Appl Health Econ Health Policy
DOI 10.1007/s40258-017-0338-6

ORIGINAL RESEARCH ARTICLE

Private Health Insurance Incentives in Australia: In Search of Cost-Effective Adjustments

P. Marcin Sowa[1,2] · Sam Kault[3] · Joshua Byrnes[4] · Shu-Kay Ng[4] · Tracy Comans[4] · Paul A. Scuffham[4]

Abstract

Background The appropriate structure, scope and cost of government incentives in the private health insurance (PHI) market is a matter of ongoing debate.

Objective In order to inform policy decisions we designed a two-stage study to (1) model the uptake of PHI covering hospital treatment in Australia, and (2) identify the costs of various policy scenarios to the government.

Methods Using a microsimulation with a cost-benefit component, we modelled the insurance decisions made by individuals who collectively represented the Australian insurance population in the financial year 2014–15.

Results We found that the mean willingness to pay (WTP) for PHI ranged from A$446 to A$1237 per year depending on age and income. Our policy scenarios showed a considerable range of impacts on the government budget (from A$4 billion savings to A$6 billion expense) and PHI uptake (from 3.4 million fewer to 2.5 million more individuals insured), with cost-effectiveness ranging from −A$305 to A$22,624 per additional person insured, relative to the status quo.

Conclusions Based on the scenario results we recommend policy adjustments that either increase the PHI uptake at a small per-person cost to the public budget or substantially reduce government subsidisation of PHI at a relatively small loss in terms of persons insured.

Key Points for Decision Makers

Small-scale adjustments targeting age groups through the so-called lifetime health cover mechanism offer ways of increasing health insurance uptake at a low cost to the federal budget.

Individual income tax incentives can impact uptake rates across all age groups but come at a high incremental cost per additional person insured.

Substantial budget savings can be achieved at a relatively small loss in the number of persons insured.

Offsetting changes can be bundled for an overall optimisation of policy although the total effect might differ from the sum of individual effects.

1 Introduction

Since the introduction of Medicare between 1975 and 1984, healthcare financing in Australia has relied on a mix of public and private sources. Despite the dominant role played by Medicare, private health insurance (PHI) has

✉ P. Marcin Sowa
m.sowa@uq.edu.au

1 Centre for Business and Economics of Health, University of Queensland, Brisbane, QLD, Australia

2 NHMRC Chronic Kidney Disease Centre of Research Excellence, Faculty of Medicine, University of Queensland, Brisbane, QLD, Australia

3 Department of Mathematics, University of Queensland, Brisbane, QLD, Australia

4 Centre for Applied Health Economics, Menzies Health Institute Queensland, Griffith University, Brisbane, QLD, Australia

Published online: 12 July 2017

remained a substantial component of healthcare funding. By international standards, Australia has a large PHI market with 55.2% of the population voluntarily buying a type of PHI cover in 2014 [1], compared to 11% in England, 20% in Germany, and 33% in New Zealand [2]. Nearly 86% of the PHI policies held by Australians include a hospital treatment component giving access to services provided in private hospitals [1]. In the financial year 2013–14, private health insurers funded 48.6% of private hospital expenditure and 12.4% of overall hospital sector expenditure [3].

This level of PHI uptake has been achieved and maintained largely thanks to the government support offered to the private sector. Following the gradual introduction of Medicare since 1975 and a corresponding decline in PHI rates from nearly 80% of the population in the 1970s down to 30% in the 1990s, the federal government responded with the aim of reinforcing the presence of PHI in Australia. The mix of policies, which included the lifetime health cover (LHC), the Medicare levy surcharge (MLS) and the PHI rebate, was generally successful, stabilising PHI uptake at 40–50% since 2001 [4–6].[1] It was complemented in 2012 by a fourth element, means testing of the MLS and PHI rebate using income and age criteria. A description of each of these policies is provided in Table 1.

The existence of the above incentive policies, which remain in place to this day, has been called into question. In particular, the PHI rebate has been criticised for being a redistribution mechanism that may not be fully justified from a social policy perspective [7–12]. In addition, the federal budget expenses related to the Private Health Insurance Act have been substantial, in 2016–17 amounting to A$6.2 billion. To put this number into perspective, expenditures associated with the two pillars of Australian Medicare, the Medicare Benefits Schedule and the Pharmaceutical Benefits Scheme, were A$21.9 and A$10.1 billion, respectively [13]. However, a recurring argument is that, in the presence of community rating, without government intervention the uptake rates would collapse initiating a 'death spiral' in the market. That is, in the absence of these policies, the insured population would have a greater proportion of high healthcare cost individuals, leading to increased insurance premiums. Consequently, those with expected low healthcare costs would withdraw from PHI, placing further upward pressure on premiums. Ultimately, this 'spiralling' would result in a collapse of the market as only those with high expected costs and high premiums would remain in the insurance pool.

In response to this ongoing public debate, we explored the effects that conceivable, incremental changes in the incentive policies would have on both the PHI uptake and on the public budget, with the objective of identifying scenarios with a favourable cost-effectiveness ratio. We were interested in assessing the effects of adjustments to the four existing policy mechanisms (the LHC, MLS, PHI rebate and the means testing thresholds) as well as three hypothetical new policies that could be introduced to foster PHI market growth (LHC amnesty, tax credit and tax exemption of employer-purchased PHI as a fringe benefit). Our study focused on the PHI for hospital treatment because this is the most important type of insurance from the perspective of the government, the insurers and the individuals, in terms of the value of services provided in the Australian market.

