KNMP – The potential for pharmaceutical quality services
Context

- The KNMP has asked Booz & Company to assess the revenue potential for quality based services for pharmaceutical care in The Netherlands.

- This document represents the draft deliverable for phase 1 that was agreed between KNMP and Booz & Company – It provides a quantitative view on the cost savings potential for health insurers if pharmacy quality services are implemented on a large scale.

- The KNMP can approve a next phase of the study: a combined stakeholder analysis and high-level implementation plan.
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Executive Summary (1/6)

This report evaluates the potential for investing in quality services of pharmacists

Pharmacists generate income based on the quantity of prescriptions they provide to patients, which includes the prescription fee and trade margin. This year the NZa introduced new performance definitions that allow health insurers to pay pharmacists for quality services in addition to the traditional prescription fee. The new performance definitions allow pharmacists to invest more time in their role as care provider.

High quality pharmaceutical care not only offers value for patients, but can also save costs in other parts of the health care system. Our analysis shows for example that corrections of doctor prescriptions by pharmacists save €120–160 million in short term acute hospitalizations.

Pharmacists face increasing revenue pressure because of declining trade margins and a recent decrease in medication sales. Smaller margins increase the need for efficiency but increasing efficiency typically results in less time spent per patient, leading to a decline in quality of pharmaceutical care. This can in turn lead to an increase in total health care costs due to more medication errors and more hospitalizations caused by adverse drug reactions.

The KNMP has asked Booz & Company to explore the cost saving potential of additional pharmaceutical quality services. The analysis can serve as a basis for contracting discussions between pharmacists and health insurers. The report is limited to the quantification of benefits from additional pharmaceutical quality services. It does not address the costs of the implementation of the quality services.
Executive Summary (2/6)

Our analysis indicates € 500–750 million value of pharmaceutical quality services

Booz & Company evaluated the potential for three quality services that can be delivered in addition to the quality services associated with medication dispensing.

– Medication reviews for patients above 65 that are using five or more medications
– Pharmaceutical support of patients following hospital discharges
– Pharmacist support to encourage therapy adherence for heart disease, diabetes and COPD/Asthma

Our macro estimates are based on the extrapolation of a large selection of individual studies

We identified the main drivers of potential cost savings for each of the three quality areas such as the reduction in hospitalizations due to medication reviews. We reviewed national and international scientific research to assess the potential cost savings. The studies were weighted according to perceived relevance for a broad patient population.

The studies showed a wide variation in results. Differences may be attributable to (1) differences in the design of the intervention (e.g. regular phone calls or group session to follow up therapy adherence), (2) differences in patient groups (e.g. patients in elderly homes or patients living at home), (3) differences in countries or (4) differences in the leading actor (e.g. a community pharmacist or a clinical pharmacist).
Executive Summary (3/6)

Based on the results of individual studies we defined a range of what is plausible in the Netherlands. Our assessment was based on a weighted average of the study results, on the conservative side of the range. Combining the results from scientific studies with Dutch market data (such as the number of hospitalizations, number of patients etcetera) we derived macro estimates for the total cost saving potential. The range of these figures reflects the uncertainty that is associated with extrapolating results from individual studies. Further research is needed in this area, in particular in the Netherlands. The lack of local data forced us to develop estimates based on national and international studies. International results are not necessarily fully achievable in the Netherlands. Hence, we took a conservative approach in our estimates.

Medication reviews for patients above 65 that are using multiple medications

In a medication review, a pharmacist typically performs an overall assessment of the appropriateness of the combined medication usage of a patient. In the literature, medication reviews are recommended for patients over the age of 65 and for those who use 5 or more medications. This group accounts for the lion share of medication usage as more than 50% of all medication is prescribed for people aged 65 and above. Further, more than 90% of all medication costs for people over the age of 65 are in the group of patients using 5 or more medications. A comprehensive medication review will improve overall medication appropriateness for patients (as measured by the Medication Appropriateness Index) and is shown to lead to a decrease in drug related problems.
Executive Summary (4/6)

Our analysis indicates a €150–200 million potential in cost savings gained from medication reviews. The first driver of cost savings is a reduction in medication costs. Scientific studies suggest that on average 10-12% of medications are discontinued safely as a result of medication reviews. The second driver is prevention of hospitalizations. Research indicates that medication reviews contribute to a 15-17% decline in hospitalizations relating to Adverse Drug Related events. The current analysis excludes less direct adverse effects of medication interaction such as the impact of medication on the effectiveness of chemotherapy.

Pharmaceutical support of patients after hospital discharges (continuity of care)

Pharmaceutical support after hospital discharges aims to optimize patient transition between different providers of health care. Hospitalizations often lead to substantial changes in the medication profile of patients, and create a need for pharmaceutical support. Pharmacist-led continuity of care interventions are shown to improve appropriateness of medication and reduce preventable adverse drug events after discharge.

Our assessment of the cost saving potential in this area is €100–160 million. The main driver for cost savings for pharmaceutical support after hospital charges is the prevention of repeat hospitalizations. Scientific studies suggest that the hospitalization risk can be reduced by 35 to 50%. Any cost benefits from discontinuing medication or from switching to cheaper alternative medications have not been included in the assessment.
Pharmacist support in encouraging therapy adherence

Non-adherence to therapy is a common and persistent problem in health care. Our health care system is more focused on identifying health problems and selecting the most appropriate treatment, than on ensuring that prescribed therapies are followed-up appropriately. In research literature there are many examples of diseases programs focused on improving medication adherence. They show a variety of interventions, such as education, monitoring, proactive follow-up, counseling or innovations in packaging. These interventions may have specialists, GPs, nurses or pharmacists in the lead. Disease programs where pharmacists are in the lead are shown to be effective in improving therapy adherence.

In this study we focused on three significant diseases where medication therapy plays an important role: heart disease, diabetes, asthma / COPD. Therapy adherence is associated with lower hospitalization risk on the short term, and in the long term, it also reduces the likelihood of complications (few peer reviewed studies quantify this effect). In this study we take a conservative view on the total potential given the focus on three diseases and the focus on short term hospitalization risks only (i.e. 1-2 years in most studies). An indicative calculation suggested that in diabetes alone there could be an additional € 150 million potential for long term complication reduction.

Our assessment is that € 250-400 million potential cost savings in short term hospitalizations can be realized with therapy adherence programs for the selected diseases. These potential savings take into account a corresponding increase in medication costs, as we have assumed that extra medication administered will also lead to additional medication sold instead of reduction of unused medication waste.
We leveraged studies that indicate the results of adherence improvement interventions and studies that compared hospitalizations of patients that are adherent above a certain threshold with patients that are less adherent than the threshold. Although the latter studies do not provide direct evidence that interventions do improve adherence, they provide a good indication about the potential of improved adherence. In particular, studies indicate that adherence improvement interventions can reduce short-term hospitalizations by 15-25% for heart disease, 25-45% for diabetes and 20-60% for Asthma / COPD patients.

A compelling long-term vision, no quick changes

This potential is neither easy nor quick to realize. Firstly, it will require incentive models that allow pharmacists to invest in these initiatives. Time availability is a serious constraint. Secondly, it will require incentive models for general practitioners and hospitals that reward collaboration with pharmacists. Lastly, it will require a long-term integral view on care contracting. A positive business case on a per-patient basis does not guarantee positive macro-level results. Even if benefits from fewer hospitalizations and fewer complications are realized on a per-patient basis, hospitals may reallocate resources to the treatment of other patients, obscuring any macro benefits.

Australia, Germany, UK and Denmark have already made steps in remunerating quality services. The potential for wins in quality and wins in long-term cost can and should underpin a compelling long-term vision in health care in the Netherlands as well.
Dispensing medications generate pharmacist revenues

Pharmacy Remuneration
2010 in € MN

<table>
<thead>
<tr>
<th>Description</th>
<th>2010 in € MN</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prescription fee</td>
<td>1,232</td>
</tr>
<tr>
<td>Non-WMG</td>
<td>37</td>
</tr>
<tr>
<td>Total</td>
<td>1,269</td>
</tr>
</tbody>
</table>

Per Pharmacy
2010, in €

| 1) Prescription fee | € 623,000 |
| 2) Non-WMG          | € 18,000² |
| Total               | € 641,000 |

Drivers

- 183 MN prescriptions
- Maximum remuneration €7.91 per prescription
- 8 MN prescriptions (at a trade margin)

1) 1980 pharmacies in Netherlands in 2010 (SFK, 2011)
2) Buiten-WMG margin based on G-standard selling price. In practice margin likely to be lower

Source: SKF Data en Feiten (2011), Booz & Company analysis
There is a risk that increasing revenue pressure on pharmacists crowds out time for quality

The Dysfunctional Circle of Efficiency May Lead to Less Time for Quality and Higher Costs

- Higher Cost (e.g. Unnecessary Medication, Hospitalizations)
- Reduced Medication Appropriateness and Patient Support
- Less Time per Patient for Pharmaceutical Care
- Increased Dispensing Efficiency Compensates for Lower Remuneration
- Lower Dispensing Remuneration

Less Time for Quality Can Lead to Higher Overall Health Care Costs

- Cost for unnecessary medication
- Hospitalizations as result of drug related events
- Doctor visits due to drug related events

Higher Cost
Although quality is not directly rewarded, pharmacists already create substantial value with quality interventions

Pharmacist Interventions Improve Quality of Medication Prescriptions

- Pharmacist intervene with a frequency of **4.3% of all prescriptions**, yielding an average of 14.3 adjustments per pharmacy (Buurma, 2004)
- Pharmacist medication review on evidence based guidelines strongly improves the **appropriateness of medication** (Gallagher, 2008)
- Medication reviews **lower the number of medication related hospitalizations** especially for patients with multi-morbidity - factor 2 reduction on average (Leendertse, 2008)
- Pharmacist interventions **reduce drug related problems in elderly patients** (>65 years) by 16.3% (Vinks, 2009)

Pharmacist Interventions Improve Health and Avoid Drug Related Problems

- **In >50% of the cases**, pharmacist intervention on a prescription is aimed at **preventing a drug related issue** – in half of the cases the prevented drug related issue would have had severe consequences (e.g. hospital admission) (Buurma, 2004)
- **In elderly patients** (>70 years) nearly **half of the medication could be safely discontinued**; successful discontinuation of medication is likely to improve health in 88% of cases (Garfinkel, 2010)
- Medication reviews could yield **over 94 MN** in the Netherlands through a reduction of hospitalizations (Leendertse, 2012)
Currently, prescriptions that are positively modified by pharmacists avoid €120 – 160 MN in drug related hospitalizations.

**Current Value Added through Modified Prescriptions**

In €

- **Economic Value Prevented Hospitalizations** ~€110–150 MN
- **Economic Value Prevented Primary Contacts** ~€10 MN
- **Prevention of Hospitalization** 3%4)
- **Average Cost per Hospitalization** €3,816–5,4613)
- **# of Interventions that Prevented an ADR** ~936,000
- **Prevention of Primary Care Contact** 13%4)
- **Average Cost Primary Care per Patient** €77.023)
- **# of Prescriptions Annually** 191 MN1)

**Interventions Aimed at Preventing ADRs**

- **Prescriptions Positively Modified** 0.49%2)
- **Interventions Positively Modified** 49%

**Total Economic Value Added** ~€120–160 MN

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1) SFK data en feiten (2011)
2) Buurma (2004)
3) CVZ handleiding kostenonderzoek, Leendertse (2008)
4) Westerlund (2009)
5) CVZ kosten per verzekerd exclufief inschrijfgeld (2011)

Source: Booz & Company analysis
But there is strong potential for increased focus on quality – e.g. 40-60% of medication related hospitalizations is preventable.

