ACE–PREVENTION PAMPHLETS

GENERAL POPULATION RESULTS PAMPHLET 5
COST-EFFECTIVENESS OF SKIN, CERVICAL AND PROSTATE CANCER PREVENTION AND BREAST CANCER TREATMENT.

1. MAIN MESSAGES

- The current cervical cancer screening program would become more efficient if the starting age is raised to 25; or the screening interval is extended to three years; or a more accurate screening test is used.
- HPV vaccination of 12-year old girls in Australia is cost-effective if accompanied by a screening program with a starting age of 25 and/or a three-year, instead of two-year interval.
- HPV DNA testing is a cost-effective replacement for Pap smear screening.
- Primary prevention for skin cancer by SunSmart is cost-effective.
- Prostate cancer screening using the PSA test decreases health at a cost, and should be avoided.
- The one-year course of Trastuzumab for early breast cancer treatment is cost-ineffective.

2. BACKGROUND

Cancer is one of the National Health Priority Area and currently accounts for 31% of male deaths and 26% of female deaths. Cancer contributed 19% of total disability adjusted life years (DALYs), representing 32.2% of years of life lost (YLL) and 6.5% of years of life with disability (YLD), as the greatest cause of burden in Australia in 2003. The burden from cancer is significant mainly due to premature death. Some cancers have modifiable risk factors; others require early detection to reduce the mortality and morbidity. The primary aim of this paper is to examine the cost-effectiveness of primary prevention (vaccination to prevent risk factor exposures) for cervical cancer and secondary prevention (early detection through mass screening) for cervical and prostate cancer. Another primary prevention intervention for skin cancer and one treatment intervention for breast cancer as a benchmark are also presented.

3. INTERVENTIONS

We reviewed current policies in line with cancer control and literature to identify a range of interventions to be evaluated. While some interventions are currently in practice, the interventions we assessed are potential options for change of current policy based on existing evidence of program effectiveness (SunSmart), efficacy of vaccination, and effectiveness of screening tests. Some variations in screening frequency and target population for screening interventions are also assessed.

NHMRC GRANT NO. 351558
PROJECT LEADERS
PROF THEO VOS (UQ)
PROF ROB CARTER (DEAKIN)
PAMPHLET AUTHOR
SOPHY SHIH

FOR FURTHER INFORMATION
WWW.SPH.UQ.EDU.AU/BODCE-ACE-PREVENTION

1. **Pap test screening:** Routine screening by conventional Pap test in women who have ever been sexually active and have no symptoms or history suggestive of cervical pathology.

2. **HPV DNA test screening:** Routine screening by HPV DNA test (Hybrid Capture II) in women who have ever been sexually active and have no symptoms or history suggestive of cervical pathology.

3. **Combined Pap test and HPV DNA test screening:** Routine screening by a combination of conventional Pap test and HPV DNA test (positive on either test will be referred for further investigation) in women who have ever been sexually active and have no symptoms or history suggestive of cervical pathology.

4. **HPV vaccination and Pap test screening:** Vaccinate girls at age 12 in 2003 with HPV[1] vaccine and continue screening with Pap test.

5. **HPV vaccination and HPV DNA test screening:** Vaccinate girls at age 12 in 2003 with HPV vaccine and continue screening with HPV DNA test.

6. **HPV vaccination and combined Pap and HPV DNA test screening:** Vaccinate girls at age 12 in 2003 with HPV vaccine and continue screening with combined Pap and HPV DNA test.

7. **SunSmart program[2] for skin cancer prevention:** An on-going national SunSmart program with increased investment at $0.28 per capita for the next 20 years.

8. **Screening for prostate cancer:** a one-off screening test for prostate specific antigen (PSA) in the male population aged 55-70 in 2003. Comparator is no screening.

9. **Trastuzumab (HerceptinTM) treatment for breast cancer:** adjuvant trastuzumab and chemotherapy (ATC) for all newly diagnosed breast cancer aged 30-100 with positive human epidermal growth factor receptor 2 (HER2) in 2003. Comparator is no trastuzumab.