2 Methods

2.1 Overview

The study design was based on the notion that, for the purposes of policy making, it is sufficient to know the willingness to pay (WTP) within population groups rather than that of the individuals. Our study relied on a microsimulation design in which the WTP for PHI of the individuals was sampled from distributions defined at the group level, with groups defined by age and income (Table 2). By repeating the randomisation procedure, and simulating the individual insurance choices, we determined the most likely distribution parameters and the uncertainty of the estimates [14, 15]. We then used the WTP distributions to populate the model and simulate the insurance decisions made under modified incentives faced by the individuals. This enabled us to assess policy impacts using mean effects on uptake and their standard errors. The model simulated a single period of 1 year's duration. All benefits and costs were expressed in annual terms.

2.2 Age, Income and Insurance Uptake

The modelled population resembled that of Australia with respect to age and income. Age-income cohorts were defined based on 5-year age bands and income quintiles of the Australian population. The nine age bands in conjunction with five income quintiles together defined 45 groups. The definition of the age-income groups mirrored that of data on the purchase of PHI [16], which enabled the comparison of the simulated and observed uptake rates.

The age structure of the population was taken from the Australian Bureau of Statistics published for June 2014 [17]. The analysis was restricted to adults aged 25 years and older. This was because in Australia persons below the age of 25 years predominantly rely on their parents' family

[1] Comprehensive discussions of the trend and policy responses are available in the literature [4–7, 9, 22, 30].

Table 1 Private health insurance (PHI) incentives (existing and hypothetical) considered in this study

Policy name	Description
Existing	
Lifetime health cover	A financial penalty added to the PHI premium price and paid to the insurer. Defined as a 2% loading accumulated each year over the age of 30 years provided the individual does not hold PHI, up to the maximum of 70% after 35 years. The penalty is erased after 10 consecutive years of maintaining hospital cover [32]
PHI rebate	Subsidy for PHI purchase, claimed through a premium reduction or tax offset. Defined as a percentage of premium, which depends on age and income of the insuring individual [33]
Medicare levy surcharge	Additional tax levied on individuals who are above defined income thresholds and do not hold hospital cover PHI [33]
Means testing	Income tiers used to determine the eligibility for PHI rebate and the liability for MLS
Hypothetical	
Lifetime health cover amnesty	A one-off event removing the lifetime health cover penalty, i.e. setting the accumulated loading as nil for all individuals
Tax credit	Reduction in taxable personal income by a proportion of insurance premium in eligible groups
Fringe benefits tax exemption	Opportunity for employers to offer PHI as part of benefit package exempted from income tax

MLS Medicare levy surcharge

Table 2 Estimated uptake of private health insurance for hospital treatment in 2014–15 (number of Australian Health Survey respondents)

Age group, years	Income quintile (A$)				
	1 (<14,616)	2 (14,616; 27,546)	3 (27,547; 48,515)	4 (48,516; 75,499)	5 (≥75,500)
25–29	30% (378)	31% (302)	31% (611)	44% (765)	68% (535)
30–34	34% (366)	36% (232)	33% (404)	47% (644)	77% (644)
35–39	29% (471)	23% (286)	37% (407)	49% (566)	72% (739)
40–44	26% (680)	30% (342)	38% (508)	42% (538)	74% (691)
45–49	27% (876)	34% (399)	38% (569)	48% (599)	75% (704)
50–54	37% (642)	34% (362)	50% (561)	52% (557)	75% (574)
55–59	50% (382)	38% (384)	57% (440)	63% (446)	83% (451)
60–64	53% (434)	35% (488)	52% (343)	66% (271)	84% (248)
65+	49% (572)	42% (1963)	58% (627)	72% (284)	78% (192)

Presented uptake rates are based on 2013 values [16] adjusted for the uptake trend, population growth and income growth

insurance packages. Since they do not make their own insurance decisions, they are not individually subject to the financial incentives offered by the government. To further simplify the simulated market structure, the insurance products were considered to be individual plans, i.e. a family plan would attract the same premium as for two adults. As dependants were previously excluded from the analysis, the added implications of this were that partners' purchase decisions do not influence each other, and couples do not receive a discount for insuring together. A focused survey of the market indicated that such discounts were not available for entry-level hospital treatment insurance packages; however, a discount up to 34% could be received by a couple purchasing the highest level of comprehensive insurance product [18]. Consequently, our analysis most adequately represented the lower cost hospital treatment cover bundled with few extras, which was in line with the predefined scope of study.

Pre-tax income was randomly assigned to simulated individuals in each simulation cycle based on income quintiles reported from the Australian Census [19]. Individual income was uniformly distributed between the bounds of each income group with the exception of the top quintile where the income was modelled as a half-normal distribution to capture the diminishing frequency of very high incomes. The 2011 Census of Population and Housing income data were brought forward to June 2015 using the Wage Price Index [20].

Data on insurance uptake in the Australian population were derived from the most recent 2011–12 edition of the Australian Health Survey [16] updated to the financial year 2014–15. The uptake rates, shown in Table 2, were

adjusted using the growth rates of the insured population [1] offset by the overall population growth rate [17] calculated per age group. The uptake in the full survey sample was 48.6%, compared with 46.6% reported for Australia in June 2012 [1].

2.3 Willingness to Pay and Cost of Insuring

We associated the individual WTP with the reservation price, i.e. the maximum amount representing the total cost associated with the purchase of PHI at which a person would decide to insure [21, 22]. Consistent with this definition, the WTP represented all value considerations associated with the PHI cover as well as the circumstances under which the decision is made. Such intrinsic value factors included the individual's perceived healthcare needs, anticipation of healthcare use, risk aversion, the strength of preference for private over public hospitals or vice versa, and the decreased valuation of PHI due to the presence of co-payments and deductibles. The WTP did, however, exclude the government incentives, which were modelled explicitly.

