# ECONOMIC EVALUATION OF THE NPS MEDICINEWISE PROGRAM: EXPLORING INHALED MEDICINES USE AND ASTHMA CONTROL (2014)

## Cost-Benefit Analysis Report

June 2017

Independent, not-for-profit and evidence based, NPS MedicineWise enables better decisions about medicines and medical tests. NPS MedicineWise receives funding from the Australian Government Department of Health.

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# Contents

# EXECUTIVE SUMMARY

Asthma is a chronic inflammatory disease that causes wheezing and breathlessness due to the narrowing of the airways. Asthma is associated with significant morbidity and mortality. It affects around 10% of the Australian population and occurs in both children and adults. Despite the availability of national and international guidelines for asthma, a number of quality use of medicines and medical tests issues are evident in Australia.

In 2014 NPS MedicineWise launched the "Exploring Inhaled Medicines Use and Asthma Control" program (Asthma program). The program was selected to address quality use of medicines (QUM issues related to the management of asthma in the Australian community including over prescribing of inhaled corticosteroids and long-acting beta agonists (ICS+LABA) combination medicines, prescribing of ICS+LABA combination medicines in children (age <6 years), patients' adherence to preventer medicines, inhaler technique and ownership of written asthma action plans. By addressing these issues, the program aimed to improve general practitioner (GP) practice in line with Australian clinical guidelines, improve asthma control in people with asthma and reduce unnecessary costs to the pharmaceutical benefits scheme (PBS).

The Asthma program was one of NPS MedicineWise's nationally implemented therapeutic programs. Interventions and resources for GPs, were developed as part of this program and included one-to-one educational visiting, small group case-based visiting, a clinical e-adult, online case study, online learning module, prescribing (PBS) feedback and distribution of written information.

The objective of this economic evaluation is to identify in monetary terms the cost and benefit of the Asthma program from the perspective of the payer, the Australian Government Department of Health (DoH), and the cost-effectiveness of the program in achieving the anticipated outcomes.

Two independent studies were conducted: the first was a cost-benefit analysis at the population level using PBS data and the second was a cost-consequence study at the GP practice level using data from the MedicineInsight program.

**Study one: population level cost-benefit analysis**

This study involved an impact evaluation of the changes in medicine utilisation on the PBS. It measured the benefit of the Asthma program in terms of reductions in unnecessary costs to the Australian Government DoH. Time series analysis was used to measure the impact of the program on provider level reimbursement data for the following asthma medication classes: ICS+LABA therapy, ICS monotherapy, cromones and the leukotriene receptor antagonist. This data was obtained from the Australian Government Department of Human Services for the period 1 July 1996 to 30 June 2016.

In the 2 year period following the Asthma program, dispensing of ICS+LABA combination medicines decreased relatively by 2.51% from the predicted trend without the Asthma program. This corresponds to an estimated mean reduction of 259,446 prescriptions from July 2014 to June 2016 and a savings to the PBS of $13,012,090 attributed to the Asthma program. In the period following the Asthma program there was an increase in dispensing of ICS monotherapy medicines, by a relative 4.18% from the predicted trend without the Asthma program. This corresponds to an estimated mean increase of 45,026 prescriptions from July 2014 to June 2016 and an introduced cost to the PBS of $1,194,740 attributed to the Asthma program. No statistically significant association was found between the Asthma program and PBS reimbursement for cromones and the leukotriene receptor antagonist.

The results of this impact evaluation using PBS data, together with program cost data, collected from NPS MedicineWise finance and timesheet systems, were used to conduct a cost-benefit analysis. The resources required to develop and deliver the Asthma program were $4,632,783 ($4,470,116 after discounting and adjusting). Costs and benefits of the Asthma program were discounted at a rate of 5% per year. All program costs were adjusted to 2016 currency using Australian Consumer Price Index (CPI). The net benefit of the Asthma program was $6,423,621, this is the difference between the net savings to the PBS and the cost of the Asthma program. The net savings to the PBS include the savings from reduced prescriptions for ICS+LABA combination medicines ($11,994,226 after

discounting) and the introduced costs from the increase in prescriptions for ICS monotherapy medicines ($10,893,737 after discounting). The benefit to cost ratio was 2.44, indicating that for every dollar spent on the program, $2.44 was gained in monetary benefit.

The results of the cost benefit analysis regarding ICS+LABA utilisation on the PBS, were highly sensitive to the introduction of variation around the effect estimate of the Asthma program.

**Study two: GP behaviour level cost-consequence analysis**

This study involved an impact evaluation of the Asthma program's effect on GP prescribing practice and patient asthma management using MedicineInsight data. MedicineInsight is a general practice longitudinal data program that includes over 500 practices from across Australia. Three outcomes were considered in this analysis: prescribing of medicines for asthma; prescribing of medicines for asthma in patients aged 6 and younger; and reference to the provision of a written asthma action plan. There is a lack of evidence for the safety and efficacy of LABAs, including in combination with ICS, in young children.[1, 2] Written asthma action plans have been recommended in guidelines since 1989[3] and have been found to reduce mortality due to asthma.[4] Time series analysis was used to measure the impact of the whole national Asthma program on all GPs in MedicineInsight and the specific impact of the visiting interventions on GPs who chose to participate in these interventions.

Among MedicineInsight GPs the whole national asthma program was associated with a significant relative 32% reduction (0.6% absolute reduction) in the prescription of ICS+LABA combination medicines in patients aged 6 and younger for the period June 2014 to December 2016. The visiting interventions were associated with a significant relative 43% increase (absolute 5 per thousand patients per month) in the provision of written asthma action plans among GPs who choose to participate in one of these interventions.

The results of this impact evaluation at the GP level, together with program cost data, collected from NPS MedicineWise finance and timesheet systems, were used to conduct a cost consequence analysis. A cost consequence analysis is a variant of cost-effectiveness analysis, used when multiple outcomes, not suitable for combining, are evaluated. Each significant outcome was considered in relation to the total cost of the program calculated at a unit level.

The total monthly program cost per GP patient aged 6 and younger who visited the GP and received a prescription was $7.51 for the program excluding visiting and an additional $40.89 in costs where the GP had a face to face visit. The consequence of this cost was a change in prescription rate for ICS+LABA combination medicines of an absolute 0.6% fewer children prescribed an ICS+LABA combination product each month.

The total monthly program cost per GP patient who visited the GP for the reason of asthma was $0.64 for the program, excluding visiting, and an additional $2.51 in costs where the GP had a face to face visit. The consequence of this cost was an absolute change of 5 more written asthma action plans per 1000 patients each month, in GPs participating in the visiting intervention.

The most influential variables in the sensitivity analysis for the cost-effectiveness analyses was the effect estimates of the program impact.

**Conclusion**

This economic evaluation found that the 2014 NPS MedicineWise Asthma program had economic benefit in terms of reducing costs to the PBS and had a positive impact on GP adherence to guideline recommended prescribing and patient asthma management. The Asthma program was associated with a net benefit to the payer, the Australian Government Department of Health, of $6,423,621; a decrease in prescribing ICS+LABA combination medicines in patients 6 years and younger; and an increase in the provision of written asthma action plans amongst GPs who participated in a visiting intervention.

The MedicineInsight analysis found important outcomes to be affected by different types of interventions included in the Asthma program. This evaluation highlights value of multimodal programs to improve clinical practice when the quality use of medicine issues are complex and multifaceted.

Summary of findings:

- **Net Benefit** of the program was $6,423,621 to the payer, the Australian Government Department of Health. **Benefit to cost ratio:** every dollar spent on the program, $2.44 was gained in monetary benefit.
- Amongst children (≤ 6 years) who were prescribed an asthma medicine, **an absolute 0.6% fewer children** were prescribed an ICS+LABA combination product each month as result of the national program
- An absolute change of **5 more written asthma action plans per 1000 patients** each month, in GPs participating in the visiting intervention.

# INTRODUCTION

In 2014 NPS MedicineWise launched the "Exploring Inhaled Medicines Use and Asthma Control" visiting program (herein after called the Asthma program). The objective of this program was to support clinicians to improve or optimise their prescribing behaviour of inhaled medications for asthma. The program was in-field from May 2014 to June 2015 and approximately 30%[i] (n=10,082) of General Practitioners (GPs) Australia-wide actively participated in the program.[5]

## Objectives of this report

The objective of this report is to present an economic evaluation of the 2014 Asthma program, which identifies, in monetary terms, the costs and benefits of the Asthma program and the cost-effectiveness of the program at achieving the anticipated outcomes.

Due to the availability of different levels of data, this evaluation is presented as two studies:

- Study one provides an economic evaluation at the population level. The program effectiveness is evaluated using a time series analysis of national administrative data from the Pharmaceutical Benefits Scheme (PBS). Total program costs are used to conduct a cost-benefit analysis.
- Study two provides an economic evaluation at the GP behaviour level. The program effectiveness is evaluated using a time series analysis of GP clinical software data from the MedicineInsight dataset. Both prescribing and patient management outcomes are evaluated in a cost consequence analysis.

## The NPS MedicineWise Asthma Program

### Rationale for the program

Asthma is a chronic inflammatory disease that causes wheezing and breathlessness due to the narrowing of the airways. Asthma is associated with significant morbidity and mortality. It affects around 10% of the Australian population and occurs in both children and adults. Asthma is commonly managed in the primary care setting and as such prescriptions written by GPs account for the majority of asthma medicines dispensed.

Asthma medication act either to relieve or prevent the symptoms of asthma. In Australia the most commonly used reliever medicines are short-acting beta agonists (SABAs). Preventer medicines are available as either monotherapy (inhaled corticosteroids (ICS) are the most common in Australia), or combination therapy (ICS and long-acting beta agonists (LABAs)). Other preventer medicines used in asthma include montelukast (PBS subsidised for patients aged 2 to 5 inclusive, and 6 to 14 inclusive, depending on dose) and the cromones (cromoglycate and nedocromil). Appropriate medicine use should take into consideration the pattern of asthma symptoms, level of asthma control of the asthma, ability to use the device, the person's preferences and the age of the person with asthma.

Despite the availability of national and international guidelines for asthma, a number of quality use of medicines and medical tests issues are evident in Australia. The following were identified in the NPS MedicineWise formative research report on Asthma and informed the design of the 2014 NPS MedicineWise Asthma progam.[3]

- Over prescribing of ICS+LABA combination medicines compared with guideline recommendations.

i Proportion is calculated using a denominator of 33,275 GPs, the number of prescribing GPs during 2008/2009. Source: The Department of Health, General practice statistics http://www.health.gov.au/internet/main/publishing.nsf/content/general+practice+statistics-1

- Use of ICS+LABA combination medicines in children aged younger than 6 years which is not recommended due to a lack of evidence of safety and efficacy in this age group.
- Lack of precision in assessment of asthma control and imprecise prescribing according to control (over and under treatment) and lack of review.
- Poor patient adherence with medicines.
- Poor inhaler technique by patients and inadequate review by health professionals.
- Low use by GPs and patients of written asthma action plans.

## Key program objectives and messages

*The 2014 Asthma program aimed to improve the awareness, knowledge and skills of health professionals and consumers in line with key messages.*

*The key messages for **health professionals** were:*

1. *Consider asthma diagnosis, symptoms and risk factors before treating to achieve control*
2. *Initiate or continue inhaled medicines following a review of asthma control*
   - *Good control: consider stepping down treatment*
   - *Poor control: confirm symptoms relate to asthma, check adherence and inhaler technique before stepping up*
3. *Provide written, individualised information to encourage patient self-management and improve asthma outcomes*

*The key messages for **consumers** were:*

1. *It is important that your asthma is reviewed regularly. Asthma can change over time, so your treatment may need to be adjusted, even if you are not unwell.*
2. *Understand what "well-controlled" asthma means (recognising your asthma symptoms will help you know how well-controlled your asthma is)*
3. *Check any written information provided to you about managing your asthma and make sure it is current. Recognising your asthma symptoms and how to manage them can help you control your asthma more effectively.*
4. *Use inhalers, and the appropriate equipment, as prescribed. Following your treatment plans and using medicines as intended can help to optimise your treatment*

## Overview of the program's interventions and reach

*The Asthma program* was a national visiting program targeted primarily at health professionals that was in the field being delivered by Clinical Service Specialists (CSS') from May 2014 to June 2015.

The main activities and interventions for the Asthma program are shown in Table 1. Reach (not unique) for all health professionals (HPs) and GPs is shown where applicable.

Table 1: **INTERVENTION AND ACTIVITIES SUITE FOR THE 2014 NPS ASTHMA PROGRAM.**

| Health professionals | Health professionals | Consumer and media |
|---|---|---|
| 1-1 Educational visiting - 6053 HPs (including 5371 GPs) | MedicineWise News | Consumer knowledge hub |
| Small group case-based visits - 5701 HPs (including 3964 GPs) | Knowledge hubs (website) | Media releases |
| Conference workshop - 136 HPs (including 26 GPs) | NPS Direct | Social media campaign |
| Clinical e-audit (566 GPs) | Engagement with asthma specialists | Consumer messages delivered by HPs / partner organisations |
| Online case study - 469 GPs | Prescribing (PBS) feedback | HP and consumer EDMs |
| e-Pharmacy practice review 1055 Pharmacists | | |
| Online learning module on inhaler technique (partnership with Asthma Australia) - 1393 HPs and students, (including 21 GPs) | | |

Educational visiting involves a NPS MedicineWise clinical service specialist (CSS) meeting with the GP individually in their practice to discuss evidence based therapy on a particular topic. A discussion aid (educational visiting card) is used to guide the conversation and left for the GP as a reference (see appendix 3). This type of intervention is also known as academic detailing and is one of the most effective and proven intervention to bring about prescribing behaviour change.[6, 7] Small group case-based discussions are another intervention facilitated by a NPS MedicineWise CSS for GPs. These groups may include members of the multidisciplinary team such as pharmacists and practice nurses. In this invention a case scenario depicting real clinical dilemmas are used as the basis of discussion in a group of up to 10 participants.

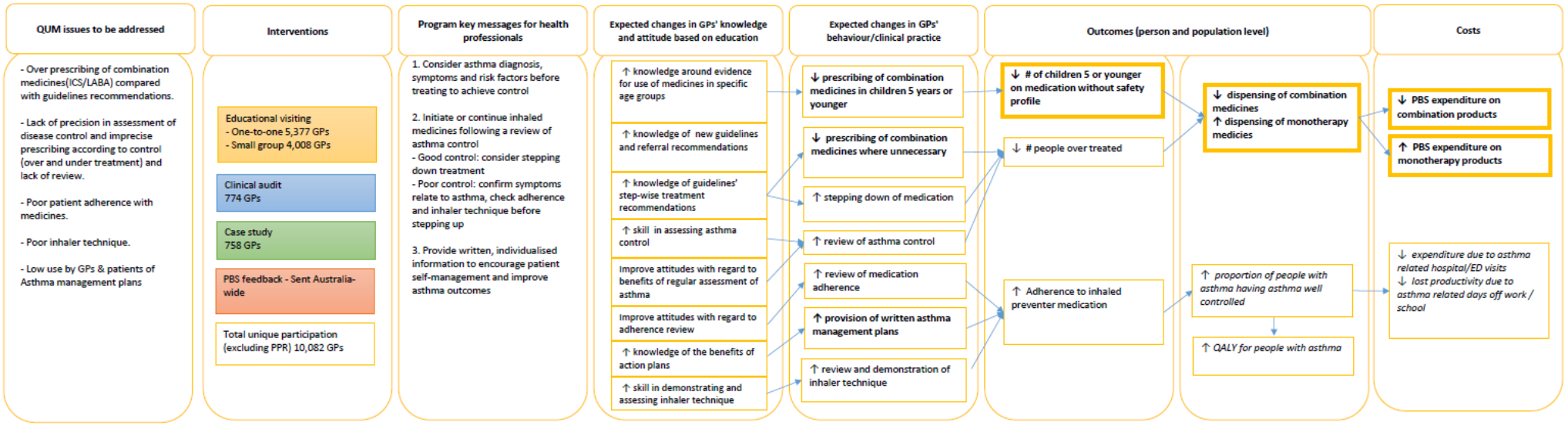
A Prescribing (PBS) feedback, known as a prescribing practice review, is a paper based intervention sent via mail to Australian GPs. The Prescribing (PBS) feedback presents GPs with their prescribing patterns for the selected therapeutic topic in comparison with their peers. It also contains relevant messages for reflection and information on the quality use of medicines. This personalised prescribing feedback data is drawn from Pharmaceutical Benefits Schedule (PBS) data and coordinated through the Department of Human Services (see appendix 2). This intervention is sent to all GPs who had prescribed over $1000 of medicines on the PBS over a 3 month period.

## Expected program outcomes

Based on key messages, educational materials, and current prescribing and patient management patterns the expected outcomes of the program were:

- Reduced inappropriate prescribing of combination medicines for asthma, particularly in children, and associated reduced PBS expenditure on these products.
- A corresponding increased prescribing of monotherapy medicines for asthma. These changes in prescribing patterns may indicate: increased stepping down of combination therapy; increased use of the step-wise approach during treatment initiation; and increased review of adherence and inhaler technique prior to stepping up of therapy.
- Increased provision of written asthma action plans.

Figure 1: **EXPECTED OUTCOMES OF THE 2014 NPS MEDICINEWISE ASTHMA PROGRAM.**




**BOLD - some level of measurement possible with data avaliable to NPS**

# Program evaluation

The impact of the 2014 Asthma program on health professionals' attitudes, confidence, knowledge and self-report practices has previously been evaluated. The methods of this evaluation include a GP survey, Clinical e-audit analysis and qualitative interviews with GPs.

