

Tony Blakely and Nisha Nair
Otago Spotlight Series: Cancer Research
20 October 2015



Burden of Disease Epidemiology, Equity
and Cost Effectiveness Programme

Health gain and cost- effectiveness in cancer prevention and management



Burden of Disease Epidemiology, Equity
and Cost Effectiveness Programme



WELLINGTON

Overview

- What we do: prevention ↔ palliation
- What we will tell you today:
 - **HPV vaccination** - it will take very cheap vaccine cost and very cheap administration costs before vaccinating boys will be cost-effective.
 - **Colorectal cancer screening** - very cost-effective overall, but is not going to reduce health inequalities
 - **Cancer care coordinators (patient navigators)** - probably cost effective
 - **Trastuzumab (i.e. Herceptin)** varies enormously in cost effectiveness by hormone status and age. Given personalized medicine, why are funding decisions are not also made by clinical and demographic groupings?
 - **Single fractionated radiotherapy** - just as effective as multiple fractionated radiotherapy for metastatic bone pain. Why are we still providing multiple fractionated radiotherapy, wasting precious health system resources?
- What we can tell you tomorrow:
 - **Knowledge translation**: website, data tools, blogs and site visits.

What we do



Cost-effectiveness

What do we do more of?

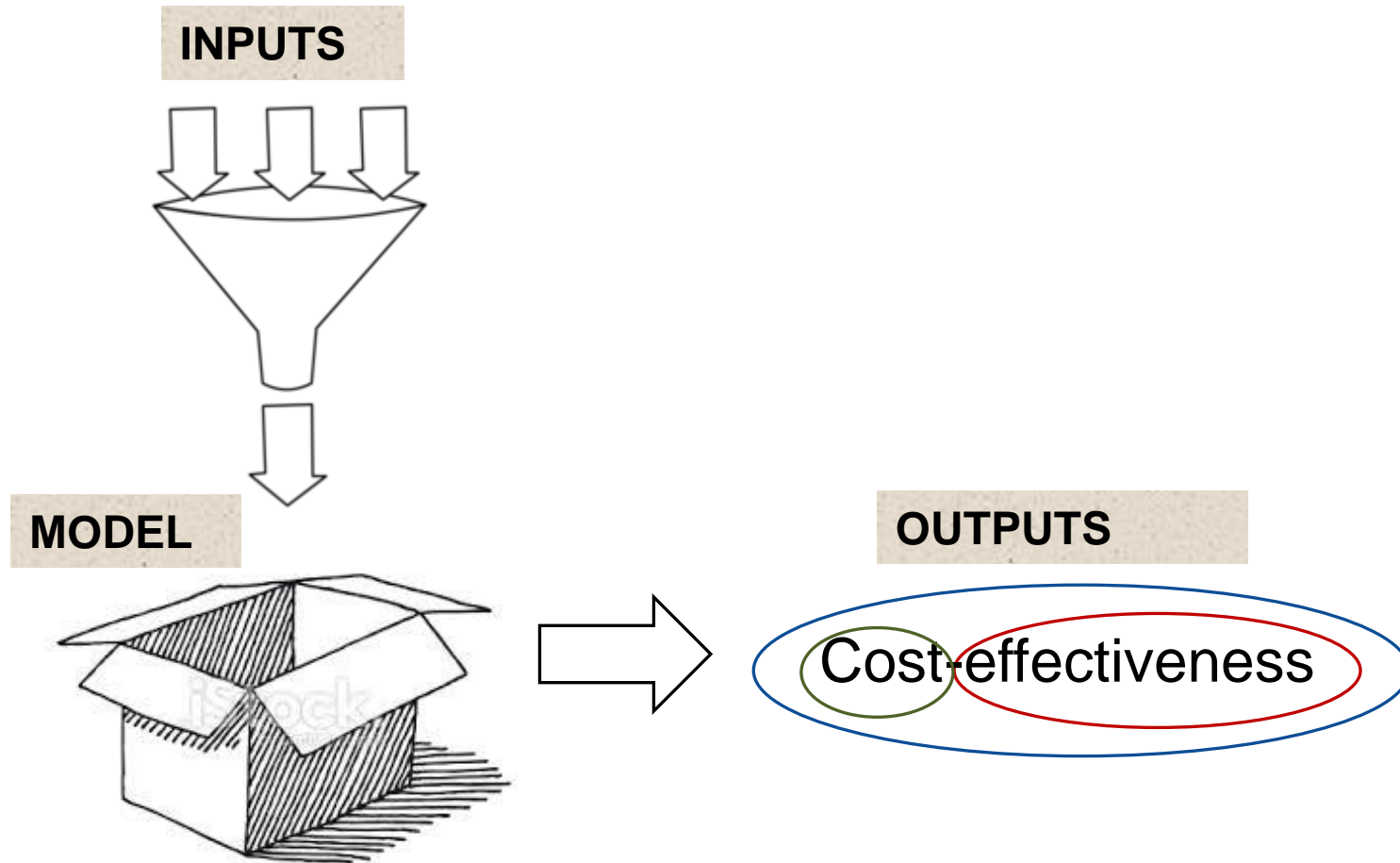
What do we do less of?

Is this a sensible thing to do?

Who should get this?

