EFFECTIVENESS AND COST EFFECTIVENESS OF DOSE ADMINISTRATION AIDS (DAAS)

FINAL REPORT

5 November 2004

Project conducted by Quality Medication Care Pty Ltd in conjunction with the Therapeutics Research Unit, University of Queensland, Princess Alexandra Hospital

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ISBN 1864998210
# LIST OF ABBREVIATIONS

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Description</th>
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<tbody>
<tr>
<td>ADR</td>
<td>Adverse drug reaction</td>
</tr>
<tr>
<td>AIN</td>
<td>Assistant in Nursing</td>
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<tr>
<td>AMDS</td>
<td>Automated medication dispensing system (automated DAA)</td>
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<tr>
<td>CP</td>
<td>Community patient</td>
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<tr>
<td>DAA</td>
<td>Dose Administration aid</td>
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<tr>
<td>DDR</td>
<td>Daily dose reminder (Dosett type DAA)</td>
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<tr>
<td>DON</td>
<td>Director of nursing</td>
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<tr>
<td>EN</td>
<td>Enrolled Nurse</td>
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<tr>
<td>GP</td>
<td>General practitioner</td>
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<tr>
<td>HIC</td>
<td>Health insurance commission</td>
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<tr>
<td>MBS</td>
<td>Medical benefits scheme</td>
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<tr>
<td>MDS</td>
<td>Monitored dosage system (blister pack DAAs)</td>
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<tr>
<td>OP</td>
<td>Original pack</td>
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<tr>
<td>PBS</td>
<td>Pharmaceutical benefits scheme</td>
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<tr>
<td>PRN</td>
<td>As required</td>
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<tr>
<td>PSA</td>
<td>Pharmaceutical Society of Australia</td>
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<tr>
<td>QCPP</td>
<td>Quality Care Pharmacy Program</td>
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<tr>
<td>RCF</td>
<td>Residential care facility</td>
</tr>
<tr>
<td>RN</td>
<td>Registered Nurse</td>
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<tr>
<td>WTP</td>
<td>Willingness to pay</td>
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PREFACE

Inappropriate medication use limits any beneficial patient outcomes from therapy and is more likely to occur when patients are on multiple medications being taken at various times. Dose administration aids (DAAs) can facilitate better medication compliance, especially for solid dose forms such as tablets and capsules, and, as a consequence, facilitating optimal patient outcomes. This project sought to examine the cost effectiveness of DAAs for patients in the community and in residential care settings.

The project undertaken collected data throughout Australia and involved patients, pharmacies, general practitioners, nurses, residential facilities and researchers. Two key outcomes emerged. Firstly, DAAs may be seen as being effective by the users and improve clinical outcomes for those who would benefit from their use. Secondly, and of concern, pharmacies are, in general, providing them to patients at home and in RCFs at a loss. As a consequence, we have suggested a range of recommendations that may help address this issue.

Two people have been instrumental in making this project happen: Julie Stokes and Clare Ientile. Julie Stokes oversaw the project, guided database design and instrument development, contributed to the literature review and overviewed the presentation of the final report, Clare Ientile provided day-to-day project co-ordination and administration, data management and analysis, literature review and wrote much of this report. Other key members of the team were: Geoff Lewis, who helped with the day-to-day running of this multi-site study, data management and analysis and also made a significant contribution to the writing of the literature review and final report; Annika Jensen, who contributed to study design, instrument development and literature review; James Leslie who also helped with the day-to-day running of this study and Maureen Hendry who assisted with the literature review. The database was designed by Jaysen Marais; Kristin Hore, Richelle Cox and Anji Walters provided additional data entry and coding. Narelle Walker assisted with accounts processing and administration. Judy Craft proof read the report. We also recognise the very significant contribution of Chris Doran with economic modelling and Tim Haslett on the system-wise analysis of DAA provision. The following personnel from the Pharmacy Guild of Australia – Vaskin Demirian, Michael Tatchell and Lance Emerson, as well as Kos Sclavos, National Vice-President, all freely gave advice and assistance at various stages of the project. We are also grateful to the various pharmacy and nursing students who acted as observers and data enterers in the study.