The GP survey consisted of a participant survey sent to a random sample of 1600 GPs who had participated in a 1-1 educational visit or small group cased based meeting as part of the Asthma program and a control survey sent to a random sample of 800 GPs who had not actively participated in the Asthma program but had engaged in an educational activities through NPS MedicineWise previously. The surveys were self-completion, paper based questionnaires. The surveys were conducted approximately 12 months after program launch and were in field for a period of 6 weeks. The initial mail-out occurred in April 2015, followed by two reminder letters sent at 1.5 week intervals. The response rates for the participant and control surveys were 24% and 25% respectively.[5]

In-depth qualitative phone interviews were conducted with 20 GPs who had responded to the survey to gain a deeper understanding of GPs attitudes and practices regarding asthma management in light of some unexpected results from the survey component. This component of the evaluation was conducted between March and June 2016.[5]

The Clinical e-audit is an educational intervention available for GPs to gain feedback on their management of patients. The Clinical e-audit available for the Asthma program used six key indicators related to the prescribing and management of asthma. Participating GPs enter information about a sample of their patients at two time points. Paired-samples t-test were conducted to examine the impact of the NPS MedicineWise activity on the number of patients meeting each indicator pre and post the intervention. This data from 566 participating GPs was analysed for the program evaluation.[5]

## GP survey results[5]

In some key areas, the attitudes of GPs were already in line with program messages and no difference was observed between participant and control survey respondent GPs.

The program activities were successful at increasing confidence levels for more than one third of participant GPs, with regard to the specified treatment decisions and assessing and demonstrating inhaler technique.

Several knowledge questions about prescribing inhaled medicines were asked. No difference was seen between those exposed and unexposed to active interventions regarding prescribing combination ICS+LABA medicines in children with poorly controlled asthma and the portion of adults with asthma needing a combination ICS+LABA medicine. GPs who had participated in the NPS MedicineWise program were significantly more likely to mark the desired response to a knowledge question regarding the off-label use of asthma medicines for the short-term treatment of respiratory infections in patients without asthma. A significantly higher proportion of GPs ($p<0.01$) who were female, working in a larger practice with 3 or more GPs, and saw fewer than 100 patients per week selected the desired responses to these knowledge statements compared with their counterparts.

Participant GPs were asked to assess the level of change in their practice as a result of their participation in the NPS MedicineWise educational activity. Just over half of the participant GPs reported that they had 'increased' their practice of discussing asthma control and management issues such as symptom frequency with their patients (54%), and checking patient inhaler technique (51%). Approximately 40% of participant GPs 'increased' and 30% 'intending to increase' their use of the Australian guidelines and the provision of written asthma action plans for their patients after participating in the educational activity. Just over half (51%) of participant GPs had either increased or intended to increase their use of an inhaled corticosteroid as first line preventer treatment in adults with asthma.

The survey asked GPs about how they responded to the Prescribing (PBS) Feedback intervention which was sent to them. More than 50% of GPs reported the feedback intervention helped them to

reflect on their prescribing and approximately one quarter of GPs reported a change in their prescribing that was prompted by this activity.

## Clinical audit results[5]

The asthma clinical e-audit prompted significant improvements in GP practice in five of the six clinical indicators (see Table 2 below). This activity was particularly effective at increasing the use of written asthma action plans and appeared to have more of an impact in prompting GPs to implement the 'stepping down' approach than the educational visit.

Table 2: **CLINICAL AUDIT RESULTS**

| | | Patients | | |
|---|---|---|---|---|
| **Clinical indicators** | | **Initial audit phase** | **Review audit phase** | **Difference** |
| 1. Use of long-acting beta agonist in children 5 years and under (not recommended) | % | 32.1 | 25 | -7.1 (p=0.162) |
| | n | 9 | 7 | 2 |
| 2. Reviewed current level of asthma control based on symptoms and reliever use over the previous 4 weeks | % | 87.0 | 97.6 | 10.6 (p<0.0001) |
| | n | 3,805 | 4,271 | **466** |
| 3. Trialled a step down of inhaled preventer medicine when asthma has been well controlled for at least 3 months | % | 38.0 | 66.9 | 28.9 (p<0.0001) |
| | n | 858 | 1,511 | **653** |
| 4. Assessed inhaler technique | % | 79.4 | 92.7 | 13.3 (p<0.0001) |
| | n | 3,477 | 4,055 | **578** |
| 5. Assessed adherence to preventer regimen | % | 96.2 | 99.5 | 3.3 (p<0.0001) |
| | n | 4,209 | 4,355 | **146** |
| 6. Ensured patient has an up-to-date written asthma action plan | % | 48.9 | 83.4 | 34.5 (p<0.0001) |
| | n | 2,139 | 3,648 | **1,509** |

# STUDY ONE: POPULATION LEVEL NET ECONOMIC EVALUATION

This study involved an economic evaluation at the population level. The program effectiveness was evaluated using a time series analysis of national administrative data from the Pharmaceutical Benefits Scheme (PBS). Total program costs were used to conduct a cost-benefit analysis.

## Stage 1: Program effectiveness

### Methods

#### *Evaluation design*

The impact of the 2014 NPS MedicineWise Asthma program on the utilisation of medications for asthma was evaluated using time series analysis on PBS dispensing data. PBS dispensing volume data was used to estimate any change in utilisation. The expected outcome of the program was a reduction in the utilisation of ICS+LABA combination agents. This outcome would likely lead to an increase use of monotherapy agents, particularly ICS, as a result of changed prescribing patterns. These changes in prescribing patterns may indicate, for example: increased stepping down of combination therapy, increased use of the step-wise approach during treatment initiation and increased review of adherence and inhaler technique prior to stepping up of therapy.

PBS reimbursement data was used to create an average reimbursement cost to the PBS per prescription dispensed for each month. This average was multiplied by the estimated volume change to calculate an estimated decrease or increase in PBS expenditure associated with the NPS MedicineWise program.

#### *Data sources*

The provider level dispensing and reimbursement data for asthma medications listed on the PBS (See Table 3) were obtained from the Commonwealth Department of Human Services (DHS). The data provided covered the period from 1 July 2012 to 30 June 2016.The DHS supplied the PBS data in aggregate form at the GP level. The PBS data comprises the number of subsidised scripts prescribed, both original and repeats, with a breakdown by general and concessional beneficiary entitlement levels. Repatriation Pharmaceutical Benefits Scheme (RPBS) data were not included.

The PBS data were supplied according to the following specifications:

- Vocationally Registered General Practitioners (VRGPs) and Other Medical Practitioners (OMPs)
- PBS prescribing by scrambled provider number
- 1 July 1996 to 30 June 2016 time period
- Date of prescribing and date of supply of medicine
- Price and net benefit of scripts by PBS medication item code

Table 3: **PREVENTER ASTHMA MEDICATIONS LISTED ON THE PBS**

| **Class** | **Active Ingredient** | **Dose form* and strength** (mcg/dose unless otherwise specified) |
|---|---|---|
| Inhaled Corticosteroids (ICS) | Beclomethasone | MDI: 50, 100 |
| | Budesonide | DPI: 100, 200, 400 |
| | Ciclesonide | MDI: 80, 160 |
| | Fluticasone propionate | MDI: 50, 125, 250<br>DPI: 100, 250, 500 |
| Inhaled Corticosteroid/Long Acting Beta$_2$ Agonist (ICS+LABA) | Budesonide/eformoterol | MDI: 50/3, 100/3, 200/6<br>DPI: 100/6, 200/6, 400/12 |
| | Fluticasone furoate/vilanterol | DPI: 100/25, 200/25 |
| | Fluticasone propionate/ eformoterol | MDI: 50/5, 125/5, 250/10 |
| | Fluticasone propionate/salmeterol | MDI: 50/25, 125/25, 250/25<br>DPI: 100/50, 250/50, 500/50 |
| Other – Cromones | Cromoglycate | MDI: 1mg/dose, 5mg/dose<br>DPI: 20mg/dose |
| | Nedocromil | MDI: 2mg/dose |
| Other – Leukotriene receptor antagonist | Montelukast | Chewable tablet: 4mg, 5mg |

* Metered dose inhaler (MDI) and dry powder inhaler (DPI) preparations can be administered via different devices

### *Time series analysis*

Time series analysis was used to quantify the impact of NPS MedicineWise Asthma program GP prescribing of ICS+LABA combination preventer medicines and monotherapy preventer medicines (ICS, cromones and montelukast). Based on actual PBS prescribing volumes, statistical models were developed to estimate the volume of PBS prescribing for these medicines.

Prescribing volumes were estimated in the *presence* and *absence* of the NPS MedicineWise intervention being investigated. These estimates are represented in the charts that appear in this report by a red line and green trend line respectively.

### *Environmental factors considered*

When exploring the PBS data trends for ICS+LABA combination and ICS monotherapy medicines, a trend change in 2012 was evident. This change was the same direction as the expected impact of the program, an increase in the dispensing of ICS monotherapy medicines and a decrease in the dispensing of ICS+LABA combination medicines. Potential causes of this trend change were investigated through the literature, key guidelines, activities of peak asthma organisation in Australia and sources of medication warnings. Professor Helen Reddel, who is a leading Australian researcher in the area of asthma, was also contacted for advice regarding influential environment changes in 2014. A single most likely cause was not identified. One potential contributing factor may have been The Asthma Child and Adolescent Program (ACAP) which was delivered though Asthma Australia and the various state and territory asthma foundations. The program aims to provide information and emergency response training for asthma and linked respiratory conditions (allergy and rhinitis) to pre-school and school staff nationally. The program also includes a focus on self-management in adolescents. By June 2012, half of all schools and a third of pre-schools nationally had received training with the majority of staff reporting that they had increased knowledge, awareness and confidence in asthma management after participating. While the program did not aim to change prescribing practice, changes may have occurred as a result of better asthma control and medicine adherence.[3, 8] Another potential contributing factor was a series of articles published in Australian Prescriber in 2012 that focused on appropriate management of Asthma with a focus on appropriate prescribing.[2, 9, 10] In October 2012, the NSW Ministry of health distributed clinical practice guideline about the *Acute Management of Asthma in Infants and Children* to all Divisions of General Practice. The Clinical Practice guidelines focus was on the response to acute asthma but included some messaging about longer term management with preventer medicines and the use of Asthma action plans.[11] The trend change observed in the PBS data was not isolated to NSW. We were unable to determine a strong or likely causal link between any one particular factor and the trend change seen. The trend change was accounted for in all the time-series analyses below to ensure a conservative effect estimate for the 2014 Asthma program.

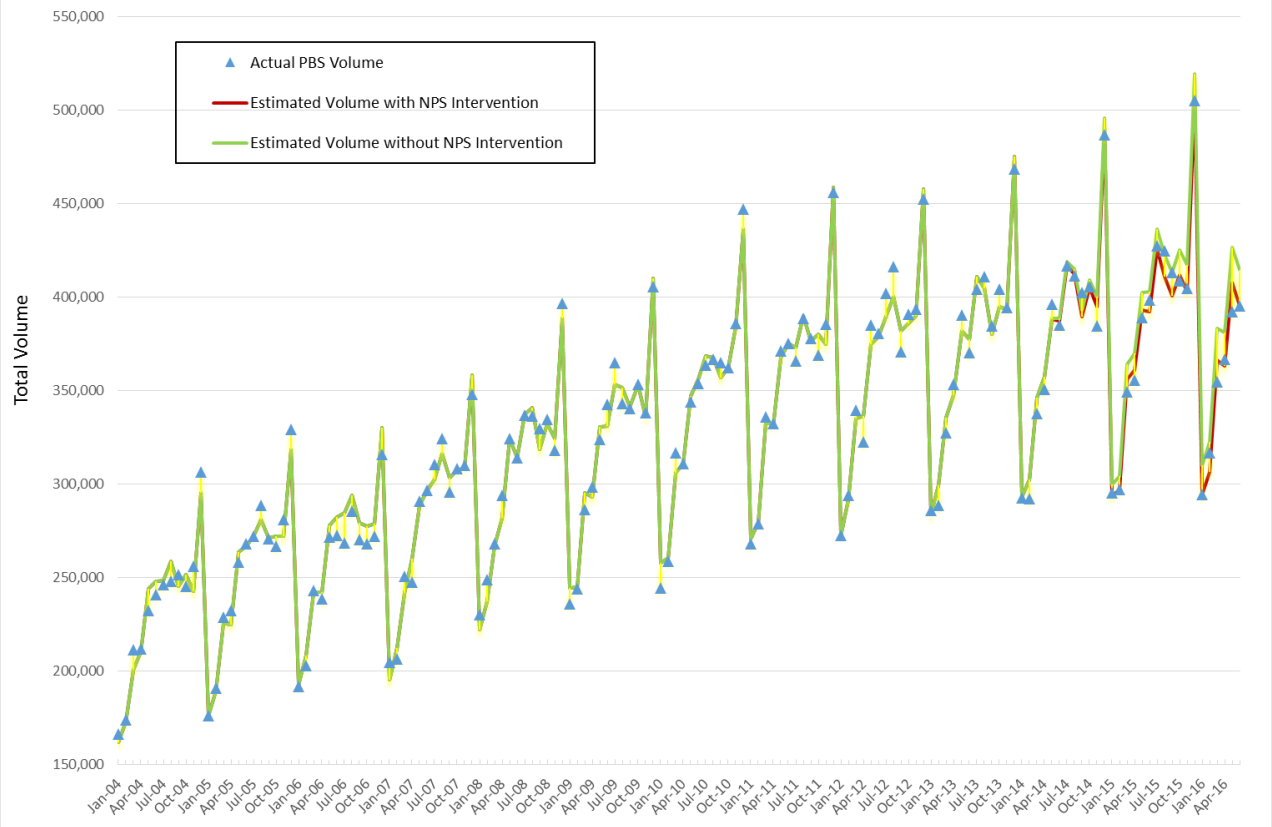
***ICS+LABA combination medicines***

The NPS MedicineWise Asthma program was associated with a statistically significant reduction in dispensing of ICS+LABA combination medicines.

For the period May 2014 to June 2016, the averaged estimated reduction in PBS dispensing volume of ICS+LABA combinations associated with the NPS MedicineWise 2014 Asthma program, was 259,446 prescriptions. That is, a relative reduction of 2.51% in the modelled PBS volume. The average cost to the PBS per dispensing was $51.62 for the period May 2014 to June 2016, giving savings to the PBS attributable to the program of $13,012,090.

In figure 2 the yellow shaded area between the estimated volume with the NPS MedicineWise program included (red line) and the estimated volume of prescriptions without the program (green line) presents the impact of the program in reducing the volume of ICS+LABA combination medicines dispensed. As shown in Figure 2, the plot of the 'estimated volume with intervention' (red line) closely follows the 'actual PBS prescription volume' (blue triangles). This indicates that the time series model fits the data well.

Figure 2: **TIME SERIES OF PBS DISPENSING VOLUME OF *ICS+LABA COMBINATIONS MEDICINES***

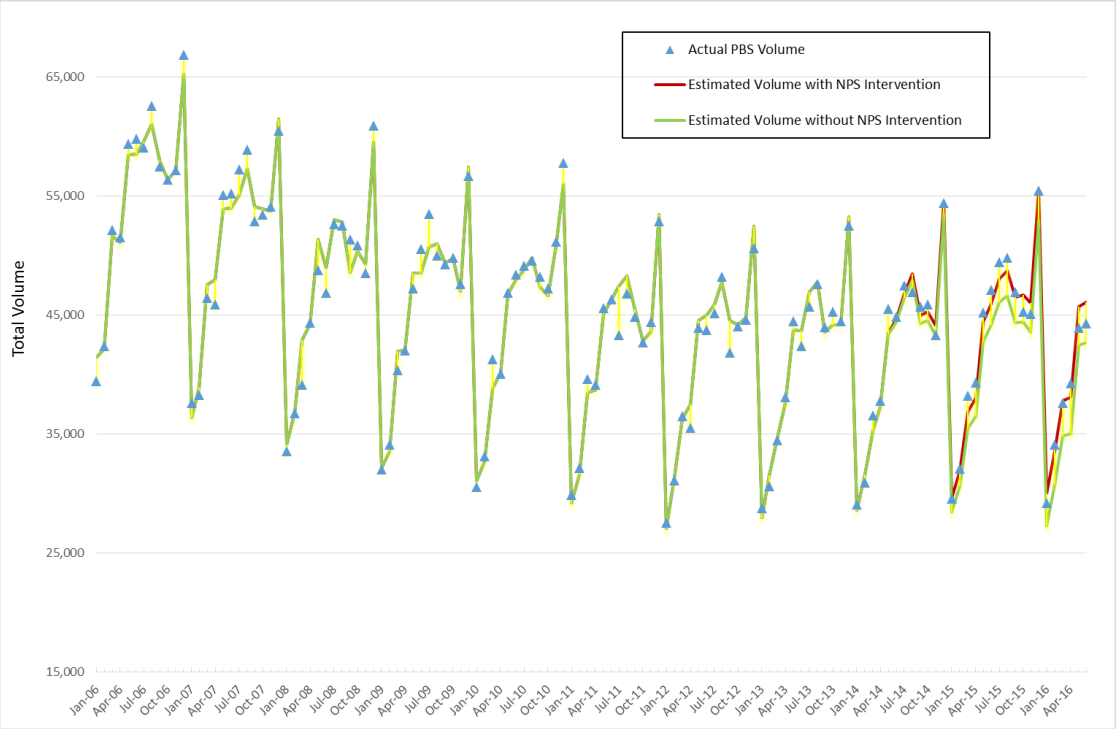


### *ICS monotherapy medicines*

The NPS MedicineWise Asthma program was associated with a statistically significant increase in dispensing of ICS monotherapy medicines. Figure 3 present the time series of PBS dispensing volume of ICS monotherapy medicines. See the description in the section above on how to read the chart.

For the period July 2014 to June 2016, the averaged estimated increase in PBS dispensing volume of ICS monotherapy medicines associated with the NPS MedicineWise 2014 Asthma program, was 45,026 prescriptions. That is, a relative increase of 4.18% in the modelled PBS volume. The average cost to the PBS per dispensing was $26.84 for the period July 2014 to June 2016, giving an increase cost to the PBS attributable to the program of $1,194,740.