**Drug Related Hospitalizations**

% Preventable Drug Related Hospitalizations

<table>
<thead>
<tr>
<th>Source</th>
<th>Category</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Beijer (2002)</td>
<td>Elderly</td>
<td>87 – 88.5%</td>
</tr>
<tr>
<td>Lindley (1992)</td>
<td>Elderly</td>
<td>50%</td>
</tr>
<tr>
<td>HARM (2006)</td>
<td>All</td>
<td>46%</td>
</tr>
<tr>
<td>Bates (1995)</td>
<td>All</td>
<td>28%</td>
</tr>
<tr>
<td>Beijer (2002)</td>
<td>Non-Elderly</td>
<td>24%</td>
</tr>
<tr>
<td>Weighted Average</td>
<td></td>
<td>40 - 60%</td>
</tr>
</tbody>
</table>

1) Percentage from total drug related admissions

Studies suggest that more time for pharmaceutical quality could have a large savings potential in other health care costs

Example Assessment for Preventing Hospitalizations
Potential Additional Savings, In € MN

**Leendertse (2012): EUR 96 MN**
- Retrospective study to determine the percentage of drug related hospitalizations in 4 hospitals in the Netherlands
- From screening of *unplanned admissions*, 5.6% was related to an adverse drug event (ADE); 46.5% of these hospitalizations was assessed to be preventable

**Beijer (2002): EUR 390-490 MN**
- Meta-analysis to determine percentage of drug related hospitalizations based on meta-analysis
- Drug related hospital admissions account for approximately 15 – 20% of total hospital admissions, of which ~50% was said to be preventable

Note: Savings calculation based on total population, not elderly patients exclusively; differences in study outcome likely due to definitions of numerator/denominator
Source: Leendertse (2012), Westerlund (2009), Beijer (2002), Booz & Company analysis
Since 2012, there are possibilities for health insurers to pay pharmacists for additional quality services

Performance Definitions NZa

1. Medication Dispensing (receptregel)
   - Distribute prescription medication in standard/weekly form
   - Check correctness/safety of prescription

2. Medication Instructions
   - Provide usage instructions in case of first time issuance or non-compliance with user instructions

3. Medication Review
   - Periodically review individual (elderly) medication therapy of patients with chronic medication use

4. Continuity of Care Hospitalization
   - Conduct one-on-one interview with patient
   - Ensure correct transition of medication details to other providers of care

5. Continuity of Care Discharge
   - Conduct one-on-one interview with patient
   - Provide clear guidance on medication therapy, incl. changes due to hospitalization

6. Self Management Education
   - Provide education in group format on self-management to optimize medication utilization (medication adherence/utilization)

7. Self Management Counselling
   - Provide counselling per individual patient’s request on potential drug-drug interactions in medication therapy (e.g. combination prescription/OTC)

8. Medication Related Travel Counselling
   - Provide counselling per individual patient’s request on medication utilization and storage during travelling

9. Disease Prevention Travel Counselling
   - Provide information per individual patient’s request on risk of diseases for certain travel destinations

10. Mutual Services
    - Support other healthcare providers in execution of activities as defined under performance definitions
We have assessed the cost savings potential of quality services across the entire value chain

Key Areas of Added Value in the Medication Process

<table>
<thead>
<tr>
<th>Medication Process</th>
<th>Quality Service</th>
<th>Description</th>
<th>Driver of Revenue</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Medication Dispensing</td>
<td>Distribute prescribed medications and provide user instructions (identify medication errors if applicable)</td>
<td>▪ Quantify of distributed medication</td>
</tr>
<tr>
<td></td>
<td>Medication Review</td>
<td>Pharmaceutical evaluation of medication through periodic assessment of individual patients’ pharmacotherapy</td>
<td>▪ Decrease in unnecessary medication per patient ▪ Decrease in hospitalizations</td>
</tr>
<tr>
<td></td>
<td>Disease Programs</td>
<td>Provide chronic disease patients with continuous support to increase therapy adherence and to stimulate self-management</td>
<td>▪ Increase in therapy adherence ▪ Decrease in hospitalizations ▪ Decrease in doctor visits</td>
</tr>
<tr>
<td></td>
<td>Care Transition (Hospitalization)</td>
<td>Provide overview of medication pre-hospitalization and closely track required medication post-hospitalization</td>
<td>▪ Decrease in re-hospitalizations ▪ Decrease in primary care visits</td>
</tr>
</tbody>
</table>

Source: Prestatiebeschrijvingbeschikking NZA, Booz & Company analysis
The quality services captured in this study capture six of the NZa performance definitions:

**Quality Service** | **Matching NZa Performance Definition**
---|---
Medication Review | 3. Medication review
Continuity of Care | 4. Continuity of Care Hospitalization
| 5. Continuity of Care Discharge
Disease Programs | 2. Medication Instructions
| 6. Self Management Education
| 7. Self Management Counselling
Medication Dispensing | 1. Prescription fee (receptregel)
Other | 8. Medication related travel counselling
| 9. Diseases prevention travel counselling
| 10. Mutual services
Our estimates are based on findings from peer reviewed studies and public statistics – 3 Step approach

**High Level Approach**

- **Step 1: Literature Research**
  - Defined key quality and cost metrics to study (e.g. medication appropriateness, reduced number of hospitalizations)
  - Defined a list of (national and international) scientific studies for each of the quality services based on the defined metrics

- **Step 2: Evaluation of Studies**
  - Selected metrics that can be translated into cost estimates
  - Weighted studies based on relevance to the business case
    - E.g. extent to which study population is representative for a broad age-based population, extent to which a community pharmacists as in the lead, study size
  - Assessed an appropriate range to extrapolate

- **Step 3: Quantify Macro Potential**
  - Extrapolated results to relevant Dutch population to estimate macro potential for the large scale roll-out of such interventions
    - Based on relevant metric ranges from step 2
    - Based on public statistics (e.g. average medication cost, and average cost of hospitalizations)

**Implications**

- **We leverage national and international experience for the Dutch Context**

- **We assess the potential, not the how** (e.g. we do not assess how therapy adherence can be improved). The how might vary depending on pharmacist preferences

- **We extrapolate small scale results to the macro level** (assuming that what can be proven to be achieved on a small scale setting can be achieved on a larger scale)
Focusing on quality of pharmaceutical services could deliver EUR 500 – 750 M savings throughout the heath care system.

Potential Quality Services

<table>
<thead>
<tr>
<th>Service</th>
<th>In € MN</th>
</tr>
</thead>
<tbody>
<tr>
<td>Medication Review</td>
<td>150-200</td>
</tr>
<tr>
<td>Continuity of Care</td>
<td>100-150</td>
</tr>
<tr>
<td>Therapy Adherence (Heart Diseases, Diabetes, Asthma COPD)</td>
<td>250-400</td>
</tr>
<tr>
<td>Total</td>
<td>500-750</td>
</tr>
</tbody>
</table>

Excluding the cost related to providing the service.

Note: Numbers rounded
Source: Booz & Company analysis
Pharmacies could add substantial value with quality services on top of current dispensing revenues

Potential Quality Services Per Pharmacy

<table>
<thead>
<tr>
<th>Service</th>
<th>Indicative Potential Per Service Delivery</th>
<th>Quantity of Service Per Pharmacy (estimated)</th>
<th>PER PHARMACY</th>
</tr>
</thead>
<tbody>
<tr>
<td>Distribution</td>
<td>~€150$^1$</td>
<td>650-650$^1$ reviews</td>
<td>~641</td>
</tr>
<tr>
<td>Medication Review</td>
<td>~€200$^2$</td>
<td>~300 hospitalizations leading to changes in medication profile</td>
<td>75-100</td>
</tr>
<tr>
<td>Continuity of Care</td>
<td>~€150-300$^3$</td>
<td>Number of eligible chronically ill of patients (e.g. 140 diabetes patients on insulin)</td>
<td>55-75</td>
</tr>
<tr>
<td>Therapy Adherence</td>
<td></td>
<td></td>
<td>130-200</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td></td>
<td>~900-1,000</td>
</tr>
</tbody>
</table>

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1) Based on total number of elderly with polypharmacy
2) One-third of hospitalizations are for elderly (600,000 in The Netherlands per year, CBS) of which 50% is estimated to lead to a medication change (Mansur 2008). 50% of medication cost is with people under 65 (SFK, 2011). Hence total number of hospitalization leading to change in medication profile estimated at ~ 600,000
3) Depending on disease and eligibility criteria (numbers are indicative for inclusion therapy adherence for diabetes insulin patients and for all COPD / Asthma patients)

Source: Booz & Company analysis
Quality service provide a compelling visions for long term earning models, but savings are neither quick nor easy to realize

Requirements

- Incentive models that reward pharmacists to invest in quality services
  - Time available for pharmacists for quality services is constrained
  - Remuneration is needed to allow pharmacists to invest time and resources in quality services
  - *Illustrative calculation:* Assuming that a pharmacist would spend 2 days a week on additional quality services, he could do 4 medications reviews, this would lead to 150-200 medication reviews per year, and no time for other quality services

- Incentive models for general practitioners and hospitals that reward collaboration with pharmacists
  - Collaboration with other care providers is needed and desired

- A long-term integral view on care contracting of insurers
  - A positive business case on a per-patient basis does not guarantee positive macro-level results. Even if benefits from fewer hospitalizations and fewer complications are realized on a per-patient basis, hospitals may reallocate saved resources to the treatment of other patients, obscuring any macro benefits.
Business Case for Value Added Services

Detailed Business Cases

– Medication Review
– Continuity of Care
– Therapy Adherence

International Context

References
Medication review is typically targeted at elderly polypharmacy patients

Distribution of # of Medicines Per Age
% Age Category, 2009

Cost of Medication 65+
Per # of Medication

<table>
<thead>
<tr>
<th>Age Category</th>
<th>0 Medications</th>
<th>1-4 Medications</th>
<th>≥ 10 Medications</th>
<th>Total Costs</th>
</tr>
</thead>
<tbody>
<tr>
<td>65-74 year</td>
<td>22%</td>
<td>40%</td>
<td>8%</td>
<td></td>
</tr>
<tr>
<td>75-84 year</td>
<td>19%</td>
<td>30%</td>
<td>16%</td>
<td></td>
</tr>
<tr>
<td>85+ year</td>
<td>31%</td>
<td>21%</td>
<td>20%</td>
<td>€ 1.9 BN</td>
</tr>
<tr>
<td></td>
<td>100%</td>
<td>100%</td>
<td>100%</td>
<td>1-4 Medications</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Total Costs</td>
</tr>
</tbody>
</table>

Source: van Dijk (2009), SFK (2011), Booz & Company analysis
Medication reviews will improve overall medication appropriateness for patients

<table>
<thead>
<tr>
<th>Medication Appropriateness Score (MAI)(^{1,2})</th>
<th>Study Population</th>
<th>Methodology</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean Change in MAI Score</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Crotty (2004a)</td>
<td>4.51</td>
<td>110 adults, mean age 82.7 years</td>
</tr>
<tr>
<td>Crotty (2004b)</td>
<td>3.56</td>
<td>10 high-level aged care facilities, 154 residents experiencing medication problems / challenging behaviours</td>
</tr>
<tr>
<td>Spinewine (2007)</td>
<td>18.98</td>
<td>203 patients receiving geriatric care by a specialist clinical pharmacist, Age &gt; 70 years</td>
</tr>
<tr>
<td>Hanlon (1996)</td>
<td>4.30</td>
<td>208 elderly outpatients receiving care at Veterans Affairs Medical Center, Age &gt; 65 years with at least 5 chronic medications</td>
</tr>
</tbody>
</table>

EXAMPLES

1) Selection based on Cochrane review by Patterson (2012) on interventions to improve appropriate use of polypharmacy
2) Medication Appropriateness Index based on 10 dimensions to determine in appropriate prescribing – positive change indicates increased appropriateness, see appendix for more details
3) Geriatric Evaluation and Management

Medication review has a potential €150–200 MN in reducing drug costs and preventing hospitalizations

Source: Booz & Company analysis
Large scale medication reviews will lead to €95–110 MN cost savings on medication only

Direct Savings Potential Medication Review

Maximum Savings Potential Through Medication Reviews ~ €95–110 MN

2) SKF data en feiten (2011)
3) van Dijk (2009)
Source: Booz & Company analysis
Medication reviews on average lead to a $10-12\%$ reduction of the number of medications per patient.
Study outcomes were weighted to account for differences in intervention, setting and population across studies.

