# TESTING EVIDENCE FOR ROUTINE PRACTICE: Using an implementation framework to embed a clinically proven asthma service in Australian community pharmacy

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# ABSTRACT

**INTRODUCTION:** Community pharmacists are well placed and evidence clearly demonstrates that they can be suitably trained to deliver professional services that improve the management of asthma patients in clinical, economic and humanistic terms. However the gap between this evidence and practice reality remains wide. In this study we measure the implementation process as well as the service benefits of an asthma service model.

**METHODS:** Using an Implementation-effectiveness hybrid design, a defined implementation process and outcomes (progression from *Exploration* through *Preparation* and *Testing* to *Operation* stages) and clinical outcomes (asthma control and inhaler technique) an asthma service was tested in 17 community pharmacies across metropolitan Sydney.

**RESULTS:** Seven pharmacies reached the *Operation* stage of implementation. Eight pharmacies reached the *Testing* stage of implementation and two pharmacies did not progress beyond the *Preparation* stage of implementation. A total of 128 patients were enrolled in the asthma service with 110 patients remaining enrolled at the close of the study. Asthma control showed a positive trend throughout the service with the overall proportion of patients with ‘poor’ asthma control at baseline decreasing from 72% to 57% at study close. There was a statistically significant increase in the proportion of patients with correct inhaler technique from 12% at Baseline (Visit 10) to 33% at Visit 2 and 57% at study close.

#### CONCLUSION: Implementation of the asthma service varied across pharmacies. Different strategies specific to practice sites at different stages of the implementation model may result in greater uptake of professional services. The asthma service led to improved patient outcomes overall with a positive trend in asthma control and significant change in inhaler technique.

# Introduction

Good asthma control is a primary objective in the management of asthma patients (GINA, 2015). However, asthma control in many patients is sub­optimal (Hendersson *et al,* 2013; Partridge *et al,* 2006). Recent population-based data indicates that approximately 50% people with asthma in Australia have partially or poorly controlled symptoms (Reddel *et al,* 2015). This has negative implications for the patient's health, quality of life and/or health care costs. Evidence clearly demonstrates that community pharmacists are well placed and can be suitably trained to deliver professional services that effectively improve the management of asthma patients (Armour *et al,* 2013; Basheti *et al,* 2007; Garcia-Cardenas *et al* 2013; Garcia-Cardenas *et al,* 2015; Giraud *et al,* 2011; Gordois *et al,* 2012). However the gap between this evidence and practice reality remains wide (Armour *et al,* 2011; Cazzoletti *et al*, 2007; Dima *et al*, 2015; Garcia-Cardenas *et al,* 2013; Giraud *et al,* 2011; Lavorini *et al*, 2008; Peters *et al*, 2006) with ongoing issues of non-adherence and incorrect inhaler technique (Basheti *et al,* 2007; Giraud *et al,* 2011; Haughney *et al*, 2008; Horne *et al*, 2002; Lavorini *et al*, 2008).

Conversely, usual practice in delivering asthma management in the contemporary community pharmacy setting often does not include counselling on medication adherence or inhaler technique (Armour *et al,* 2011; Cazzoletti *et al*, 2007; Dima *et al*, 2015; Haughney *et al*, 2008; Horne *et al*, 2002; Horne *et al* 2006; Lavorini *et al*, 2008; Peters *et al*, 2006). This occurs despite the evidence provided of improved inhaler technique leading to substantial improvements in asthma control (Bateman *et al*, 2008; British Thoracic Soc 2008; Dima *et al*, 2015) and strategies to improve adherence leading to improved outcomes (Gamble *et al*, 2011). Data from previous outcome-based asthma management programs highlight that pharmacists’ involvement can successfully impact on asthma symptoms, pulmonary function or asthma severity (Basheti *et al,* 2007; Giraud *et al,* 2011). Similarly, updated asthma guidelines highlight the importance of implementing strategies aimed at improving patients' knowledge, skills and attitudes for self-management of their asthma (GINA, 2015). Correct inhaler technique and adherence are therefore important skills necessary for patients’ asthma self-management that pharmacists are well placed to address through effective professional services. Interestingly, non­adherence to asthma medications is estimated to occur in 30 to 70% of individuals and is a significant risk factor for asthma morbidity and mortality (Haughney *et al*, 2008; Horne *et al*, 2002). It is considered an important factor in poor asthma control and related healthcare expenditure (Armour *et al,* 2011; Cazzoletti *et al*, 2007; Dima *et al*, 2015; Peters *et al*, 2006). Clearly medication optimisation including adherence support and inhaler use education are key elements of asthma care provision.