- Cancer care coordinators for colon cancer
- Cancer care coordinators for breast cancer
- Taxanes for breast cancer
- Radiotherapy for bone metastases
- HPV vaccination for girls
- HPV vaccination for boys
- Tobacco taxes
- Restricting tobacco outlets
- CT screening for lung cancer
- Colorectal cancer screening
- Salt reduction
- Housing interventions

How we do it



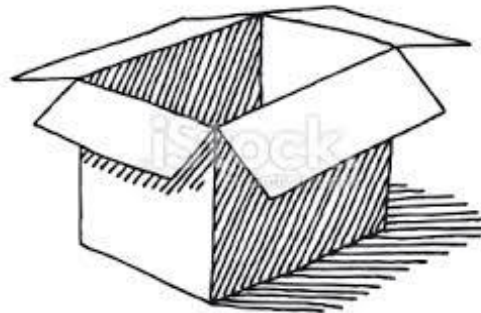
INPUTS

Colon cancer incidence
Colon cancer mortality
Colon cancer morbidity
Colon cancer costs

Background mortality
Background morbidity
Background health system costs

Baseline wait time to surgery
Baseline wait time to chemo
Baseline uptake of chemo

CCC effect on wait time to surgery
CCC effect on wait time to chemo
CCC effect on chemo coverage
CCC cost



Overview

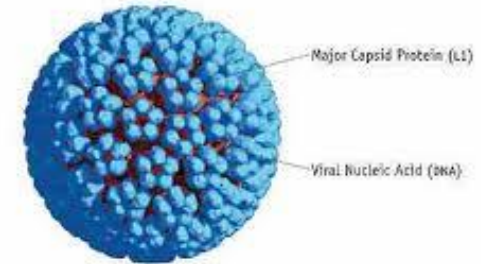
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HPV vaccination

Human papillomavirus (HPV)