Figure 3: **TIME SERIES OF PBS DISPENSING VOLUME OF ICS MONOTHERAPY MEDICINES**

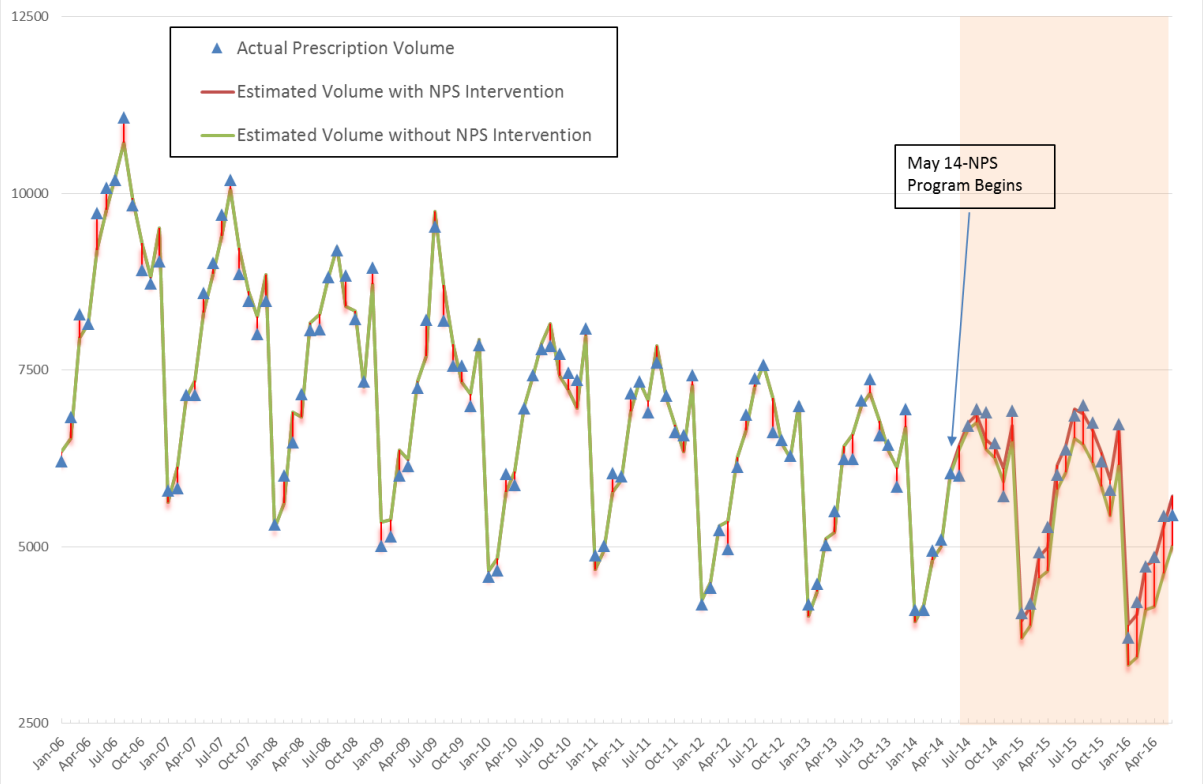


### *Other inhaled preventer monotherapies*

For the period July 2014 to June 2016, the averaged estimated increase in PBS dispensing volume of other inhaled monotherapy medicines (nedocromil and cromoglycate) associated with the NPS MedicineWise 2014 Asthma program, was 9530 prescriptions. That is, a relative increase of 6.8% in the modelled PBS volume. This increase was not statistically significant.

The average cost to the PBS per dispensing was $25.07 for the period July 2014 to June 2016, giving an increase cost to the PBS attributable to the program of $248,677 (95%CI -$10,186 - $507,539).

Figure 4: **TIME SERIES OF PBS DISPENSING VOLUME OF OTHER INHALED MONOTHERAPY MEDICINES (NEDOCROMIL AND CROMOGLYCATE) FOR ASTHMA**

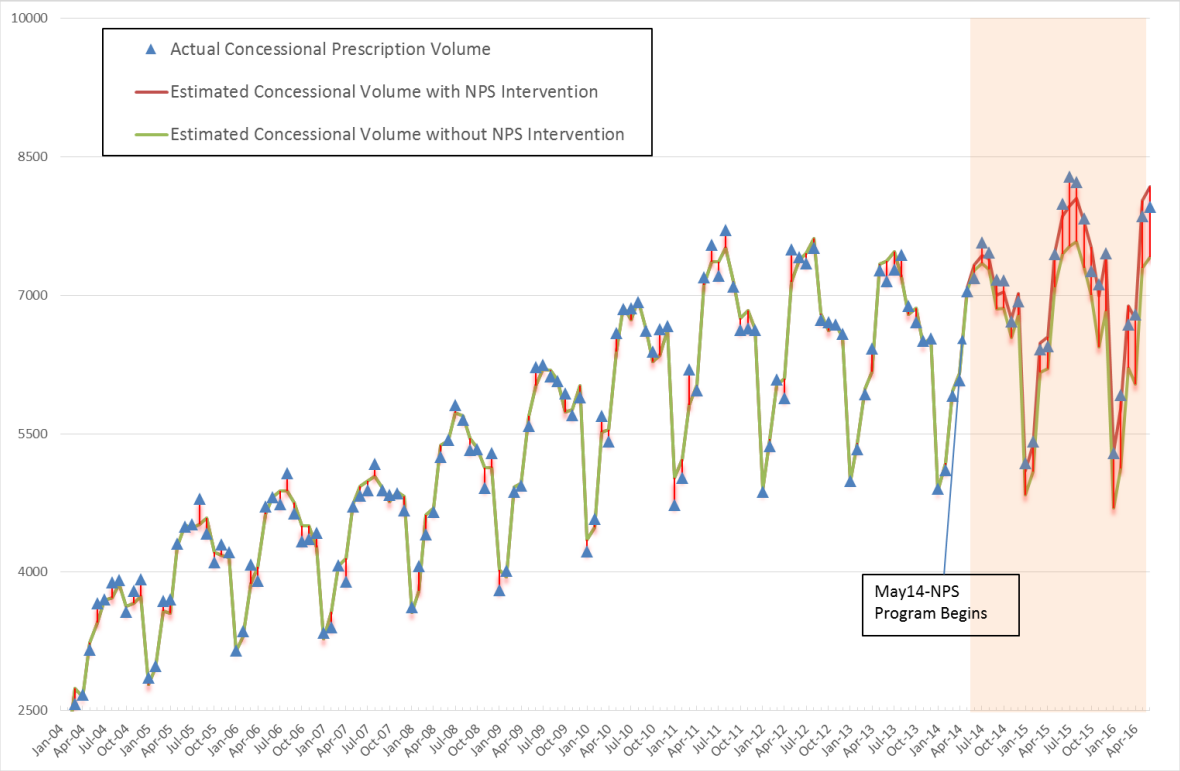


***Tablet formulation preventer monotherapy (montelukast)***

For the period July 2014 to June 2016, the averaged estimated increase in PBS dispensing volume of tablet formulation preventer monotherapy (montelukast) associated with the NPS MedicineWise 2014 Asthma program, was 50,803 prescriptions (95% CI 24,932 – 76,673). That is, a relative increase of 12.9% in the modelled PBS volume. As this medicine is under co-payment for general beneficiaries on the PBS, the only cost to the PBS is associated with the medicines use in the concessional population. In the concessional population the averaged estimated increase in PBS dispensing volume of montelukast associated with the NPS MedicineWise 2014 Asthma program, was 10,231 prescriptions, a 5.9% relative increase in the modelled PBS volume. The increase associated with the NPS MedicineWise Asthma program was significant in the general population but was not significant in the concessional population.

The average cost to the PBS per dispensing for the concessional population was $26.11 for the period July 2014 to June 2016, giving an increase cost to the PBS attributable to the program of $230,480 (95%CI -$103,570 - $1,049,851).

Figure 5: TIME SERIES OF PBS DISPENSING VOLUME OF TABLET FORMULATION MONOTHERAPY (MONTELUKAST) FOR ASTHMA



# Stage two: Cost benefit analysis

## Method

### *Evaluation design*

A cost benefit analysis was used to compare the costs and effects of the 2014 NPS MedicineWise Asthma program, expressed in monetary terms from the perspective of the payer. The payer is the Commonwealth Department of Health which funds both the quality use of medicine (QUM) programs implemented by NPS MedicineWise and the PBS. The measures used in this analysis are:

- The **costs** of the resources required to deliver the 2014 NPS MedicineWise Asthma program (presented in Table 5)
- The **benefits** of the program expressed as the monetary value of the effects generated by the program. In this analysis the benefits are restricted to the direct savings associated with the reduction in PBS benefit paid for ICS+LABA combination medicines, accounting for the cost associated with the increase of ICS monotherapy medicines.

The cost-benefit analysis was conducted by calculating the program net benefit and the benefit-cost ratio. The *net benefit* is calculated as the difference between the benefits and the costs. Values higher than zero indicate that the benefits exceed the costs, and thus the program represents an efficient use of public resources. The *benefit-cost ratio* is calculated as the ratio of benefits to costs. Values higher than one indicate that the benefits exceed the costs.

### *Data sources*

The economic evaluation is based on the program effectiveness results presented in stage one of this study (study one) and program cost data collected from NPS MedicineWise organisational timesheet data, invoice records and budget data.

Table 4 presents the PBS expenditure changes associated with the NPS MedicineWise Asthma program based on the program effectiveness results presented in stage one of this study (study one). Only expenditure effects that were significantly associated with the NPS MedicineWise Asthma program are included in the base case cost-benefit analysis.

Table 5 presents the NPS MedicineWise program costs and the source and year of these costs.

Estimates of variation for invoiced costs and staff resource costs were derived from three national NPS MedicineWise visiting programs that occurred at a similar time to the Asthma program and involved a similar intervention product suite. These programs were the 2015 Blood Pressure program, the 2015 Chronic Pain program and the 2016 Depression program. The Blood Pressure program did not include a PBS feedback intervention, which the Asthma and the other comparison programs included. To account for this difference, the invoiced cost of the PBS feedback in the Asthma program was added to the invoiced cost total of the Blood Pressure program. All costs were adjusted to 2015/2016 financial year equivalent value, using Australian CPI values published by the ABS and discounted at a rate of 5% per year after the first year.[12] See details in *Discounting and cost standardisation* section below. The costs for the Asthma program were the greatest of the four programs. Variation estimates were calculated by varying the Asthma base case by the standard deviation of the four similar program costs.

The cost of delivery of one to one educational visits and small group case based meetings was calculated using the average cost per GP face to face visit for the 2014/15 financial year ($332.19) and the number of GP face to face visits based on participation data for the Asthma program (9,375). Note that 99.51% of GP face to face visits for the Asthma program occurred in the 2014/15 financial year.

The estimate of variation for the cost of delivery of visiting was derived from the average cost per GP face to face visits for the three financial years 2013/14, 2014/15 and 2015/16. There was a 15% reduction in this cost from 2014/15 to 2015/16. This change was due to change in delivery model; from

delivery primarily through contracts with Medicare locals to a majority in-house workforce delivery model.

For details of the variation estimates see Appendix 1.

Table 4: **PBS EXPENDITURE CHANGES ASSOCIATED WITH NPS MEDICINEWISE ASTHMA PROGRAM**

| Medication class | Direction of change | Expenditure change in 13/14 (2 months) | Expenditure change in 14/15 | Expenditure change in 15/16 | Total accounting for discounting | 95%CI (accounting for discounting) |
|---|---|---|---|---|---|---|
| ICS+LABA combinations | Decrease | $118,070 | $3,988,828 | $8,905,192 | $11,994,226 | ($1,850,369-$22,136,676) |
| ICS monotherapy | Increase | $9,973 | $350,544 | $834,223 | $1,100,489 | ($300,910-$1,896,591) |
| **Total change** | **Decrease** | | | | **$10,893,737** | |

Table 5: **NPS MEDICINEWISE PROGRAM COSTS**

| Activity | Year 1 (2013/14) | | Year 2 (2014/15) | | Year 3 (2015/16) | | Year 4 (2016/17) | | Total with discounting applied | Source | Variation estimate |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Raw cost | Adjusted to 2015/16 | Raw cost | Adjusted to 2015/16 | Raw cost | Adjusted to 2015/16 | Raw cost | Adjusted to 2015/16 | | | |
| **NPS MedicineWise Invoiced Asthma Program costs (not including NPS MedicineWise staff time)** | | | | | | | | | | | |
| Non Specific Team Work | $9,419.00 | $9,712.71 | $25,576.60 | $25,929.75 | | | | | $34,407.72 | | |
| Program Folder | $3,759.52 | $3,876.75 | | | | | | | $3,876.75 | | |
| Educational Visiting Products | $16,259.39 | $16,766.41 | $2,253.69 | $2,284.81 | | | | | $18,942.42 | | |
| MedicineWise News | $30,056.84 | $30,994.10 | $6,307.17 | $6,394.26 | | | | | $37,083.87 | | |
| Prescribing (PBS) Feedback | $19,000.00 | $19,592.48 | $40,526.03 | $41,085.60 | | | | | $58,721.62 | | |
| Clinical Audit - eAudit | $5,646.33 | $5,822.40 | | | | | | | $5,822.40 | | |
| Pharmacy Practice Review - eAudit | $1,190.04 | $1,227.15 | | | | | | | $1,227.15 | | |
| Medicare Data | $25,067.07 | $25,848.74 | | | | | | | $25,848.74 | | |
| e-Learning | $42,504.77 | $43,830.20 | | | | | | | $43,830.20 | | |
| NPS On-line | $5,942.50 | $6,127.81 | | | | | | | $6,127.81 | | |
| Educational Visiting Programme | $22,507.83 | $23,209.69 | $14,288.57 | $14,485.86 | | | | | $37,005.75 | | |

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Conference | $184.55 | $190.30 | $3,010.98 | $3,052.55 | | | | | $3,097.50 | | |
| Stakeholder Report / Engagement / Advice | $683.43 | $704.74 | | | | | | | $ 704.74 | | |
| Marketing and Promotion | $17,254.34 | $17,792.38 | $7,047.00 | $7,144.30 | | | | | $24,596.48 | | |
| Subtotal of invoiced program costs | | | | | | | | | $301,293.14 | Invoiced financial statement. | ($235,992 - $366,593) [ii] |
| **Asthma NPS staff costs**[iii] | $57,133.78 | $677,625.22 | $247,977.77 | $251,401.75 | $6,364.74 | $6,364.74 | 3,535.96 | $3,482.37 | $902,130.59 | Timesheet and human resources data | |
| Infrastructure, support services (24%) on staff costs | | | | | | | | | $300,710.20 | | |
| Subtotal of Asthma NPS staff costs | | | | | | | | | $1,202,840.78 | | ($1,192,564 - $1,276,334)[iv] |
| **Delivery costs** | | | | | | | | | | | |
| Cost of field deliver (including salaries, travel and other costs) | | | $3,114,281.25 | $3,157,282.09 | | | | | $2,965,982.14 | Financial arrangements and budget records[v] | ($2,690,625 - $3,178,125)[vi] |
| **Total** | | | | | | | | | **$4,470,116.06** | | |

[ii] Base case plus and minus standard deviation (SD: 65301) from cost data of 3 NPS visiting programs with a similar product suite and Asthma program

[iii] The timing of NPS staff costs was estimated using a breakdown of the timing of staff effort.

[iv] Base case plus and minus standard deviation (SD: 31,414) from cost data of 3 NPS visiting programs with a similar product suite and Asthma program

[v] Average cost per GP face to face visit for the FY 14/15 ($332.19) times the number of GP face to face visits based on participation data for the Asthma program (9,375)

[vi] Average cost to NPS per GP face to face visit for FYs 13/14 and 15/16.

### *Time frame*

The development of the 2014 Asthma program started in 2013/14. The evaluation of impact of the program on the PBS has been calculated until 30 June 2016.

### *Discounting and cost standardisation*

All costs have been adjusted to 2015/2016 financial year equivalent value for the base case, using Australian CPI values published by the ABS.[12] The CPI value for the financial year was calculated by averaging the CPI values for the four quarters within that financial year. To adjust costs that occurred in 2016/2017 the average CPI value of the three available quarters was used.

Program costs and savings to the PBS after the first year (2013/14) were discounted at a rate of 5% per year.

### *Decision tree*

In order to undertake sensitivity analysis a simple decision tree was created in TreeAge Pro[13] with the net costs and benefits associated with the NPS MedicineWise Asthma program compared to no program at a population level.

Figure 6: **DECISION TREE FOR COST BENEFIT ANALYSIS**

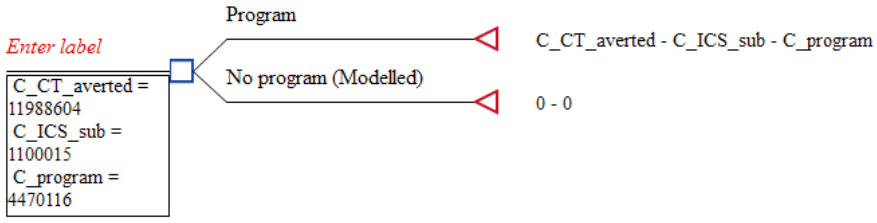



Table 6: **DESCRIPTION OF VARIABLES USED IN DECISION TREE**

| Decision tree variables | Description |
|---|---|
| C_program | Total cost of NPS MedicineWise Asthma program |
| C_CT_averted | PBS costs averted by decrease in volume of ICS+LABA combination medicines dispensed associated with the Asthma program |
| C_ICS_sub | PBS costs introduced by increase in ICS monotherapy medicines dispensed associated with the Asthma program |

### *Uncertainty*

Univariate analyses were conducted with scenarios based on the key assumptions and variations of point estimates used.

## Results

### *Cost-benefit analysis*

The NPS MedicineWise Asthma program aimed to reduce cost to the Australian health system via reduction in unnecessary use of ICS+LABA combination medicines. Table 7 presents the results of the cost-benefit analysis of the NPS MedicineWise Asthma program. The net benefit and benefit to cost ratio are used to compare the cost of the program to the benefit gained from savings to the PBS.