Despite the evidence behind professional pharmacy services, many of them fail to be integrated into routine practice, mainly due to a lack of implementation programs and strategies. Implementation science has increasingly become recognised as a pathway for bridging knowledge to practice gaps due to its nature of identifying and addressing the complex process of service implementation (Damschroder *et al,* 2009; Eccles *et al,* 2006; The National Implementation Research Network, 2016).

Different theories and frameworks aimed at describing, understanding and evalu- ating the translation of evidence into practice have been developed. The need to use theoretical models and frameworks to facilitate the implementation services has been widely recognized (Nilsen, 2015), in order to reduce the existing gap between evidence and practice in different disciplines like pharmacy (Garcia-Cardenas *et al*, 2016).

Practice change facilitation is a widely used implementation approach used to support practice change in different settings (Harvey *et al*, 2002) including pharmacy (Houle *et al*, 2017).

There is evidence that practice change facilitators can effectively assist in implementing changes and facilitate quality improvement (Baskerville *et al*, 2012), helping individuals and teams to understand what they needed to change and how they needed to change it (Kitson *et al*, 1998).

The Framework for the Implementation of Services in Pharmacy (FISpH) is a systematic approach that uses implementation science theories (Moullin *et al*, 2015). Using the FISpH combined with an evaluation framework, we aimed to evaluate a service implementation program in community pharmacies focused on asthma medication management services. Specifically we aimed to:

* Measure the implementation program process in terms of progress in practice change and level of service provision (reach, that is, the number of patients receiving the service);
* Evaluate the effectiveness of the service (service benefits) being implemented in terms of patient outcomes (inhaler technique and asthma control).

# Methods

The study was conducted using an Implementation-effectiveness hybrid design over a six-month period. Effectiveness-implementation hybrid designs are intended to test the effectiveness of both an intervention and an implementation strategy (Curran *et al,* 2012; Peters *et al,* 2013).

The study population consisted of community pharmacies located in the Sydney metropolitan area with 18 pharmacies recruited to the study. Staff from each pharmacy were required to be trained in both the provision and implementation of the asthma service at a study specific training workshop. Upon completion of the training workshop pharmacists were requested to enrol 10 asthma patients in the service. To be eligible to participate in the study, patients were required to:

* Be aged 18 years or older
* Have physician diagnosed asthma
* Have uncontrolled asthma according to the *Asthma Control Assessment* 5-itemed questionnaire (LeMay *et al,* 2014).
* A patient having an asthma prescription dispensed in the previous six-month period.

## Asthma Service to be implemented

Provider pharmacists were trained to deliver targeted interventions that addressed behavioural change in patients. These interventions were directed at any issues relating to the patient’s adherence and/or inhaler technique. Our training was based on that we had previously used for interventions incorporating issues with adherence and inhaler technique in pharmacy (Armour *et al*, 2013; Garcia-Cardenas *et al*, 2013). Issues were identified by first using a purpose-designed questionnaire that measured asthma control and inhaler technique. Asthma control was measured using the *The Asthma Control Assessment* 5-item questionnaire due to its good sensitivity and specificity (LeMay *et al,* 2014). Each step of patients’ inhaler technique was assessed using previously implemented device-specific checklists (Basheti *et al,* 2014). Providers interacted with patients on four occasions during the project, that is, at the initial consultation visit then follow up consultation visits at one month, three months and six months. During these visits patients were educated using verbal instructions, physical demonstration and/or written information about inhaler device use. At the end of each visit the provider and patient jointly agreed goals or points for improvement to be adopted by the next visit.