- Cancer of cervix, anus, oropharynx
- Genital warts

THREE-DIMENSIONAL MODEL OF HUMAN PAPILLOMAVIRUS



NZ HPV vaccination programme

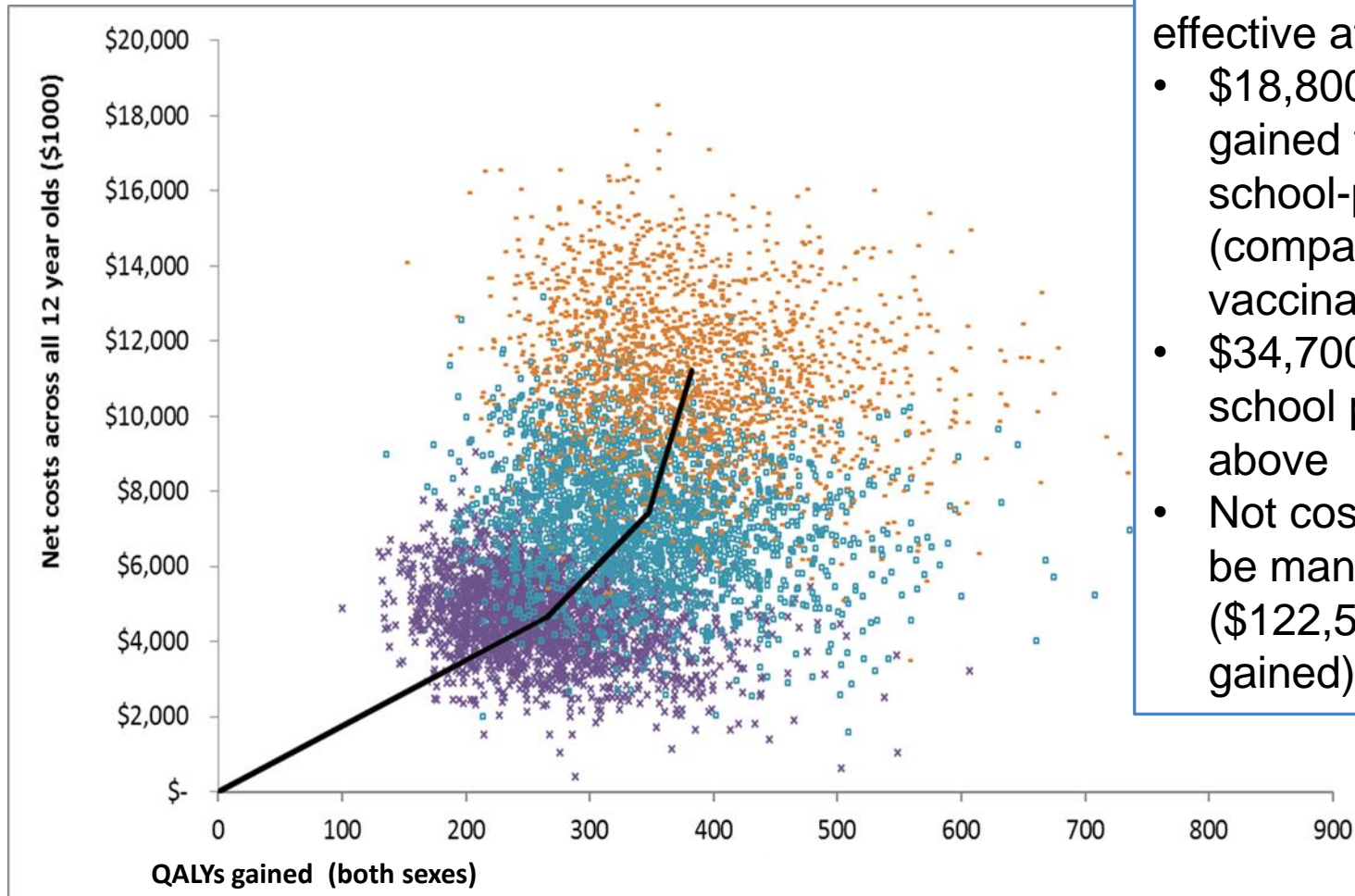
School age girls

3 doses

In school or through primary care provider



HPV vaccination in girls

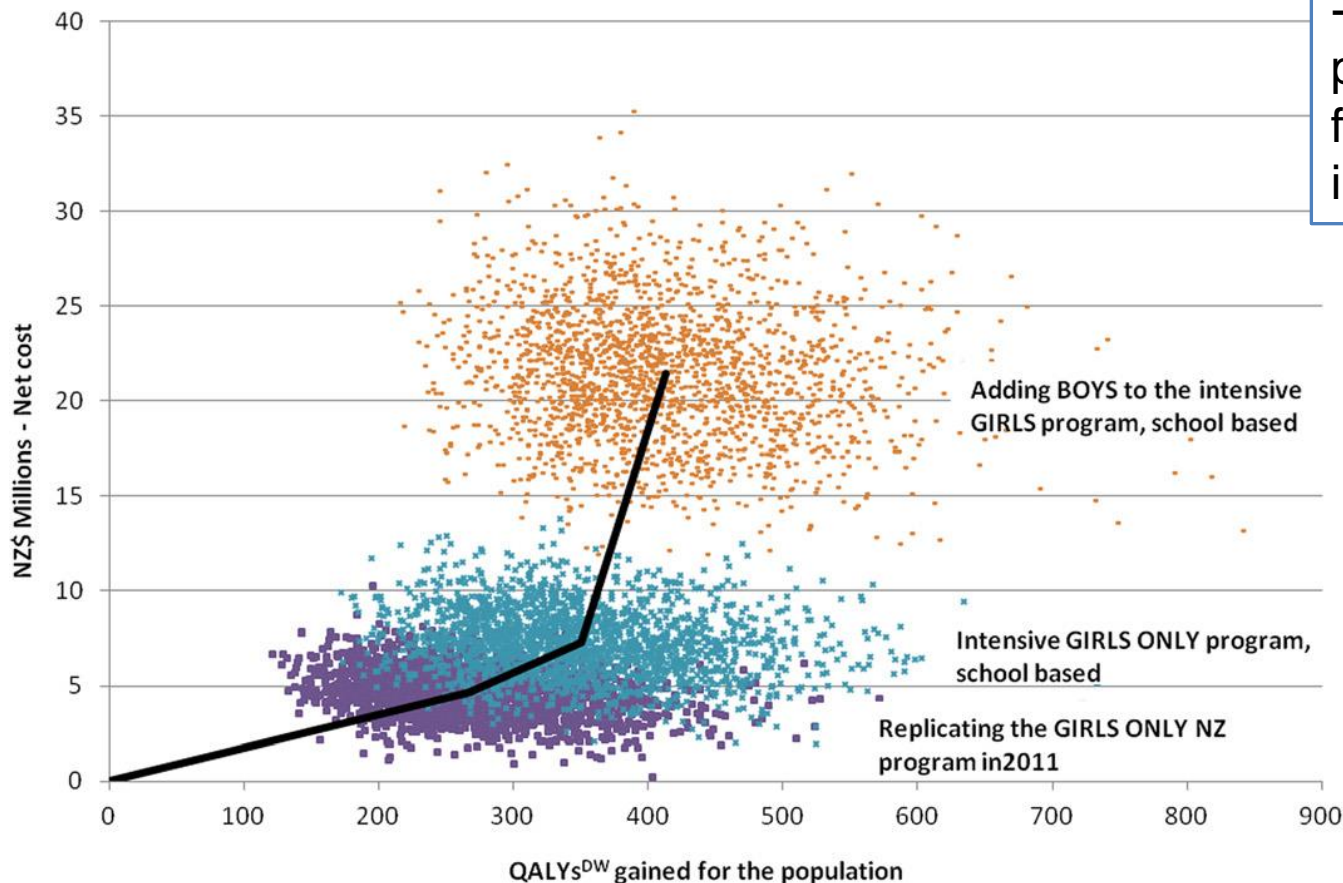


Vaccinating girls cost-effective at:

- \$18,800 per QALY gained for current school-programme (compared with no vaccination)
- \$34,700 for intensified school programme c.f. above
- Not cost-effective to be mandatory (\$122,500 per QALY gained)