<table>
<thead>
<tr>
<th>Category</th>
<th>Description</th>
<th>Ranking</th>
</tr>
</thead>
</table>
| Population     | Accounts for differences across study population such as community patients vs. hospitalized patients | 2 – Community / long term care facility  
                |                                                                                   | 1 – Clinical patients                                 |
| Intervention   | Accounts for differences in interventions to better measure the effect of medication reviews vs. a more broad intervention | 2 – Medication Review  
                |                                                                                   | 1 – Broader Intervention incl. medication review       |
| Representation | Accounts for differences in size and thus representativeness of study population across the different studies | 3 – Population > 500  
                |                                                                                   | 2 – Population 300 - 500  
                |                                                                                   | 1 – Population <300                                       |
### Details on Medication Reduction (1/3)

<table>
<thead>
<tr>
<th>Medication Reduction</th>
<th>Study Population</th>
<th>Methodology</th>
<th>Weight¹)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Spinewine (2007)</td>
<td>203 patients receiving geriatric care by a specialist clinical pharmacist</td>
<td>Tested effect of pharmaceutical care on Geriatric patients in addition to acute Geriatric Evaluation and Management</td>
<td>1.0</td>
</tr>
<tr>
<td></td>
<td>Age &gt; 70 years</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Garfinkel (2010)</td>
<td>Community dwelling patients</td>
<td>Determined drug discontinuation based on Good Palliative-Geriatric Practice</td>
<td>1.7</td>
</tr>
<tr>
<td></td>
<td>Mean Age = 82.8 years</td>
<td>Mean follow up time of 19 months</td>
<td></td>
</tr>
<tr>
<td>Williams (2004)</td>
<td>Community dwelling patients</td>
<td>Determined effect of medication review on regimen changes for polypharmacy patients in ambulatory clinic</td>
<td>1.7</td>
</tr>
<tr>
<td></td>
<td>&gt; 5 medications</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Total population 133</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Taylor (2003)</td>
<td>69 medically underserved patients in Alabama (USA)</td>
<td>Researched effect pharmaceutical care on prevention / detection of medication related problems on high risk patients</td>
<td>1.3</td>
</tr>
<tr>
<td></td>
<td>High risk of medication issues</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lipton (1994)</td>
<td>236 Hospitalized patients &gt;65</td>
<td>Studied impact of clinical pharmacists on geriatric drug prescribing in terms of appropriateness of prescribing</td>
<td>1.0</td>
</tr>
<tr>
<td></td>
<td>Discharged with 3&gt; medications for chronic conditions</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Roberts (2001)</td>
<td>3230 nursing home residents divided over intervention /control group in 52 nursing homes in Australia</td>
<td>Assessed effect of a clinical pharmacy program, incl. education and medication review on drug use</td>
<td>2.0</td>
</tr>
<tr>
<td>Lenaghan (2007)</td>
<td>136 patients mostly &gt;80 years old, living at home</td>
<td>Researched effect of home-based medication review via two community pharmacist visits</td>
<td>1.7</td>
</tr>
<tr>
<td></td>
<td>4&gt; medication</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Grymonpre (2001)</td>
<td>Patients &gt;65 years</td>
<td>Measured the impact of a community-based pharmaceutical care model in community health clinic</td>
<td>1.7</td>
</tr>
<tr>
<td></td>
<td>2&gt; prescribed drugs</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Non-institutionalised elderly</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

¹) Weight based on 3-point scale, details provided in appendix
## Details on Medication Reduction (2/3)

<table>
<thead>
<tr>
<th>Medication Reduction In %, Per Patient</th>
<th>Study Population</th>
<th>Methodology</th>
<th>Weight&lt;sup&gt;1)&lt;/sup&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hanlon (1996)</td>
<td>208 elderly outpatients, Age &gt; 65 years, &gt;5 chronic medications</td>
<td>Evaluated the effect of clinical pharmacist interventions on patients at Veterans Affairs Medical Centre</td>
<td>1.3</td>
</tr>
<tr>
<td>Nelissen (2007)</td>
<td>Long term care home setting, Total 278 patients in 7 care homes, &gt;5 chronic medications</td>
<td>Assessed effect of patient specific case conferences between GP, pharmacist, and care home employee</td>
<td>1.7</td>
</tr>
<tr>
<td>Vinks (2009)</td>
<td>Patients &gt; 65 years, &gt;6 chronic medications, Total of 174 patients included</td>
<td>Investigated impact of community pharmacist-led intervention on medication</td>
<td>1.7</td>
</tr>
<tr>
<td>Holland (2005)</td>
<td>872 hospitalized patients, &gt;80 years, &gt;2 drugs daily at discharge</td>
<td>Determined whether home based medication review by pharmacist affects hospital readmissions ratios</td>
<td>1.3</td>
</tr>
<tr>
<td>Schmader (2004)</td>
<td>Clinical setting with geriatric patients, Patients of 11 Veteran affairs hospitals, &gt; 65 years, meeting frailty criteria</td>
<td>Reviewed if in/outpatient geriatric evaluation and management reduces suboptimal prescribing in frail elderly</td>
<td>1.7</td>
</tr>
<tr>
<td>Holland (2007)</td>
<td>Meta analysis of 32 studies; 17 studies included pharmacist-led medication reviews</td>
<td>Results not included as individual studies of meta analysis reviewed and included</td>
<td>NA</td>
</tr>
<tr>
<td>Furniss (2000)</td>
<td>1188 community dwelling patients, &gt;65 years, 1&gt; repeat prescriptions</td>
<td>Determined impact of pharmacist effectiveness in reviewing repeat prescriptions</td>
<td>2.0</td>
</tr>
<tr>
<td>Naunton (2003)</td>
<td>121 hospitalized patients, &gt;60 years, &gt;4 more regular medications</td>
<td>Evaluated pharmacist-conducted follow-up at home of high-risk elderly patients discharged from hospital</td>
<td>1.0</td>
</tr>
</tbody>
</table>

<sup>1</sup> Weight based on 3-point scale, details provided in appendix
### Details on Medication Reduction (3/3)

<table>
<thead>
<tr>
<th>Study Population</th>
<th>Medication Reduction In %, Per Patient</th>
<th>Methodology</th>
<th>Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>Krska (2001)</td>
<td>3</td>
<td>Studied effect of pharmacist medication review on costs based on medical records and patient interviews</td>
<td>2.0</td>
</tr>
<tr>
<td>Mackie (1999)</td>
<td>2</td>
<td>Studied impact of home / GP based medication review by research pharmacist enacted with GP</td>
<td>1.3</td>
</tr>
<tr>
<td>Bernsten (2001)</td>
<td>1</td>
<td>Measured outcomes of structured pharmaceutical care program provided by European community pharmacists</td>
<td>2.3</td>
</tr>
<tr>
<td>Zermansky (2006)</td>
<td>1</td>
<td>Measured impact of pharmacist-conducted clinical medication review based on medical records</td>
<td>2.3</td>
</tr>
<tr>
<td>Sellors (2001)</td>
<td>-1</td>
<td>Investigated the efficacy / cost effectiveness of pharmacist consultation in family practice</td>
<td>1.7</td>
</tr>
<tr>
<td>Begley (1997)</td>
<td>-3</td>
<td>Studied effect of patient counselling during 5 domiciliary pharmacy visits on medication management</td>
<td>1.0</td>
</tr>
<tr>
<td>Sellors (2003)</td>
<td>-3</td>
<td>Examined whether face-to-face intervention by a community pharmacist could reduce # of medication units</td>
<td>2.3</td>
</tr>
<tr>
<td>Kassam (2001)</td>
<td>-15</td>
<td>Described process of pharmaceutical care used by community pharmacists in specific project, incl. patient phone call</td>
<td>1.7</td>
</tr>
</tbody>
</table>

1) Weight based on 3-point scale, details provided in appendix
Potential discontinuation differs per drug category – Laxatives and anti-inflammatory can most frequently be safely discontinued.

### Change in Prescriptions per Drug Category

#### # of Prescriptions per Year, per 1000 Residents

<table>
<thead>
<tr>
<th>Drug Category</th>
<th>% Reduction Post Intervention</th>
</tr>
</thead>
<tbody>
<tr>
<td>Antacids</td>
<td>-25%</td>
</tr>
<tr>
<td>H2 Antagonists</td>
<td>0%</td>
</tr>
<tr>
<td>Laxatives</td>
<td>-52%</td>
</tr>
<tr>
<td>Digoxin</td>
<td>-6%</td>
</tr>
<tr>
<td>Diuretics</td>
<td>7%</td>
</tr>
<tr>
<td>Antibacterials</td>
<td>-17%</td>
</tr>
<tr>
<td>NSAIDs</td>
<td>-43%</td>
</tr>
<tr>
<td>Paracetamol</td>
<td>18%</td>
</tr>
<tr>
<td>Psycholeptics</td>
<td>-19%</td>
</tr>
<tr>
<td>Benzodiazepines</td>
<td>-23%</td>
</tr>
</tbody>
</table>

1) As reported in study

Note: Study based on medication review in intervention and control nursing homes in Australia

Source: Roberts (2001), Booz & Company analysis

Significantly reduced as result of intervention¹)
Our estimate for savings in medication costs by medication reviews seems in line with results from other studies.

Medication Cost Savings
In €, Per Patient per Year

1) Medication Cost after one year timeline; diverging trend in medication cost intervention-control
2) Based on patients not needing full quota of medication as result of monitoring/controlling repeat prescriptions
3) Article explicitly mentions potential higher cost savings in other countries due to relatively low cost level of medication in Australia

## Details on Cost studies (1/2)

<table>
<thead>
<tr>
<th>Study Population</th>
<th>Methodology</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total 259 patients</td>
<td>Assessed impact of pharmacist initiated interventions on costs</td>
</tr>
<tr>
<td>Average age 60 years</td>
<td>6 university hospital pharmacist recorded patient specific cost recommendations</td>
</tr>
<tr>
<td>Total of 1226 interventions</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>Long term care home setting</td>
<td>Assessed effect of patient specific case conferences between GP, pharmacist, and care home employee</td>
</tr>
<tr>
<td>Total 278 patients in 7 care homes</td>
<td></td>
</tr>
<tr>
<td>At least 5 chronic medications</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>Long term care residents in North Carolina, USA</td>
<td>Evaluated impact of large scale medication therapy program on drug cost per patient</td>
</tr>
<tr>
<td>Total of 5255 patients with polypharmacy</td>
<td>Pharmacist review of drug regimens</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>Total patients 332</td>
<td>Studied effect of pharmacist medication review on costs</td>
</tr>
<tr>
<td>Patients &gt;65 years</td>
<td>Review based on medical records and patient interviews</td>
</tr>
<tr>
<td>&gt; 2 chronic disease states</td>
<td></td>
</tr>
<tr>
<td>&gt; 4 prescribed medications</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>3074 patients on repeat prescription subscribed in 62 community pharmacies</td>
<td>Compared a community pharmacist managed repeat prescribing system with established methods</td>
</tr>
</tbody>
</table>

**Medication Cost Savings**

<table>
<thead>
<tr>
<th>Study</th>
<th>Medication Cost Savings (€)</th>
<th>Note: For studies that did not report a 1-year follow up period (e.g. 30 days), 1-year savings were calculated</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nelissen (2007)</td>
<td>190</td>
<td></td>
</tr>
<tr>
<td>Trygstad (2009)</td>
<td>185</td>
<td></td>
</tr>
<tr>
<td>Krksa (2001)</td>
<td>159</td>
<td></td>
</tr>
<tr>
<td>Bond (2000)</td>
<td>107</td>
<td></td>
</tr>
</tbody>
</table>
## Details on Cost studies (2/2)

<table>
<thead>
<tr>
<th>Medication Cost Savings</th>
<th>Study Population</th>
<th>Methodology</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>In €, Per Patient per Year</strong></td>
<td><strong>4 general practices</strong>&lt;br&gt;<strong>1188 patients aged &gt;65</strong>&lt;br&gt;<strong>At least 1 repeat prescription</strong>&lt;br&gt;<strong>Community dwelling</strong></td>
<td><strong>Determined effectiveness of pharmacist review of repeat prescriptions through proactive consultations</strong></td>
</tr>
<tr>
<td><strong>Zermansky (2001)</strong></td>
<td>99</td>
<td></td>
</tr>
<tr>
<td><strong>Sorensen (2004)</strong></td>
<td>98</td>
<td></td>
</tr>
<tr>
<td><strong>Bos (2005)</strong></td>
<td>70</td>
<td></td>
</tr>
<tr>
<td><strong>Roberts (2001)</strong></td>
<td>38</td>
<td></td>
</tr>
<tr>
<td><strong>Zermansky (2006)</strong></td>
<td>37</td>
<td></td>
</tr>
</tbody>
</table>

**Note:** For studies that did not report a 1-year follow up period (e.g. 30 days), 1-year savings were calculated.

**Source:** McMullin (1999), Nelissen (2007), Trygstad (2009), Krksa (2001), Bond (2000), Booz & Company Analysis
Medication reviews can realize €55–90 MN in savings by avoiding ~15,000 hospitalizations

Direct Savings Potential Medication Review

- Total Reduction # Hospitalizations Elderly 14,900–16,900
- Total Cost Savings Hospitalizations Elderly ~€55–90 MN
- ADR Related Admissions Elderly (Polypharmacy) 101,611
- Total Reduction Medication Review 15–17%
- ADR Related Hospitalizations Elderly 651,187
- % Polypharmacy 94%
- # of Hospitalizations Elderly 16.60%
- # of Hospitalizations Elderly 16.60%
- % Polypharmacy 94%
- Total Reduction Hospitalizations Elderly 14,900–16,900
- ADR Related Hospitalizations Elderly 16.60%
- % Polypharmacy 94%
- Average Cost Per Hospitalization €457–€654
- Average Days ADR Hospitalization 8.35


1) CBS Statline 2008, Clinical hospitalizations only
2) Beijer (2002)
3) Calculated value – see p.17
4) Referentie prijzen CVZ, Leendertse (2008)
Pharmacist are highly effective in identifying DRPs, of which almost half has potentially severe consequences.