While the WTP is not directly observable, under certain assumptions it can be derived indirectly from the population parameters and the observed levels of insurance uptake (i.e. revealed preference). Here, each simulated individual was assigned a WTP for hospital treatment insurance that was randomly generated from a normal distribution, with the mean and standard deviation specific for their respective age-income group. The implication of this was that, after controlling for age and income, all remaining characteristics that influence a person's WTP would result in the WTP to be normally distributed within the groups. This corresponded to a reservation price model in which the utility of the product is a linearly decreasing function of price [21].

The standard deviation of the WTP was postulated to be proportional to the mean, following Bock et al. [23], who estimated the standard deviation of the WTP for health insurance in the elderly population of Germany at 66% of the mean. We used this estimate to inform the shape of the normal distribution in our model. Still, the standard deviation may vary between countries and between population groups within a country; in order to increase the robustness of our results, we allowed it to vary between simulation cycles. Specifically, this parameter was randomised once for each cycle of the simulation, taking values from a normal distribution with a 95% chance of falling within the range between 50 and 82% of the mean (expected value 66%, SD 8.25%).

The total cost of PHI comprised of the insurance premium and government incentives that affect the premium price and individual tax paid. The Australian PHI market features community rating, which implies that all insurees pay the same premium. The premium may differ depending on the comprehensiveness of the insurance package, with more generous ancillary benefits generally being more expensive. Our model represented a simplified version of the market with only one type of hospital treatment cover available. The price of this package, A$1829, was defined as the average premium of PHI plans covering hospital treatment in Australia in the financial year 2014–15 [24].

2.4 Microsimulation

Mean WTP in each of the age-income groups (μ_g) was the unknown we sought to find. The parameter was tested over the range between nil and A$2000, with the upper limit determined in a calibration run. For each value of μ we calculated the difference between actual and simulated uptake, using the computationally-efficient criterion of minimum absolute difference, to determine the best match. Formally, for each age-income group g independently, we sought:

$$\mu_g = \underset{\mu \in (0,2000)}{\arg\min} \left| \frac{n_g^{ins}}{n_g} - \text{uptake}_g^{obs} \right|, \quad (1)$$

where n_g^{ins} denotes the number of persons insured, n_g, total number of persons, and uptake_g^{obs}, observed uptake rate, in group g.

The modelled uptake rates were aggregated from individual PHI purchase decisions. The decision to buy PHI was made based on a net benefit consideration, that is, when the individual reservation price of insurance less the total cost of cover was non-negative. Hence, an individual i of age-income group g chooses to insure if:

$$\text{WTP}_{i,g} - P \times (1 + l_i) \times (1 - r_i) + c_i + \text{inc}_i \times s_i \geq 0, \quad (2)$$

where the $\text{WTP}_{i,g}$ of individual i depends on the distribution parameters of group g

$$\text{WTP}_{i,g} \sim N(\mu_g, \varphi_k \times \mu_g), \quad (3)$$

with φ_k randomised in each model cycle k

$$\varphi_k \sim N(66\%, 8.25\%) \quad (4)$$

and P denotes the community-rated insurance premium; l_i, accumulated LHC loading; r_i, subsidy from PHI rebate; c_i, present value of avoided future cost associated with increased LHC loading given failure to insure; inc_i, individual taxable income; and s_i, MLS surcharge, of individual i.

A consideration of the cumulative LHC penalty was introduced through the term c_i. Based on the annual growth of WTP and premium price, the model computed the time when the individual would insure in the future, and calculated the present value of LHC penalty avoided by insuring today. The time horizon set for this component

was 35 years, consistently with the LHC penalty cap (Table 1). The costs occurring in the future were discounted at a constant rate of 5% [25]. Confidence intervals were estimated by repeating the minimisation procedure (Eq. 1) over 250 simulation cycles. The model population comprised 10,000 individuals, which ensured that every income-age group included at least 100 individuals.

Having determined parameters for the WTP distribution, we modelled effects of modifications to PHI policies described in Table 3. The same micro-decision model was used here; however, the simulated individuals ($N = 10{,}000$) were faced with modified incentives. For each policy scenario, means and standard errors were calculated from 100 independent runs in which the model was repopulated from the underlying distributions. The federal government perspective was assumed for the analysis of costs with only direct effects accounted for. These included budget implications of the PHI rebate, MLS, and other scenario-specific tax incentives, as shown in Table 5, but excluded cost consequences of changing PHI uptake for the public payer, notably the possibility of higher or lower demand for public hospital services. All cost values were calculated as 2015 Australian dollars (A$).

3 Results

3.1 Willingness to Pay

The WTP results are presented in Table 4. The table should be interpreted as follows: for each age-income group, the reported value represents the mean of the WTP distribution that most accurately reproduces the PHI uptake rates observed in that group. For example, in the age group 25–29 years in the first income quintile mean WTP is A$954, with the 95% confidence interval of A$948–A$960 based on the standard error of the mean from 250 cycles of the simulation. The individual WTP in this group is normally distributed with a standard deviation of A$630.

3.2 Policy Scenarios

Table 5 presents the key cost and effectiveness outcomes for the simulated scenarios grouped by the incentive mechanism. The results are reported in incremental terms, with the simulated 2014–15 levels serving as a comparator. This reflects the fact that in our study any scenario was a modification of the policy existing at that point in time (i.e. the status quo).

The cost to the public budget comprises PHI rebate, the MLS, and 'other tax', representing scenario-specific tax concessions (tax credit and exemption from fringe benefits tax). Effectiveness is defined in terms of a change in the insured population expressed both in thousands of insured individuals and, for reference, in percentage points. The last column presents the incremental cost-effectiveness of each policy scenario, calculated as the change in cost to the federal budget divided by the change in the number of people holding health insurance.