Ethics approval for the project was obtained from the UTS Human Research Ethics Committee (Approval number: UTS HREC REF NO. 2014000677).

## Implementation process

The Asthma Service implementation process was guided by *The Framework for the Implementation of Services in Pharmacy* (FISpH) model (Moullin *et al*, 2015). This model appropriately conceptualizes the complexity and provides a structured and systematic approach to the implementation process and breaks down the process into a series of stages (steps) of implementation and identifiable influencing factors, strategies and evaluations (Damschroder *et al*, 2009, Moullin *et al*, 2015). The FISpH model is shown in **Figure 1**.



**Figure 1.** The FISpH model of implementation framework (Moullin *et al*, 2015).

### Stages of Implementation

The implementation process was reliant on the movement of the pharmacies in a structured manner sequentially through the five stages. Each of the five stages had an objective specific to the respective stage of the implementation process as detailed further in **Table 1**.

|  |  |  |
| --- | --- | --- |
| Stage of Implementation | Objective | Implementation Strategies |
| Exploration | To prepare the pharmacy system and environment for the service implementationThis phase ends with the decision of the pharmacy owner to adopt or to reject the asthma service.  | - Exploration of the system and environment- Exploration of pharmacies and pharmacy owners in terms of willingness to participate |
| Preparation | To prepare pharmacies and pharmacists for the service implementation. | - Pharmacist training / service provider training on change management and leadership training- Initial evaluation of barriers and facilitators for service implementation by providers and practice change facilitator |
| Testing | To test the service provision in the pharmacy. Reached when the service is provided to the first patient. | - Ongoing evaluation of barriers and facilitators for service implementation as above- Practice Change Facilitation- Follow up |
| Operation | To facilitate the service implementation and its integration into pharmacies. It is reached when asthma service is provided to target population. | - Practice Change Facilitation- Follow up- Training of internal champions, change management and leadership training |
| Sustainability | Integration and continuation of service provision, maintenance service environment, including the system capacity (support and funding) and maintaining results. | * Revision of feedback and training
* Evaluation
* Continuous quality improvement.
 |

**Table 1.** Stages of implementation.

Using the FISpH model, implementation strategies, selected by a trained practice change facilitator were applied to those implementation factors identified as barriers or facilitators that influenced the process of implementation and the progression of pharmacies through the implementation stages. Barriers or facilitators in implementation science are unanticipated influences that either hamper (barrier) or enable (facilitator) the implementation process (Damschroder *et al,* 2009).

### Practice Change Facilitation

In implementation science a *practice change* *facilitator* is an individual who is affiliated with an outside entity (external to the community pharmacy) and formally influences or facilitates the implementation process by using interventions that drive the implementation of the service. A facilitator usually, but not necessarily, has professional training in a technical field related to organisational change science or in the technology being introduced into the organisation (Baskerville *et al*, 2005; Harvey *et al*, 2002; Nagykaldi *et al*, 2005). In the asthma service, the role of the facilitator was to intervene and facilitate the pharmacist’s practice change identifying and prioritising areas of improvement as well as to develop individual change plans to improve quality of care.

The practice change facilitator’s main objective was:

* To encourage the implementation of the sustainable asthma service model as part of the dispensing process in those pharmacies delivering the service.