HPV vaccination in boys

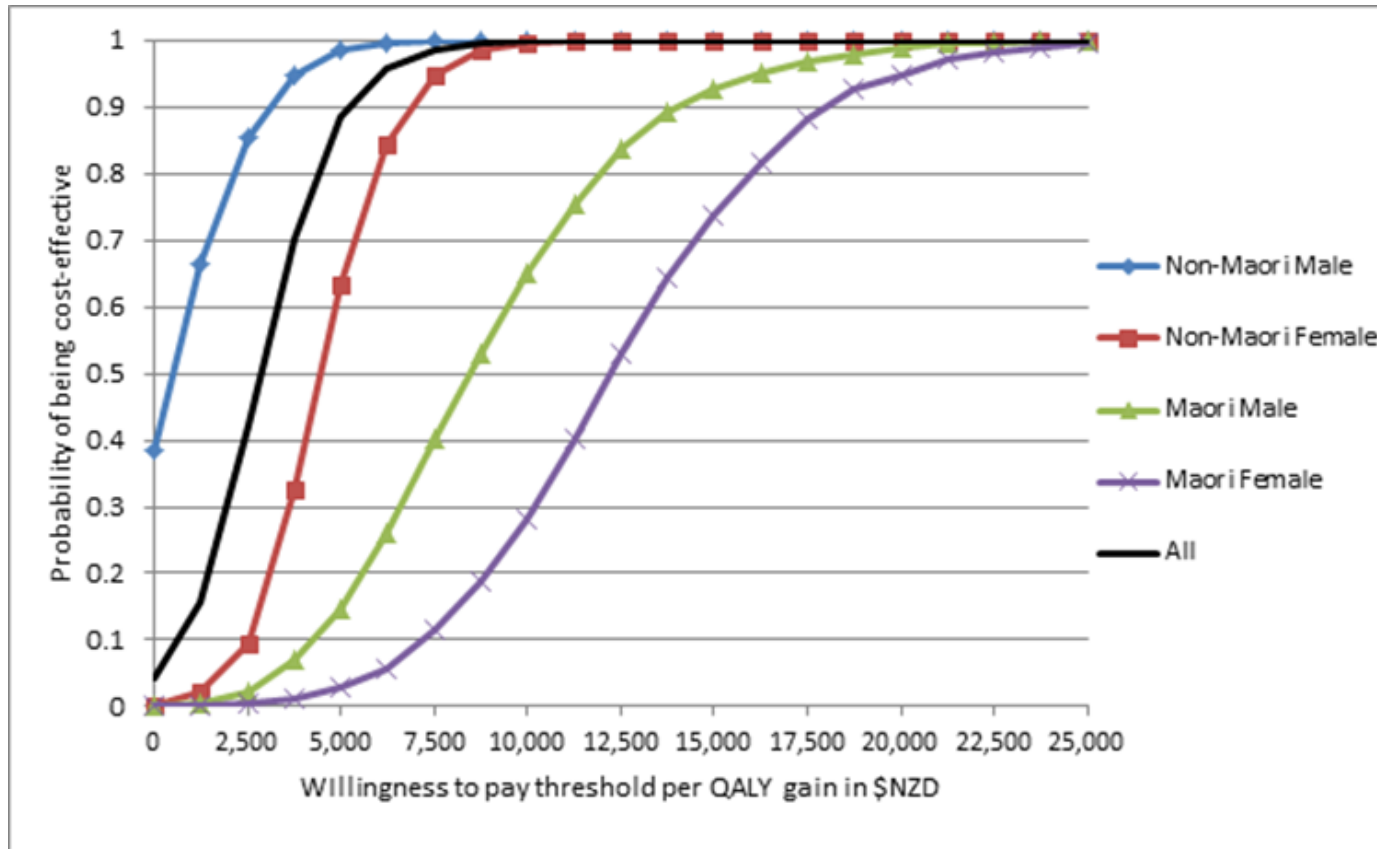
Vaccinating boys **not** cost-effective at \$247,000 (\$119,000 - \$474,000) per QALY gained for BOYS added to intensive GIRLS



- Replicating the GIRLS ONLY NZ program in 2011
- × Intensive GIRLS ONLY program, school based
- Adding BOYS to the intensive GIRLS program, school based

Colorectal Cancer Screening

Preliminary, not for dissemination



- CRC screening high cost effective ... lets get on with it... but lets not pretend it will reduce health inequalities.....
- Reducing health inequalities occurs elsewhere (e.g. tobacco control, food taxes and subsidies)

Cancer care coordinators

Cancer services a national priority

- 'continuity of care'
- 'a single point of contact'
- 2012 Budget:
\$16 million for care coordination nurses



patient navigators
key workers
liaison nurses
case managers
care coordinators

Cancer care coordinators in stage III colon cancer

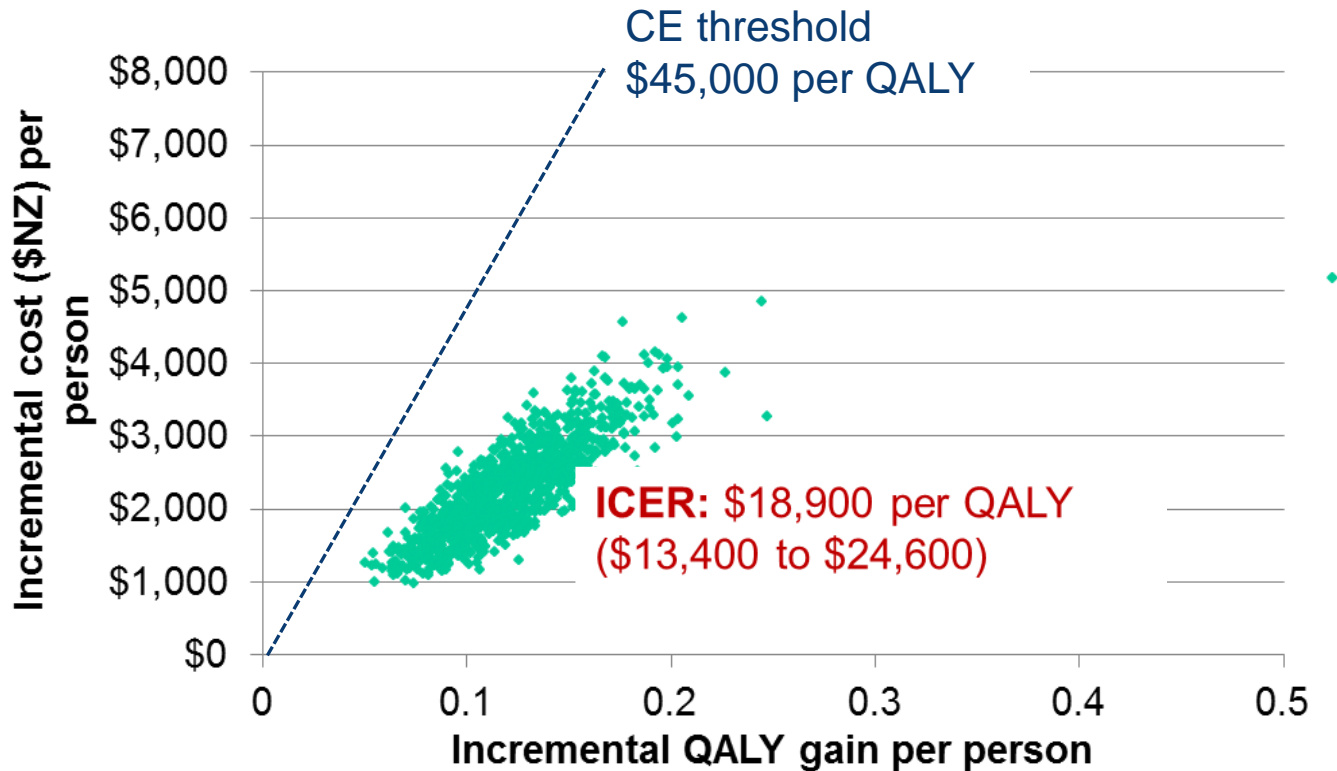
Clinical nurse specialist
Hospital-based
versus 'usual practice'