Interventions to Reduce Drug Related Problems
% of Positively Modified Prescriptions

- Buurma (2004): 49.8%
- Westerlund (2009): 32.0%

Severity of DRPs
In % of Total Pharmacist DRP Interventions

- Low: 47.0%
- High: 27.7%

Pharmacist are effective in identifying DRPs when checking patients prescriptions.

Source: Buurma (2004), Westerlund (2009), Booz & Company analysis
Medication reviews are shown to identify additional drug related problems

### Drug Related Problems
Decrease after Medication review, % of Patients

- **Schmader (2004)**: 35%
- **Sorensen (2004)**: 27%
- **Hanlon (1996)**: 25%
- **Vinks (2009)**: 16%

**Comprehensive Medication Reviews result in a significant decrease in DPRs**

---

1) Study completed in Clinical Geriatric setting
Medication reviews can lead to a reduction in hospitalizations of by 15–17%
## Details on Hospitalization reduction (1/3)

<table>
<thead>
<tr>
<th>Hospitalization Reduction</th>
<th>Study Population</th>
<th>Methodology</th>
<th>Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>In %, Per Patient</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
| McCombs (1998)            | ▪ Patients from 2 health maintenance organizations  
▪ Selected ambulatory high risk patients | ▪ Studies the impact of 3 alternative models of pharmacist consultation on use and cost of healthcare services | 2.0    |
|                           |                                                                                  |                                                                                                                |        |
| Taylor (2003)             | ▪ 69 medically underserved patients (AL)  
▪ High risk of medication issues | ▪ Researched effect pharmaceutical care on prevention / detection of medication related problems on high risk patients | 1.3    |
|                           |                                                                                  |                                                                                                                |        |
| Thompson (1984)           | ▪ LA skilled nursing facility | ▪ Determine outcome of clinical pharmacist assuming responsibility for drug management of geriatric patients | 1.0    |
|                           |                                                                                  |                                                                                                                |        |
| Cummings (1984)           | ▪ 160 ambulatory adults | ▪ Full Article NA                                                                                              | 1.0    |
|                           |                                                                                  |                                                                                                                |        |
| Bond (2000)               | ▪ 3074 patients on repeat prescription subscribed in 62 community pharmacies | ▪ Compared a community pharmacist managed repeat prescribing system with established methods | 1.7    |
|                           |                                                                                  |                                                                                                                |        |
| Naunton (2003)            | ▪ 121 hospitalized patients  
▪ >60 years  
▪ >4 more regular medications | ▪ Evaluated pharmacist-conducted follow-up at home of high-risk elderly patients discharged from hospital | 1.0    |
|                           |                                                                                  |                                                                                                                |        |
| Lai (1998)                |                                                                                  | ▪ Full Article NA                                                                                              | 1.0    |
|                           |                                                                                  |                                                                                                                |        |
| Krkska (2001)             | ▪ 332 patients >65 years  
▪ > 2 chronic disease states  
▪ > 4 prescribed medications | ▪ Studied effect of pharmacist medication review on costs based on medical records and patient interviews | 2.0    |
Details on Hospitalization reduction (2/3)

<table>
<thead>
<tr>
<th>Hospitalization Reduction In %, Per Patient</th>
<th>Study Population</th>
<th>Methodology</th>
<th>Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>Zermansky (2006)</td>
<td>• 661 elderly care home residents  &lt;br&gt; • &gt;65 years  &lt;br&gt; • &gt;1 medication</td>
<td>• Measured impact of pharmacist-conducted clinical medication review based on medical records</td>
<td>2.3</td>
</tr>
<tr>
<td>Bernsten (2001)</td>
<td>• Multicounty study – 7 countries  &lt;br&gt; • 2454 elderly patients  &lt;br&gt; • 65+ years</td>
<td>• Measured outcomes of structured pharmaceutical care program provided by European community pharmacists</td>
<td>2.3</td>
</tr>
<tr>
<td>Roberts (2001)</td>
<td>• 3230 nursing home residents divided over intervention/control group in 52 nursing homes in Australia</td>
<td>• Assessed effect of a clinical pharmacy program, incl. education and medication review on drug use</td>
<td>2.0</td>
</tr>
<tr>
<td>Stowasser (2002)</td>
<td></td>
<td>• Full article NA</td>
<td>1.0</td>
</tr>
<tr>
<td>Trygstad (2009)</td>
<td>• Long term care residents in NC, USA  &lt;br&gt; • Total of 5255 patients with polypharmacy</td>
<td>• Evaluated impact of large scale medication therapy program on drug cost per patient</td>
<td>1.0</td>
</tr>
<tr>
<td>Hanlon (1996)</td>
<td>• 208 elderly outpatients  &lt;br&gt; • Age &gt; 65 years  &lt;br&gt; • &gt;5 chronic medications</td>
<td>• Evaluated the effect of clinical pharmacist interventions on patients at Veterans Affairs Medical Centre</td>
<td>1.3</td>
</tr>
<tr>
<td>Vinks (2009)</td>
<td>• Patients &gt; 65 years  &lt;br&gt; • &gt;6 chronic medications  &lt;br&gt; • Total of 174 patients included</td>
<td>• Investigated impact of community pharmacist-led intervention on medication</td>
<td>1.7</td>
</tr>
<tr>
<td>Lim (2004)</td>
<td>• 126 geriatric patients with risk-factors for non compliance</td>
<td>• Studied impact of a pharmacist consult clinic on the care of elderly outpatients</td>
<td>1.0</td>
</tr>
</tbody>
</table>
## Details on Hospitalization reduction (3/3)

<table>
<thead>
<tr>
<th>Hospitalization Reduction</th>
<th>Study Population</th>
<th>Methodology</th>
<th>Weight¹)</th>
</tr>
</thead>
</table>
| Nazareth (2001)           | ▪ 362 Patients >75 years  
                            ▪ 4 or more medications  
                            ▪ Discharged from hospital | ▪ Investigated effectiveness of a pharmacy discharge plan in elderly hospitalized patients | 1.3 |
| Malone (2000)             | ▪ 1054 ambulatory, high risk patients at 9 Veteran Affairs medical centers | ▪ Determined effect of clinical pharmacists on economic resource use and humanistic outcomes | 1.3 |
| Sellors (2001)            | ▪ 132 patients  
                            ▪ >65 years  
                            ▪ >4 medications taken regularly | ▪ Investigated the efficacy / cost effectiveness of pharmacist consultation in family practice | 1.7 |
| Lipton (1994)             | ▪ 236 Hospitalized patients >65  
                            ▪ Discharged with 3+ medications for chronic conditions | ▪ Studied impact of clinical pharmacists on geriatric drug prescribing in terms of appropriateness of prescribing | 1.0 |
| Lenaghan (2007)           | ▪ 136 patients mostly >80 years old, living at home  
                            ▪ >4 medications | ▪ Researched effect of home-based medication review via two community pharmacist visits | 1.7 |
| McMullin (1999)           | ▪ Total 259 patients  
                            ▪ Average age 60 years  
                            ▪ Total of 1226 interventions | ▪ Assessed impact of pharmacist initiated interventions on costs in 6 university hospitals | 1.0 |
| Holland (2005)            | ▪ 872 hospitalized patients  
                            ▪ >80 years  
                            ▪ >2 drugs daily at discharge | ▪ Determined whether home based medication review by pharmacist affects hospital readmissions ratios | 1.3 |
| Sellors (2003)            | ▪ 24 family practice sites Ontario  
                            ▪ 889 community dwelling elderly  
                            ▪ >.5 medication taken daily | ▪ Examined whether face-to-face intervention by a community pharmacist could reduce # of medication units | 2.3 |
| Smith (1997)              | ▪ 53 patients discharged from hospital to their own home  
                            ▪ Mean age 77.5 years | ▪ Investigate how seamless pharmaceutical care could be delivered  
                            ▪ Hospitalizations not as primary outcome | 1.0 |
Business Case for Value Added Services

Detailed Business Cases

- Medication Review
- **Continuity of Care**
- Therapy Adherence

International Context

References
Continuity of care services aim to optimize the patient transition between different providers of health care

- Continuity of care aims to optimize the patient transition between different healthcare providers.
- Frequently these transitions impose a risk of adverse events on the patients due to changes in therapy and medication.
- Formalizing the process by means of a structured approach and defined roles and responsibilities could minimize the risk of transition.
- Pharmacist could play an important role in assuring continuity of care due to accessibility from a patient perspective, overview of medication and expertise.
- Goal of the pharmacist would be to ensure correct utilization and appropriateness of medication to optimize therapy and avoid DRPs.

Source: Roughead (2002), Booz & Company analysis
Hospitalization and discharge often lead to large changes in the usage of medication

- Following hospitalization, **up to 40% of medications used at admission are not continued** at discharge and up to 45% of medications prescribed at discharge are medications first prescribed to the patient during their hospitalizations (Beers et al, 1989, USA)

- **14.1% of patients** (>65, community dwelling after hospital discharge) **experiences 1 or more medication discrepancies post discharge** in comparison to the pre- and post-hospital medication regimen, of which 50.8% are identified as patient-associated (Coleman, 2005, USA)

- **49.8% of 212 elderly patients experienced in hospital modifications of medication regimen** – An in hospital modification rate of 50% or higher significantly increased the risk for mortality (Mansur, 2008, USA)

- **70.7% of patients discharged to home experienced at least one actual or potential unintentional medication discrepancy**, of which the most common unintentional discrepancy was an incomplete prescription at discharge requiring clarification (Wong, 2008, USA)
Pharmacist interventions aim to clarify post discharge medication and ensure correct utilization

### Pharmacist-Led Continuity of Care
Activities in the Hospitalization Process

<table>
<thead>
<tr>
<th>Pre-Admission</th>
<th>Admission</th>
<th>Treatment</th>
<th>Discharge</th>
<th>Post-Discharge</th>
</tr>
</thead>
<tbody>
<tr>
<td>Monitor medication</td>
<td>Provide medication summary</td>
<td>Informed on treatment by specialist/GP</td>
<td>Patient counselling</td>
<td>Proactive follow up through</td>
</tr>
<tr>
<td></td>
<td>Provide ADEs history</td>
<td>Appropriateness of medication check</td>
<td>Patient education</td>
<td>– Patient Home visits</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Development of care plan</td>
<td>Discrepancy check</td>
<td>– Telephone calls</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Discharge medication summaries</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Synchronisation of medication for similar period of time</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Medication intake scheme</td>
<td></td>
</tr>
</tbody>
</table>

**ILLUSTRATIVE**

<table>
<thead>
<tr>
<th>Specialist</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clinical Pharmacist</td>
</tr>
<tr>
<td>Pharmacist</td>
</tr>
</tbody>
</table>
Pharmacist led continuity of care interventions have shown to significantly improve appropriateness of medication

<table>
<thead>
<tr>
<th>Summated Medication Appropriateness</th>
<th>Study Population</th>
<th>Methodology</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre Intervention</td>
<td>Post Intervention</td>
<td></td>
</tr>
<tr>
<td>Crotty (2004b)</td>
<td>3.20</td>
<td>2.50</td>
</tr>
<tr>
<td>Gallagher (2011)</td>
<td>10.00</td>
<td>3.00</td>
</tr>
<tr>
<td>Vs. Worsening score in control group</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- 110 adult patients transferred from hospitals to long term residential care in Australia
- Mean age 82.7
- Average 7 medications at admission

- Assessed impact of a pharmacist transition coordinator for older adults at hospital discharge
- Intervention included transfer of medication summaries and case conferences with GP

- 382 hospitalized patients in Ireland
- Age >65 years
- ~70% of patients polypharmacy

- Determine the effect of STOPP/START criteria on inappropriate prescribing for elderly patients
- Recommendation of (dis)continuation of medication provided to physician

---

1) Selection based on Cochrane review by Patterson (2012) on interventions to improve appropriate use of polypharmacy, data shown for intervention group only
2) Geriatric Evaluation and Management

Note: Medication Appropriateness Index based on 10 dimensions to determine appropriate prescribing; decrease in summated score indicates improvement in medication

Pharmacist led continuity of care interventions reduce preventable adverse drug events after discharge

**Post Discharge ADEs**

% of Patients Experiencing ADEs

- **Lipton (1992)**: 88%
- **Paulino (2004)**: 23%
- **Forster (2003)**: 19%
- **Dudas (2001)**: 19%

**Reduction in ADRs Post Discharge**

- Schnipper et al. (2006) identified adverse drug events during and after hospitalization in a group of 178 patients discharged from the general medicines services.