As part of the implementation process, the practice change facilitator conducted:

* An *initial assessment* of barriers and facilitators (as enablers) in each of the pharmacist provider/s and the participating pharmacies
* The *planning and delivery of strategies to overcome the barriers and reinforce the facilitators*, according to the barriers and needs identified in the initial assessment.
* *Identification and training of the internal champion to ensure the continuation of service provision.*

The practice change facilitator visited each pharmacist on a monthly basis and documented all factors that were classed as barriers or facilitators that affected the implementation of the asthma service using a standardised form. Strategies, developed from experience with other pharmacy projects were explored by the trained practice change facilitator for each barrier encountered and tested to enhance the delivery of the service and patient recruitment. Using the FISpH model, the implementation process was monitored throughout the project at the practice change facilitator visits. Implementation strategies were applied to those implementation factors identified as barriers or facilitators that influenced the process of implementation and the progression of pharmacies through the implementation stages.

### Evaluation and variables

The implementation process and its results were also evaluated using an evaluation model adapted specifically for the Asthma Service (Moullin *et al,* 2015). The level of implementation or *implementation outcomes* are assessed by the level of provision or service provision (*reach*). *Reach* refers to the number of patients that receive the service. **Figure 2** highlights the difference between the implementation program evaluation (Implementation indicators) and professional service outcome (Asthma service and patient outcomes). In this paper we report on implementation progress (stage, rate), level of provision (reach) and service benefits (patient clinical outcomes).

**Service Benefits**

Humanistic, Clinical, Economic

**Implementation Climate** (including factors, strategies & evaluations)

**Level of Provision**

Reach

**Implementation Progress** Stage, Rate

**Figure 2**. Asthma Service Evaluation Model (Adapted and simplified from Moullin *et al*, 2015).

# Results

### Implementation progress

A total of 68 pharmacies where contacted (FISpH model), of which 18 (26%) chose to enrol in the service (*Exploration* stage). The pharmacies were approached based on personal contacts, they were not randomly chosen. All but one of these pharmacies (17 (25%)) continued into the *Preparation* stage by sending pharmacists or pharmacy staff to be trained in the delivery of the asthma service at the workshops. All 17 of the pharmacies that committed staff members to training progressed into the *Testing* stage of implementation. Seven pharmacies (10%) reached the *Operation* stage of implementation defined as having delivered the asthma Service to 10 or more patients. Of the remaining 10 pharmacies that had sent staff to service provision training, eight (12%) had reached the *Testing* stage of implementation defined as having delivered the service to between one and nine patients. The two (3%) remaining pharmacies of the 17 who attended training did not progress past the *Preparation* stage of implementation, as the Asthma Service was either not delivered to enrolled patients or the pharmacy refused further practice change facilitator visits. Overall patient numbers per pharmacy are shown in **Table 2**.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Implementation Stage  | Number of pharmacies  | Number of Patients Enrolled | Patients at One month Follow-up | Patients at Three month Follow-up | Practice Change Facilitator Visits |
| Operation | 7 | 72 | 52 | 41 | 42 |
| Testing | 8 a | 51 | 27 | 12 | 55 |
| Preparation | 2 b, c | 5 | 0 | 0 | 7 |
| Exploration | 1 | 0 | 0 | 0 | 0 |
| Total | **18** | **128** | **79** | **53** | **104** |

**Table 2.** Participating pharmacies and Stage of Implementation at the end of the study

1. One pharmacy participated in pilot phase of project.
2. One pharmacy enrolled patients in asthma service but failed to deliver service to theses patients.
3. One pharmacy declined further practice change facilitator visits.

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**Figure 3**. Progression of pharmacies through the implementation Stages over the study period

The progression of the pharmacies through the four stages of implementation over the study period is shown in **Figure 3**. Most pharmacies progressed to a preparation stage by month 2 and a testing stage by month 3. The operation stage was not reached by any pharmacy until month 3.

### Level of provision (Reach)

A total of 128 patients were enrolled in the Asthma Service by the 17 pharmacies. The number of patients in the service per study month is shown in **Figure 4**. This number was, however, not maintained throughout the study due to patient withdrawals or lost to follow-up. Providers continued to approach new patients and a total of 110 patients were enrolled in the Asthma Service at the close of the project. However not all patients had completed follow-up at the project’s close.

**Figure 4**. Asthma Service *Reach* shown as number of patients enrolled in the service over the study period.

It took until month 4 for most pharmacists to have reached their target number of patients.