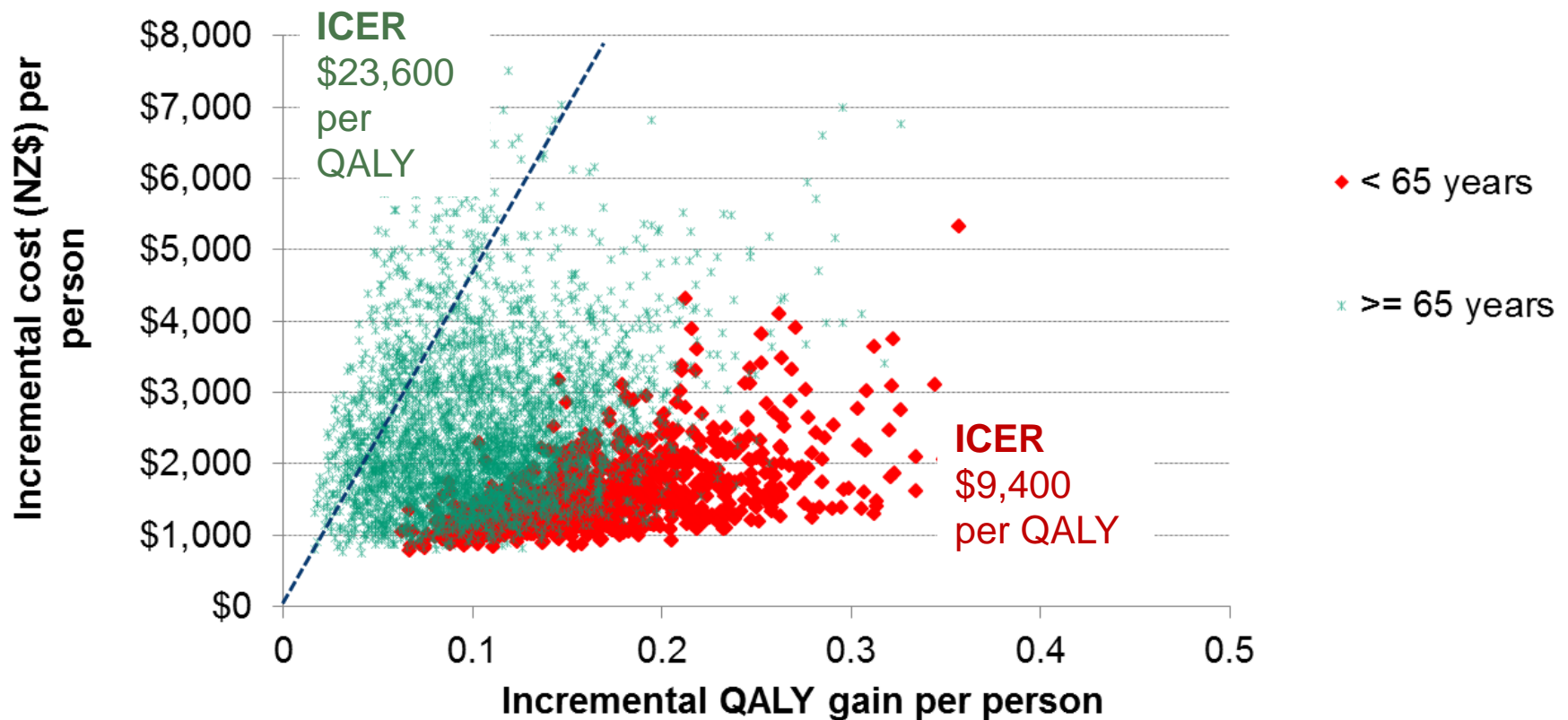
Reduce time to surgery
Reduce time to chemotherapy
Increase chemo coverage
Improve patient QOL



Cancer care coordinators in stage III colon cancer



But not the same for everyone



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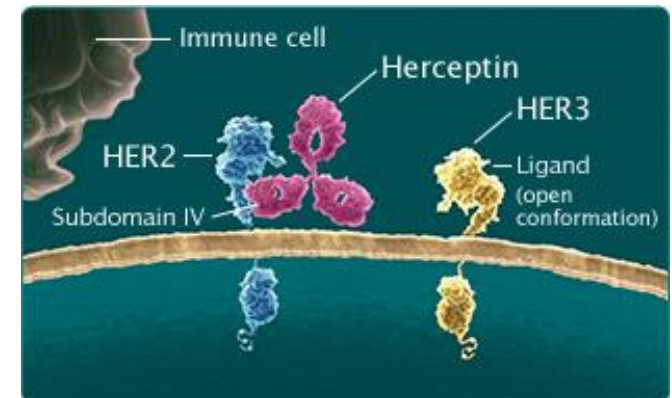
Herceptin in *node+ HER2+ early breast cancer*

12 month regimen of Herceptin
versus no Herceptin

Approx. NZ\$ 70,000 per year at
formulary prices

How does cost-effectiveness differ by:

- age?
- oestrogen receptor (ER) and
progesterone receptor (PR) status?