4. CHOICE OF COMPARATOR

Unless stated otherwise, the comparator to the interventions is current practice. Current practice for cervical cancer screening is a 2-yearly screening in women aged 18 to 69 by conventional Pap test delivered through the National Cervical Screening Program.

5. INTERVENTION COST-EFFECTIVENESS

Prior to introduction of HPV vaccination program, changing current cervical screening to a less resource-intensive scenario will save money but with a considerable health loss (Intervention A & B in Table 1). Though, cervical screening could be improved by adding HPV DNA testing to Pap screen with extended screening frequency or delaying age at commencing screening, without health loss (Intervention E and F in Table 1).

After introduction of HPV vaccination program, current cervical screening can be changed to a more relaxed program because of enormous health gain provided by HPV vaccination. With HPV vaccination program in place, the current screening program should extend screening frequency to 3 years and/or increase the screening starting age to 25, which would save large amount of costs in screening and management/ treatment for an abnormal Pap test (to offset the vaccination program cost).
(Intervention H and I in Table 1).

The SunSmart program also demonstrates health gain and net cost saving, when compared to current practice, from Australian Government perspective as a third-party funder. From a broader health sector perspective to include individual costs, it still achieves a good cost-effectiveness result (Intervention N in Table 1).

Prostate cancer screening does decrease prostate cancer mortality, but at the cost of a large increase in diagnosed and treated cases (overtreatment). Because of the severe side-effects of treatment, the increase in morbidity outweighs the mortality benefit, and on balance there is health loss with an increase in costs (dominated).

The one-year course of trastuzumab for early breast cancer is cost-ineffective, mainly because of the very high costs
(Intervention P in Table 1).

1 Quadrivalent human papillomavirus (HPV) types 6/11/16/18 L1 virus-like particle (VLP) vaccine.

2 SunSmart program is a skin cancer prevention program which incorporates mass media work, resource development and dissemination, professional education, advocacy of policy development and a strong research and evaluation component.

Table 1: Incremental cost-effectiveness ratios (ICER) for all interventions, when compared to current practice

Intervention	*DALY averted*	*Incremental net cost ($m)*	*ICER $/DALY base case[3] (ranges)*
Pap test screening			
A. Pap screen every 2 year from age 25	-100	-15.1	health loss with less cost 152,000^
B. Pap screen every 3 year from age 18	-393	-29.2	health loss with less cost 74,000^
HPV DNA test screening			
C. HPV DNA test screen every 3 year from age 18	59	0.6	11,000
Combined Pap and HPV DNA test screening			
D. Combined Pap screen and HPV DNA test screen every 3 year from age 18	190	16.0	84,000
E. Pap screen for age 18-29 and combined screen from age 30 every 3 year	84	-1.4	Dominant*
F. Combined screen every 3 year from age 25	156	-1.9	Dominant*
HPV vaccination and Pap test screening			
G. HPV vaccination at age 12 and Pap screen every 2 year from age 18	786	35.9	46,000 (40,000 - 55,000)
H. HPV vaccination at age 12 and Pap screen every 2 year from age 25	765	20.8	27,000 (23,000 – 34,000)
I. HPV vaccination at age 12 and Pap screen every 3 year from age 18	679	8.5	12,000 (10,000 – 18,000)
HPV vaccination and HPV DNA test screening			
J. HPV vaccination at age 12 and HPV DNA test screen every 3 year from age 18	828	33.9	41,000 (36,000 - 49,000)
HPV vaccination and combined Pap & HPV DNA test screening			
K. HPV vaccination at age 12 and combined Pap & HPV DNA test screen every 3 year from age 18	878	49.3	56,000 (51,000 – 65,000)
L. HPV vaccination at age 12 and Pap screen for age 18-29 and combined screen from age 30 every 3 year	857	33.7	39,000 (35,000 – 46,000)
M. HPV vaccination at age 12 and combined Pap & HPV DNA test screen every 3 year from age 25	873	32.9	38,000 (34,000 – 44,000)
SunSmart program for skin cancer prevention #			
N. SunSmart program for 20 years	120,000	2,000	16,000 (12,000 – 22,000)
Screening for prostate cancer			
O. One-off screening for males 55-70 in 2003	-3,400	Not calculated	Health loss with higher costs
Trastuzumab treatment for breast cancer #			
P. Adding trastuzumab (HerceptinTM) to standard chemotherapy for all newly diagnosed breast cancer with positive human epidermal growth factor receptor 2	1366	131.8	96,000 (73,000 - 139,000)

* Dominant means health gain with cost saving.