Finally, on behalf of my team, I reiterate our thanks to all those who helped make this possible at all levels from our Reference committee members, the EAG committee, the management and staff of participating pharmacies, residential aged care facilities, community nursing services (in particular Bluecare) and manufacturers of the various dose administration aids. Key information was provided by customers of community pharmacies and residents of RCFs who took part in the study. Our hope is that the findings of this work are implemented to the extent possible and result in a more cost effective use of DAAs in both RCFs and in the community.

M.S. Roberts
Brisbane, November 2004
EXECUTIVE SUMMARY

AIM
The aim of this project, funded as part of the Third Community Pharmacy Agreement between the Commonwealth and the Pharmacy Guild of Australia, was to evaluate the effectiveness and cost effectiveness of Dose Administration Aids (DAAs) in the community and Residential Care Facility (RCF) settings. Of particular interest were the effects of DAAs on medication management for community patients and RCF staff, and the impact of providing DAAs on the pharmacies that do so.

This report addresses the following issues and questions:
1. Are DAAs effective in the community setting?
2. Are DAAs cost effective in the community setting?
3. Are DAAs effective in the RCF setting?
4. Are DAAs cost effective in the RCF setting?
5. What are the requirements for best practice DAA provision?

APPROACH
Purposive samples were drawn from populations of pharmacies (N=83), RCFs (RCFs) (N=27), community patients (CPs) (N=353), general practitioners (GPs) (N=34), community nurses (N=60) and DAA manufacturers (N=4). RCFs were sourced through the Aged Care Standards and Accreditation Agency; facilities nominated GPs that may have been interested in participating in the study. Pharmacies were sourced from the Yellow Pages phone directory, and they identified community patients for participation.

Data collection for the evaluation of project aims involved interviews (total of 544), questionnaires (615), observations (381) and self-report logs (778). Each of the data collection tools were developed in consultation with the members of the reference committee, and focused specifically on evaluating the relevant aspects of the effectiveness and cost effectiveness of DAAs in each setting. All data was collected on location around Australia from both rural and urban sites by 27 trained observers. Analysis of the data centered on identifying the current situation with respect to DAA use in the community and RCF settings in Australia.

In particular, we sought to assess the effectiveness and cost effectiveness of DAAs. Effectiveness was evaluated using the clinical value compass approach which provides a framework for the integration of the clinical, functional, satisfaction and cost measures. The cost-effectiveness aspect of this study was evaluated through a comparison of the costs of providing medication to community customers and RCFs in original packs (OPs) or DAAs. The costs were identified, measured and costed from the pharmacists’ perspective, and as such, this evaluation represents one of the first real attempts at economic appraisal in this area. In addition, the consequences of using OPs and DAAs in terms of the healthcare costs and benefits to community customers were measured and costed. Finally, we have compared the alternative options of OPs or DAAs in the community setting based on the cost per adverse drug reaction.
prevented (cost-effectiveness analysis) and the ratio of costs to benefits (cost-benefit analysis). In the RCF setting where the literature indicates high levels of compliance irrespective of the medication system used, the least cost alternative between DAAs and OPs was determined (cost minimisation analysis).

**FINDINGS – ADDRESSING THE STUDY AIMS**

1. **ARE DAAs EFFECTIVE IN THE COMMUNITY SETTING?**

   The clinical value compass suggests that DAAs are effective in the community setting (see Figure 1 for a summary of the findings).

   It is important to recognize that DAA users in general exhibit a greater severity of illness. As shown in the clinical and functional measures in Figure 1, DAA users:
   - Are more likely to live alone, more likely to have a carer, and more likely to make greater use of community health workers than non-DAA users.
   - Have lower scores for functionality on the Older Americans Resource and Services instrumental activities of daily living scale (OARS-IADL).
   - Have more hospitalisations per year and fewer illnesses but the same number and type of medicines as non-DAA users.