Table 7: **COST BENEFIT ANALYSIS RESULTS FOR 2014 NPS MEDICINEWISE ASTHMA PROGRAM**

| Parameter | Benefit: Savings from reduced utilisation of combination therapy minus the cost of increased monotherapy | Cost of program |
|---|---|---|
| Total cost of intervention | $11,994,226 - $1,100,489 = $10,893,737 | $4,470,116 |
| Net Benefit | $10,893,737 - $4,470,116 = **$6,423,621** | |
| Benefit to cost ratio | $10,893,737 / $ 4,470,116 = **2.44** | |

The net benefit is the difference in the cost of changing prescribing patterns and the costs of the NPS MedicineWise program, ie $10,893,737 - $4,470,116 = **$6,423,621**. This represents a net savings as a result of the program.

The benefit to cost ratio is calculated by dividing the estimated cost of changing prescribing patterns by the cost of the NPS MedicineWise program. Benefit to cost ratio $10,893,737 / $ 4,470,116 = **2.44.** Values higher than one indicate that the benefits exceed the costs. The value of 2.44 indicates that for every dollar spent on the program, $2.44 was gained in monetary benefit.

### *Sensitivity analysis*

Table 8 below presents univariate sensitivity analysis for the net benefit and benefit to cost ratio of the Asthma program. The scenarios run are:

- the inclusion of estimated additional introduced PBS costs from increase in PBS dispensing volume of tablet formulation preventer monotherapy (montelukast) and other inhaled monotherapy medicines (nedocromil and cromoglycate).
- Variation in the estimated cost of the Asthma program. Variation was estimated by varying the Asthma base case by the standard deviation of the four similar program costs.
- The estimate of effect of the program on PBS utilization of ICS+LABA combination medicines and ICS monotherapy medicines. Variation estimates are based on the 95% confidence intervals from the time-series analysis results.

The inclusion of estimated additional introduced PBS costs from an increase in PBS dispensing volume of tablet formulation preventer monotherapy (montelukast) and other inhaled monotherapy medicines (nedocromil and cromoglycate), which were not found to be statistically significant in the model, decreased the net benefit from $ 6,423,621 to $ 5,981,766 and the benefit to cost ratio from 2.44 to 2.34.

The variation scenarios for maximum program costs and upper confidence interval for effect of the program on ICS medicine utilization both changed the benefit to cost ratio to 2.26.

The most influential impact on the cost-benefit estimates was from the variation from the effect estimates of the program on ICS+LABA combination medicine utilisation. Using the upper confidence interval the benefit to cost ratio increased to 4.71 and the net benefit to $16,566,071. Using the lower confidence interval the benefit to cost ratio decreased to 0.17 and the net benefit is a net loss of $3,720,236. The scenario using the lower confidence interval is the only scenario in which the monetary benefit of the program is less than the cost of the program.

Table 8: **UNIVARIATE SENSITIVITY ANALYSIS RESULTS, BENEFIT TO COST RATIO AND NET BENEFIT**

| Domain | | Benefit to cost ratio | Net benefit |
|---|---|---|---|
| | **Base case** | 2.44 | $ 6,423,621 |
| **Addition of non-significant PBS costs (base case – costs not included)** | **(extra introduced costs of $441,855)** | 2.34 | $ 5,981,766 |
| **Program Cost (base case $4,470,116)** | **Max: $4,821,052** | 2.26 | $ 6,072,685 |
| | **Min: $4,119,181** | 2.64 | $ 6,774,556 |
| **Effect of Asthma program on PBS ICS+LABA medicine utilization (base case $11,994,226)** | **Max: $22,136,676** | 4.71 | $ 16,566,071 |
| | **Min: $1,850,369** | 0.17 | - $ 3,720,236 |
| **Effect of Asthma program on PBS ICS monotherapy medicine utilization (base case $1,100,489)** | **Max: $1,896,591** | 2.26 | $ 5,627,519 |
| | **Min: $300,910** | 2.62 | $ 7,223,200 |

# Study discussion

Analysis of PBS data found evidence of a change in asthma medicine utilisation associated with the Asthma program which aligned with the predicted outcome of the Asthma program. In the period following the Asthma program, dispensing for ICS + LABA combination medicines decreased relatively by 2.51% from the predicted trend without the Asthma program and dispensing of ICS monotherapy medicines increased relatively by 4.18% from the predicted trend without the Asthma program. This program impact was associated with a net savings to the PBS of $10,893,737 for the period July 2014 to June 2016. The cost of the development and delivery of the Asthma program was $ 4,470,116. The cost benefit analysis found a net benefit of the program of $6,423,621 from the perspective of the payer, the Australian Government Department of Health. The benefit to cost ratio of the program was 2.44. A benefits to cost ratio greater than one, such as for this program means the benefits exceed the costs, and thus the program represents an efficient use of public resources.

Time series analysis was used to quantify the impact of the Asthma program through investigating whether there was a statistically significant change in trend over a defined period of time that could be attributed to the program. A change in trend, decreasing ICS + LABA and increasing ICS medicines, was observed in 2012 that could not be attributed to the 2014 Asthma program. This was accounted for in the time series analysis to ensure an accurate effect estimate for the 2014 Asthma program.

The results of the cost benefit analysis showed little change when variation was introduced regarding: program costs; non-significant increases in PBS costs for cromones and the leukotriene receptor antagonist; and the effect estimate of the Asthma program on PBS ICS monotherapy medicine utilisation. The results of the cost benefit analysis were highly sensitive to the introduction of variation around the effect estimate of the Asthma program on PBS ICS+LABA combination medicine utilisation. If the true effect estimate was the lower confidence interval the benefit to cost ratio was 0.17 meaning the costs exceed the benefits.

The strengths of this cost-benefit analysis include the quality of the data sources used and the ability of the time series method to accurately estimate the attributable effect of the Asthma program. Program cost data was sourced directly from organisation records. Invoiced records from NPS MedicineWise were used to capture external costs of the program from inception until completion. All NPS MedicineWise staff are required to complete a daily timesheet, in which they allocate the time they spend on specific programs that day. This timesheet data was linked to salary data for each individual to calculate the resources spent on the program. There is a high level of consistency between the staff resource costs for similar programs (Appendix 1) which supports the reliability of this method. The cost of visiting is calculated from the average cost to NPS MedicineWise of the delivery

of visiting per GP visited. The PBS data used includes all dispensed prescriptions reimbursed by the PBS for the Australia population. This census administrative data set is not affected by selection, sampling, recall or self-report biases.

This study used established statistical and health economics methodologies to demonstrate that the 2014 Asthma Program was an efficient use of public resources. For every dollar spent on the program, $2.44 was gained in monetary benefit. Further analysis using MedicineInsight data (study two) provides further insights into the impact of the Asthma program on GPs' clinical practice.

# STUDY TWO: GP LEVEL PRACTICE CHANGE ECONOMIC EVALUATION

This study provides an economic evaluation of the 2014 NPS MedicineWise Asthma Program at the GP behaviour level. The program effectiveness is evaluated using a time series analysis of data extracted from GP clinical information system which is available in the MedicineInsight dataset. Both prescribing and patient management outcomes are evaluated in a cost consequence analysis, a variant of cost-effectiveness analysis which is suitable when multiple outcomes are evaluated that are not able to be combined.

## Stage one: Program effectiveness

### Method

#### *Evaluation design and population*

The impact of the 2014 NPS MedicineWise Asthma program on GP prescribing and patient management behaviour was evaluated using time series analysis with MedicineInsight data. This study used MedicineInsight data to evaluate the impact of the visiting component of the Asthma program on participating GPs and the impact of nationwide components of the Asthma program (e.g. PBS feedback and information dissemination) on the whole population of GPs within MedicineInsight Practices.

Outcome indicators for this study were developed based on the Asthma program key messages and expected outcomes, and availability of data in the MedicineInsight database.

The analysis measured the rate at which specific prescribing occurred each month in patients encountering the GP for the reason of asthma. Some outcome indicators were only relevant to young children. Prescriptions issued to children (≤ 6 years) were extracted by calculating the age of each patient at the date of prescription. Since actual date of birth are not provided in the MedicineInsight database this was done using each patient's year of birth and assuming a birthdate of June 15th at their year of birth. The data were then selected where age at prescription date was 6 years or younger.

Patients with chronic obstructive pulmonary disease (COPD) or COPD and asthma were excluded from the analysis.

#### *Data sources*

This study uses GP practice data from the MedicineInsight dataset and GP program participation data from the NPS MedicineWise database.

MedicineInsight is a national general practice data program developed and managed by NPS MedicineWise. It is the first large-scale general practice data program in Australia that extracts longitudinal de-identified patient health records from the software GPs already use to manage patient records and write prescriptions. MedicineInsight includes 7% of general practices in Australia and contains approximately 3.5 million active patients.

MedicineInsight utilises a third party data extraction tool which extracts, de-identifies, encrypts and securely transmits whole of practice data from the GP Clinical Information System of over 500 general practices. Patient level data is de-identified 'at source' meaning the patients' personal identifiers such as name, date of birth, and address are not extracted by the tool (although year of birth and postcode are extracted enabling the calculation of age and Socio-Economic Indexes for Areas [SEIFA]). The data held in the MedicineInsight database are anonymous. However, each patient has a unique identifying number which allows all the records (clinical, prescription, referral, etc.) held in the database for a particular individual over time to be linked.

MedicineInsight extracts data from general practices including: 1) patients' demographic and clinical data (except for progress notes) for all encounters entered directly by GPs or practice staff into the system; 2) system generated data (e.g. start time and date of an encounter); and 3) GP identifiable information. De-identified patient data are extracted regularly from each participating practice, collated with de-identified GP information, and analysed centrally in the data repository held by NPS MedicineWise in an external, secure environment.

MedicineInsight includes data from 1 January 2006 to 31 December 2016. The following data tables from MedicineInsight were used for this study:

- Patient conditions
- Diagnosis
- Encounter (including reason for encounter)
- Prescription
- Prescription history
- Patient flags
- Patient (for year of birth)
- Provider

NPS MedicineWise participation data was used to identify the interventions from the Asthma program that GPs involved in MedicineInsight participated in. This information was used to create the study variable for the analysis.

### *Study Factor(s):*

The study factor for the analysis of the impact of the visiting intervention was the GPs' participation in either a one-to-one educational visit or a small group case based meeting as part of the Asthma program

To evaluate the impact of the program as a whole, the analysis examined the trend pre and post the start of the Asthma program in June 2014. This included the visiting by CSS to about 1,000 GPs and PBS feedback and information which was available to all GPs.

### *Outcome measurements:*

The study examined three areas of GP behaviour which the program may have influenced:

- prescribing in the general population
- prescribing in young children (≤ 6 years)
- provision of written asthma action plans

Prescribing of asthma medicine in the general patient population was examined by the different classes of asthma medicine (ICS, ICS+LABA, cromones and montelukast). The asthma program aimed to address the quality use of medicines (QUM) issue of the over prescribing of ICS+LABA combination medicines.[3] The program had educational messages about the appropriate approach to the initiation and stepping up and stepping down of asthma medicines according to patients' asthma control. The importance of assessing adherence and inhaler technique before stepping up medicines in patients who have poorly controlled asthma was also addressed. As a result of the Asthma program it was expected that there would be a reduction in the proportion of patients being prescribed an ICS+LABA combination medicine when visiting a GP for asthma.

Prescribing for young children (≤ 6 years) was examined separately to the general population. There is a lack of evidence for the safety and efficacy of LABAs, including in combination with ICS, in children aged five years or younger.[1, 2] The analysis used ≤ 6 years rather than ≤5 years to account for the lack of patient's day and month of birth in the MedicineInsight data set. A birthdate of June 15th at their

year of birth was assigned to patients and the definition of ≤ 6 years was used to ensure comprehensive capture the population. The educational visiting intervention of the asthma program recommended the referral of children <6 years whose asthma is poorly controlled on a low-dose ICS to a specialist. Stepping up treatment to low-dose ICS/LABA, high-dose ICS, or ICS plus montelukast was ONLY recommended for children ≥6 years whose asthma was poorly controlled on an ICS alone.[14] The PBS feedback intervention of the asthma program provided feedback regarding the prescribing of ICS + LABA combination medicines in different age groups and noted as a point of reflection that guidelines recommend against the use of combination inhalers or long-acting $beta_2$ agonists in children ≤ 5 years due to lack of evidence for efficacy and safety. As a result of the Asthma program it was expected that there would be a reduction in the proportion of young children who were prescribed an ICS+LABA combination medicine when visiting a GP for asthma.

Written asthma action plans have formed part of Australian national asthma management guidelines since 1989. Despite this, ownership of a written asthma action plan is low. A written asthma action plan enables people with asthma to recognise deterioration in their condition promptly and respond appropriately, by integrating changes in symptoms or peak expiratory flow measurements with written instructions to adjust medication. The aim of a written asthma action plan is to enable early intervention and to prevent or reduce the severity of asthma exacerbations.[3, 15] One of the three key message of the NPS MedicineWise Asthma program was to provide patients with written information tailored to their identified needs that will enable them to manage their asthma.

### *Time series analysis*

For each outcome of interest, a time series of the proportion of patients with the outcome of interest was calculated at a month time-step. The analyses were conducted using the CausalImpact package of R.[16] The intervention was defined as beginning in June 2014.

To analyse the impact of active participation in the Asthma program (participation in an educational visit), GPs were allocated to a participating or non-participating group (data obtained from the NPS MedicineWise participation database). A counterfactual time series was constructed for the participating group on what the outcome of interest would have been had this group *not* actively participated in the Asthma program. This counterfactual time series was constructed using data on the pre-intervention behaviour of participating GPs and the pre and post-intervention behaviours of non-participating GPs.

Notably, an analysis which directly compares the practice behaviours of participating compared to non-participating GPs may be confounded in a retrospective observational study and is therefore inappropriate in this instance.

To analyse the impact of the nationwide components of the 2014 Asthma program on the whole population of GPs a similar analysis was undertaken using the CausalImpact package of R.[16] In this analysis, data from both participating and non-participating GPs were pooled. The forecasts of the expected rate of GP prescribing and management behaviours had the intervention not taken place are based on pre-intervention data only.

## Results

A total of 1,010 GPs who had data in the MedicineInsight database for the study period participated in a visiting intervention as part of the Asthma program. This represents a 10.7% sample of all Australian GPs who participated in a visiting intervention as part of the 2014 Asthma program. An additional 2,295 GPs had data in the MedicineInsight database for the study period and did not actively participate in the 2014 Asthma program.

Table 9 below shows the rates of the outcome measures in the year prior to the start of the Asthma program (May 2013 to April 2014) for GPs who did and did not later participate in a visiting intervention as part of the Asthma program. The rate of reference to written asthma action plans was lower in GPs who participate in the Asthma program visiting intervention the following year compared to GPs who did not participate in the Asthma program visiting intervention.

Table 9: **KEY INDICATOR RATES IN THE YEAR PRIOR TO THE START OF THE ASTHMA PROGRAM (MAY 2013 TO APRIL 2014) FOR GP WHO DID AND DID NOT LATER PARTICIPATED IN A VISITING INTERVENTION AS PART OF THE ASTHMA PROGRAM**

| | Patient prescribed an ICS+LABA medicine per 100 patients prescribed a medicine for asthma (average monthly) | Among patients aged 6 years and younger: patients (≤ 6 years) prescribed an ICS+LABA medicine per 100 patients (≤ 6 years) prescribed a medicine for asthma (average monthly) | Rate of reference to written asthma action plans per 1000 patients seen for asthma (average monthly) |
|---|---|---|---|
| GPs who would later participate in a visiting intervention as part of the Asthma program (n=1,010) | 54.1% | 7.3% | 15.8 per thousand patients per month |
| GPs who would NOT later participate in a visiting intervention as part of the Asthma program (n=2,295) | 53.7% | 7.8% | 27.9 per thousand patients per month |
| All GPs (n=3,305) | 53.8% | 7.6% | 23.0 per thousand patients per month |

### *Outcome measure 1: Prescribing behaviour*

Table 10 shows GP prescribing behaviour for patients of all age groups.

No significant change in the proportion of patients prescribed an ICS monotherapy or ICS+LABA combination therapy after GP participation in the visiting intervention or national program was detected in this analysis using MedicineInsight data.

Evidence of an impact of the visiting and national program was seen on Short Acting Beta$_2$ Agonist (SABA) and montelukast prescribing, however the absolute change for these was small.

On average the proportion of patients prescribed a SABA was a relative 3.7% (1% absolute) lower than expected for participating GPs following the start of exposure to the visiting program (BCI95 = -5.9%, -1.5%) and a relative 6.0% (3% absolute) lower than expected for all GPs following the start of the national program (BCI95 = -9.8%, -1.9%).

On average, the proportion of patients prescribed a montelukast was a relative 8.5% (0.4% absolute) higher than expected for participating GPs following the start of exposure to the visiting program (BCI95 = 0.14%, 17%) and 20% (0.96% absolute) higher than expected for all GPs following the start of the national program (BCI95 = 12%, 28%).

Table 10: **GP PRESCRIBING BEHAVIOUR FOR ALL AGE GROUPS RESULTS FROM THE TIME SERIES ANALYSIS OF THE EFFECT OF THE ASTHMA PROGRAM AND THE VISITING INTERVENTION**

| Intervention level analysed | Medication class | Actual average proportion after intervention (June 2014 –December 2016) | Modelled average proportion after intervention (June 2014 – December 2016) had intervention not occurred (BCI 95%) | Relative intervention effect (BCI 95%) |
|---|---|---|---|---|
| Visiting program participants | **SABA** | **47%** | **48% (47%, 49%)** | **-3.7% (-5.9%, -1.5%)** |
| | ICS | 18% | 18% (17%, 18%) | -0.39% (-3.5%, 2.7%) |
| | ICS+LABA | 55% | 54% (53%, 55%) | 1.5% (-0.36%, 3.4%) |
| | Anticholinergics | 4.5% | 4.8% (4.5%, 5.1%) | -6.3% (-13%, 0.2%) |
| | **Montelukast** | **4.8%** | **4.4% (4.1%, 4.8%)** | **8.5% (0.14%, 17%)** |
| National program - All GPs | **SABA** | **46.26%** | **49.21%** | **-6% (-9.8%, -1.9%)** |
| | ICS | 17.69% | 18.13% | 2.5% (-4%, 8.7%) |
| | ICS/LABA | 54.16% | 54.38% | 0.4% (-4.2%, 4.7%) |
| | Anticholinergics | 4.37% | 4.82% | -9.4% (-19%, 0.78%) |
| | **Montelukast** | **4.81%** | **5.77%** | **20% (12%, 28%)** |

*Outcome measure 2: Prescribing for young children (≤ 6 years)*

Table 11 below shows GP prescribing behaviour for children (≤ 6 years).