\# Modelled population varies by intervention; therefore the health gain for these 2 interventions is not comparable to that of other interventions.

^ Interventions with health loss and less cost fall in quadrant 3: there is some health loss but with cost saving; a greater ICER is more favourable and values greater than $50,000 per DALY would indicate that this intervention is more efficient and desirable.

3 The base case of HPV vaccination intervention is based on assumption of full vaccination protection for 5 years and then declining at rates determined by loss of detectable serum HPV antibody.

ACE–PREVENTION PAMPHLETS

6. CONCLUSIONS

Current practice already prevents between half and two thirds of cervical cancer. The proposed screening strategies make small adjustments to existing gains from current practice. The efficiency of the current screening program could be improved by more accurate screening tests (HPV DNA testing instead of Pap smears); with a later starting age (25 instead of 18); and with a longer screening interval (3 instead of 2 years). The newly introduced HPV vaccination of 12 year old girls is cost-effective if combined with the above recommended changes to the screening program.

Strength of evidence is the most important of the second-stage filter criteria in evaluating cervical cancer prevention interventions. These results are sensitive to screening test accuracy (sensitivity and specificity) and the assumptions about the largely unobserved natural history of early lesions and cancer. Duration of vaccine immunity is another key element in the determination of cost-effectiveness. Clinical trials have demonstrated immunity for at least 5 years. Long term efficacy of the vaccine is critical in estimation of health outcomes but is yet to be determined by future clinical studies. Substitution by other malignant HPV strains and cross-protection of vaccine on infection by other HPV strains are uncertain and to be determined by future studies too.

Primary prevention for skin cancer by SunSmart is cost-effective, achieving health gain and net cost saving, from Australian Government perspective. From a broader health sector perspective, it is still cost-effective.

Prostate cancer screening with PSA should be avoided, because it adds to costs at a loss of health. Treatment for early breast cancer with Trastuzumab is cost-ineffective.

For more information on this topic area, please visit website **www.sph.uq.edu.au/bodce-ace-prevention**

7. ABOUT ACE-PREVENTION

To aid priority setting in prevention, the Assessing Cost-Effectiveness in Prevention Project (ACE-Prevention) applies standardised evaluation methods to assess the cost-effectiveness of 100 to 150 preventive interventions, taking a health sector perspective. This information is intended to help decision-makers move resources from less efficient current practices to more efficient preventive action resulting in greater health gain for the same outlay.

PAMPHLETS IN THIS SERIES

Methods:

A. The ACE-Prevention project
B. ACE approach to priority setting
C. Key assumptions underlying the economic analysis
D. Interpretation of ACE-Prevention cost-effectiveness results
E. Indigenous Health Service Delivery

Overall results

1. League table
2. Combined effects

Indigenous population results

1. Cardiovascular disease prevention
2. Diabetes prevention
3. Screening and early treatment of chronic kidney disease

General population results

1. Adult depression
2. Alcohol
3. Blood pressure and cholesterol lowering
4. Cannabis
5. Cervical cancer screening, Sunsmart and PSA screening
6. Childhood mental disorders
7. Fruit and vegetables
8. HIV
9. Obesity
10. Osteoporosis
11. Physical activity
12. Pre diabetes screening
13. Psychosis
14. Renal replacement therapy, screening and early treatment of chronic kidney disease
15. Salt
16. Suicide prevention
17. Tobacco

THE UNIVERSITY OF QUEENSLAND AUSTRALIA
DEAKIN UNIVERSITY AUSTRALIA