### Asthma Control

Overall asthma control for those patients that had completed Visit 3 follow-up at the close of the project is reported in **Table 3**. A total of 53 patients from 12 of 17 pharmacies (71%) had completed Visit 3 follow-up at project closure. The overall proportion of patients with ‘poor’ asthma control at baseline decreased from 72% to 58% at Visit 3 follow-up. The overall proportion of patients with ‘fair’ asthma control was 27% at baseline and at Visit 3 follow-up. From another perspective, the proportion of patients with ‘good’ asthma control was 0% at Visit 1 as these patients were excluded from being enrolled. However at Visit 3 the proportion of patients with ‘good’ asthma control had increased to 15%. These results are further detailed in **Table 3** and shown in **Figure 5**.

|  |  |  |  |
| --- | --- | --- | --- |
| Implementation Stage | Baseline Initial Visit PatientsAsthma Control | Visit 2 Follow-up PatientsAsthma Control | Visit 3 Follow-up PatientsAsthma Control |
|  | **POOR**  | **FAIR**  | **GOOD** | **POOR** | **FAIR** | **GOOD** | **POOR** | **FAIR** | **GOOD** |
| Operation | 29/40(72%) | 11/40(28%) | 0/40(0%) | 27/40(68%) | 10/40(25%) | 3/40(7%) | 25/40(63%) | 10/40(25%) | 5/40(12%) |
| Testing | 9/12(75%) | 3/12(25%) | 0/12(0%) | 6/12(50%) | 5/12(42%) | 1/12(8%) | 5/12(42%) | 4/12(33%) | 3/12(25%) |
| TOTAL | **38/52****(73%)** | **14/52****(27%)** | **0/52****(0%)** | **33/52****(63%)** | **15/52****(29%)** | **4/52****(8%)** | **30/52****(58%)** | **14/52****(27%)** | **8/ 52****(15%)** |

**Table 3**. Asthma Control at Baseline (Visit 1), Visit 2 follow-up and Visit 3 follow-up.

O = operation stage of implementation, T= testing stage of implementation.

NB: One of these patients had not completed the Asthma Control questions at Baseline and therefore no results are reported for this patient.

**Figure 5**. Overall Asthma Control at Baseline (Visit 1), Visit 2 follow-up and Visit 3 follow-up.

### Inhaler Technique

The overall mean score for *Inhaler Technique* was 6.8 ± 1.4 at Baseline (Visit 1), 8.3 ± 1.1 at Visit 2 Follow-up, and 9.1 ± 1.0 at Visit 3 Follow-up. The mean score for *Inhaler Technique* in those pharmacies that reached the *Operation Stage* was 6.6 ± 1.4 at Baseline (Visit 1), 8.1 ± 0.6 at Visit 2 Follow-up, and 8.9 ± 1.0 at Visit 3 Follow-up. These results are further detailed in **Figure 6**. The mean score for *Inhaler Technique* in those pharmacies that reached the *Testing Stage* was 7.0 ± 1.7 at Baseline (Visit 1), 8.5 ± 1.2 at Visit 2 Follow-up, and 9.4 ± 1.1 at Visit 3 Follow-up. These results are further detailed in **Figure 6**. There was a statistically significant increase in the proportion of patients with correct inhaler technique from 12% at Baseline (Visit 1) to 33% at Visit 2 and 57% at Visit 3 (**Figure 7**) (p<0001, Chi squared 58.78, df 2).

**Figure 6**. Mean Inhaler Technique scores per Implementation Stage at Baseline (Visit 1), Visit 2 follow-up, and Visit 3 follow-up.



**Figure 7**: Number of patients with correct and incorrect inhaler technique from Baseline (Visit 1), Visit 2 and Visit 3.