There was evidence of a decrease in the proportion of young children prescribed an ICS+LABA combination product associated with the national program. On average the proportion of young children prescribed a ICS+LABA combination was a relative 32% (2.6% absolute) lower than expected for all GPs following the start of the national Asthma program (BCI95 = -49%, -14%). See figure 7.

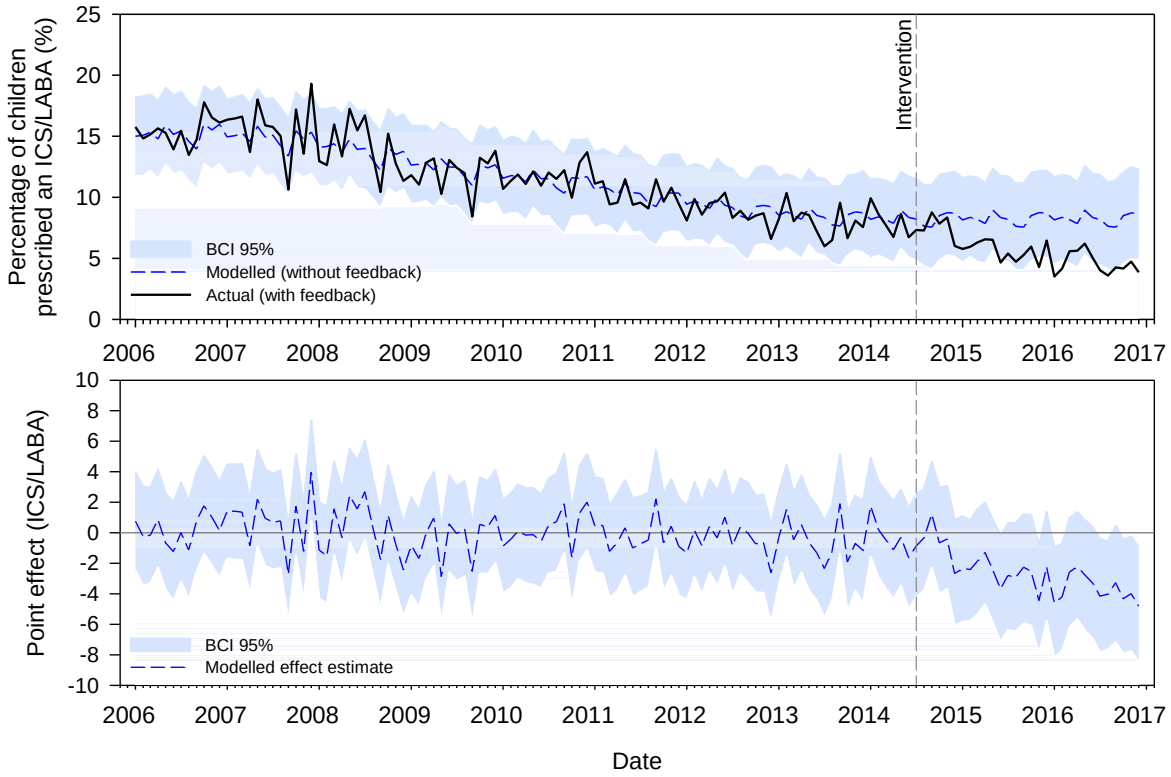
No significant effect of the visiting intervention was seen in participating GPs. However trends were observed toward a decrease in ICS+LABA combination therapy prescribing and an increase in ICS monotherapy prescribing, in young children. There was evidence of an increase in the proportion of young children prescribed montelukast, which is consistent with a best practice move away for the prescribing of ICS+LABA combination medicines to monotherapy medicines in young children. On average the proportion of young children prescribed montelukast was a relative 25% (4% absolute) higher than expected for participating GPs following the start of exposure to the visiting program (BCI95 = 16%, 34%).

Table 11: **GP PRESCRIBING BEHAVIOUR FOR CHILDREN (≤ 6 YEARS), RESULTS FROM THE TIME SERIES ANALYSIS OF THE EFFECT OF THE ASTHMA PROGRAM AND THE VISITING INTERVENTION**

| Intervention level analysed | Medication class | Actual average proportion after intervention (June 2014 –December 2016) | Modelled average proportion after intervention (June 2014 – December 2016) had intervention not occurred (BCI 95%) | Relative intervention effect (BCI 95%) |
|---|---|---|---|---|
| Visiting program participants | **SABA** | **56%** | **61% (59%, 63%)** | **-8.5(-12%,-5.5%)** |
| | ICS+LABA | 6.3% | 7.3% (6.1%, 8.4%) | -14%(-29%, 1.8%) |
| | ICS | 41% | 39% (37%, 41%) | 5.1% (-0.86%, 11%) |

| | | | | |
|---|---|---|---|---|
| | Anticholinergics | 1.2% | 1.1% (0.23%, 2%) | 11% (-68%, 90%) |
| | **Montelukast** | **20%** | **16% (14%, 17%)** | **25% (16%, 34%)** |
| National program - All GPs | **ICS+LABA** | **5.6%** | **8.2% (6.8%, 9.7%)** | **-32% (-49%, -14%)** |

Figure 7: **TIME SERIES ANALYSIS OF THE EFFECT OF THE ASTHMA PROGRAM AND THE VISITING INTERVENTION ON GP PRESCRIBING BEHAVIOUR FOR CHILDREN (≤ 6 YEARS)**




*Outcome measure 3: Written asthma action plans*

Table 12 and Figure 8 below present the results of the analysis of GPs provision (reference to provision) of a written asthma action plan for all asthma patients.

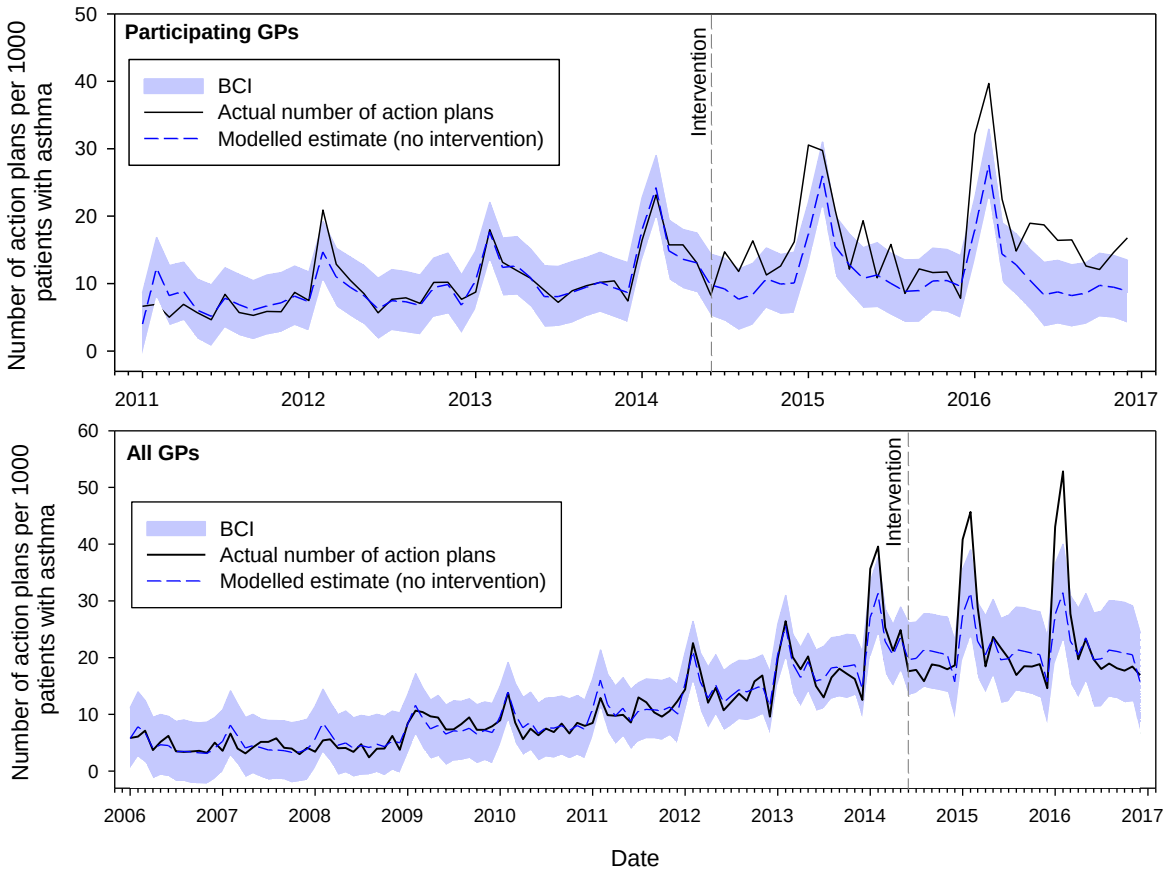
No significant effect of the national program on the provision of written asthma action plans by all GPs was detected.

There was evidence of an impact of the visiting program on GPs who participated. However the proportion of people attending the GP for asthma each month with a record of receiving a written asthma action plan was very small. On average, the proportion of patients with a record of the provision of a written asthma action plan was a relative 43% (absolute 5 per thousand patients per month) higher than expected for participating GPs following the start of exposure to the visiting program (BCI95 = 32%, 53%). The number of records of written asthma action plans peaked early every year and, after the intervention, most of the increase in recorded written asthma action plans associated with the visiting intervention was estimated to have occurred in these peak periods (see Figure 8).

Table 12: **GP PROVISION OF WRITTEN ASTHMA ACTION PLANS, RESULTS FROM THE TIME SERIES ANALYSIS OF THE EFFECT OF THE ASTHMA PROGRAM AND THE VISITING INTERVENTION**

| Intervention level analysed | Actual average proportion after intervention (June 2014 –December 2016) | Modelled average proportion after intervention (June 2014 – December 2016) had intervention not occurred (BCI 95%) | Relative intervention effect (BCI 95%) |
|---|---|---|---|
| Visiting program participants | 17 per thousand patients per month | 12 per thousand patients per month (BCI = 13.3, 10.8) | 43% (BCI = 32%, 53%) |
| National program - All GPs receiving feedback and information | 22.8 per thousand patients per month | 21.6 per thousand patients per month | 5.6% (BCI = -12%, 22%). |

Figure 8: **TIME SERIES ANALYSIS OF THE EFFECT OF THE ASTHMA PROGRAM AND THE VISITING INTERVENTION ON GP PROVISION OF WRITTEN ASTHMA ACTION PLANS**



# Stage two: Cost consequence analysis

## Method

### *Evaluation design*

The Asthma program aimed to change GP behaviour towards guideline based 'best practice'. The relationship between program costs and measurable 'best practice' outcomes is evaluated at the GP level in this cost consequence study.

Based on the findings from the MedicineInsight GP level program effectiveness analysis (stage one of this study), the outcomes of prescribing behaviour for young children and the provision of written asthma action plans were considered for a cost consequence study.

In this cost consequence study each outcome of interest, a consequence of the program, was considered separately. The costs and consequences of the Asthma program are summarised. A cost-effectiveness analysis was also conducted for each outcome being considered separately in relation to total costs.

The cost-effectiveness analysis was conducted by calculating the incremental cost effectiveness ratio (ICER) for the program effect on GP behavioural outcomes. The ICER is calculated using the formula below.[17]

$$ICER = \frac{Cost_a - Cost_b}{Effect_a - Effect_b} = \frac{\Delta\, Cost}{\Delta\, Effect}$$

The 'best practice' outcomes considered for this stage of the study are:

- Prescribing practices for young children
    - Measured by the rate of young children (≤ 6 years) receiving an asthma prescription who were prescribed an ICS+LABA combination.
- Provision of written asthma action plan
    - Measured by the rate of reference to the provision of a written asthma action plan among GPs' patients attending for the reason of asthma. This outcome is considered only for the cost-effectiveness of the visiting component of the program as no evidence was found in the analysis of an impact of the national program on all GPs. This was expected as the main component of the national intervention, the PBS feedback intervention, focused on prescribing rather than other management aspects.

### *Data sources*

Program cost data is presented previously in Table 5 in the cost-benefit analysis section. The total costs of the Asthma program was $4,470,116. This was separated into a base cost for the program ($1,504,134; included all program development and the implementation of all non-visiting intervention) and cost of delivering the one-to-one and small group based visiting to GPs ($2,965,982). Costs were calculated at the unit level for each outcome. See Table 13 for details of calculations.

Table 13: **VARIABLES USED TO CALCULATE THE UNIT LEVEL COST OF THE ASTHMA PROGRAM**

| | |
|---|---|
| a) Total program costs | $ 4,470,116.06 |
| b) Total base cost for the program development and implementation of all non-visiting interventions | $ 1,504,133.92 |
| c) Cost of delivering the visiting intervention to GPs | $ 2,965,982.14 |
| d) Number of GPs practicing in Australia at time of program who were sent the PBS feedback intervention | 23,130 |
| e) Number of GPs who participated in a visiting intervention | 9,375 |
| f) Number of months of evaluation | 31 |
| g) Average number of patients with an encounter for asthma per month per GP (All GPs in MedicineInsight analysis) | 3.29 |
| h) Average number of patients with an encounter for asthma per month per GP (GPs in MedicineInsight who participated in the asthma visiting intervention) | 4.07 |
| i) Average number of patients (≤ 6 years) with an encounter for asthma prescription per month per GP (all GPs in MedicineInsight analysis) | 0.28 |
| j) Average number of patients (≤ 6 years) with an encounter for asthma prescription per month per GP (GPs in MedicineInsight who participated in the visiting intervention) | 0.25 |
| Written asthma action plan outcome - Unit level base program cost $\frac{b)}{d)*f)*g)}$ | $0.64 |
| Written asthma action plan outcome - Unit level visiting cost $\frac{c)}{e)*f)*h)}$ | $2.51 |
| Prescribing in children (≤ 6 years) - Unit level base program cost $\frac{b)}{d)*f)*i)}$ | $7.51 |
| Prescribing in children (≤ 6 years)- Unit level visiting cost $\frac{c)}{e)*f)*j)}$ | $40.89 |

For the indicator of prescribing behaviour in children (≤ 6 years), the relevant program cost per GP per month per patients (≤ 6 years) prescribed a medication for asthma was calculated for both GPs who were visited and those who would have only been exposed to the other national program interventions.

For the indicator of written asthma action plan provision, a program cost per GP per month per patient who had an encounter for asthma was calculated for both GPs who were visited and those who would have only been exposed to the other national program interventions.

Time series analysis of GP clinical data from the MedicineInsight dataset, described in the previous section, provided the estimates of the effect of the Asthma program on GP 'best practice' outcomes. The key results relevant to this economic evaluation are summarised in Table 14 and 15 below.

Table 14: **SUMMARY OF KEY RESULTS FROM PROGRAM EFFECTIVENESS ANALYSIS USING MEDICINEINSIGHT DATA FOR THE OUTCOME: PRESCRIBING PRACTICES FOR YOUNG CHILDREN**

| Intervention level analysed | Visiting program participants | National program - All GPs |
|---|---|---|
| Indicator | ICS+LABA prescribing in young children | ICS+LABA prescribing in young children |
| Actual average proportion after intervention (June 2014 –December 2016) | 6.30% | 5.60% |
| Modelled average proportion after intervention (June 2014 –December 2016) had intervention not occurred (BCI 95%) | 7.3% (6.1%, 8.4%) | 8.2% (6.8%, 9.7%) |
| Modelled average proportion after intervention (June 2014 –December 2016) had intervention not occurred (BCI 95%) with discounting (5% per year) | 7.2% (5.9%-8.5%) | 7.6% (7.1%-8.1) |
| Relative intervention effect (BCI 95%) | -14%(-29%, 1.8%) | -32% (-49%, -14%) |
| Relative intervention effect with discounting (5% per year) | -12.70% | -25.20% |

Table 15: **SUMMARY OF KEY RESULTS FROM PROGRAM EFFECTIVENESS ANALYSIS USING MEDICINEINSIGHT DATA FOR THE OUTCOME: PROVISION OF WRITTEN ASTHMA ACTION PLANS**

| Intervention level analysed | Visiting program participants |
|---|---|
| Indicator | Written asthma action plans |
| Actual average proportion after intervention (June 2014 –December 2016) | 16.7 per thousand patients per month |
| Modelled average proportion after intervention (June 2014 –December 2016) had intervention not occurred (BCI 95%) | 11.7 per thousand patients per month (BCI = 13.3, 10.8) |
| Modelled average proportion after intervention (June 2014 –December 2016) had intervention not occurred (BCI 95%) with discounting (5%per year) | 12 .1 per thousand per month (BCI 13.7, 11.2) |
| Relative intervention effect (BCI 95%) | 43% (BCI = 32%, 53%) |
| Relative intervention effect with discounting (5% per year) | 37.70% |

There was no evidence of impact of the whole program on rates of provision of written asthma action plans in the national GP population. Evidence of an impact was seen only for the visiting intervention, which is the focus of the cost-effectiveness analysis.

For the indicator of prescribing practice in young children (≤ 6 years), both the effect of the national program and the visiting intervention was considered. The point estimates from the time-series analysis of the national program intervention was used in the cost-effectiveness analysis. The effect size from the time-series analysis of the visiting intervention within the national program was used to impute the probabilities for the visiting and non-visiting branches within the national program branch of the decision tree (see Figure 9).

### *Time frame*

The development of the 2014 Asthma program started in 2013/14. The evaluation of the program effectiveness using MedicineInsight GP clinical data ends on 31 December 2016. The time frame for the evaluation is 31 months.