The scenarios we investigated resulted in a considerable variety of cost, uptake and cost-effectiveness. The impact on the public budget ranged from A$4 billion savings to

Table 3 Policy scenarios

Incentive mechanism	Parameter	Current value	Values tested
Lifetime Health Cover	Starting age	31	26, 29, 33, 36
	Loading	2%	1, 3, 5%
			Negative 2% per year accumulated starting at age 25 until age 31
	Accumulated penalty	Individual record based on insurance history	Amnesty and 0% loading
Private Health Insurance Rebate	Subsidy	[33]	Percent reduction of current values: −30, −10, +10, +30%; flat 0 or 30% for all ages and incomes
Medicare Levy Surcharge	Levy	[33]	Percentage point reduction of current values: −1, −0.5, +0.5, +1; flat 0 or 1% for all incomes
Means testing	Thresholds	[33]	Current thresholds adjusted by −A$30,000, −A$10,000, +A$10,000, +A$30,000
Tax credit	Proportion of premium	N/A	20% for all incomes; 20% for individuals with annual income below A$90,000; 50% for individuals with annual income below A$30,000
Fringe Benefits Tax exemption	Proportion of employers offering access to benefit	N/A	33, 60, 100%

Table 4 Simulated willingness to pay for hospital treatment private health insurance (2014–15)—means (A$) with 95% confidence intervals based on standard errors of the mean

Age group, years	Income quintile (A$)				
	1 (<14,616)	2 (14,616; 27,546)	3 (27,547; 48,515)	4 (48,516; 75,499)	5 (≥75,500)
25–29	954 (948–960)	988 (980–995)	973 (967–980)	1186 (1179–1192)	1155 (1139–1170)
30–34	674 (668–680)	713 (707–718)	658 (653–663)	895 (888–902)	1082 (1056–1108)
35–39	486 (482–491)	446 (443–450)	542 (538–546)	652 (647–658)	599 (591–607)
40–44	473 (469–476)	493 (489–496)	555 (551–559)	590 (586–595)	645 (635–656)
45–49	476 (472–480)	534 (530–537)	556 (552–560)	660 (655–664)	653 (641–665)
50–54	545 (541–549)	533 (528–538)	674 (669–680)	699 (693–704)	629 (618–639)
55–59	679 (672–686)	559 (555–562)	772 (766–778)	880 (871–890)	1015 (985–1045)
60–64	727 (720–733)	548 (544–552)	719 (713–725)	1000 (987–1014)	1237 (1200–1273)
65+	642 (639–646)	569 (567–570)	793 (788–798)	1224 (1195–1253)	960 (922–998)

A$6 billion expense. The effect on the additional number of people insured ranged from 3.4 million fewer to 2.5 million more. We found one policy scenario that had the potential to increase the number of people insured while generating a budget saving of A$305 per additional person insured: increasing the LHC penalty for not insuring from 2 to 3% per year. On the other hand, the highest recorded incremental cost-effectiveness was A$22,624 per additional person insured when a flat PHI rebate at 30% of the insurance premium was set across all population groups. The scenarios also had a considerable range of impacts on the average age of the insured pool, ranging from a 2.0-year decrease to a 1.3-year increase. The magnitude of impacts in specific age groups is presented in Table 6.

Figure 1 presents the scenarios plotted on a cost-effectiveness plane, with the change in number of people insured indicated on the horizontal axis and the incremental cost to the government on the vertical axis. Mirroring Table 5, the values are presented as incremental relative to the status quo comparator, i.e. the set of policies current as of 2014–15, which is indicated at the origin.

4 Discussion

4.1 Willingness to Pay

Our simulations indicate that the mean WTP for hospital treatment cover across age-income groups ranged from A$446 to A$1237 and varied considerably with age and income. This reasonably well reflects the spread between low- and high-cost groups in Australia; for example, a recent Treasury analysis reported a fourfold difference in expected healthcare costs between people in their 30 s and people over 60 years of age [26]. Mean WTP values generally are highest in the youngest group (25–29 years), below average among individuals aged 35–39 years, and then increasing with age, as one would predict. The individual's age is likely to correlate with a number of factors that contribute to insurance purchase decision, including self-assessed health [27], risk aversion, ability to make complex financial decisions and stronger preference for convenience and amenities [28]. Within each age group the WTP was positively correlated with income, in line with previous evidence [6].

Two outcomes require a closer look. First, mean WTP found in the youngest age group exceeds the population average. While rates of uptake among younger people are generally below average (Table 2), higher WTP reflects the fact that their uptake is still relatively high considering low healthcare needs and weaker financial incentives, notably the lack of LHC penalty that applies in higher age groups (terms l_i and c_i in Eq. 2). In addition, younger people who choose to insure face the unfavourable community rating (in Eq. 2 represented by a uniform price P), which means they pay the same premiums as older people despite the fact that on average they represent a lower risk of incurring healthcare costs. Second, in five out of nine age groups mean WTP in the highest income quintile was slightly lower than in the fourth quintile. This may be due to the fact that high-income individuals have a strong tax-related incentive to take out PHI (term $\text{inc}_i \times s_i$ in Eq. 2) and will insure regardless of their subjective valuation of the PHI cover, which might also explain why the WTP values drop off in the highest income bracket.