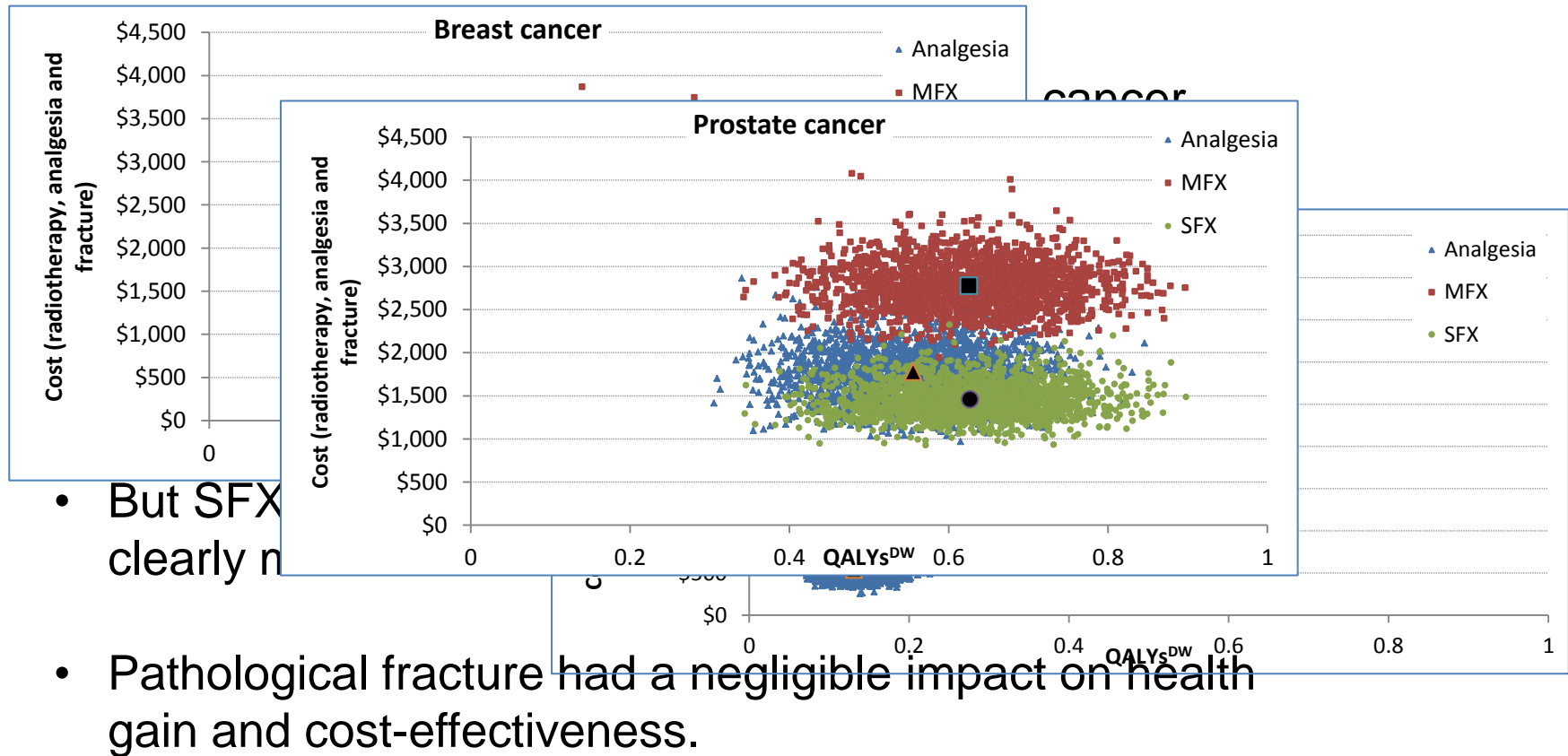
Herceptin in *HER2+ breast cancer*



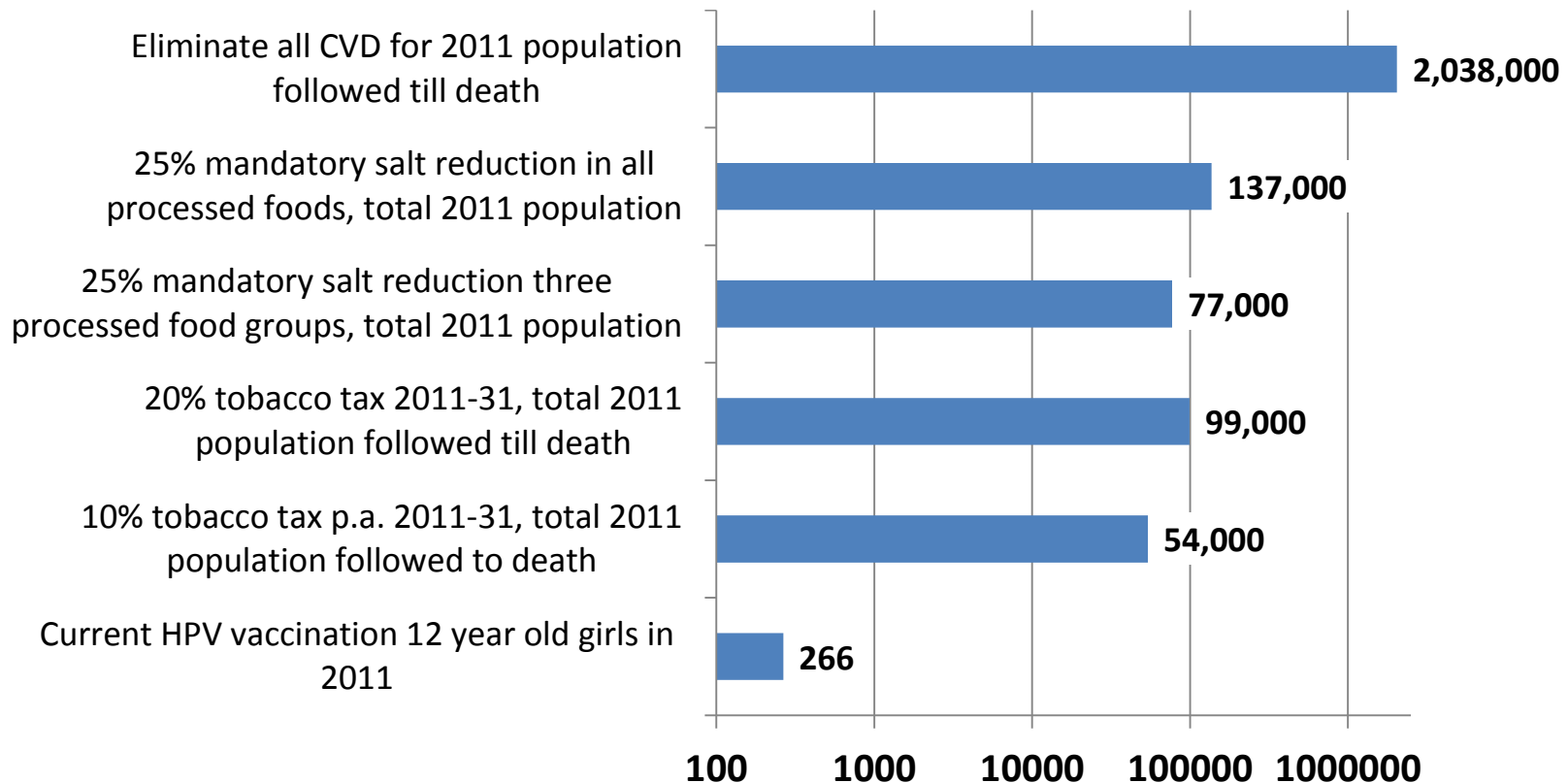
ICERs	ER+/PR+	ER+/PR–	ER–/PR+	ER–/PR–	Pooled
25-44	73,529	56,181	37,003	34,206	46,151
45-54	98,687	74,469	47,272	43,160	59,319
55-64	96,680	73,735	48,117	44,293	59,674
65-74	102,266	79,335	54,172	50,564	65,751
75-84	170,176	130,817	87,237	80,857	105,894
≥ 85	337,945	255,681	162,962	148,919	198,365

ER estrogen receptor; *ICER* incremental cost-effectiveness ratio; *PR* progesterone receptor;

Single versus multiple fractionated radiotherapy for metastatic bone pain



The beginnings of a league table



PRELIMINARY RESULTS – will change a little with pending improvements. Not for citation

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Research dissemination & translation: BODE³ website = 'hub'

www.otago.ac.nz/bode3

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HPV Vaccination of School-Age Girls comparing the cost-effectiveness of 3 delivery programmes

SUMMARY

Human papillomaviruses (HPV) are common sexually transmitted viruses. They can cause several types of cancer (such as cancers of the cervix, anus, and oropharynx) and illnesses like genital warts. New Zealand has a national HPV vaccination programme aimed at preventing these diseases. Three doses of HPV vaccine (Gardasil) are currently offered to 12-year-old girls, in school or through their primary care provider. This pamphlet compares the cost-effectiveness of the existing HPV vaccination programme to two other alternative vaccine delivery programmes with higher estimated coverage. All three programmes vaccinate only school-age girls, but we include benefits to both males and females (via herd immunity) in our evaluation.

We evaluated three HPV vaccine delivery programmes

These were:

- **Current:** what we do currently, where the vaccine is offered through schools or primary care. The observed coverage is only 47%.
- **Intensified School-based:** where the vaccine is offered only through schools. The estimated coverage is 73%.
- **Mandatory School-based:** where the vaccine is offered only through schools and a new law requires parents to actively opt-out if they do not want their daughter vaccinated. The estimated coverage is 93%.

We used a simulation model to estimate cost-effectiveness using NZ data

For each programme, the model estimates how much health benefit is gained (in quality-adjusted life-years or QALYs), and how much it costs the health system. These are combined into a single Incremental Cost-Effectiveness Ratio or ICER.

Most health gain is through prevention of genital warts

The greatest health gain was from the prevention of genital warts, with smaller gains from reduced rates of cervical, oropharyngeal, and anal cancer. Moving from no vaccination to the **Current** programme gives 266 QALYs gained, at a net cost of NZ\$ 4.65 million per year. Moving from **Current** to **Intensified School-based** adds 82 QALYs, at an extra net cost of NZ\$ 2.77 million per year. Moving from there to **Mandatory School-based** adds another 35 QALYs, but for an additional net cost of \$3.78 million per year (mainly from the cost of passing the law).