   DAAs appeared to have a positive impact on the satisfaction, medication management practices and the clinical status of the users. This conclusion is based upon the following findings (see also Figure 1):
   - DAA users maintained a better continuity of medication supply (i.e. were less likely to run out of medication) and were less likely to hoard medications compared with non-DAA users.
   - DAA users reported fewer adverse drug reactions compared with non-DAA users.
   - DAA users were more likely to rate their medication management system as useful, easy and convenient.

   DAA patients themselves considered pharmacy supplied DAAs to be effective and valued this service at $5.25 per week. Even though some patients experienced difficulties, pharmacists unanimously agreed that DAAs were useful in improving patients’ medication management, and recognized the importance of this service by their willingness to subsidise DAAs in the belief that they offer benefits to the customer.

   In conclusion, DAAs are effective in helping community patients to manage medications provided that the limitations of supplying and using DAAs are addressed. It is also clear that community patients value DAAs, as evidenced by their high levels of satisfaction and willingness to pay for the service.
2. ARE DAAS COST-EFFECTIVE IN THE COMMUNITY SETTING?

At present, DAAs are not cost-effective in the community setting. This is largely because the provision of DAAs by pharmacy is a labour-intensive and costly exercise. Sensitivity analysis, however, suggests the potential for delivery of a cost-effective DAA service if the magnitude of the benefits and the efficiency of the service provision were greater. The collection of additional outcome and service use data, including follow-up of community patients who participated in the study may provide an alternative view on cost-effectiveness.

Costs to pharmacy

This evaluation represents the first real systematic attempt to explore the costs to pharmacy of providing DAAs in a community setting. The key findings are:

- It costs $55,769 to supply DAAs to 30 community customers for one year, compared with $28,282 to supply 30 community customers with OPs.
- The cost difference (cost of DAAs minus OPs) of $27,487 for 30 customers per year is largely attributable to the labour costs involved in packing and checking DAAs.
- Providing DAAs to 30 community customers requires approximately eight hours (one full day) of staff time per week.
- This burden is only increased by providing prescription management, delivery and account management (as is currently provided to the majority of DAA customers and a minority of OP customers).
- The additional cost of providing DAAs to community customers equates to $17.62 per customer per week.
- Pharmacists bear a shortfall of an average of $14 per DAA customer per week, despite pharmacists’ reports of charging community customers an average of $3.50 per week.

**Benefits of DAAs**

The costs of DAA provision may be offset by the benefits to the customers (measured by willingness to pay) and the potential savings to the healthcare system due to the prevention of ADRs. These benefits and their values include:
- A difference in the rate of ADRs between customers using OPs and DAAs of 15% that translates to a potential saving for the DAA group of $15,316 in one year.
- A willingness to pay a mean of $5.25 per DAA/per week by community customer. This equates to a total of $8,190 per 30 customers per year.

**Cost-benefit ratio**

The costs of providing DAAs to 30 community customers, however, outweighed the benefits of DAAs by $3,982 per year (see Figure 2).

<table>
<thead>
<tr>
<th>Cost to pharmacy</th>
<th>Cost-savings to Government</th>
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<tbody>
<tr>
<td>Providing DAAs to 30 community patients/ year</td>
<td>DAAs preventing 15% of ADRs</td>
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<tr>
<td>=Cost DAA-Cost OP</td>
<td>Healthcare OP-Healthcare DAA</td>
</tr>
<tr>
<td>=-$27,487</td>
<td>=$15,316</td>
</tr>
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<table>
<thead>
<tr>
<th>Benefits to customers</th>
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<tr>
<td>Measured by willingness to pay (WTP)</td>
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<tr>
<td>=$5.25 x 30 x 52</td>
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<tr>
<td>=$8,190</td>
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<p>| |</p>
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<th></th>
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<tbody>
<tr>
<td>= -$3,982</td>
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Figure 1  Cost-benefit ratio components and results based on 30 community customers using pharmacy supplied DAAs

In conclusion, pharmacists are to be commended for providing a community service in response to customer demand, at a financial loss to themselves.
3. ARE DAAs EFFECTIVE IN THE RCF SETTING?