Since simulated WTP values are normally distributed, negative values may be obtained for some individuals. This is intuitive as some individuals can be expected to refuse to take out insurance even at a zero monetary cost, due to being ideologically opposed to the idea of private insurance or because they are not concerned with their insurance status. Still, even individuals who have a negative

Table 5 Policy scenario outcomes—means and standard errors of change from current policy (the status quo)

No.	Scenario	Cost to budget (A$ million, negative values are savings)				PHI uptake		Average age insured (years)	ICER
		Rebate	MLS	Other tax	Total	% points	*n* ('000s)		
Lifetime health cover									
1	At age 26	308 (4.0)	5 (3.6)	N/A	313 (7.6)	3.7 (0.05)	581 (7.2)	−1.5 (0.01)	538
2	At age 29	131 (3.8)	2 (3.6)	N/A	133 (7.5)	1.6 (0.04)	247 (7.0)	−0.6 (0.01)	538
3	At age 33	−122 (3.8)	−3 (3.6)	N/A	−125 (7.4)	−1.5 (0.04)	−231 (6.9)	0.5 (0.01)	540
4	At age 36	−275 (3.7)	−10 (3.6)	N/A	−285 (7.3)	−3.3 (0.04)	−520 (6.7)	1.2 (0.01)	547
5	Loading 1%	−292 (3.9)	66 (3.4)	N/A	−226 (7.3)	−3.1 (0.04)	−501 (7.0)	0.0 (0.01)	451
6	Loading 3%	50 (3.9)	−72 (3.7)	N/A	−21 (7.6)	0.4 (0.04)	70 (7.1)	−0.1 (0.01)	−305
7	Loading 5%	−1092 (3.9)	−175 (3.8)	N/A	−1267 (7.7)	−12.3 (0.04)	−1962 (7.1)	−1.5 (0.02)	645
8	Negative at age 25	50 (3.8)	8 (3.6)	N/A	57 (7.4)	0.6 (0.04)	97 (6.9)	−0.3 (0.01)	592
9	Amnesty	228 (3.9)	30 (3.4)	N/A	258 (7.3)	2.5 (0.04)	392 (7.1)	0.6 (0.01)	659
PHI rebate									
10	Decrease by 30%	−1552 (2.8)	−41 (3.7)	N/A	−1593 (6.5)	−6.5 (0.05)	−1027 (7.3)	−0.1 (0.01)	1551
11	Decrease by 10%	−568 (3.6)	−13 (3.7)	N/A	−582 (7.3)	−2.3 (0.05)	−367 (7.3)	0.0 (0.01)	1587
12	Increase by 10%	593 (4.4)	13 (3.6)	N/A	606 (7.9)	2.1 (0.04)	333 (7.1)	0.1 (0.01)	1816
13	Increase by 30%	1951 (4.9)	40 (3.5)	N/A	1991 (8.5)	6.9 (0.04)	1091 (6.9)	0.1 (0.01)	1824
14	Flat 0%	−3829 (0.0)	−141 (4.0)	N/A	−3970 (4.0)	−21.3 (0.04)	−3381 (5.9)	−0.9 (0.02)	1174
15	Flat 30%	655 (3.9)	185 (3.0)	N/A	840 (6.9)	0.2 (0.04)	37 (7.0)	−0.7 (0.01)	22,624
Medicare levy surcharge									
16	Decrease by 1 point	−158 (3.8)	−2865 (1.6)	N/A	−3023 (5.4)	−5.3 (0.04)	−843 (6.9)	0.9 (0.02)	3586
17	Decrease by 0.5 point	−59 (3.7)	−1599 (3.2)	N/A	−1658 (6.9)	−2.0 (0.04)	−320 (6.8)	0.3 (0.01)	5184
18	Increase by 0.5 point	52 (3.7)	1698 (3.7)	N/A	1751 (7.4)	1.4 (0.04)	216 (6.6)	−0.2 (0.01)	8087
19	Increase by 1 point	71 (3.7)	3249 (4.0)	N/A	3321 (7.8)	1.8 (0.04)	280 (6.5)	−0.2 (0.01)	11,863
20	Flat 0%	−183 (3.8)	−3313 (0.0)	N/A	−3496 (3.8)	−7.3 (0.05)	−1154 (7.2)	1.3 (0.02)	3030
21	Flat 1%	1117 (3.8)	2343 (4.4)	N/A	3460 (8.2)	11.8 (0.04)	1879 (7.0)	−0.8 (0.01)	1841
Means testing thresholds									
22	Decrease by $30,000	−436 (3.5)	2045 (4.5)	N/A	1610 (8.0)	3.8 (0.04)	605 (6.8)	−0.7 (0.01)	2660
23	Decrease by $10,000	−113 (3.8)	646 (4.2)	N/A	533 (8.0)	1.1 (0.04)	180 (7.1)	−0.2 (0.01)	2967
24	Increase by $10,000	99 (3.8)	−510 (3.8)	N/A	−411 (7.7)	−0.8 (0.04)	−123 (6.8)	0.1 (0.01)	3347
25	Increase by $30,000	225 (3.7)	−1565 (3.5)	N/A	−1341 (7.3)	−2.5 (0.04)	−395 (6.7)	0.5 (0.01)	3398
Tax credit									
26	Flat 20%	1407 (3.8)	221 (3.0)	3929 (2.4)	5557 (9.2)	16.4 (0.04)	2605 (6.6)	−0.5 (0.01)	2133
27	20% incomes <$90,000	1367 (3.8)	0 (3.6)	3105 (2.4)	4472 (9.9)	15.3 (0.04)	2438 (6.9)	−0.4 (0.01)	1835
28	50% incomes <$30,000	1377 (3.7)	0 (3.6)	4583 (4.3)	5960 (11.6)	15.0 (0.04)	2389 (6.6)	0.6 (0.01)	2495
Fringe benefits tax exemption									
29	33% employers	414 (3.7)	105 (3.0)	1127 (2.5)	1645 (9.2)	5.2 (0.04)	821 (6.5)	−0.8 (0.01)	2004
30	66% employers	831 (4.0)	212 (2.6)	2251 (3.0)	3293 (9.6)	10.4 (0.04)	1650 (7.0)	−1.5 (0.01)	1995
31	100% employers	1263 (4.0)	324 (2.4)	3411 (2.0)	4998 (8.3)	15.8 (0.04)	2511 (6.9)	−2.0 (0.01)	1991

