and biopsy of non-malignant skin moles is not modelled
- Future SunSmart will need to manage a more complex message in which the risks of skin cancer are balanced alongside the necessary levels of sunlight in relation to Vitamin D deficiency