All stakeholders believe DAAs are effective in the RCF setting. Indeed, DAAs are presently used in the majority of RCFs in Australia. Unfortunately, this has created the limitation that we could not identify a sufficient number of controls to do a robust comparison between DAAs and original packs. Hence, the emphasis in this study has been on identifying issues in current practice that could be improved upon, and criticisms regarding the effectiveness of DAA systems.

Given the high uptake of DAAs in the RCF setting, the question becomes: “Can DAAs be used more effectively in the RCF setting?” As shown in Figure 2, there are a number of areas where DAA use is effective, and areas where DAA use could be improved. The benefits of DAAs reported by nurses include:

- DAAs reduce administration errors.
- DAAs save nurses’ time (3.51 minutes to administer per resident when using DAAs compared with 5.18 minutes per resident using OPs).
- DAAs ease the burden of medication management (i.e. ordering and prescription management).

The key issues to be addressed in the RCF setting include packing error rates, payment for DAA services and the professional deskilling of Registered Nurses (RNs). The following evidence indicates that packing errors may be a significant problem in the RCF setting:

- Directors of nursing (DONs) reported a packing error rate of 1.4%.
- Observations of DAA packs and residents charts indicated a packing error rate of 3.1%.
- Nurses reported a mean confidence level of 76.4 that the DAAs provided by the pharmacy would be error free (0 = not at all confident, 100 = completely confident).

The provision of DAA services by pharmacy was undervalued by the facilities. Only 57.8% of facilities reported that the pharmacy was paid for DAA services. Of the facilities that did pay, depending on whether the charge was per pack or per patient, the average amount paid was $1.73 per pack per week or $3.32 per week per resident. Only 61.5% of RCF staff believed that the pharmacy should be paid for the provision of DAA services, despite high levels of reported satisfaction with DAA services.

In conclusion, we observed that DAAs are highly relied upon in the RCF setting. The value of this service is not recognised financially, however, as evidenced by the low rate of payment for the service. This problem is compounded by pharmacies discounting their services in order to win and/or retain RCF contracts.
### Clinical Measures

- No difference in the risk of administration errors found between RCFs using DAAs and RCFs not using DAAs.
- In RCFs using DAAs there was a difference between the DONs estimates of packing error rate (1.39%) and the observed packing error rate (3.1%).
- The most common errors when DAAs were used included wrong dose/drug packed in DAA, and incorrect number of medications packed in DAA.

### Functional Measures

- No difference in confidence levels of nursing administering from DAA vs. original packs.
- DAA vs. Non-DAA: Medication administration time per patient less with DAAs (3.51 minutes) than original packs (5.18 minutes).
- No difference in time required for RCFs to receive medications (189.17 minutes on main delivery day).
- No difference in time spent ordering medications each week (4.87 hours) and time spent signing prescriptions each week (1.54 hours).
- DAAs vs. Non-DAA: RCFs using DAAs less likely to have an imprest than RCFs using DAAs.

### Satisfaction

- Overall, nurses using DAAs are satisfied with them.
- Nurses’ confidence that DAAs will be packed without error (76.36/100).
- DAAs vs. Non-DAA: Nurses reported that DAAs reduce errors, save time and ease medication management.
- 69.8% of pharmacies said that DAA use had improved their relationship with RCFs.

### Cost

- 58.33% of RCFs using DAAs paid for the service.
- Average amount paid is $1.73 per pack per week or $3.32 per patient per week.
- 33% of pharmacies charge RCF patients directly, mean charge is $2.86 per week.
- 61.5% of RCFs think they should pay for DAAs (50% of these favour government subsidisation).
- 100% of pharmacies believe they should be paid for providing DAAs.