Trastuzumab (Herceptin) in Breast Cancer cost-effectiveness in regional breast cancer

Growth factor receptor 2-positive (HER2+) tends to be more aggressive, more resistant to treatment, and has a poorer prognosis. In women who have HER2+ breast cancer who also have involved lymph nodes, 12 months of Herceptin added to standard chemotherapy reduces risk of death. Herceptin is however expensive (an added cost of NZ\$ 74,000 in NZ), and has some (usually reversible) cardiac side-effects. We evaluated the cost-effectiveness of 12 months of Herceptin added to standard chemotherapy alone. We specifically investigated Herceptin's cost-effectiveness in regional breast cancer subtypes, representing relatively good to relatively poor prognoses.

Herceptin is given intravenously every three weeks for a total period of 12 months, and patients also have cardiac monitoring scans every 3 months to monitor for the risk of heart failure. The target population here is women with node-positive (‘regional’) HER2+ breast cancer who are ‘fit’ for Herceptin on initial cardiac assessment. They are further divided into four different breast cancer subtypes, defined by estrogen receptor (ER) status and progesterone receptor (PR) status. ER+/PR+/HER2+ subtype has the best prognosis, ER-/PR-/HER2+ has the worst prognosis, and the other two subtypes fall in between these two extremes.

For each subtype, the model estimates how much health benefit is gained (in quality-adjusted life years or QALYs) from Herceptin, and how much it costs or saves the health system. These are combined into an Incremental Cost-Effectiveness Ratio or ICER.

The cost-effectiveness of 12 months of Herceptin for early regional breast cancer varied markedly by breast cancer subtype and by age. For the best prognosis subtype (ER+/PR+/HER2+), the cost-effectiveness ranged from NZ\$73,500 per QALY for 25-44 year-old women, through to NZ\$ 338,000 per QALY for women who were 85+ years. For the worst prognosis subtype (ER-/PR-/HER2+), it ranged from NZ\$ 34,200 per QALY for 25-44 year-olds

Public Health Expert

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Can CT screening for lung cancer in New Zealand be cost-effective?

Monday, September 28th, 2015 | Kate Sloane | [5 Comments](#)



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Dr Richard Jaine, Dr Nisha Nair and Professor Tony Blakely

There is now strong evidence that screening for lung cancer with low-dose computed tomography (LDCT) scans is effective at reducing lung cancer mortality. So why aren't countries rushing to introduce a screening programme? Because there is still doubt about its cost-effectiveness. In this blog, we discuss the uncertainties and suggest a



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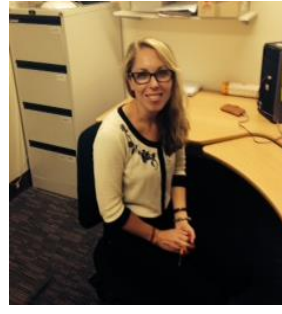
Data

Gender	Female	Disease	Cervix
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RESULTS

Age group	A = Citizen cost not last 6 months of life, without tobacco related disease	B = Citizen cost in last 6 months of life, without tobacco related disease	C - A = 'Excess' costs of specified disease in first year of diagnosis	D - A = 'Excess' costs of having prevalent specified disease	E - A = 'Excess' cost of being in last 6 months of life if dying from specified disease
0	\$ 4,599	\$ 76,154	\$ 19,565	\$ 3,047	\$ 35,997
1-4	\$ 1,068	\$ 16,579	\$ 19,565	\$ 3,047	\$ 35,997
5-9	\$ 549	\$ 20,027	\$ 19,565	\$ 3,047	\$ 35,997
10-14	\$ 540	\$ 17,004	\$ 19,565	\$ 3,047	\$ 35,997
15-19	\$ 870	\$ 12,447	\$ 19,565	\$ 3,047	\$ 35,997
20-24	\$ 1,129	\$ 17,756	\$ 19,565	\$ 3,047	\$ 35,997
25-29	\$ 1,235	\$ 14,752	\$ 19,565	\$ 3,047	\$ 35,997
30-34	\$ 1,385	\$ 18,622	\$ 19,565	\$ 3,047	\$ 35,997
35-39	\$ 1,277	\$ 18,568	\$ 19,565	\$ 3,047	\$ 35,997
40-44	\$ 1,093	\$ 19,769	\$ 19,565	\$ 3,047	\$ 35,997
45-49	\$ 1,189	\$ 19,545	\$ 18,517	\$ 1,803	\$ 28,765
50-54	\$ 1,311	\$ 21,082	\$ 18,517	\$ 1,803	\$ 28,765
55-59	\$ 1,485	\$ 20,042	\$ 18,517	\$ 1,803	\$ 28,765
60-64	\$ 1,748	\$ 17,130	\$ 18,517	\$ 1,803	\$ 28,765
65-69	\$ 2,233	\$ 16,780	\$ 20,549	\$ 2,932	\$ 32,827
70-74	\$ 2,658	\$ 16,894	\$ 20,549	\$ 2,932	\$ 36,110
75-79	\$ 3,107	\$ 12,630	\$ 25,529	\$ 4,666	\$ 15,918
80-84	\$ 3,548	\$ 13,063	\$ 25,529	\$ 4,666	\$ 17,366
85-89	\$ 3,887	\$ 9,810	\$ 19,297	\$ 3,344	\$ 17,366
90-94	\$ 4,006	\$ 9,118	\$ 19,297	\$ 3,344	\$ 18,813
95-99	\$ 3,585	\$ 6,639	\$ 19,297	\$ 3,344	\$ 18,813

Who we are





Burden of Disease Epidemiology, Equity
and Cost Effectiveness Programme

Health gain and cost- effectiveness in cancer prevention and management



**MINISTRY OF BUSINESS,
INNOVATION & EMPLOYMENT**
HĪKINA WHAKATUTUKI



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