Values indicate change from current policy

PHI private health insurance, *MLS* Medicare levy surcharge, *ICER* incremental cost-effectiveness ratio calculated as the total budget impact divided by the change in number of persons insured

valuation of PHI could be persuaded to take out insurance, when faced with a sufficiently strong reward or penalty. Our model predicted that an average of 6.5% (SD 0.24%) of Australians have negative WTP. The prediction reasonably well reflected the outcome of an Australian health insurance survey in which 8% of responders declared that they would not take out private health insurance because they see healthcare financing as a

Table 6 Change in the uptake of hospital treatment private health insurance (PHI) by age group—point estimates by policy scenario

No.	Scenario	Change in uptake per age group, years								
		25–29	30–34	35–39	40–44	45–49	50–54	55–59	60–64	65–99
Lifetime health cover										
1	At age 26	+46%	+28%							
2	At age 29		+28%							
3	At age 33		−27%							
4	At age 36		−40%	−23%						
5	Loading 1%		−5%	−9%	−10%	−9%	−7%	−6%	−7%	−5%
6	Loading 3%		+1%	+2%	+2%	+1%	+1%	+1%	+1%	
7	Loading 5%		−13%	−27%	−29%	−28%	−27%	−21%	−23%	−34%
8	Negative at age 25	+13%								
9	Amnesty			+2%	+3%	+4%	+5%	+5%	+7%	+10%
PHI rebate										
10	Decrease by 30%	−18%	−10%	−12%	−13%	−12%	−11%	−9%	−10%	−16%
11	Decrease by 10%	−6%	−4%	−4%	−5%	−4%	−4%	−3%	−3%	−5%
12	Increase by 10%	+6%	+3%	+3%	+4%	+3%	+3%	+2%	+3%	+6%
13	Increase by 30%	+19%	+11%	+13%	+13%	+12%	+11%	+9%	+9%	+18%
14	Flat 0%	−50%	−31%	−40%	−42%	−40%	−39%	−32%	−35%	−52%
15	Flat 30%	+4%	+3%	+4%	+4%	+4%	+4%	+2%	+2%	−9%
Medicare levy surcharge										
16	Decrease by 1 point	−13%	−12%	−19%	−17%	−17%	−16%	−6%	−3%	−2%
17	Decrease by 0.5 point	−5%	−4%	−7%	−6%	−6%	−6%	−2%	−1%	−1%
18	Increase by 0.5 point	+3%	+3%	+5%	+4%	+4%	+4%	+2%	+1%	
19	Increase by 1 point	+3%	+4%	+6%	+5%	+5%	+6%	+3%	+2%	
20	Flat 0%	−16%	−16%	−27%	−24%	−23%	−22%	−9%	−5%	−2%
21	Flat 1%	+43%	+26%	+25%	+28%	+25%	+20%	+15%	+15%	+18%
Means testing thresholds										
22	Decrease by $30,000	+15%	+10%	+12%	+12%	+10%	+8%	+5%	+3%	+1%
23	Decrease by $10,000	+5%	+3%	+4%	+3%	+3%	+3%	+1%	+1%	
24	Increase by $10,000	−3%	−2%	−3%	−2%	−2%	−2%	−1%		
25	Increase by $30,000	−8%	−6%	−9%	−7%	−7%	−8%	−3%	−1%	−1%
Tax credit										
26	Flat 20%	+45%	+29%	+37%	+38%	+34%	+31%	+22%	+25%	+30%
27	20% incomes <$90,000	+43%	+27%	+33%	+35%	+31%	+28%	+21%	+24%	+30%
28	50% incomes <$30,000	+39%	+22%	+24%	+27%	+22%	+23%	+20%	+27%	+44%
Fringe benefits tax exemption										
29	33% employers	+17%	+12%	+15%	+15%	+13%	+12%	+9%	+8%	+1%
30	66% employers	+35%	+25%	+30%	+31%	+27%	+24%	+17%	+16%	+2%
31	100% employers	+53%	+38%	+45%	+47%	+42%	+37%	+25%	+25%	+2%

Values represent percentage change from the status quo in the number of people insured in each age group

responsibility of the government, they do not trust in private healthcare, they are unable to see a difference between public and private healthcare provision, or they choose to self-insure, all of which may imply a negative WTP for PHI [29]. Such attitudes can be observed among high-income individuals who choose to pay the MLS in excess of the lowest price eligible PHI product.

4.2 Policy Scenarios

The results show that policy options are available to increase the uptake levels at a relatively low per unit cost to the public budget. We found the most cost-effective scenarios to be modifications of the LHC mechanism (Table 5, scenarios 1–9). It appears to be the cheapest policy that has