- Patient in the intervention group received pharmacist counselling at discharge and a follow-up telephone call 3-5 days later.

- Comparing trial outcomes 30 days post discharge, preventable ADEs were detected in 11% of control group patients vs. 1% intervention patients (p=0.01, unadjusted Odds Ratio 0.10)

1) Geriatric Patient Group
Source: Booz & Company analysis
Continuity of care services have a savings potential of €105–160 MN by reducing re-hospitalization and primary care visits.
Avoidance of re-hospitalizations potentially yields a total €105–150 MN savings

- Total Cost Savings Hospitalizations €105–150 MN
- % Reduction Re-Hospitalizations 43%
- Cost Per Hospitalization €3,816–€5,461
- Average Cost Per Hospitalization €457–€654
- Average Days ADR Hospitalization 8.35
- % Re-Hospitalizations Elderly 4.4%
- % Re-Hospitalizations Non-Elderly 3.0%
- Total # Re-Hospitalizations Elderly 28,652
- Total # Re-Hospitalizations Non-Elderly 35,755
- Total # Re-Hospitalizations 64,408

1) CBS Statline 2011
2) RIVM, Essink-Bot (2009)
3) Rehospitalization defined as clinical hospitalization within 30 days post discharge
4) Referentie prijzen CVZ, Leendertse (2008)

Source: Booz & Company Analysis
Pharmacist are effective in reducing re-hospitalizations post-discharge

Re-Hospitalization Risk
Reduction in % per Patient

<table>
<thead>
<tr>
<th>Source</th>
<th>Reduction in % Per Patient</th>
</tr>
</thead>
<tbody>
<tr>
<td>Schnipper (2006)</td>
<td>87</td>
</tr>
<tr>
<td>Crotty (2004)</td>
<td>62</td>
</tr>
<tr>
<td>Shaw (2000)</td>
<td>62</td>
</tr>
<tr>
<td>Bellone (2010)</td>
<td>58</td>
</tr>
<tr>
<td>Dudas (2001)</td>
<td>40</td>
</tr>
<tr>
<td>Naunton (2002)</td>
<td>38</td>
</tr>
<tr>
<td>Walker (2009)</td>
<td>36</td>
</tr>
<tr>
<td>Spinewine (2007)</td>
<td>34</td>
</tr>
<tr>
<td>Stowasser (2002)</td>
<td>11</td>
</tr>
<tr>
<td>Nazareth (2002)</td>
<td>1</td>
</tr>
<tr>
<td>Holland (2005)</td>
<td>-31</td>
</tr>
</tbody>
</table>

Source: See graph, Booz & Company analysis
## Details on re-hospitalizations (1/2)

<table>
<thead>
<tr>
<th>Re-Hospitalization Risk</th>
<th>Study Population</th>
<th>Intervention</th>
<th>Weight&lt;sup&gt;1)&lt;/sup&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reduction in % per Patient</td>
<td>178 patients discharged from large teaching hospital in US</td>
<td>Identified DRPs during / after hospitalizations and determine the effect of pharmacist follow up</td>
<td>1</td>
</tr>
<tr>
<td>Schnipper (2006)</td>
<td>Mean age 60 years</td>
<td>Intervention included counselling at discharge and follow up call 3-5 days later</td>
<td></td>
</tr>
<tr>
<td>Mean age 8 medications at discharge</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>87%</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Assessed impact of a pharmacist transition coordinator for older adults at hospital discharge</td>
<td></td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Crotty (2004)</td>
<td>110 adult patients transferred to long term residential care in Australia</td>
<td>Intervention included transfer of medication summaries and case conferences with GP</td>
<td>1</td>
</tr>
<tr>
<td>Mean age 82.7</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Average 7 medications at admission</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>62%</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Evaluated effect of pharmacy discharge planning on discharge of mental health patients</td>
<td></td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Shaw (2000)</td>
<td>97 patients discharged from 3 acute admission psychiatric wards in Scotland</td>
<td>Intervention incl. sending discharge plan to community pharmacist / home visits at 1, 4 and 12 weeks</td>
<td></td>
</tr>
<tr>
<td>No further information available</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>62%</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Determined effect of a pharmacist consultation on hospital readmissions rates 60 days post discharge</td>
<td></td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Bellone (2010)</td>
<td>131 patients discharged patients in Austin, Texas</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mean age 47 years</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&gt; 3 prescription medicines</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>58%</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Studied impact of pharmacist involvement in discharge planning on healthcare utilization</td>
<td></td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Dudas (2001)</td>
<td>221 general medical service patient at teaching hospital in San Francisco</td>
<td>Intervention included sharing discharge plan send to community pharmacist and follow up call from pharmacy within 2 days of discharge</td>
<td>2</td>
</tr>
<tr>
<td>Mean age 54 years</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No info on disease condition</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>40%</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<sup>1)</sup> Weight calculation based on location of intervention and sample size

Source: See graph, Booz & Company analysis
## Details on re-hospitalizations (2/2)

<table>
<thead>
<tr>
<th>Re-Hospitalization Risk Reduction in % per Patient</th>
<th>Study Population</th>
<th>Intervention</th>
<th>Weight&lt;sup&gt;1)&lt;/sup&gt;</th>
</tr>
</thead>
</table>
| Naunton (2002)                                   | ▪ 120 patients in Australia  
▪ > 60 years, > 4 regular medications  
▪ >2 chronic medication conditions          | ▪ Evaluated impact of pharmacist-conducted follow-up at home of high-risk elderly patients at 5 days post-discharge | 1 |
| Walker (2009)                                    | ▪ 624 patients discharged to home in US  
▪ Mean age 58 years  
▪ High risk for medication problems            | ▪ Reviewed medication discrepancies at hospital discharge and tested effect of pharmacist intervention on healthcare utilization  
▪ Intervention included a follow up call       | 2 |
| Spinewine (2007)                                 | ▪ 203 patients in acute Geriatric Management and Evaluation unit (BE)  
▪ Age >70 years  
▪ Avg. 9.8 daily drug administrations          | ▪ Evaluated the effect of pharmaceutical care provided in addition to acute Geriatric management and evaluation during and post discharge | 2 |
| Stowasser (2002)                                 | ▪ 240 patients discharged from medical and surgical wards to community in two Australian hospitals  
▪ No additional information available          | ▪ Researched the effect of pharmacist intervention on unplanned re-admissions  
▪ Intervention included sharing discharge plan with GP/ community pharmacist | 1 |
| Nazareth (2002)                                  | ▪ 362 patients discharged from 3 general and 1 long stay hospital in UK  
▪ Age >75 years  
▪ >4 medication                                 | ▪ Investigated effectiveness of pharmacy discharge plan in elderly hospitalized patients  
▪ Intervention included discharge plan plus domiciliary follow up by community pharmacist | 2 |
| Holland (2005)                                   | ▪ 872 patients discharged from emergency admission in UK  
▪ Age >80 years  
▪ Avg. 6 daily drugs at admission               | ▪ Determined effect of home based medication review by pharmacist on hospital readmissions rates among older people | 2 |

<sup>1)</sup> Weight calculation based on location of intervention and sample size

Source: See graph, Booz & Company analysis
A reduction in post-discharge primary care contacts could yield savings of approximately ~€5 MN

Total Cost Savings Hospitalizations ~€5 MN

% Reduction in Patients With ADEs Post Discharge 91%\(^3\)

Cost of Doctor Visit Per Patient €77\(^4\)

1) CBS Statline 2011
2) Westerlund (2009)
3) Schnipper (2006)
4) CVZ total costs of GP visit per “verzekerde” excl. “inschrijfgeld”
Source: Booz & Company Analysis
Business Case for Value Added Services

Detailed Business Cases

– Medication Review
– Continuity of Care
– Therapy Adherence

International Context

References
High non-adherence rates to medical therapy is a common and stubborn problem

Non-Adherence Rate to Medical Recommendations
Results from 2004 Meta Analysis of International Adherence Studies

1) Excluding leukemia
Note: Definition of Non-Adherence differs per study
Source: DiMatteo (2004), Booz & Company & Bertelsmann Foundation
Interventions to improve adherence can result in health improvement and cost benefits

Adherence Can be Improved
- Depression education increased medication adherence from 33% to 66%
- Electronic prescriptions led to 10-15% lower non-pick up rates as compared to paper prescriptions for diabetes and hypertension
- Pharmacist interventions improved medication adherence by 15-20%

Higher Adherence is Associated with Better Health Outcomes
- Education sessions improved adherence for hypertensive patients by 37% and reduced blood pressure by 20-25 mm
- Self-management sessions about asthma education and attack management reduced hospitalizations by 90%
- Coaching & patient networks reduced hospitalization for diabetes by 44%

Higher Adherence is Often Associated with Lower Costs
- Higher adherence reduces average health care expenditures/year for diabetes by up to 50%
- Annual total care spend for hypertension for adherent patients was $3,800 lower than non-adherent patients
- Education sessions on medication adherence and methods to prevent asthma attacks reduced emergency room visits costs per person per year by 60%

Source: Booz & Company & Bertlesmann Foundation
Pharmacist-led disease programs aim to improve medication utilization and adherence through a wide range of interventions

Pharmacist Role In Adherence

Importance of Adherence

- Adherence to medication therapy is essential to reach **therapeutic goals**
- Medication adherence is especially relevant for those patients diagnosed with chronic diseases and thus largely dependent on **chronic medication**

What Can Pharmacists Do?

- In the chain of healthcare providers, the pharmacy has **is well positioned** to detect problems concerning the chronic use of medication (van Wijk, 2005)
- Hence, pharmacist could engage in **multiple interventions to improve adherence**, potentially as part of disease programs, through
  - **Education** (e.g. focussing on self management)
  - **Monitoring**
  - **Proactive follow up** (e.g. home visits/telephone calls)
  - **Counselling** (advanced vs. non-advanced)
  - **Optimization of packaging** (e.g. Bextering)
Disease programs led by pharmacists can be effective in improving therapy adherence

**Therapy Adherence**

% Improvement Resulting From Pharmacist Interventions

<table>
<thead>
<tr>
<th>Study</th>
<th>Year</th>
<th>Heart Patients</th>
<th>Diabetes</th>
<th>Asthma/COPD</th>
<th>Non-Disease Specific</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jarab</td>
<td>2011</td>
<td>39%</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>McKenney (1973)</td>
<td></td>
<td>37%</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Volume (2001)</td>
<td></td>
<td>19%</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>McKenney (1978)</td>
<td></td>
<td>19%</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Murray (2007)</td>
<td></td>
<td>16%</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Park (1996)</td>
<td></td>
<td>14%</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Chabot (2003)</td>
<td></td>
<td>9%</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Elliot (2008)</td>
<td></td>
<td>8%</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bouvy (2003)</td>
<td></td>
<td>4%</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Barnette (2000)</td>
<td></td>
<td>1%</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Weinberger (2002)</td>
<td></td>
<td>0%</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Average: 13%
Details on Studies (1/2)