*Discounting and cost standardisation*

| Decision tree variables | Description |
|---|---|
| C_ProgramBase | The base cost of the program per GP per month per child patient (≤ 6 years) seen for asthma prescription |
| C_ProgramVisit | The visiting cost of the program per GP per month per child patient (≤ 6 years)seen for asthma prescription |
| P_IntPart_CT | Average monthly rate of prescriptions for ICS+LABA combination medicines for children (≤ 6 years)with asthma by GPs who participated in a visiting intervention |
| P_IntNoPart_CT | Average monthly rate of prescriptions for ICS+LABA combination medicines for children (≤ 6 years) with asthma, estimated had the GPs who participated in a visiting intervention not participated. |
| P_NoInt_CT | Average monthly rate of prescriptions for ICS+LABA combination medicines for children (≤ 6 years) with asthma, estimated had the Asthma program not occurred. |
| P_Participation | Percent of total GPs who participated in a visiting intervention. |

All costs have been adjusted to 2015/2016 financial year equivalent value for the base case. Details are provided in the Cost-Benefit Section. Program costs and outcomes after the first year (2013/14) were discounted at a rate of 5% per year.

## *Decision trees*

A decision tree for each cost-effectiveness analysis was created in TreeAge Pro.[13] The decision tree for the outcome of written asthma action plans compared the costs and effects associated with participation with non-participation in the visiting component of the Asthma program. The decision tree for the outcome of prescribing behaviour in young children (≤ 6 years) compared the costs and effects associated with the visiting and national program interventions to the program not occurring. See Figures 9 and 10 and Tables 16 and 17 below.

### Prescribing behaviour for young children (≤ 6 years)

Figure 9: **DECISION TREE FOR PRESCRIBING BEHAVIOUR FOR YOUNG CHILDREN (≤ 6 YEARS) COST-EFFECTIVENESS ANALYSIS**

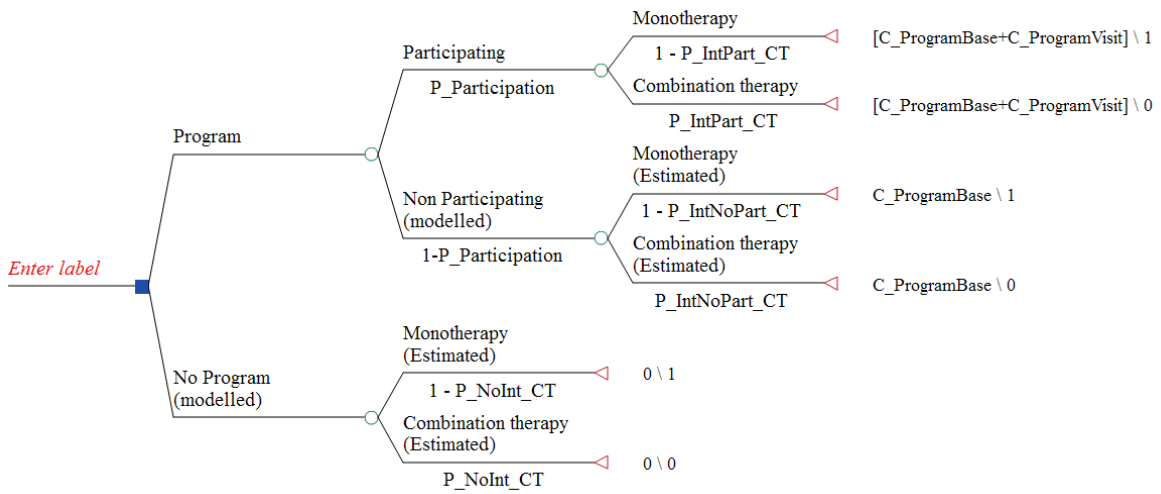


Table 16: DESCRIPTION OF VARIABLE USED IN THE PRESCRIBING BEHAVIOUR FOR YOUNG CHILDREN (≤ 6 YEARS) DECISION TREE

| Decision tree variables | Description |
|---|---|
| C_ProgramBase | The base cost of the program per GP per month per patient seen for asthma |
| C_ProgramVisit | The visiting cost of the program per GP per month per patient seen for asthma |
| P_IntPart_AP | Average monthly rate of written asthma action plans by GPs who participated in a visiting intervention |
| P_IntNoPart_AP | Average monthly rate of written asthma action plans, estimated had the GPs who participated in a visiting intervention not participated |
| P_Participation | Percent of total GPs who participated in a visiting intervention. |

### Written asthma action plans

Figure 10: DECISION TREE FOR WRITTEN ASTHMA ACTION PLAN COST-EFFECTIVENESS ANALYSIS

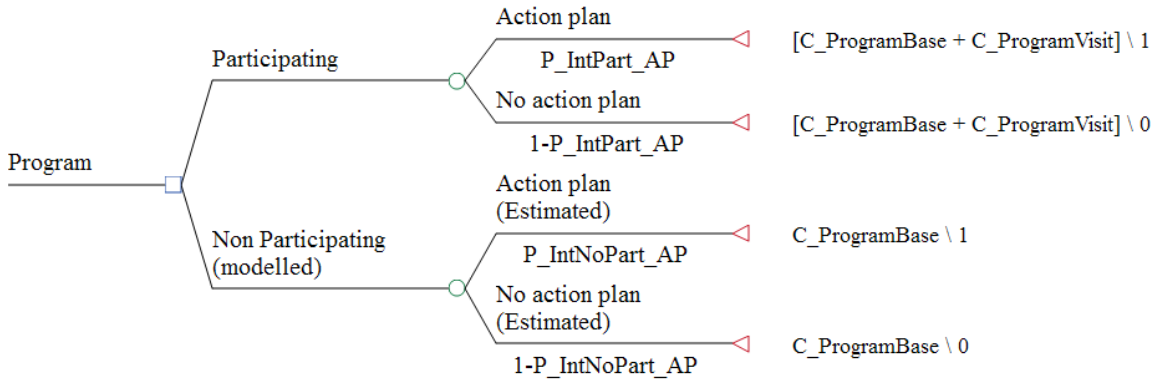



Table 17: DESCRIPTION OF VARIABLE USED IN THE WRITTEN ASTHMA ACTION PLAN DECISION TREE

#### *Uncertainty*

Univariate sensitivity analysis was conducted in TreeAge Pro.[13]

## Results

The NPS MedicineWise Asthma program aimed to improve GP clinical practice based on guideline recommendations. Specific program aims included prescribing more appropriate medicines for young children and the provision of written asthma action plans to support people with self-managed asthma. The cost and consequences of the Asthma program are presented in the Table 18 below.

Table 18: SUMMARY OF COSTS AND CONSEQUENCES OF THE ASTHMA PROGRAM BASED ON 31 MONTH EVALUATION PERIOD

| Costs | Consequences from GP level analysis |
|---|---|

| | |
|---|---|
| **Total program costs $4,470,116**<br>Cost per child (≤ 6 years) seen for asthma prescription each month (based on MedicineInsight GPs):<br>– Base cost national program: $7.51<br>– Additional in visited GPs: $40.89<br>Cost per patient seen for reason of asthma each month (based on MedicineInsight GPs):<br>– Base cost national program: $0.64<br>– Additional in visited GPs: $2.51 | Amongst children (≤ 6 years) who were prescribed an asthma medicine, an absolute 0.6% fewer children were prescribed an ICS+LABA combination product each month as result of the national program<br>5 more written asthma action plans per 1000 patients each month, in GPs participating as a result of the visiting intervention. |

A cost effectiveness analysis was used to assess the relationship between the program costs and the effects of the program on the two outcomes described above.

An incremental cost effectiveness ratio (ICER) was calculated for the program (a) with the alternative of no program (b), or visiting participation (a) with the alternative of non-participation in visiting.

$$ICER = \frac{Cost_a - Cost_b}{Effect_a - Effect_b} = \frac{\Delta\, Cost}{\Delta\, Effect}$$

### *Cost effectiveness analysis – Medication prescribing behaviour for young children (≤ 6 years)*

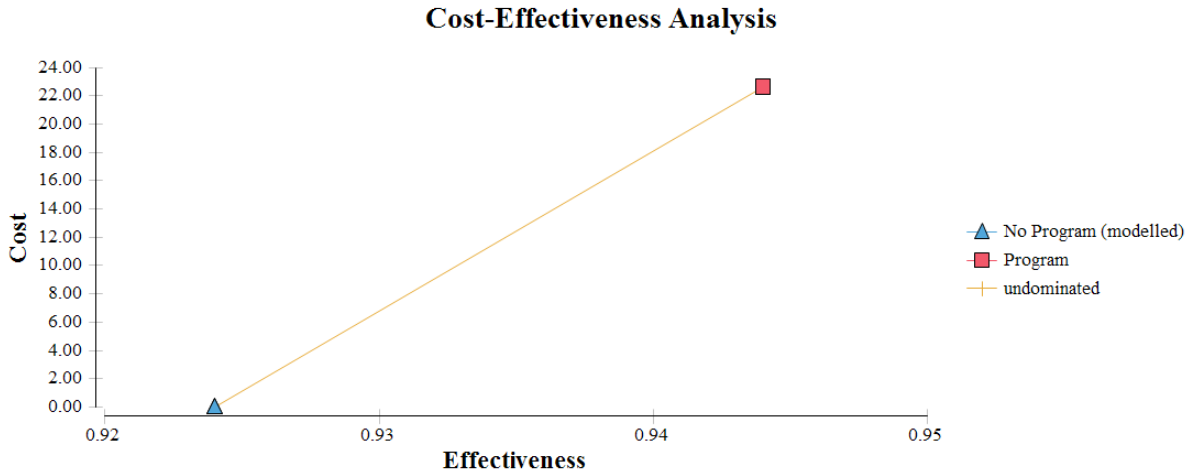
The ICER for ICS+LABA combination prescriptions avoided in children (≤ 6 years) is 1131.98. For every $1131.98 spent on the program, one combination script was averted in children (≤ 6 years). Figure 11 shows the comparison of the costs and effectiveness for this outcome of the program (red square b) with the alternative of no program (blue triangle).

The ICER only incorporates the single stated outcome (ICS+LABA combination prescriptions avoided in children (≤ 6 years) and does not incorporate any additional outcomes. This analysis only used the information from the program effectiveness evaluation using MedicineInsight data and excluded the savings to the PBS from the population level analyses.

Table 19: **INCREMENTAL CHANGE IN COSTS AND EFFECTS OF THE ASTHMA PROGRAM REGARDING GP PRESCRIBING BEHAVIOUR IN CHILDREN (≤ 6 YEARS).**

| | Average program cost per GP encounter with young child (≤ 6 years) for asthma prescription | Probability of NOT being prescribing an ICS+LABA medicine (Discounted – base case) |
|---|---|---|
| With program | $22.64 | 0.94 |
| Without program | 0.00 | 0.92 |
| Incremental difference | $22.64 | 0.02 |
| ICER | $1131.98 per combination script avoided in children (≤ 6 years) | |

Figure 11: **COST-EFFECTIVENESS ANALYSIS CHART FOR OUTCOME OF PRESCRIBING BEHAVIOUR IN CHILDREN (≤ 6 YEARS).**




*Cost-effectiveness analysis – Written asthma action plans*

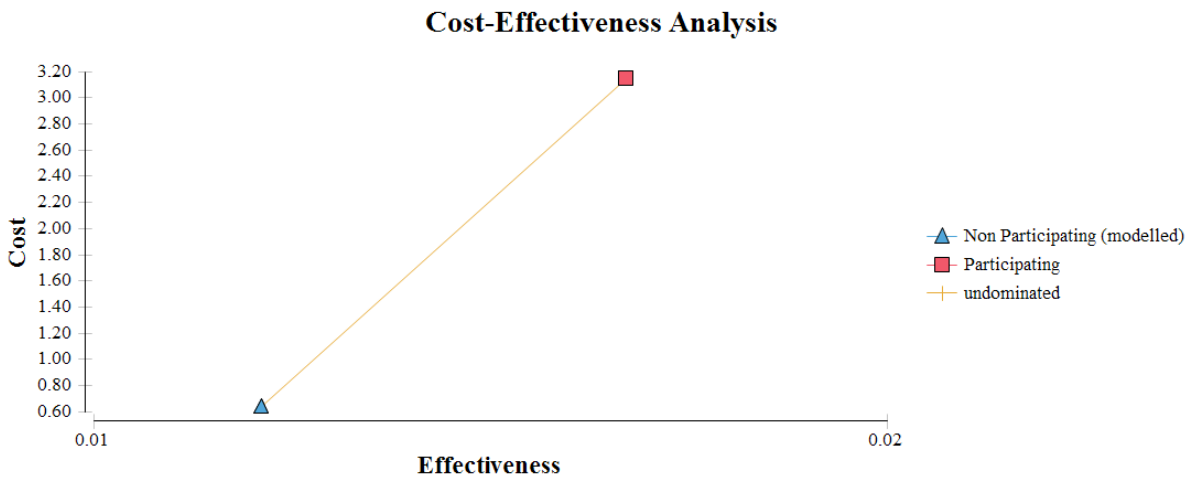
The ICER for each additional written asthma action plan is 545.48. For every $545.48 spent on the visiting intervention of program, one additional written asthma action plan occurred in the GP population who participated in visiting (see Table 20). Figure 12 shows the comparison of the costs and effectiveness for this outcome of GP participation in the visiting intervention of program (red square) b) with the alternative of those GPs not participating in the visiting intervention of program (blue triangle).

The ICER only incorporates the single stated outcome (provision of written asthma action plans) and does not incorporate any additional outcomes. This analysis only used the information from the program effectiveness evaluation using MedicineInsight data and excluded the savings to the PBS from the population level analyses.

Table 20: **INCREMENTAL CHANGE IN COSTS AND EFFECTS OF THE ASTHMA PROGRAM REGARDING GP PROVISIONS OF WRITTEN ASTHMA ACTION PLANS**

| | Cost of program per GP encounter with patient for asthma | Probability of provision of written asthma action plan being recorded |
|---|---|---|
| GP participated in educational visit | $3.15 | 0.0167 |
| If GP had not participated in educational visit (modelled) | $0.64 | 0.0121 |
| Incremental difference | $2.51 | 0.0046 |
| ICER of visiting | $545.48 per additional written asthma action plan due to visiting | |

Figure 12: **COST-EFFECTIVENESS ANALYSIS CHART FOR OUTCOME OF PRESCRIBING BEHAVIOUR IN CHILDREN (≤ 6 YEARS).**




*Sensitivity analysis*

### Univariate sensitivity

Tables 21 and 22 below present the univariate sensitivity analysis for the two cost-effectiveness analyses. The scenarios run are:

- No discounting of the outcome, which is discounted at a rate of 5% annually in the base case
- Variation in the estimated cost of the Asthma program
    - Variation was estimated in the case costs of the national program by varying the Asthma base case by the standard deviation of the four similar program costs. Variation in the cost of visiting was varied by the cost of visiting per GP in the financial years prior and post the Asthma program.
- The estimate of effect of the program
    - Variation estimates are based on the 95% confidence intervals from the time-series analysis results.
- The participation rate was varied by an absolute increase and decrease of 10%.

The most influential impact on the ICER for combination prescriptions averted in young children were outcome discounting and the effect estimate of the national program impact. In the scenario that outcome discounting did not occur the ICER changed from $1131.98 to $870.86 per outcome. Using the upper confidence interval of the modelled average had the national program intervention not occurred, the ICER is $905.58 per outcome and with the lower confidence interval the ICER is $1509.31 per outcome.

Table 21: **UNIVARIATE SENSITIVITY ANALYSIS RESULTS FOR ICER FOR ICS+LABA PRESCRIBING AVERTED IN YOUNG CHILDREN (≤ 6 YEARS).**

| Domain | | ICER Combination prescriptions averted in young children ≤ 6 years ($ per outcome) |
|---|---|---|
| | **Base case** | 1131.98 |
| **Discounting (Base case 5% annual)** | **No discounting of effect** | 870.86 |

| Domain | | ICER Combination prescriptions averted in young children ≤ 6 years ($ per outcome) |
|---|---|---|
| Program Cost – Base (Base case $1,504,134) | Max: 1642927 | 1166.98 |
| | Min: 1428556 | 1113.48 |
| Program Cost – Visiting (Base case $332.19 per GP visited) | Max: 339 per GP visited | 1061.86 |
| | Min: 287 per GP visited | 1186.18 |
| Modelled average had visiting intervention not occurred (Base case 7.2%) | Max: 8.5% | 1131.95 |
| | Min: 5.9% | 1131.97 |
| Modelled average had national program intervention not occurred (Base case 7.6%) | Max: 8.1% | 905.58 |
| | Min: 7.1% | 1509.31 |
| Participation rate (Base case 0.37) | Max:0.47 | 1289.12 |
| | Min:0.27 | 962.86 |

The most influential impact on the ICER for provision of written asthma action plans were the cost of visiting and effect estimate of the visiting intervention impact. In the scenario that visiting cost $339 per GP visited (cost from financial year prior to the Asthma program) the ICER changed from $545.48 to $584.48 per outcome. In the scenario that visiting cost $287 per GP visited (cost from financial year post asthma program and after delivery model changed) the ICER decreased to $494.83 per outcome. Using the upper confidence interval of the modelled average, had the visiting intervention not occurred, the ICER is $836.40 per outcome and with the lower confidence interval the ICER is $456.22 per outcome.

Table 22: UNIVARIATE SENSITIVE ANALYSIS RESULTS FOR ICER FOR PROVISION OF WRITTEN ASTHMA ACTION PLANS

| Domain | | ICER written asthma action plan ($ per outcome) |
|---|---|---|
| | Base case | 545.48 |
| Discounting (Base case 5% annual) | No discounting of effect | 501.84 |
| Program Cost – Visiting (Base case $332.19 per GP visited) | Max: 339 per GP visited | 584.48 |
| | Min: 287 per GP visited | 494.83 |
| Modelled average had visiting intervention not occurred (Base case 7.2%) | Max: 0.0137 | 836.40 |
| | Min: 0.0112 | 456.22 |

# Study discussion

This study used GP clinical data from the MedicineInsight database and found evidence of a statistically significant association between the national Asthma program and:

- a reduction in GP prescribing of SABA or reliever medicines in asthma patients (6% relative decrease)
- an increase in GP prescribing of montelukast medicines in asthma patients (20% relative increase)
- a reduction in GP prescribing of ICS + LABA combination medicines in asthma patients aged 6 years and younger (32% relative decrease).