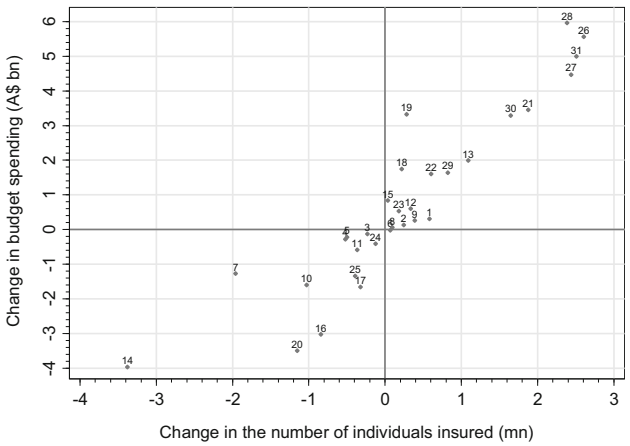

Fig. 1 Policy scenario outcomes plotted on a cost-effectiveness plane Scenario numbers correspond to those in Table 5

the potential to 'do the trick', corroborating Butler [30]. The drawback of this strategy is that the magnitude of its effect is limited because of natural restrictions on the policy parameters: individuals below age 25 years enjoy access to family insurance plans and often do not make their own purchase decisions, whereas repeating the LHC amnesty would undermine the credibility of the system. Increasing the loading from 2 to 3% was the only scenario that produced higher insurance uptake while generating cost savings to the Government, making it a dominating strategy. Still, the gain from this adjustment is small. In our simulation, it amounts to an additional 70,000 insurees at a modest budget saving of A$21 million, resulting in a cost-effectiveness ratio of −A$305. In sum, the LHC scenarios affect only certain age groups; on the other hand, they have the potential to selectively attract younger people to PHI (Table 6), which is important for maintaining a sound balance of low and high risks in the insurance pool.

Policies that target individuals' income rather than age, such as the PHI rebate, tax credit and the fringe benefit tax exemption, have the potential to increase the insured population by the millions. Yet, these would come at a higher cost per additional person insured. The incremental cost-effectiveness ratio for several scenarios exceeded the premium, causing the incentivisation strategies to be dominated by a direct purchase of insurance cover by the government (Table 5, scenarios 15–31). In practice, however, additional considerations can be made justifying the cost to the government in excess of the premium. These considerations might include the savings in public health spending generated from additional PHI, the feasibility of identifying the individuals eligible for a selective government-purchased cover, and the question of its social acceptability and fairness.

Our simulations indicate that the 30% flat PHI rebate offered to all Australians, as implemented in January 1999, would be economically wasteful adding little uptake at a prohibitive incremental cost to the government of A$22,624 per additional person insured. The current phasing out of this mechanism thus is a step towards rationalising the government spending in this area.

The scenarios where high cost-effectiveness ratios concur with decreases in the number of individuals insured indicate an opportunity for the government to reduce its spending on PHI incentives in exchange for small reductions in PHI uptake. For example, lowering the MLS by 0.5 percentage points and increasing the means test thresholds by A$10,000 are two such options, generating A$5184 and A$3347 in public budget savings per uninsured person, respectively (Table 5, scenarios 17 and 24). The government could implement these strategies and, for those who become uninsured, purchase insurance at the market price, and be better off.

The identification of policy scenarios that increase insurance uptake at a low incremental cost on the one hand, and those that generate substantial per capita savings while forgoing some of the cover on the other hand, opens up the possibility of combination policies that could be introduced with offsetting effects. For example, to the extent that the policy effects are additive, lowering the LHC qualifying age while simultaneously increasing the means test thresholds creates an opportunity to optimise the overall policy cost while maintaining the existing rates of uptake.

5 Limitations and Caveats

First and foremost, WTP values are modelled rather than measured and relate to a population only described by age and income. Our simulated market assumes away existing product differentiation in PHI as well as differences in incomes and premiums between Australian states and territories. Furthermore, we did not consider some PHI features such as tiered products that offer benefits over and above basic cover for hospital treatment, the possibility to downgrade an insurance cover, and the relationship between deductibles ('excess payments') and premiums. Accounting for these aspects would require a more comprehensive data set than the one available.

We designed a static, one-period model to explore the impact of a policy parameter change on pre-defined outcomes within a financial year. One limitation of this design is that it does not show the second-round effects such as the premium price adjustment in response to the changing structure of the insurance pool. To alleviate for this shortcoming, Table 6 presents the effect on insured population by age group. This information can be used to predict the premium in the subsequent period, in order to further explore the consequences of various policies.

In defining the policy scenarios we considered the fact that small incremental changes are not only more realistic in terms of political viability, but also give more reliable simulation results. For this reason, we generally avoided simulating large policy changes, such as eliminating all incentives, because it could have implications beyond the modelled parameters and in particular could influence the WTP distribution in an unknown way. Furthermore, the possibility that multiple policy scenarios could be implemented simultaneously to yield additive effects remains to be demonstrated.

The incremental cost-effectiveness ratio provides an adequate tool for comparing alternative policy options within our defined policy objectives. Nevertheless, any actual policy making would consider not only the cost-effectiveness ratio, thresholds for which may differ between spending being increased or reduced, but also the budget cost and the implications for the PHI market separately. In addition, it would likely take into account other criteria such as the perceived social fairness of various alternatives and the income redistribution performed by the incentive mechanisms. Finally, changing PHI uptake has important implications for the costs faced by Medicare and public hospitals. Cheng [31] as well as Frech and Hopkins [5] provide excellent analyses of this problem. Integrating this type of evidence into our model remains an important goal for future research.

6 Conclusion

We used a purpose-built microsimulation to model decisions made by Australians regarding the purchase of PHI. Our results indicate that WTP values for PHI covering hospital treatment vary considerably with age and income. Individuals aged below 35 years and above 60 years value PHI more highly than others, which is also true of those with higher incomes. The differences between the high and low PHI valuations correspond to the ratios of healthcare cost expected in respective age groups. Looking for ways to improve the incentive policies we found that the small-scale adjustments targeting age groups through the LHC mechanism can be recommended as an economically justified way of increasing the uptake of insurance. On the other hand, there are options for achieving substantial budget savings in return for relatively small losses of PHI uptake. Therefore, policy improvements are available regardless of the government favouring a greater or smaller degree of market intervention. In addition, it can be hypothesised that these offsetting strategies could be bundled together to optimise the overall incentive policy. Finally, the incentive mechanisms that target individual income have the potential to importantly affect all age groups. However, we find that those scenarios would come at a high incremental cost per additional person insured.