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**Figure 2** Summary of results of the effectiveness of DAAs in the RCF setting presented using a clinical value compass framework

### 4. ARE DAAS COST-EFFECTIVE IN THE RCF SETTING?

The use of DAAs in the RCF setting is cost-effective. When the costs of providing medicines to residents using DAAs from the pharmacist and the RCF perspective are summed and compared with the costs for providing OPs, DAAs are the lower cost alternative.

#### Costs to pharmacy

This evaluation represents the first real systematic attempt to explore the costs to pharmacy of providing DAAs in a RCF setting. The key findings are:

- It costs $175,704 to provide DAAs to 120 residents in 2 facilities for one year, compared with $109,127 to supply 120 residents with OPs.
- The cost difference (cost of DAAs-OPs) of $66,576 for 120 residents per year equates to $10.67 per resident per week.
- This difference is largely attributable to the labour costs involved in packing and checking DAAs. Providing a DAA service to 120 residents at 2 facilities requires approximately 22 hours of staff time per week.
Pharmacists supplying DAAs to RCFs are out-of-pocket an average of $7.66 per resident per week, even after accounting for the 60% of facilities/residents that reported paying an average of $3.01 per resident per week.

**Costs to RCFs**
The provision and administration of medication to residents in the RCF is also labour intensive and costly to the facility. The key findings are:

- It cost $236,724 to administer medication in DAAs to 120 residents at two facilities for one year, compared with $388,609 to administer to 120 residents with OPs, at two facilities.
- The cost difference (cost of DAAs minus OPs) of -$151,884 for 120 residents per year is largely attributable to the labour costs involved in administering medication rounds.
- Administering medication using DAAs to 120 residents at two facilities requires approximately 143 hours of staff time per week, compared with 210 hours when OPs are used.
- Using DAAs may allow for the redirection to other areas of 67 hours per week of nursing staff time.

**Cost minimisation**
Cost minimisation analysis indicated that using DAAs compared with OPs resulted in a saving of $85,307 per year for 120 residents or a saving of $710.90 per resident per year. However, the use of DAAs resulted in a cost-shift as the proportion of the total costs borne by the pharmacy and RCF was dependent on whether DAAs or OPs were used. With OPs, pharmacies bear 22% of the total costs of providing medication to residents whereas when DAAs are used, the pharmacy bears 43% of the total costs (see Figure 4).

**Figure 3** Summary of the cost-minimisation results indicating overall savings for DAAs and a shift in costs between the pharmacy and RCF

In summary, there is a reduction in the total costs to facilities when DAAs are used over original packs. However, the proportion of cost borne by the pharmacy is much greater.
5. WHAT ARE THE REQUIREMENTS FOR BEST PRACTICE DAA PROVISION?

Presently, while there are a range of guidelines and standards that relate to DAA use, there are no specific best practice guidelines for DAA provision. The quality of DAA services currently provided by pharmacies is inconsistent and does not conform to all Pharmaceutical Society of Australia (PSA) guidelines and PSA/Quality Care Pharmacy (QCP) standards. We found that the majority of pharmacies performed two functions of DAA provision in a consistent manner and to a high standard. These were:

- The provision of DAAs to RCFs and community patients in a timely manner.
- The packing of DAAs no more than four weeks in advance.

The majority of pharmacies, however, were inconsistent in performing many of the functions related to DAA provision. The areas where improvement is required are:

- RCF staff and community patients received inadequate training in the use of DAAs.
- The frequency and quality of communication between pharmacies, patients, RCFs and GPs regarding medication changes was inadequate.
- DAA packing sessions did not optimally utilise the skills and experiences of pharmacists, and in some cases packing sessions were unsupervised.
- During packing sessions, pharmacists and pharmacy staff had limited resources to refer to regarding the effect of DAAs on the stability of many medications.
- The amount of information placed on the labels of DAA packs varied greatly.
- In a number of pharmacies and community patients’ homes, DAA packs were not stored under recommended conditions.
- Some pharmacies packed ‘as needed’ medications (also known as PRN medications) in multi-dose DAAs and re-used PRN medication that had been returned to the pharmacy.