<table>
<thead>
<tr>
<th>Therapy Adherence Improvement in %</th>
<th>Patient Group</th>
<th>Study Population</th>
<th>Intervention</th>
</tr>
</thead>
</table>
| Jarab (2011)                      | COPD Patients                         | ▪ 127 patients in Jordan  
▪ Mean age 63 years  
▪ Adherence measured as self-reported  
    adherence on 4 point Morisky scale  | ▪ Structured COPD education program incl.  
    education summary booklet  
▪ 6-month follow up during scheduled visit |
| McKenney (1973)                   | Hypertension Patients                 | ▪ 49 US patients  
▪ Mean age 60 years  
▪ Adherence as % of doses taken  | ▪ Monthly visits for 5 months, monitoring,  
    counselling, contact with prescribers  
    and education; Follow up at 12 months |
| Volume (2001)                     | Patients With > 2 Medications         | ▪ 336 patients in Canada  
▪ Mean age 73.5 years  
▪ Adherence as avg. % of dose taken  | ▪ 6 telephone calls per month, education,  
    counselling, monitoring  
▪ Follow up at 12-13 months |
| McKenney (1978)                   | Hypertension Patients                 | ▪ 136 US patients  
▪ Mean age 53.5 years  
▪ Adherence as avg. % of dose taken  | ▪ Counselling during refill of medication,  
    monitoring, education  
▪ Follow up at 4 months |
| Murray (2007)                     | Heart Failure Patients                | ▪ 314 patients with HF in United States  
▪ Mean age 62 years  
▪ Adherence as % of prescribed medication taken  | ▪ Review of medication history, medication  
    education and assessment of medication  
    compliance |
| Park (1996)                       | Hypertension Patients                 | ▪ 53 US patients  
▪ Mean age 60 years  
▪ Adherence as avg. % of dose taken  | ▪ 3 monthly visits with BP and HR  
    assessments, lifestyle counselling and  
    drug therapy; Follow up at 3 months |
## Details on Studies (2/2)

<table>
<thead>
<tr>
<th>Therapy Adherence Improvement in %</th>
<th>Patient Group</th>
<th>Study Population</th>
<th>Intervention</th>
</tr>
</thead>
</table>
| Chabot (2003)                     | Hypertension Patients | 100 patients in Canada at 9 community pharmacies  
Equal distribution across age classes  
Adherence as % of patient adherent | Encouragement and rewards for good adherence; recommendations to physician if needed |
| Elliot (2008)                     | Newly Prescribed Medication for Chronic Patients | 500 US patients >75 years or chronic patients  
Self reported non-adherence defined as having missed at least one dose in last 7 days | Proactive telephones patients 2 weeks after starting new medication |
| Bouvy (2003)                      | Heart Failure Patients | 152 patients with heart failure in NL  
Mean age 70 years  
Adherence as # of days with medication | Monthly consultations from community pharmacist focussed on compliance |
| Berringer (1999)                  | Type1 or 2 Diabetes Patients | Pharmacist telephones patients 2 weeks after starting new medication  
Adherence as avg. % of dose taken | Pharmacist telephones patients 2 weeks after starting new medication |
| Grant (2003)                      | Type 2 Diabetes | 120 participants selected from community health centre  
Adherence as # adherent days past week | Tailored education to reduce self-reporting barriers; outcomes of intervention reported to primary care physician |
| Barnett (2000)                    | First Description Chronic Medication | 47 US patients  
Mean age 46 years  
Adherence as avg. % of dose taken | Incorporated written questions of patients into counselling  
Follow up at 5 days |
Mean age 62.5 years  
Adherence based on a scale of 4 | Counselling at refill and education  
Follow up at 12 months |
Increased adherence will typically lead to higher medication cost, but lower hospitalizations rates

Adherence vs. Hospitalization Risk

Diabetes

Hypertension

Hypercholesterolemia

Congestive HF

Note: Adherence calculated as % days supply / 1 year
Source: Sokol (2005), Booz & Company analysis

- - Medication Cost
- Hospitalization Risk

- - Medication Cost
- Hospitalization Risk

- - Medication Cost
- Hospitalization Risk

- - Medication Cost
- Hospitalization Risk
Also in a pharmacist-led program, the increase in medication cost can be offset by a decrease in healthcare utilization cost.

### Mean Cost Results

$ Per Patient, Per Month

<table>
<thead>
<tr>
<th></th>
<th>Not Controlled for Disease Severity</th>
<th>Controlled for Disease Severity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prescription Cost</td>
<td>Intervention: 82, Control: 88</td>
<td>Intervention: 52, Control: 56</td>
</tr>
<tr>
<td>Total Cost</td>
<td>Intervention: 853, Control: 647</td>
<td>Intervention: 723, Control: 1017</td>
</tr>
<tr>
<td></td>
<td>Decrease: $206, $-293</td>
<td>Decrease: $1,017, $-293</td>
</tr>
</tbody>
</table>

### Effect of Pharmacist Intervention

- Studied effect of pharmacist interventions in a **community retail setting** for patients with hypertension, diabetes, asthma or hypercholesterolemia.
- Intervention included specialized training for pharmacist, **patient education**, performing **systematic monitoring**, offering feedback, **behaviour modification** and communicating regularly with patients’ GP.
- **118** patients with mean age 67.2 at 3 intervention vs. **401** patients in the control group (mean age 63.3).
- Economic effect determined based on comparison of **prescription and total medical utilization cost** based on billed charges as a proxy for cost.
- Results indicated savings of **$206-$293 total medical costs per patient per month**, although average cost per prescription were significantly higher in the intervention group.

Source: Munroe (1997), Booz & Company analysis
Several studies report a positive cost-benefit for increased levels of adherence

**Cost-Benefit Increased Adherence**  

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Hypertension</td>
<td>4.1 : 1</td>
<td>10.1 : 1</td>
</tr>
<tr>
<td>Diabetes</td>
<td>7.1 : 1</td>
<td>6.7 : 1</td>
</tr>
<tr>
<td>Hypercholesterolemia</td>
<td>5.1 : 1</td>
<td>3.1 : 1</td>
</tr>
</tbody>
</table>

**Details on Studies**  

- **Sokol (2005)**
  - Evaluated the impact of medication adherence on healthcare utilization and cost
  - Population based sample of 137,277 patients < 65 years
  - Increase in adherence provides net economic return for selected chronic conditions

- **Roebuck (2009)**
  - Conducted cost benefit analysis based on medical cost related to heart failure
  - 224,131 patients with 1 or more chronic vascular condition
  - Increase in pharmacy costs is offset by substantial medical savings
Also adherence programs for asthma have demonstrated high ROI ratios

Medical Benefits to Medical Costs Ratio for Asthma

- Open Airways: 11:1
- Harvard Plan: 8:1
- Henry Ford: 7:1
- Germany Program: 5:1
- Ohio Study: 2:1

Outcome Driven by Adherence

- A: Single outreach nurse program reduced emergency department visits and hospitalizations among those who had been hospitalized previous year by 50%
- B: Education sessions reduced emergency ward admissions by 79% and hospital admissions by 86%
- C: Self-management sessions reduced the number of days on which the activity of participants was limited by 35%
- D: Self-management sessions produced net benefits in cost savings
- E: Single outreach nurse program reduced hospitalizations and work absences

Source: Adherence to long term therapies, evidence for action WHO 2003: Multiple studies from various researchers aggregated by WHO, Booz & Company Analysis
We calculate the potential savings resulting from improved therapy adherence as a result of disease programs

**Effect of Disease Programs**

<table>
<thead>
<tr>
<th>€ Outcome</th>
<th>Clinical Outcome</th>
<th>Disease Programs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Healthcare Utilizations - Primary Care - Hospitalizations - Polyclinic Care</td>
<td>Therapy / Medication Adherence</td>
<td>Example Levers for Increased Adherence</td>
</tr>
<tr>
<td>Medication Costs</td>
<td>Patient Education Focused on Self-Management</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Optimized Packaging to Simplify Medication Therapy Management for Patient</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Proactive Follow-Up on Therapy Adherence Via Home Visits/Telephone Calls</td>
<td></td>
</tr>
</tbody>
</table>

**Quantification Method**

- Pharmacist interventions have a direct effect on improving therapy adherence for chronic disease patients
- Therapy adherence is an important determinant of the success of medication therapy – strong adherence has shown to decrease healthcare utilization cost and increase patient productivity
- This relationship is frequently defined for a specific patient group – diseases to investigate are selected based on:
  - Medication cost per disease (Cost of Illness, RIVM)
  - Healthcare utilization per disease (CBS)
  - Most prevailing diseases (CBS)
We selected diseases for quantifying adherence potential based on medication intensity, share of total medication cost and prevalence.

**Selection Criteria Patients Groups**
Quantification of Improved Adherence Potential

- Understand the importance / cost of medication in overall therapy
- Determine point of gravity in terms of healthcare providers
- Understand which diseases require chronic medication therapy
- Understand the prevalence of different chronic diseases
- Understand the spread of medication costs over disease categories
- Determine which diseases have relatively high medication costs
We have looked at 5 disease groups
Medication costs are evenly distributed across disease categories – the 5 highest categories account for ~60% of medication cost.

**Medication Cost Per Disease Category**

<table>
<thead>
<tr>
<th>Disease Category</th>
<th>Median Cost (€ MN)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diseases of the nervous system</td>
<td>1,451</td>
</tr>
<tr>
<td>Diseases of the circulatory system</td>
<td>1,330</td>
</tr>
<tr>
<td>Diseases of the musculoskeletal system and connective tissue</td>
<td>851</td>
</tr>
<tr>
<td>Endocrine, nutritional and metabolic diseases</td>
<td>781</td>
</tr>
<tr>
<td>Diseases of the respiratory system and incomplete diagnoses</td>
<td>675</td>
</tr>
<tr>
<td>Neoplasms</td>
<td>590</td>
</tr>
<tr>
<td>Mental and behavioural disorders</td>
<td>510</td>
</tr>
<tr>
<td>Diseases of the genitourinary system</td>
<td>509</td>
</tr>
<tr>
<td>Not allocated/ Not disease related</td>
<td>483</td>
</tr>
<tr>
<td>Diseases of the digestive system</td>
<td>416</td>
</tr>
<tr>
<td>Infectious and parasitic diseases</td>
<td>365</td>
</tr>
<tr>
<td>Diseases of the skin and subcutaneous tissue</td>
<td>231</td>
</tr>
<tr>
<td>Pregnancy, childbirth and the puerperium</td>
<td>164</td>
</tr>
<tr>
<td>Other</td>
<td>143</td>
</tr>
<tr>
<td>Other</td>
<td>140</td>
</tr>
</tbody>
</table>

**Total cost of medication and medical aid materials are 8.6 BN in 2007, of which ~50% is issued by community pharmacies.**

1) Medication cost include "medical aid materials", such as contacts, glasses etc.

The importance of medication as cost component differs across disease categories

Cost Per Disease Category

In € MN, per Sector

1) Medication cost include "medical aid items", such as contacts, glasses etc.
Source: Kosten van Ziekten 2007 volgens Zorgberekeningen CBS, Booz & Company analysis
For these categories, we determine the importance of individual diseases – a selection of 5 diseases is made for our analysis.