Author Contributions All authors contributed to the study concept and definition of policy scenarios. PMS and SK designed the microsimulation and analysed the data. PMS, JB and PAS wrote the manuscript.

Compliance with Ethical Standards

This study is an independent academic work following from a prior consultancy report prepared for Private Healthcare Australia (PHA), the peak body representing private health insurers in Australia. The researchers received financial and material support from PHA in the preparation of the consultancy report. The methods and results in this paper have been modified substantially since that report. PMS, SK, JB, SKN, TC and PAS declare no conflicts of interest.

References

1. Private Health Insurance Administration Council. Quarterly statistics June 2014. Sydney: Private Health Insurance Administration Council; 2014.
2. Mossialos E, Wenzl M, Osborn R, Anderson C. International profiles of health care systems. New York: The Commonwealth Fund; 2015.
3. Australian Institute of Health and Welfare. Expenditure data. www.aihw.gov.au/expenditure-data/. Accessed 6 June 2015.
4. Frech HE, Hopkins S, MacDonald G. The Australian private health insurance boom: was it subsidies or liberalised regulation? Econ Pap J Appl Econ Policy. 2003;22:58–64.
5. Frech HE, Hopkins S. Why subsidise private health insurance? Aust Econ Rev. 2004;37:243–56.
6. Ellis RP, Savage E. Run for cover now or later? The impact of premiums, threats and deadlines on private health insurance in Australia. Int J Health Care Finance Econ. 2008;8:257–77.
7. Segal L. Why it is time to review the role of private health insurance in Australia. Aust Health Rev. 2004;27:3–15.
8. Denniss R. Who benefits from private health insurance in Australia? New Dr. 2005;83:23–4.
9. Walker A, Percival R, Thurecht L, Pearse J. Distributional impact of recent changes in private health insurance policies. Aust Health Rev. 2005;29:167–77.
10. Seah DSE, Cheong TZ, Anstey MHR. The hidden cost of private health insurance in Australia. Aust Health Rev. 2013;37:1–3.
11. Hajizadeh M, Connelly LB, Butler JRG. Health policy and equity of health care financing in Australia: 1973–2010. Rev Income Wealth. 2014;60:298–322.
12. Hopkins S, Zweifel P. The Australian health policy changes of 1999 and 2000. Appl Health Econ Health Policy. 2005;4:229–38.
13. Australian Government Department of Human Services. Portfolio budget statements 2016–17. Budget Related Paper No. 1.15B. Commonwealth of Australia, Canberra ACT; 2016.
14. Breidert C, Hahsler M, Reutterer T. A review of methods for measuring willingness-to-pay. Innov Market. 2006;2(4):8–32.
15. Brandimarte P. Handbook in Monte Carlo simulation: applications in financial engineering, risk management, and economics. Hoboken: Wiley; 2014.
16. Australian Bureau of Statistics. AHS sample design and selection. Australian health survey: users' guide, 2011–13. Canberra: Commonwealth of Australia; 2013.

17. Australian Bureau of Statistics. Australian demographic statistics. Canberra: Commonwealth of Australia; 2015.
18. Online quotes for persons born in Jan 1970 in various family configurations. http://comparethemarket.com.au. Accessed 25 Aug 2015.
19. Australian Bureau of Statistics. Census of population and housing. Canberra: Commonwealth of Australia; 2011.
20. Australian Bureau of Statistics. Wage price index, Australia, June 2015. Canberra: Commonwealth of Australia; 2015.
21. Kohli R, Mahajan V. A reservation-price model for optimal pricing of multiattribute products in conjoint analysis. J Market Res. 1991;28(3):347–54.
22. Robson A, Paolucci F. Private health insurance incentives in Australia: the effects of recent changes to price carrots and income sticks. Geneva Pap. 2012;37:725–44.
23. Bock JO, Heider D, Matschinger H, Brenner H, Saum KU, Haefeli WE, Koenig HH. Willingness to pay for health insurance among the elderly population in Germany. Eur J Health Econ. 2016;17(2):149–58.
24. Private Healthcare Australia. Private health insurance premium prices in Australia. http://privatehealthcareaustralia.org.au. Accessed 07 Aug 2015.
25. Department of Health and Ageing and enHealth Council. Guidelines for economic evaluation of environmental health planning and assessment, vol. 1. The guidelines. Canberra: Commonwealth of Australia; 2003.
26. Australian Government Treasury. Intergenerational report: Australia in 2055. Canberra: Commonwealth of Australia; 2015.
27. Doiron D, Jones G, Savage E. Healthy, wealthy and insured? The role of self-assessed health in the demand for private health insurance. Health Econ. 2008;17:317–34.
28. Buchmueller TC, Fiebig DG, Jones G, Savage E. Preference heterogeneity and selection in private health insurance: the case of Australia. J Health Econ. 2013;32:757–67.
29. Australia Ipsos. Healthcare and insurance survey. Sydney: Ipsos Healthcare; 2009.
30. Butler JRG. Policy change and private health insurance: did the cheapest policy do the trick? Aust Health Rev. 2002;25(6):33–41.
31. Cheng TC. Measuring the effects of reducing subsidies for private insurance on public expenditure for health care. J Health Econ. 2014;33:159–79.
32. Australian Government Department of Health. Lifetime health cover. www.health.gov.au/internet/main/publishing.nsf/content/health-privatehealth-lhc-providers-general.htm. Accessed 20 July 2015.
33. Australian Government Department of Health. Private health insurance circular PHI 27/14. Canberra: Commonwealth of Australia; 2014.