In conclusion, pharmacies are performing some of the tasks of DAA provision adequately, but are not compliant with many of the current guidelines. A synthesis of the above findings was used to develop a preliminary best practice model with the goal of resolving some of the effectiveness and practice issues surrounding DAAs in the community. There are three key aspects to this best practice model.

1. A tri-partisan agreement between the pharmacy, patient/carer and GPs/specialists with the goal of formalising the obligations and expectations of the parties.
2. The model requires the development of a template by the pharmacist, in conjunction with other stakeholders, for the packing and checking of patient DAAs. This template will reflect the patient’s optimal medication schedule, to maximise therapeutic benefits and minimise risks. This template would be approved by all stakeholders and be subject to regular update and six-monthly review.
3. The patient or carer is given a responsibility of ensuring the template reflects current medication status. This strategy encourages the patient to take ownership of their medication management and is a valuable resource to enhance patient medication knowledge. Where the patient is unable to perform this role, a carer or family member would act as a proxy. Copies of the templates would also be held by the patient’s pharmacy and doctor(s).
The best practice implementation model is presented in Figure 4.

![Diagram of best practice model for the operation of a DAA service for community patients]

**Break out box**

<table>
<thead>
<tr>
<th>Issues to address in agreement</th>
<th>Obligations of parties - examples</th>
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<tbody>
<tr>
<td>In simple language</td>
<td>Pharmacy to prepare packs at agreed interval (frequency &amp; period in advance of distribution)</td>
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<tr>
<td>Explanation of how service expected to work</td>
<td>Any additional support services e.g. education, Home Medicines Review the pharmacy agrees to provide</td>
</tr>
<tr>
<td>Patient consent to service and necessary information sharing between GP &amp; pharmacy</td>
<td>GPs responsibilities for owing prescriptions &amp; prescription continuity (e.g. writing repeat prescriptions without patient consultation) including timeliness of prescription receipt</td>
</tr>
<tr>
<td>Patient, GP and pharmacy agreement to service obligations</td>
<td>Pharmacy processes negotiated to fit in with GP practice</td>
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<tr>
<td>Agreed cost of service including any GP costs as negotiated</td>
<td>Address GP expectations for payment &amp; who will pay if any cost</td>
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<tr>
<td>Billing/account aspects</td>
<td>Patient &amp; GP to give timely notification of pharmacy of any medication changes including those that do not generate a prescription e.g. ceasing a medication</td>
</tr>
<tr>
<td>Where prescriptions and original packs physically stored</td>
<td>Patient/carer &amp; GP to maintain patient held template</td>
</tr>
<tr>
<td>Is pack to be collected or delivered (address timeliness &amp; exception procedures)</td>
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<tr>
<td>How medication regimen changes to be handled</td>
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<td>Duration of agreement &amp; an understanding that the situation to be reviewed every 6 months</td>
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**Figure 4** Best practice model for the operation of a DAA service for community patients
RECOMMENDATIONS

The key recommendations with respect to the RCF setting are:

- Reimbursement of pharmacies for the provision of DAA services to RCFs, at a rate that reflects the true cost of this service.
- Pharmacies and RCFs collaborate to develop standard operating procedures with the goal of optimising the efficiency and effectiveness of DAA provision.

The key recommendations for DAA use in the community setting are:

- DAA services be targeted to community patients who will benefit most from their use.
- The strategies outlined in the best practice model for overcoming problems in DAA provision are implemented.
- Further evaluation of the cost effectiveness of DAAs in the community setting be conducted utilising Health Insurance Commission (HIC) (including Pharmaceutical Benefits Scheme (PBS) and Medical Benefits Scheme (MBS) data), and community service use data reported by community patients. This may provide a more accurate estimate of the magnitude of potential savings to the healthcare system arising from the use of DAAs.