# Discussion

## Implementation progress

This is the first project that has documented the implementation process of an evidence-based professional service to improve asthma control in community pharmacies. The methodology was based on a theoretical framework conceptualised specifically for implementation of professional services in the community pharmacy setting, known as the FISpH model (Moullin *et al*, 2015). The application of such a framework and the outcomes allow the learning to be employed in future implementation programs for other community pharmacy based professional services. By using a structured framework in approaching service implementation, it was possible to identify those pharmacies that were lagging with implementation early so as to provide individualised and specific support.

In terms of patient recruitment and retention the pharmacies that reached the operation stage of implementation recruited all patients required (10 patients). This number was set as a minimum requirement to reach the operation stage as it requires consideration of workflow and training as well as organisation but is not too high in terms of difficulty in recruiting. Many previous studies in Australia and Spain have shown this number is achievable (Armour *et al*, 2013; Garcia-Cardenas *et al,* 2016) There was also greater retention of these patients at the measured end point of three months. Those in the testing stage did recruit patients although none reached their target. With one exception these pharmacies did not retain these numbers at three months. It may be likely that those geared to change can do so quickly and effectively, of course it is also possible that with extended time more pharmacists may have progressed to advanced stages of implementation.

The majority of pharmacies that were represented at the Owners’ information sessions committed their pharmacy to the program by sending staff to be trained in asthma service delivery and quickly progressed from the *Exploration* stage to the *Preparation* stage of implementation resulting in a 77% rate of progression. Progression from the *Preparation* stage to that of *Testing* was immediate for 18% of the 17 pharmacies. By Month 2 of the program more than half of the pharmacies had progressed to the *Testing* stage of implementation. As early as Month 3, three pharmacies (18%) had reached the *Operation* stage of implementation having enrolled 10 or more patients. In total seven pharmacies (41%) reached the *Operation* stage of implementation during the program. However this number was not sustained throughout the entire program and fell to three pharmacies at the program’s close. It is not uncommon for pharmacies (in the case of the asthma service, pharmacies) to regress during this process until full implementation (in this case *Operation*) is reached (Moullin *et al*, 2015). Those pharmacies that regressed from the *Operation* stage to *Testing* may have been encouraged by direct financial compensation for the time spent on service provision as has been seen in other programs (Armour *et al,* 2011; Armour *et al,* 2013). However whilst remuneration for service provision may have increased providers’ focus on and prioritisation of the service, it is important to note the willingness of pharmacy owners to commit their pharmacies to such research. Financial incentives such as direct remuneration for services provided may enhance service provision in future. Furthermore, although the pharmacy owners committed their pharmacies to the project, the pharmacy owners were often not delivering the service. The pharmacists that were trained to deliver the service may not have seen any direct personal incentive and were therefore less likely to provide the service.

The process of service implementation may be improved by identifying those pharmacies that are slow to progress through the stages of implementation and provide appropriate intervention by using the FISpH framework for service implementation. The inclusion of a trained practice change facilitator has previously been successful in other research (Cohen *et al*, 2004) in supporting the implementation process through identifying barriers and providing strategies to solve the issues identified. Our study required a large number of visits to the participant pharmacies. The use of a practice change facilitator represented a big implementation effort increasing implementation costs. However, the effectiveness of practice change facilitation and its impact on the implementation process and outcomes wasn´t assessed. Although a practice change facilitator can serve as a ‘cross-pollinator’ of strategies to solve barriers across pharmacies and also provide ongoing feedback for service improvement, whether this strategy was cost-effective in our study remains unknown.

## Service benefits

The effectiveness of the implemented asthma service in terms of patient outcomes showed a general improvement in asthma control (which is a long term goal) and inhaler technique. Firstly, asthma control improved for the majority of patients by Visit 3 (three months after baseline). Secondly, the proportion of patients with correct inhaler technique significantly increased. This is in line with previous asthma service research in the community pharmacy setting (Basheti *et al*, 2007). Our study was not powered to measure significant changes in asthma control as this was not the main objective of the study and hence this outcome showed a trend only. Nevertheless we know from our previous research that improvements in inhaler technique lead to significant and clinical improvements in asthma control.