The study also found evidence of a statistically significant association between the visiting interventions of the Asthma program and:

- a reduction in participating GPs' prescribing of SABA medicines in all asthma patients (3.7% relative decrease) and in asthma patients aged 6 years and younger (8.5% relative decrease)
- an increase in participating GPs' prescribing of montelukast medicines in all asthma patients (20% relative increase) and in asthma patients aged years 6 and younger (25% relative increase)
- an increase in participating GPs' provision of written asthma action plans to all asthma patients (43% relative increase).

Based on these findings the outcomes for ICS+LABA prescribing behaviour for patients (≤ 6 years) and the provision of written asthma action plans were considered for a cost consequence study. The incremental cost effectiveness ratio was $1131.98 per ICS+LABA combination prescription avoided in patients (≤ 6 years). The incremental cost effectiveness was $545.48 per additional written asthma action plan due to visiting. These incremental cost effectiveness ratios represent the total cost of the program in relation the single specified outcome. The consequences of these program cost included more than one outcome and are likely to include outcomes not measured in this analysis. However, it is not possible to allocate a proportion cost to the outcomes based on the current analysis.

The association between the national Asthma program, the visiting interventions and GPs' prescribing of SABA inhalers (a reliever medicine) was not considered for the cost consequence study due to the ambiguity in interpreting these results. The reduction in SABA prescribing could indicate that the patients had better asthma control and therefore less need for reliever medicine. However, since SABAs are also available for purchase by patients without a prescription, this finding may also represent a situation in which patients have the same or greater requirements for SABA but are not getting them on prescription.

The association between the Asthma program and increased prescribing of montelukast medicines is not considered independently in the economic evaluation as it is associated with the move away from prescribing ICS+LABA combination medicines in children which was a primary outcome.

The effectiveness of the different levels of the intervention on different outcomes was consistent with the aims of these interventions. The national Asthma program, including visiting, prescribing (PBS) feedback and widespread information provision, was effective at changing GP prescribing behavior for children (≤ 6 years). The prescribing (PBS) feedback intervention is sent to the majority of GPs in Australia. This intervention presented a graph of GP prescribing of ICS+LABA medicines in young children compared to other GPs in their RRMA peer group[vii], along with the message "*Guidelines recommend against the use of combination inhalers or long-acting beta$_2$ agonists in children ≤ 5 years due to lack of evidence for efficacy and safety*". This type of NPS MedicineWise intervention has been shown previously to have a positive effect on the prescribing and diagnostic referral behaviour of GPs.[18] In this analysis, no significant effect was seen from the visiting intervention on this outcome once the effect of the prescribing (PBS) feedback and other interventions were accounted for.

The visiting intervention did have a significant impact on GPs' provision of written asthma action plans amongst GPs who chose to participate in the visiting intervention, while the national program did not. The prescribing (PBS) feedback did contain educational messaging about written asthma action plans

[vii] RRMA peer group is other GPs who have the same similar geographical region i.e. 1. capital cities, 2. other metropolitan centres, 3. large rural centres, 4. small rural centres, 5. other rural centres, 6. remote centres 7. other remote centres.

but no feedback on GPs' or their peer's current practice. For this outcome the visiting intervention was more successful at changing GP practice.

The strengths of this cost-consequence analysis include the unique qualities of the MedicineInsight data and ability of the analysis to identify GP exposure to Asthma program interventions.

MedicineInsight data is extracted GP clinical software data and therefore is not influenced by recall or self-report biases. The dataset captures information about patient management such as the provision of written asthma action plans, which is not broadly available through other data sources. It should be acknowledged that only actions recorded in the clinical software are captured in the dataset and it is not possible to estimate how complete this is as a true representation of patient management. The rate of recordings of written asthma action plans was low in the MedicineInsight data, 23.0 per thousand patients per month in the year prior to the Asthma program. Confidence in this rate from MedicineInsight is supported by 2010 Bettering the Evaluation and Care of Health (BEACH) data that found written asthma action plans were only provided in 1.9% of encounters with adults.[15]

Another advantage of using MedicineInsight for this economic evaluation was the ability to link it to NPS MedicineWise participation data. This allowed us to separate out GPs who participated in the NPS visiting intervention and to examine the effect that visiting interventions had beyond other aspects of the national program. The time-series analysis used the trend for GPs who did not participate in visiting interventions as a covariant in the model to predict the participating GPs trend had they not participated in a visiting intervention. We considered this method the most appropriate for an observational study in which GPs self-selected to participate in the visiting intervention.

A difference in the pre-intervention rates of recorded written asthma action plans were observed between those GPs who did and did not later choose to participate in a visiting intervention. General practitioners who choose to participate in a visiting intervention had a lower baseline rate of recorded written asthma action plans. It is positive that the program reached and had an impact on GPs who had lower levels of the desired practice behaviour. This is also important when considering what the ICER from this analysis represents. The ICER is only valid for the population the effect was measured in. Additional visiting in the population of GPs who did not choose to participate in the visiting program may not produce the same level of effect and hence not deliver similar outcomes per cost.

General practitioners who participated in the MedicineInsight data collection program are also a self-selected group and the results from analysis using their data may have limited generalisability to the total GP population. Demographic information about MedicineInsight GPs is only available for those GPs who have completed consent forms to receive personalised data reports. Demographic data from these GPs has been compared to General Practice Workforce Statistics 2014–15.[19] This comparison found that MedicineInsight GPs were younger (aged under 55 [72% vs 63%]) and more likely to be female (49% vs 44%) than those described in national data, and that GPs located in Victoria, WA, Tasmania and ACT are over-represented. [19] The impact of these difference is not possible to quantify without further analysis of how the practice of different groups of GPs are influenced by the Asthma program. Results from the Asthma program evaluation survey found that a significantly higher proportion of GPs ($p<0.01$) who were female selected the desired responses to knowledge statements compared with their counterparts.[5] The cost-effectiveness estimates from this analysis should be considered in the context of the MedicineInsight population the analysis was performed using.

A cost-consequence analysis was selected as the different outcomes evaluated were not able to be combined. The ICERs calculated in this analysis should be considered in this context. Each outcome is considered separately in relation to total costs. In addition the monetary benefit to the PBS associated with the program has not been included in this section of the economic evaluation. The costs associated with achieving these outcomes were substantial, however the analysis in study one of the report provided evidence that the net effect of the program resulted in a monetary benefit to the payer, the Australian Government Department of Health.

# CONCLUSIONS AND DISCUSSION

The NPS MedicineWise 2014 Asthma program aimed to address various QUM issues including: over prescribing of ICS+LABA combination medicines; prescribing ICS+LABA combination medicines in children (age ≤6) in whom there is a lack of evidence for safety and efficacy; patient adherence to preventer medicines; inhaler technique; and ownership of written asthma action plans. Through improvements in these areas, the Asthma program aimed to reduce unnecessary costs to the PBS, improve GP practice in line with clinical guidelines and improve asthma control in people with asthma in Australia.

The economic evaluation of the NPS MedicineWise 2014 Asthma program found that:

- The Asthma program was effective at reducing dispensing on PBS of ICS+LABA combination medicines prescribed by GPs by a relative 2.51%. In the two year period after the program there was an estimated 259,446 fewer prescriptions dispensed. This corresponded to an estimated mean savings to the PBS of $13,012,090.
- The Asthma program was effective at increasing the dispensing on the PBS of ICS monotherapy medicines prescribed by GPs by a relative 4.18%. In the two year period after the program there was an estimated 45,026 more prescriptions dispensed. This corresponded to an estimated mean introduced costs to the PBS of $1,194,740.
- At the population level from the perspective of the Australian Government Department of Health the Asthma program had a cost-benefit ratio of 2.44, with a direct net benefit of $6,423,621.
- The Asthma program was effective at influencing GP prescribing and asthma management practices towards guideline recommendations. Analysis using GP clinical software data from MedicineInsight found that:
    - Amongst children (≤ 6 years) who were prescribed an asthma medicine, an absolute 0.6% fewer children were prescribed an ICS+LABA combination product each month as result of the national program
    - As a result of the visiting intervention 5 more written asthma action plans per 1000 patients each month were provided by GPs participating in a visiting intervention.

This economic evaluation was conducted in two studies which used different datasets to provide evidence of program impact. Each of these studies had strengths and limitations which are explored in the study discussion sections.

The analysis of PBS data provided evidence of changings in prescribing behaviour, and the associated cost and benefit of these changes, using this national dataset. The trends seen in the PBS reflected the expected outcome of the Asthma program and a move towards prescribing behaviour more consistent with guideline recommendations. The PBS dataset can only be used to measure changes to prescription medicine utilisation. The de-identified nature of the data means that we are unable to explore differences based on GPs' involvement in the Asthma program, only the impact at a national population level.

The analysis of MedicineInsight data provided evidence of the influence of the Asthma program on GP's prescribing and asthma management practices. The association between the program and a decrease in ICS+LABA combination prescribing in the general patient population and the increase in ICS monotherapy medicine prescribing seen in the PBS data was not statistically significant in the MedicineInsight GP level analysis. The MedicineInsight analysis allowed the evaluation to explore outcomes not available in the PBS dataset and explore the differences in program effectiveness due to GP participation in visiting interventions. Not all intended outcomes of the program were able to be measured using the datasets available for these studies, such as adherence and inhaler technique measures, although a study using 10% PBS data will examine adherence. Both studies found evidence that the Asthma program was associated with positive changes in the management of asthma by Australian GPs.

The Asthma program was a large scale national program. The monetary benefit, in terms of PBS savings, associated with the program demonstrated that the program had a net benefit and therefore the program represents an efficient use of public resources. The outcomes which were able to be measured in MedicineInsight were found to be affected by different types of interventions included in the Asthma program. This highlights the importance of selecting and investing in the most appropriate intervention to target the problem to be addressed and the value of a range of intervention types when the quality use of medicine issues are multifaceted.

# APPENDIX 1: PROGRAM COST VARIATION ESTIMATES

| | 13/14 FY | | 14/15 FY | | 15/16 FY | | 16/17 FY | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Invoiced program costs** | **Raw** | **Adjusted to 15/16** | **Raw** | **Adjusted to 15/16** | **Raw** | **Adjusted to 15/16** | **Raw** | **Adjusted to 15/16** | **Total (with discounting)** | **Variation** |
| Pain | | | $115,769.00 | $117,367.50 | $100,555.00 | $100,555.00 | | | $202,984.92 | |
| BP | | | $178,931.00 | $181,401.61 | $61,097.00 | $61,097.00 | | | $228,180.22 | |
| Depression | | | $2,741.00 | $2,778.85 | $147,900.00 | $147,900.00 | | | $143,635.99 | SD = 65300.71 |
| Asthma | $199,475.00 | $205,695.24 | $99,010.04 | $100,377.13 | | | | | $301,292.51 | |
| **Staff costs** | | | | | | | | | | |
| Pain | $78,773.50 | $81,229.90 | $582,078.34 | $590,115.47 | $231,075.09 | $231,075.09 | $5,146.07 | $5,068.07 | $857,214.54 | |
| BP | $216,932.48 | $223,697.09 | $634,810.89 | $643,576.13 | $30,153.92 | $30,153.92 | $3,043.71 | $2,997.58 | $866,566.65 | |
| Depression | | | $236,859.63 | $240,130.10 | $643,958.22 | $643,958.22 | $15,490.15 | $15,255.38 | $867,260.72 | |
| Asthma | $657,133.78 | $677,625.22 | $247,977.77 | $251,401.75 | $6,364.74 | $6,364.74 | $3,535.96 | $3,482.37 | $925,836.67 | SD = 31413.83 |
| **Delivery - cost per GP visit** | $339.00 | $349.57 | $332.19 | $336.78 | $287.00 | $287.00 | | | | Mean = $324.45 SD = 33.06 |

# APPENDIX 2: PRESCRIBING (PBS) FEEDBACK SAMPLE

NPS MEDICINEWISE PROFESSIONAL

**EXPLORING INHALED MEDICINES USE AND**

**ASTHMA CONTROL**

Practice Review: PBS data
Sept 2014

(Print Medicare barcode)

DHS
Dr Sam Sample
123 Sample Street
SAMPLETOWN ABC 1234

1 Septmember 2014

Dear <Title> <Surname>,

NPS MedicineWise supports clinicians in professional development and continuing quality improvement with a focus on quality use of medicines and medical tests. As part of this we provide you with selected data on medicines and medical tests. The focus of the enclosed data is the dispensing of your prescriptions for corticosteroid-containing inhalers that have indications for asthma.

In Australia, poor asthma control is a common problem and is associated with poor quality of life.[1] The 2014 Australian Asthma Handbook contains several changes from the 2006 version. Some of the highlights include a new approach for stepping up and stepping down asthma medicines and an increased emphasis on assessing inhaler technique and adherence.[2]

The enclosed PBS data provides you with an opportunity to reflect on your practice and your prescribing pattern for corticosteroid-containing inhalers in patients under the age of 50 years. We highlight that this information is confidential; NPS MedicineWise does not have access to your individual prescribing data. These data have been provided for your personal reflection only and are not used for any regulatory purposes.

For more information about asthma management, see the latest NPS MedicineWise News and asthma information on our website for health professionals and consumers at **nps.org.au/asthma**

Look for other activities offered by NPS MedicineWise to support the topic: Exploring inhaled medicines use and asthma control

- **Case study** focusing on asthma control in children – register at **nps.org.au/case-studies**
- **Clinical e-Audit** – register at **nps.org.au/clinical-audits**
- **Educational visit** – if you are interested in booking a visit, contact NPS MedicineWise on (02) 8217 8700 (select option 2) and ask to speak to a Clinical Engagement Support Officer or contact your Medicare Local Facilitator. Alternatively, email **bookavisit@nps.org.au** or book a visit online at **nps.org.au/book-a-visit**

Yours sincerely,

Janette Randall

Dr Janette Randall
Chair

**Dr Sam Sample** **Provider Number‖: 099999** **Prescriber Number: 088888**

## Your confidential prescribing data

NPS MedicineWise provide these data for your reflection only. The data is from the Department of Human Services and includes all PBS prescriptions that you prescribed and that were dispensed. The indication for prescribing (i.e. whether the patient's diagnosis is asthma or chronic obstructive pulmonary disease [COPD] or another condition) cannot be determined from PBS data, so you will need to think about what proportion of your patients who receive these prescriptions have asthma. The data presented exclude prescriptions for patients aged 50 years and over to minimise the inclusion of those with COPD.

## Asthma management

The aim of asthma management is to achieve good asthma control (i.e. to achieve good control of symptoms and to minimise the risk of poor asthma outcomes such as flare-ups).[2] The choice of medicine depends on patient age, the level of symptom control, risk factors and response to previous treatment. For those requiring preventer treatment, the recommendation is to find the lowest dose that maintains good asthma control.[2]

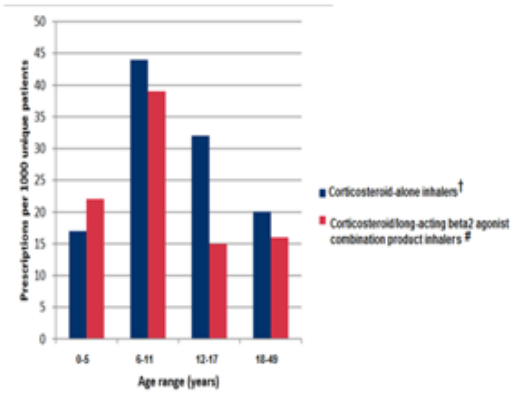
- Do you consider both symptom control and risk factors for poor outcomes when reviewing asthma control?
- Do you assess adherence and inhaler technique, especially before considering a step-up in treatment for patients with poor asthma control?
- Do all of your patients have an individualised, up-to-date written asthma action plan?

Written asthma action plans are an integral part of asthma management as they improve health outcomes when provided with self-monitoring advice and medical review as part of guided self-management education.[1,2] Written asthma action plans help the patient/carer to recognise worsening asthma and respond appropriately.

- Develop an appropriate written asthma action plan for each patient with asthma. Ensure the patient understands how and when to use their written asthma action plan.[2]
- Review written asthma action plans annually (or every 6 months for children < 12 years old) and whenever there is a significant change in the patient's asthma management or status.[2]

For more information about asthma management, see Medicinewise News at **nps.org.au/asthma**

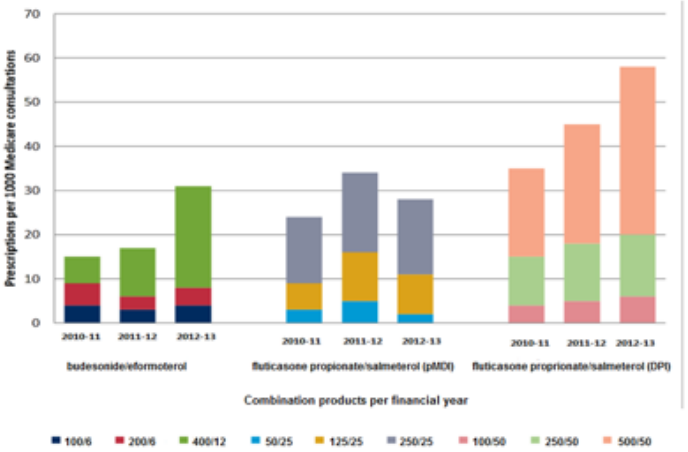
## What was your prescribing rate for preventer inhalers in 2012–13?




### Points for reflection

- Most children have infrequent intermittent asthma and a preventer is not recommended.[2]
- Guidelines recommend against the use of combination inhalers or long-acting $beta_2$ agonists in children ≤ 5 years due to lack of evidence for efficacy and safety.[2]
- Before stepping up asthma treatment, consider the possibility that symptoms may be due to a comorbid condition or alternative diagnosis. Also consider the common causes of poor symptom control such as poor adherence and poor inhaler technique.[2]
- Seek specialist advice for adults who have high-risk or difficult-to-control asthma.[2]

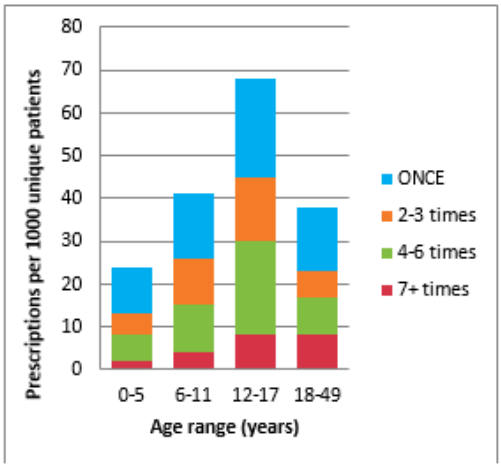
## How has your prescribing of combination inhaler products changed#?