Selection of Disease Categories
Size of the Bubble Indicate Total Costs in the Netherlands

Share of Total Medication Cost in Netherlands

Disorders of accommodation and refraction
Coronary heart disease
Ear disorders
Osteoarthritis
Parkinson's disease
Multiple sclerosis
Heart failure
Neck and back pain
Osteoporosis
Rheumatoid arthritis
Diabetes
Hypertension
Asthma / COPD

Mostly mechanical aids

% Medication / Total Cost Medication Intensity of the Therapy
# Selection of diseases – details

<table>
<thead>
<tr>
<th>Disease Category</th>
<th>Disease</th>
<th>Include/Exclude</th>
<th>Rationale</th>
</tr>
</thead>
</table>
| Diseases of the Nervous System                        | Multiple sclerosis                   | ✗               | ▪ Medication most important driver of total cost  
▪ However 75% of cost is driven by medical aid items including  
  – Contact Lenses  
  – Glasses  
  – Hearing Aid |
|                                                      | Parkinson’s disease                  | ✗               |                                                                                                                                                                                                            |
|                                                      | Epilepsy                             | ✗               |                                                                                                                                                                                                            |
|                                                      | Disorders of accommodation and refraction | ✗           |                                                                                                                                                                                                            |
|                                                      | Ear disorders                        | ✗               |                                                                                                                                                                                                            |
| Endocrine, Nutritional and Metabolic Diseases         | Diabetes                             | ✓               | ▪ Diabetes accounts for 78% of medication cost within disease category  
▪ 58% of Diabetes disease cost allocated to medication |
| Diseases of the Respiratory System                    | Asthma / COPD                        | ✓               | ▪ Medication as primary treatment  
▪ Asthma / COPD together account for 68% of medication/medical aid cost within disease category |
| Diseases of the Circulatory System                    | Hypertension                         | ✓               | ▪ 44% of medication cost within disease category related to Hypertension  
▪ Hypertension mainly treated through medication |
|                                                      | Coronary Heart diseases              | ✓               |                                                                                                                                                                                                            |
|                                                      | Heart failure                        | ✗               |                                                                                                                                                                                                            |
| Diseases of the Musculoskeletal System and Connective Tissue | Rheumatoid arthritis             | ✗               | ▪ 40% of total disease category cost related to secondary care; only 17% to medication  
▪ Rheuma accounts for 33% of medication costs for entire disease category, as 50% of its cost are related to medication |
|                                                      | Osteoarthritis                       | ✗               |                                                                                                                                                                                                            |
|                                                      | Neck and back pain                   | ✗               |                                                                                                                                                                                                            |
|                                                      | Osteoporosis                         | ✗               |                                                                                                                                                                                                            |

1) Medication cost as % of total cost per disease  
Source: Kosten van Ziekten 2007, Booz & Company analysis
Increased adherence could yield €250–400 MN in net savings through reduction of healthcare utilization and medication costs

Net Savings Therapy Adherence Focused Disease Programs
In € MN

<table>
<thead>
<tr>
<th></th>
<th>Heart Diseases</th>
<th>Diabetes</th>
<th>Asthma/COPD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Net Cost Savings</td>
<td>250–400 MN</td>
<td>~380-530</td>
<td>~200</td>
</tr>
<tr>
<td>Medication Cost</td>
<td>~290</td>
<td>380-530</td>
<td>-200</td>
</tr>
<tr>
<td>Hospitalization</td>
<td>~70</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Primary Care</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Increase in Medication Cost</th>
<th>Savings Potential</th>
<th>Increase in Medication Cost</th>
<th>Savings Potential</th>
<th>Increase in Medication Cost</th>
<th>Savings Potential</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>~300-350</td>
<td>35</td>
<td>~50-80</td>
<td>15</td>
<td>35-65</td>
</tr>
<tr>
<td>B</td>
<td>70</td>
<td>50-80</td>
<td>10</td>
<td>60-175</td>
<td>80-195</td>
</tr>
<tr>
<td>C</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>120</td>
</tr>
</tbody>
</table>

Note: Medication cost calculated by multiplying the % increase in adherence as reported in studies per disease with annual medication cost (Kosten van Ziekten, 2007)
Source: Booz & Company analysis
Medication adherence has a significant effect in reducing the number of hospitalizations for heart patients

<table>
<thead>
<tr>
<th>Study Population</th>
<th>Intervention</th>
</tr>
</thead>
<tbody>
<tr>
<td>83 patients in Northern Ireland</td>
<td>Pharmaceutical care program incl. education on disease / treatment, lifestyle changes, encouragement for compliance</td>
</tr>
<tr>
<td>97 patients in Australia; avg. 75 years</td>
<td>Home visit of multidisciplinary team (incl. nurse) to determine medication compliance 7-14 days after discharge</td>
</tr>
<tr>
<td>208 patients with mild/moderate HF</td>
<td>Pharmacist led care program focussing on intensive education and self-monitoring</td>
</tr>
<tr>
<td>152 patients with HF using loop diuretics</td>
<td>Intervention incl. monthly consultations from community pharmacist focussing on medication education / compliance ass.</td>
</tr>
<tr>
<td>314 patients with HF in United States</td>
<td>Intervention incl. review of medication history, medication education and assessment of medication compliance</td>
</tr>
<tr>
<td>154 US patients discharged from hospital with HF diagnosis</td>
<td>Intervention based on clinical pharmacist home visits focussed on assessment of medication compliance</td>
</tr>
<tr>
<td>276 patients hospitalized with HF in Canada discharged to community</td>
<td>Intervention consisted of education self-monitoring, adherence aids, newsletters, telephone hotline and proactive follow up</td>
</tr>
</tbody>
</table>

#### Adherence not directly measured

- **Varma (1999)**
  - Adherence: 74%
  - Study population: 83 patients in Northern Ireland
  - Intervention: Pharmaceutical care program incl. education on disease / treatment, lifestyle changes, encouragement for compliance

- **Stewart (1998)**
  - Adherence: 47%
  - Study population: 97 patients in Australia; avg. 75 years
  - Intervention: Home visit of multidisciplinary team (incl. nurse) to determine medication compliance 7-14 days after discharge

- **Sadik (2005)**
  - Adherence: 38%
  - Study population: 208 patients with mild/moderate HF
  - Intervention: Pharmacist led care program focussing on intensive education and self-monitoring

- **Bouvy (2003)**
  - Adherence: 20%
  - Study population: 152 patients with HF using loop diuretics
  - Intervention: Intervention incl. monthly consultations from community pharmacist focussing on medication education / compliance assessment

- **Murray (2007)**
  - Adherence: 19%
  - Study population: 314 patients with HF in United States
  - Intervention: Intervention incl. review of medication history, medication education and assessment of medication compliance

- **Triller (2007)**
  - Adherence: 15%
  - Study population: 154 US patients discharged from hospital with HF diagnosis
  - Intervention: Intervention based on clinical pharmacist home visits focussed on assessment of medication compliance

- **Tsuyuki (2004)**
  - Adherence: 3%
  - Study population: 276 patients hospitalized with HF in Canada discharged to community
  - Intervention: Intervention consisted of education self-monitoring, adherence aids, newsletters, telephone hotline and proactive follow up

#### Adherence calculated as % of prescribed medication

<table>
<thead>
<tr>
<th>Study Population</th>
<th>Intervention</th>
</tr>
</thead>
<tbody>
<tr>
<td>83 patients in Northern Ireland</td>
<td>Pharmaceutical care program incl. education on disease / treatment, lifestyle changes, encouragement for compliance</td>
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<tr>
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<td>Intervention consisted of education self-monitoring, adherence aids, newsletters, telephone hotline and proactive follow up</td>
</tr>
</tbody>
</table>

#### Adherence calculated as # of days without medication

**Range 15-25%**

1) Adherence calculated as # of days without medication
2) Adherence calculated as % of prescribed medication

Source: Booz & Company analysis
Hence, increased adherence could lead to a significant cost reduction of ~€300-350 MN

---

1) CBS Statline 2007  
2) Calculated as cost of secondary care for selected heart diseases / total cost of secondary care for heart diseases  
3) Kosten van Ziekten, RIVM/Erasmus Universiteit 2007  
4) Total # of hospitalizations * % related to selected diseases (46%)  

Source: Booz & Company analysis
Medication adherence has a significant effect on the number of hospitalizations for diabetes patients

<table>
<thead>
<tr>
<th>All Cause Hospitalizations</th>
<th>Impact on adherence</th>
<th>Study Population</th>
<th>Intervention</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reduction in %</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lau (2004)</td>
<td>Impact measured of relatively high non-adherence versus relatively low non-adherence</td>
<td>900 US enrollees from managed care organization</td>
<td>Analysis of association between medication non-adherence and subsequent hospitalization among individuals based on administrative claims data</td>
</tr>
<tr>
<td></td>
<td>61%</td>
<td>Patients aged &gt;18 years with type 2 diabetes</td>
<td>Study duration one year</td>
</tr>
<tr>
<td>Ho (2006)</td>
<td>Impact measured of relatively high non-adherence versus relatively low non-adherence</td>
<td>11,532 US patients with diabetes mellitus in a managed care organization</td>
<td>Retrospective study to assess the association of medication non-adherence</td>
</tr>
<tr>
<td></td>
<td>58%</td>
<td>Mean age 64 years</td>
<td>Adherence calculated as proportion of days covered for filled prescriptions</td>
</tr>
<tr>
<td></td>
<td>31%</td>
<td>Mean age 53.9 years</td>
<td>Retrospective cohort observation using administrative claims data</td>
</tr>
<tr>
<td>Hepke (2006)</td>
<td>Impact measured of relatively high non-adherence versus relatively low non-adherence</td>
<td>57,687 US diabetes patients &lt; 65 years, 90% aged 40 years</td>
<td>Analysis of adherence impact on well-being and health care costs</td>
</tr>
<tr>
<td></td>
<td>24%</td>
<td>Continuously enrolled with medical and drug eligibility</td>
<td>Retrospective cohort design using insurance claims</td>
</tr>
<tr>
<td></td>
<td>Range 24%-43%</td>
<td>Varying disease severity</td>
<td>Study duration one year</td>
</tr>
</tbody>
</table>

1) Adherence as independent variable to explain variation in hospitalizations (not direct study outcome), calculated as Medication possession ratio (MPR)
2) Adherence as independent variable to explain variation in hospitalizations (not as outcome), calculated as proportion of days covered for filled prescriptions

Source: Booz & Company analysis
Increased medication adherence for diabetes patients can deliver significant cost potential of €50–80 MN

1) CBS Statline 2007
2) Calculated as cost of secondary care for diabetes / total cost of secondary care for endocrine diseases
3) Total hospitalizations endocrine diseases * % related to diabetes (41%)
4) Kosten van Ziekten, RIVM/Erasmus Universiteit 2007
5) Wagner (2001)

Source: Booz & Company analysis
A reduction in diabetes related complications could yield another €150 MN (not included in this assessment)

Potential Savings Diabetes
In € MN

- Hospitalization: 35-65 MN
- Primary Care: 15 MN
- Total Potential Cost Savings: 50-80 MN
- Reduction Diabetes Complications: ~150
- Total Opportunity: 200-230

As Presented in Diabetes Study

1) Novo Nordisk Diabetes study conducted by Booz & Company
2) € reduction of other complications calculated based on 1.3 BN cost of complications * 24% reduction * 50% realization factor

Source: Booz & Company analysis
Medication adherence significantly reduces the number of hospitalizations for Asthma/COPD patients

<table>
<thead>
<tr>
<th>All Cause Hospitalizations</th>
<th>Impact on adherence</th>
<th>Study Population</th>
<th>Intervention</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reduction in %</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Greidener (1995)</td>
<td>86% Adherence not directly measured</td>
<td>53 patients, age 1-17, Ambulatory patients of HMO with 70% inner city black population</td>
<td>Asthma outreach program by nurse (8 hours per week) maintaining personal / phone contact with families on reg. basis</td>
</tr>
<tr>
<td>Jarab (2011)</td>
<td>72% 39%</td>
<td>127 Jordan patients &gt;35 years patients recruited from outpatient COPD clinic, On average 8 medications, Adherence measured as self-reported adherence on 4 point Morisky scale</td>
<td>Structured COPD education program by clinical pharmacist, incl. education summary booklet, 6-month follow up during scheduled visit</td>
</tr>
<tr>
<td>Kotses (1995)</td>
<td>63% 12% increase of Medication</td>
<td>76 US patients with moderate to severe asthma; disease generally under medical control, Average age 49.8 years</td>
<td>Education program consisting of 7x 90 min sessions with group leader presenting and discussing topics incl. medication and management</td>
</tr>
<tr>
<td>Williams (2004)</td>
<td>60% Impact measured of high versus low non-adherence 1)</td>
<td>405 US adults age 18–50 years; mean age 36.6 years, Members of HMO in Michigan</td>
<td>Retrospective study estimating the proportion of poor asthma-related outcomes attributable to ICS non-adherence</td>
</tr>
<tr>
<td>Bolton (1991)</td>
<td>22% Adherence not directly measured</td>
<td>185 US adults between 18 - 70 years, mean age 37 years, Recruited from urban and sub-urban emergency room</td>
<td>Self management program consisting of 33 educational sessions stressing importance of medication compliance, effects of drugs, attack management etc.</td>
</tr>
</tbody>
</table>

Range 22-63%

1) Adherence not included as primary outcome of study, but as independent variable

Source: Booz & Company analysis
Medication adherence could lead to a significant cost reduction of €80–195 MN

Total Cost Savings Secondary Care ~€60–175 MN

Total Cost Savings Primary Care ~€20 MN

Reduction # Hospitalizations 12,000–34,000

Cost of Secondary Care Per Hospitalization ~€5,130

Cost of Physician Visits for COPD/Asthma ~€87.80 MN

Reduction in Hospitalizations as Result of Adherence 22%–63%

# of Annual Hospitalizations Airways

% Hospitalizations Related to Selected Diseases

# of Annual Hospitalizations Asthma/COPD

Cost of Secondary Care Selected Diseases ~€277.6 MN

1) CBS Statline 2007
2) Calculated as cost for asthma/COPD secondary care / total cost for Airways diseases secondary care
3) Total hospitalizations airways diseases * % related to diabetes (27%)
4) Kosten van Ziekten, RIVM/Erasmus Universiteit 2007

Source: Booz & Company analysis

Booz & Company

Prepared for KNMP

80
For the selected extra medication costs associated with increased adherence are substantially lower than the savings potential.