It would have been interesting to divide patients into those receiving the service from pharmacies reaching the operational stage and the testing stage and analyse statistically. We have done this with asthma control and inhaler technique. The proportion of patients remaining with poor asthma control at service end was lower in the group receiving services from operational versus testing pharmacies ( 42% versus 63%) , however the numbers are small. There was also a trend for differences between the two groups of pharmacies for inhaler technique (9.4±1.0 *Operation*, 8.9±1.0 *Testing* but these figures are not significant). It may be, that had we continued the study for longer or if there was a larger study in the future these differences would trend to significance.

In terms of patient numbers, less than half of those patients (41%) initially enrolled in the asthma service completed the service, this is comparable to 50% retention in other pharmacy service research (Fuller *et al*, 2015). This may be a direct reflection of patients’ lack of knowledge and beliefs about asthma control as was identified as the most common barrier in the implementation outcomes. The lack of knowledge and consequent incorrect beliefs about asthma have been identified in previous research as a barrier to improved asthma health (Horne *et al*, 2002). Some asthma service providers commented that patients respond better to visible or tangible proof of improved results such as in the form of spirometer testing as has been successfully used in previous research (Armour *et al*, 2013). Our study used a streamlined asthma service that used the elements we and others have shown to improve asthma outcomes in pharmacy practice and could be delivered in a timely manner in a busy community pharmacy. Thus we did not include too many questionnaires to test patient outcomes or pharmacy process nor include spirometry or structured goal setting. It may be that a more focussed approach towards goal setting in the form of clearer goals defined by the patients’ themselves may lead to clearer reflection over asthma improvement and better patient retention (Smith *et al*, 2007).

The number of patients returning for the service visits declined over time. This is consistent with our previous research (LeMay *et al,* 2014). Some patients failed to attend after the initial asthma service visit. This is common to other clinical areas in pharmacy practice research (Fuller *et al*, 2015). We cannot exclude the possibility that those patients that dropped out were those with worse control and inhaler technique and therefore we have a specially selected group of patients in our study. However, such dropout rates further highlight the need for a more concerted effort on implementation studies in the pharmacy setting.

This model used a very brief intervention consistent with pharmacy workload. In previous research, complex and time-consuming models have proven the benefits of pharmacy intervention. In a knowledge translation approach, our approach was to take elements of our previous research and include them in a new simple pharmacy asthma service model focused on adherence and inhaler technique. Although we used an effectiveness-implementation hybrid design, intended to test the effectiveness of both an intervention and an implementation strategy (Curran *et al*, 2012), we did not include a control group in this study as these elements have already been shown to work in larger randomised trials in Pharmacy (Armour *et al*, 2013; Basheti *et al*, 2007). Moreover, our study met all the criteria recommended by Curran *et al.* (Curran *et al,* 2012) to use this study design. We have shown that in this current model there is value in terms of patient outcomes as asthma control and inhaler technique improve, although more patients and a longer time for study are required to validate this model.

It is difficult to say if the improved patient outcomes would be sustained over a longer period as has been shown in other research (Garcia-Cardenas *et al,* 2016). In the asthma service, some patient outcomes did decline at the second follow-up after an initial rise at the first follow-up visit. Notwithstanding these results there was still a trending improvement from baseline to the second follow-up visit (three months) in asthma control and inhaler technique.

Further research should be undertaken to test the sustainability of services in pharmacies that have reached the *Operation* phase in order to test long-term outcomes. Similarly, future research in the area of service implementation should both identify and address barriers and facilitators to implementation and provide a focussed preparation on these factors at the *Preparation* stage (workshop training) to pre-empt common barriers.

## Conclusion

#### This research examines the process of implementation of the Asthma Service into current practice in pharmacy. Results show that integration of the service into regular practice and number of patients receiving the service differs across pharmacies. The Asthma service led to improved patient outcomes overall with a positive trend in asthma control and significant improvement in inhaler technique.

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