### Points for reflection

- Guidelines recommend that few patients with asthma should be prescribed high-dose combination therapy.[2]
- Consider a gradual dose reduction (25–50% over 2–3 months) if good asthma symptom control has been maintained for 2–3 months and patients are at low risk of flare-ups. Step down the dose of the corticosteroid based on available formulations.[2]
- The aim of stepping down is to find the lowest effective inhaled corticosteroid dose to maintain good asthma symptom control, prevent flare-ups and minimise the risk of adverse effects.[2]
- Trial stepping up treatment in patients who continue to have poor asthma control despite good adherence and correct inhaler technique. Check inhaler technique and correct if necessary.[2]
- Review response 4–8 weeks after stepping down and adjust treatment, if required.[2]
- Consider each treatment adjustment as a trial. Set a review date to re-assess symptom control and adverse effects.[2]

## Number of times corticosteroid-containing inhalers dispensed to your patients in 2012–13




### Points for reflection

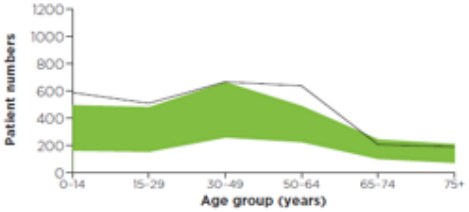
- Most adults and children with asthma are dispensed an inhaled corticosteroid-containing medicine intermittently, but treatment guidelines recommend regular daily use.[1,2]
- Have you ever prescribed inhaled corticosteroid-containing medicines for short-term treatment? There is insufficient evidence for using an inhaled corticosteroid-containing medicine in adults without asthma who have symptoms of respiratory infections.[3] High-dose inhaled corticosteroids are not recommended to manage symptoms of acute wheeze.[3]
- In an empathic manner, ask patients how often they take their inhaled corticosteroid-containing medicine.[2]

# Practice profile

Data are presented as prescribing rates (per 1000 Medicare consultations) to adjust for volume of service. The age profile of patients in your practice is provided to help you interpret your prescribing data.

**Age profile of patients in your practice**

(As per graph specifications document)




The black line represents the age profile of patients in your practice. 25% to 75% of GPs in your RRMA[‡] fall within the shaded area. Your RRMA peer group is x

**Medicare patients and concession card holders in your practice**

(As per graph specifications document)

| Patients | You | Median GPs in your RRMA[‡] |
|---|---|---|
| Total Medicare | xxx | xxx |
| Concession card holders<br>Includes those reaching Safety Net | xxx | xxx |

Data from a 3 month period that best represents your patient mix have been provided.

## Confidentiality

NPS MedicineWise has a contract with Department of Human Services to provide your PBS prescribing data directly to you. NPS MedicineWise does not have access to these data. The data contained in this report are not used for any regulatory purposes.

Discrepancies may occur between the data provided and your own practice. This may be due to either inaccurate recording of your prescriber number in the pharmacy or your prescription pad having been used by another doctor.

If you consider your individual data to be incorrect, have other data queries or general feedback please contact NPS MedicineWise on 02 8217 8700 or by email at info@nps.org.au

This information is derived from a critical analysis of a wide range of authoritative evidence. Reasonable care is taken to provide accurate information at the time of creation. This information is not intended as a substitute for medical advice and should not be exclusively relied on to manage or diagnose a medical condition. NPS MedicineWise disclaims all liability (including for negligence) for any loss, damage or injury resulting from reliance on or use of this information.

## References


1. Australian Centre for Asthma Monitoring. Asthma in Australia 2011. Canberra: Australian Institute of Health and Welfare, 2011.
2. Australian asthma handbook. Melbourne: National Asthma Council Australia, 2014. Melbourne, 2014. http://www.asthmahandbook.org.au (accessed 4 March 2014).
3. El-Gohary M, et al. Fam Pract 2013;30:492–500.


## Notes

[‖] Data shown are an aggregate for all your provider locations.
[†] Corticosteroid-alone inhalers: beclomethasone (Autohaler & pMDI), budesonide (DPI), ciclesonide (pMDI), fluticasone propionate (MDI & DPI).
[≠] Corticosteroid/long-acting beta$_2$ agonist combination inhaler products: budesonide/eformoterol (DPI), fluticasone propionate/salmeterol (MDI & DPI).
[‡] The comparator group "other GPs in your RRMA" includes all general practitioners currently located in a similar geographical region i.e. **1.** capital cities, **2.** other metropolitan centres, **3.** large rural centres, **4.** small rural centres, **5.** other rural centres, **6.** remote centres **7.** other remote centres.
**Your RRMA peer group is X**.

# APPENDIX 3: EDUCATIONAL VISITING CARD

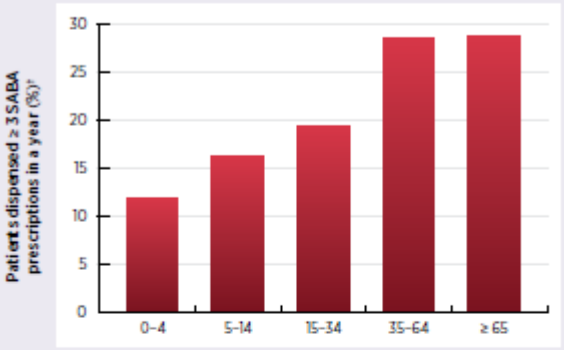
NPS MEDICINEWISE PROFESSIONAL

## EXPLORING INHALED MEDICINES USE AND ASTHMA CONTROL

Poor asthma control is common,[1] and increases the risk of flare-ups requiring oral corticosteroids, hospitalisation or emergency department (ED) visits.[2] Asthma is managed at ~5% of GP encounters with children and ~2% with adults.[1] Deaths from asthma remain high in Australia compared with many other countries.[1]

**In a year[3]...**


**FIGURE 1: Poor asthma control* is common[1]**




* ≥ 3 SABA prescriptions per year is used as a surrogate indicator for poor asthma control.

† As % of concession cardholders being dispensed any inhaled or oral medicines for asthma or COPD in the same year.

Used with permission from the Australian Institute of Health and Welfare.

## Aim to achieve good asthma control in all patients

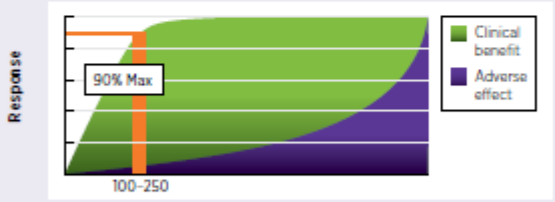
- Most people with frequent asthma symptoms have poorly controlled asthma, **not** severe asthma.
- Assess asthma control as the first step to good asthma control
  - Consider current symptom control by asking specific questions (see insert).[4]

  **AND**
  - Identify risk factors for poor outcomes (see insert).[4]

**Poor asthma control is often caused by poor adherence[4] and/or incorrect inhaler technique[4,5]**

Most of the benefit from an inhaled corticosteroid (ICS) is obtained at a low-to-moderate dose in both adults and children.[6–8]

**FIGURE 2: Stylised dose–response curve for inhaled corticosteroids[7,8]**




### Overtreatment in children with asthma

- < 35% need preventer treatment
  - 70–75% have infrequent intermittent asthma[9] and regular preventer treatment is not recommended.[4,10,11]
  - 20–25% have frequent intermittent asthma and 5–10% of children have persistent asthma,[9] only some of these children will need an ICS preventer.[4]
- ~ 40% of < 15 year olds are prescribed an ICS or an ICS/long-acting beta$_2$ agonist (LABA).[1]
- > 50% of children using an ICS are using an ICS/LABA combination treatment[1] and ~ 40% have not previously trialled ICS alone.[12]

### Overtreatment in adults and adolescents with asthma

- When inhalers are used correctly, asthma can be controlled with a low-dose ICS and an as-needed short-acting beta$_2$ agonist (SABA) for most adults.[4]
- Almost all prescriptions for ICS treatment in people ≥ 15 years are for medium or high strengths.[1]

= Children = Adults and adolescents

## Regularly assess asthma control and review treatment

**ONGOING MANAGEMENT***

**STEP 1:** **Assess asthma symptom control** and risk factors for poor outcomes

**STEP 2:** **Treat and adjust** to achieve control

**STEP 3:** **Review response** and monitor to maintain control

### 1. ASSESS ASTHMA CONTROL

Consider:

- Symptom control, risk factors for flare-ups and adverse effects
- Patient preference
- Inhaler technique and adherence
- Confirming diagnosis

### 2. TREAT AND ADJUST

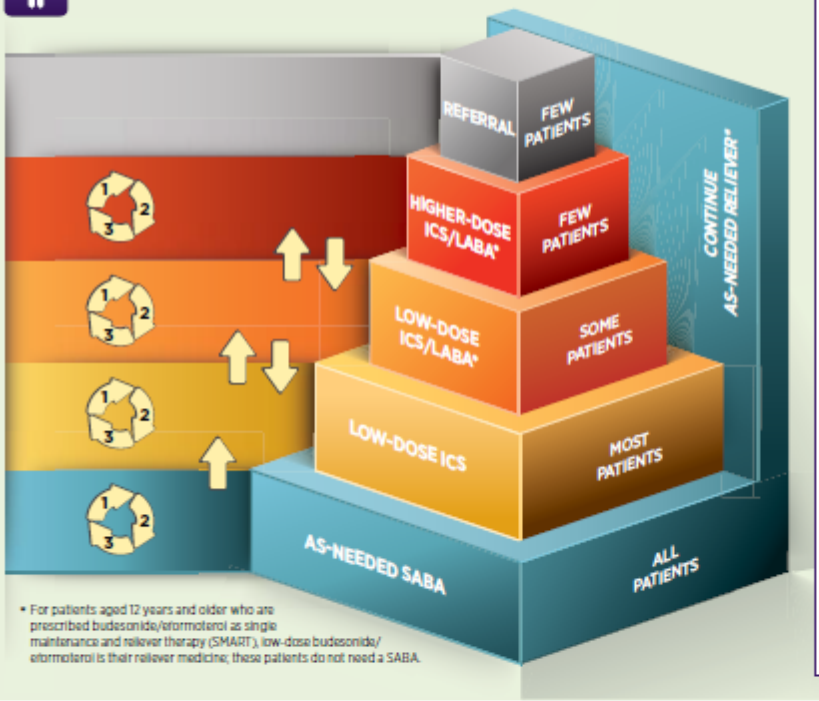
- Address modifiable risk factors, including triggers
- Symptom-guided treatment: step up, step down or maintain treatment, based on symptom control and risk factors
- Schedule a review visit after any change in treatment
- Provide a written asthma action plan

### 3. REVIEW RESPONSE

Consider:

- Asthma control
- Flare-ups
- Treatment-related adverse effects
- Lung function

**FIGURE 3: Step-wise treatment of adults, showing treatment needed by most patients[4]**




* For patients aged 12 years and older who are prescribed budesonide/eformoterol as single maintenance and reliever therapy (SMART), low-dose budesonide/eformoterol is their reliever medicine; these patients do not need a SABA.

- Before considering stepping up treatment, confirm symptoms are due to asthma, check adherence and check inhaler technique.
- For patients with poorly controlled asthma symptoms and/or risk factors such as low lung function or a flare-up in the past year, consider stepping up treatment as a 2–3 month trial and review response.
- Consider referral for patients who have continued poor symptom control and/or flare-ups despite good inhaler technique and adherence with a high-dose combination ICS/LABA.

- Consider stepping down treatment if good asthma control is maintained for at least 2–3 months and the patient is at low risk of flare-ups.
- Ensure the patient has a written asthma action plan and enough preventer medicine to resume treatment if asthma control worsens.

### BEFORE STARTING TREATMENT[4]

- Before starting or resuming treatment, confirm diagnosis based on the probability that symptoms and clinical findings are due to asthma; if possible confirm airflow limitation by spirometry.
- Document the evidence to support the diagnosis of asthma in the patient's notes.
- Determine the patient's management goals and ability to self-manage.
- Provide written and oral instructions including a written asthma action plan, and provide training in inhaler technique.

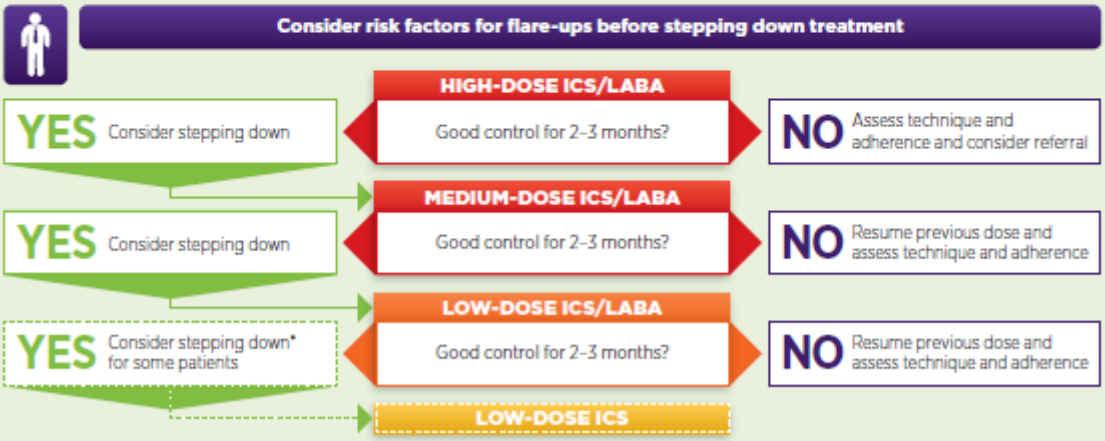
## Find the lowest dose of treatment that maintains good control

Many patients on long-term high-dose treatment can be stepped down without compromising control.[4,13,14]

**Step down gradually**[4]

- Document current asthma symptom control and risk factors for poor outcomes, and check what dose the patient is actually using and how often.
- Agree what dose adjustment to trial and schedule a follow-up appointment to review response (Table 1).

**FIGURE 4: Stepping down from high-dose ICS/LABA: maintain the LABA to reduce the risk of flare-ups**[4,15]




* For some patients using conventional maintenance treatment who are well controlled on low-dose ICS/LABA, stepping down to low-dose ICS may be considered but this may lead to poor control; monitor accordingly. For patients on SMART, the maintenance treatment may be stepped down to once daily.

### Start with a low-dose ICS as the first preventer in most patients ≥ 12 years[4]

**A regular low-dose ICS with an as-needed SABA is recommended in any adult patients:**

- with symptoms occurring at least twice per month
- waking due to asthma at least once in the last month
- who have had a flare-up needing oral corticosteroids in the last 12 months
- having ever required artificial ventilation or admission to ICU due to acute asthma.

### Most children with asthma do not need a preventer

**An ICS is ONLY recommended for:**[4]

**Children 1–2 years**

- with persistent asthma, or multiple trigger wheeze, if wheezing symptoms are disrupting sleep or play.

**Children 2–5 years**

- with moderate to severe multiple trigger wheeze
- with episodic (viral) wheeze with frequent symptoms or multiple trigger wheeze, which is poorly controlled with montelukast.

**Children ≥ 2 years**

- with moderate to severe persistent asthma
- with frequent intermittent or mild persistent asthma, which is poorly controlled with montelukast.

Refer children < 6 years whose asthma is poorly controlled on a low-dose ICS to a specialist.

Stepping up treatment to a low-dose ICS/LABA, high-dose ICS, or ICS plus montelukast is ONLY recommended for children ≥ 6 years whose asthma is poorly controlled on an ICS alone. Refer children whose asthma is poorly controlled on these treatments for specialist advice.

**TABLE 1** When to review asthma control[4]

| | | | |
|---|---|---|---|
| **ADULTS AND CHILDREN** | ▸ After an asthma flare-up<br>▸ At scheduled asthma review visits (at least every 6–12 months in patients whose asthma is well controlled; every 3 months for high-risk patients)<br>▸ Opportunistically at non-asthma visits<br>▸ When the person presents with uncontrolled asthma symptoms | **ADULTS** | ▸ 1–3 months after starting/adjusting dose, or earlier in a patient with very poorly controlled asthma at presentation<br>▸ Every 4–6 weeks during pregnancy |
| | | **CHILDREN** | ▸ 2–4 weeks after starting/adjusting treatment or after hospitalisation/ ED visit |

## Provide written, individualised information to enable guided patient self-management

**Provide patients with an individualised, regularly-updated written asthma action plan[4]**

Only 14% of people aged ≥ 15 years and 48% of children aged < 15 years with asthma have a written asthma action plan.[1]

- Education in self-management (which includes a written asthma action plan, self-monitoring and regular review) improves outcomes including reduced unscheduled doctors' visits[16] and hospitalisations for asthma.[16,17]
- In children, written asthma action plans used with standard treatment (which includes education) improve asthma control and reduce hospital visits for acute care, night time awakening and other outcomes.[18,19]
- Written asthma action plans based on symptoms are more effective than those based on peak flow for children and adolescents.[4,19]
- Select an action plan appropriate for the person's age, educational status, language and culture.[20]

See: **www.nps.org.au/asthma** for links.

**Written asthma action plans should include:[4]**

- details of the patient's usual medicines
- how to adjust/add medicines in response to symptoms
- how and when to seek medical help
- the name and contact details of emergency contact e.g. parent or carer
- the name of the person writing the plan and date it was issued.

**Complement a written asthma action plan with skills training such as inhaler technique and how to recognise and respond to changes in asthma symptoms.**

EXPERT REVIEWERS

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