<table>
<thead>
<tr>
<th>Disease</th>
<th>Medication Cost</th>
<th>Savings Potential</th>
</tr>
</thead>
<tbody>
<tr>
<td>Heart Diseases</td>
<td>~ 325 MN</td>
<td>30%</td>
</tr>
<tr>
<td>Diabetes</td>
<td>50-80</td>
<td>11%</td>
</tr>
<tr>
<td>Asthma /COPD</td>
<td>80-195 MN</td>
<td>30%</td>
</tr>
</tbody>
</table>

Note: Medication cost include "medical aid supplies"
Source: Kosten van Ziekte RIVM/Erasmus University 2007, Booz & Company analysis
Business Case for Value Added Services

Detailed Business Cases

– Medication Review
– Continuity of Care
– Therapy Adherence

International Context
Professional pharmaceutical services have been widely implemented in the international context

Pharmaceutical Professional Services Around the World

- Services formalized under Medication Therapy Management for Medicare beneficiaries, a subset of high-cost patients
- Pharmaceutical services offered by privately-owned community pharmacies on (limited) reimbursement by health insurances
- Pharmaceutical services negotiated under the “Family Pharmacy Contract” in 2004 securing remuneration for pharmacist
- Three-tier type of services offered by privately-owned community pharmacies under contract by National Health Service (NHS)
- Pharmaceutical care heavily regulated with a small number of large services providing a limited number of value added services
- Pharmaceutical care services as key component of the healthcare system, with funding for a wide range of services outside of dispensing
Remuneration for Pharmaceutical professional services depends on country specific factors

Remuneration for Pharmaceutical Professional Services
Country Level Drivers

Method of Remuneration
- Different methods of service remuneration exist, e.g. through government, health insurers and patients
- Required quality assessment can include staff / patient satisfaction and performance assessment
- Some countries require specific areas for private consultation

Legal Framework
- PPS usually not legally mandated except for patient counselling (i.e. providing information)
- Some countries include PPS as standard service obliged by law
- Difference between reimbursement for services related to OTC and prescription medicine
- Majority of countries remunerate PPS only when medicine is paid under reimbursement

Quality / Lay Out Standards

Source: Bernsten (2010)
In most countries, both government and health insurance company’s are involved in negotiating tariffs

<table>
<thead>
<tr>
<th>Quality Services</th>
<th>Pharmacy Delivery</th>
<th>Remuneration</th>
<th>Remuneration Requirements</th>
<th>Scale</th>
</tr>
</thead>
</table>
| ▪ Medication review  
▪ Provision of written drug information  
▪ Disease programs for chronic disease patients  
▪ Therapeutic decision participation | ▪ Privately owned community pharmacies under the AUS community pharmacy authority | ▪ Remuneration based on Government’s National Medicines Policy (10% of pharmacy income) | ▪ Not specified | ▪ 5,000 community pharmacies as key component of health system |
| ▪ Medication utilization advice  
▪ Medication therapy optimization  
▪ Healthy lifestyle advice  
▪ Disease programs | ▪ Privately-owned pharmacy’s (pharmacist only) with max. 4 pharmacies p.p. | ▪ Nationwide contract with largest health insurance fund (family pharmacy contract) | ▪ Non-mandatory quality guidelines on processes for specific pharma services/activities | ▪ Majority of community pharmacies (>17,000) registered for program |
| ▪ Three-tier service structure with 7 essential services to be provided by all pharmacies in tier 1 | ▪ Privately owned community pharmacies | ▪ National Health Services (NHS) | ▪ Remuneration under Quality Assurance framework as specified by NHS | ▪ 40% accredited for medication reviews (advanced service level) |
| ▪ Medication use advice  
▪ Measurement of blood glucose, blood pressure and cholesterol  
▪ Inhalation counselling | ▪ Private community pharmacies, regulated by health authorities (number and pricing) | ▪ Health authority regulated market with limited remuneration for services | ▪ Not specified | ▪ Approximately 1 pharmacy per 16,700 inhabitants; all providing services |
| ▪ Services as defined by NZA, incl. medication review, education and continuity of care | ▪ Privately owned pharmacies | ▪ Differing remuneration due to individual negotiation with insurance companies | ▪ Not specified | ▪ Not widely adopted across pharmacies – limited offering and remuneration for services |

Note: US excluded as services offered to specific patient group only
Source: Booz & Company analysis
In the UK, pharmaceutical services are provided through a three-tier structure

### Pharmaceutical Care Services – UK

#### Tier 1: Essential Services
- **Dispensing** – safe supply of medication and appliances
- **Repeat dispensing** – management of repeat prescription up to 1 year in partnership with patient/prescriber
- **Disposal** of unwanted medication – safely disposing unwanted medication
- **Healthy lifestyle promotion** – opportunistic one-to-one advice on healthy lifestyle topics (smoking) to patients collecting medication
- **Signposting** – referral of patient to other healthcare providers
- **Clinical governance** – implementation of system of clinical governance to support provision of quality care

#### Tier 2: Advanced Services
- **Medicine Use Review & Prescription Intervention Service** – adherence focused medication review with individual patients targeted at
  - Respiratory disease patients
  - Hospital discharge patients
  - Patients on high risk medication
- **New Medicine (Appliance) Service** – provide patient with information on their new medicine (appliance) and how to use it at dispensing with follow up by telephone in around a fortnight, and final consultations after 21-28 days
- **Stoma Appliance Customization Service** – ensure proper use and improve duration of usage

#### Tier 3: Enhanced Services
- Group of services commissioned locally by pharmacist based on local needs of population mostly aimed to improve public health, examples include
  - Minor ailments management
  - Palliative care services
  - Services to schools
  - Supplementary and independent prescribing by pharmacists
  - Medicines assessment and compliance support
  - Sexual health services

**EXAMPLE UK**
GP – Pharmacist collaboration forms the basis for the German “Family Contract”

Family Pharmacy Contract

- Trilateral contract between GPs, physicians and insurance companies; So called “family contract” includes patients choosing their GP and their family practice
- Concept aims to enable direct communication between the community pharmacist and the GP on issues concerning drug therapy
- Contract includes remuneration for advanced services, such as drug profiles, medication reviews, counselling and medication reports, for specific diseases such as asthma/COPD
- Under this advanced services program, patient chooses GP and family practice for a set term, usually at least one year
- All medication (prescription/OTC) are delivered by the selected pharmacy
- Pharmacist qualification for the program occurs through a one day education program; in addition pharmacist need to be in possession of right software

Health Insurance – Secure additional benefits/services for their customers at moderate cost

Pharmacist – Aim to optimize medication therapy management in terms of efficiency and efficacy

GP – Optimize prescribing of medication based on indications and patient medication therapy and history
Australian service remuneration is based on a government issued meta analysis of the effectiveness of services

Overview of Reviewed Services

<table>
<thead>
<tr>
<th>Service</th>
<th>Evidence for Effectiveness</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pharmaceutical Care Services</td>
<td>✓</td>
</tr>
<tr>
<td>Continuity of Care Services Post-Hospital Discharge</td>
<td>✓</td>
</tr>
<tr>
<td>Education Services to Consumers</td>
<td>✓</td>
</tr>
<tr>
<td>Education Services to Health Practitioners</td>
<td>✓</td>
</tr>
<tr>
<td>Pharmacist Managed Clinics</td>
<td>✓</td>
</tr>
<tr>
<td>Review of Repeat Prescribing</td>
<td>✓</td>
</tr>
<tr>
<td>Pharmacist Participation in Therapeutic Decision Making</td>
<td>✓</td>
</tr>
<tr>
<td>Administration of Vaccines</td>
<td>TBD</td>
</tr>
<tr>
<td>Involvement in Pre-Admission Clinics</td>
<td>TBD</td>
</tr>
<tr>
<td>Participation in Home Services</td>
<td>TBD</td>
</tr>
</tbody>
</table>

Business Case for Value Added Services

Detailed Business Cases

- Medication Review
- Continuity of Care
- Therapy Adherence

International Context

References
References - General

- World Health Organization. Adherence to long term therapies, evidence for action. WHO 2003
- CBS. Statistics on the prevalence of disease in The Netherlands. 2011
References - Continuity of Care

References – Medication Review (1/3)

References - Medication Review (2/3)


References – Medication Review (3/3)

References – Therapy Adherence (1/4)


References – Therapy Adherence (2/4)


References – Therapy Adherence (3/4)

References - Therapy Adherence (4/4)


Appendix
## Overall assumptions

### Professional Services Quantification

#### Overall Assumptions

<table>
<thead>
<tr>
<th>Category</th>
<th>Value</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>Population</td>
<td></td>
<td></td>
</tr>
<tr>
<td># of people 65+</td>
<td>2,567,000</td>
<td>SKF data en feiten (2011)</td>
</tr>
<tr>
<td>Polypharmacy patients 65+</td>
<td>45%</td>
<td>van Dijk (2009)</td>
</tr>
<tr>
<td>Hospitalizations</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hospitalizations in NL (2008)</td>
<td>1,843,047</td>
<td>CBS Statline 2008</td>
</tr>
<tr>
<td>Medication related admission – Average days in hospital</td>
<td>8.70</td>
<td>Beijer (2002), Leendertse (2008)</td>
</tr>
<tr>
<td>Cost of hospitalization (incl. complex medical activities)</td>
<td>€ 3816</td>
<td>CVZ (€475 per day per hospitalizations)</td>
</tr>
<tr>
<td>Cost of hospitalization (excl. complex medical activities)</td>
<td>€ 5461</td>
<td>Leendertse (2010)</td>
</tr>
<tr>
<td>Primary Care</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cost of primary care visit</td>
<td>€ 123</td>
<td>Westerlund (2009)</td>
</tr>
<tr>
<td>Medication Cost</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Average price of polypharmacy medication</td>
<td>€ 99</td>
<td>Calculated based on SKF Data en Feiten (2011)</td>
</tr>
</tbody>
</table>
Medication appropriateness is frequently evaluated using the MAI Score – a lower score indicates better medication appropriateness

**MAI Score Criteria**

<table>
<thead>
<tr>
<th>Criterion</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Indication</strong></td>
<td>Is there an indication for the drug?</td>
</tr>
<tr>
<td><strong>Choice</strong></td>
<td>Is the medication effective for the condition?</td>
</tr>
<tr>
<td><strong>Dosage</strong></td>
<td>Is the dosage correct?</td>
</tr>
<tr>
<td><strong>Modalities Correct</strong></td>
<td>Are there clinically significant drug-disease interactions?</td>
</tr>
<tr>
<td><strong>Modalities Practical</strong></td>
<td>Are the directions practical?</td>
</tr>
<tr>
<td><strong>Drug-Drug Interactions</strong></td>
<td>Are there clinically significant drug-drug interactions?</td>
</tr>
<tr>
<td><strong>Duplication</strong></td>
<td>Is there unnecessary duplication with other drugs?</td>
</tr>
<tr>
<td><strong>Duration</strong></td>
<td>Is the duration of therapy acceptable?</td>
</tr>
<tr>
<td><strong>Costs</strong></td>
<td>Is this drug the least expensive alternative compared with others of equal utility?</td>
</tr>
</tbody>
</table>

**MAI Score**

- The MAI Score consists of 10 dimensions each relating to appropriateness of medication.
- Every individual patient is reviewed to determine potential inappropriate prescriptions based on MAI dimensions.
- The score is computed by awarding each medication per patient a score based on the 10 MAI dimensions.
- A weight is applied to each of the dimensions depending on the overall objective of the study.
- The summated MAI Score is calculated for each patient by summing the scores of the individual medication – an average summated MAI Score is then taken for control and intervention group.
- The overall change in MAI score can be calculated based on a comparison of % of patients at baseline vs. follow up.
- A lower MAI score indicates higher appropriateness of medication, hence a decline in MAI Score can be interpreted as positive.