Value Demonstration with Private Payers
Adherence to Treatment & Employer Economic Impact: Literature Review
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1. Context, Scope, Sponsors, Summary & Conclusions
• According to the World Health Organization (WHO), non-adherence to treatment is a major problem, especially in people with chronic diseases. Numerous studies have been published in this regard, particularly to better understand the factors causing non-adherence and the various effects of non-adherence.

• Assuming that the person treated has been correctly diagnosed and that the doctor has prescribed the right medication at the right dose, taking into account his/her personal characteristics, there are good reasons for seeking to improve adherence to treatment. Expected benefits include improved health outcomes, improved quality of life, and savings for the individual, the health system and society. In many cases, non-adherence may result in lower treatment outcomes and increased risk of complications and hospitalization as well as higher health costs.

• It is widely documented that health care professionals who provide services involving medication need to make every effort to help patients improve adherence to their treatment, especially when considering the aging population and the increased prevalence of chronic diseases.

• This issue remains a shared responsibility between public authorities, health professionals and patients associations and individual patients. The private sector has also role to play as attested to by the various programs put in place by pharmaceutical companies, group benefits consultants, insurers, employers and unions.

• Employers, often in collaboration with unions, offer drug and other benefits to employees and are increasingly engaging in initiatives to promote healthy lifestyle and better disease management.
A working group composed of key Canadian insurance companies, group benefits consultants and innovative pharmaceutical companies, created by Innovative Medicines Canada (IMC), the Canadian association of innovative pharmaceutical companies, identified in 2017 the need to better validate the value of drug treatment adherence, especially in terms of productivity gains for employers and return on investment.

Value demonstration initiatives to date in Canada and elsewhere have focused heavily on the value of medicines, in terms of the health impacts for patients and the savings in the health system.

This is the case of a recent study by the Conference Board of Canada and the demonstration project piloted by Concerto in Quebec, in collaboration with manufacturers and the Quebec Ministry of Health and Social Services. The objective of the Concerto study was to demonstrate the impact of best-in-class first-line management on the health of the patients and on the savings in the health network, particularly in terms of stay of averted hospitalizations.

However, the relevant performance indicators for employers and payers are metrics related to productivity rather than to health care costs, namely presenteeism, absenteeism and disability rates of the employees. Although this topic appears at first sight less exploited, there are nevertheless several studies into the link between the use of drugs and employee productivity metrics.
The scope of the study

In this context, the Innovative Medicines Canada working group commissioned Pivot Strategy/Concerto to validate the link between drug adherence and workplace productivity impacts.

Scope of the study:

1. Identify relevant value indicators for private employers and payers in Canada
2. Identify therapeutic areas that lend themselves to a value demonstration evaluation related to adherence to treatment
3. Validate, through a review of the literature, the impact of adherence to treatment on productivity value indicators for employers
Study Sponsors
Summary

- The review of this literature review was done based on 26 selected scientific publications from 2009 to 2017, mainly in the United States, covering 55 studies.
- The literature review focused in on 40 studies that studied patients with four chronic conditions that represent some of the highest levels of expenditure for employers in terms of work productivity, absenteeism, presenteeism and short-term disability, namely depression, diabetes, hypertension and asthma.
- These therapeutic areas are the most identified in the literature (about 75% of all studies). They account for 25% of drug expenditures and 44% of group insurance program employees.
- The levels of medication adherence for these conditions fell within the 50% range, and below 40% for some studies for patients with asthma, hypertension and depression.
- The literature review confirmed a positive correlation between adherence to treatment and economic impact for employers. Absenteeism, followed by disability rates of the employees, were the indicators most commonly used to measure the economic impact on employers.
- In most cases, the lack of a positive correlation is attributable to the low number of employees enrolled in the study.
- Studies show significant economic impacts related to non-adherence are as follows:
  - 2 to 10 days lost (missed workdays) /employee/year in absenteeism and disability
  - $1,000 to $ 5,000 in salary losses/employee/year
- Savings generated by average treatment adherence rates ranging between $714 and $1870 (or between 3 and 16 saved workdays) per employee per year.
An illustrative study which looked at diabetes, hypertension and depression found savings generated by average treatment adherence rates between $700 and $3,300 per employee per year.

<table>
<thead>
<tr>
<th>Chronic Condition</th>
<th>Average adherence rate</th>
<th>Average days saved/year at average adherence</th>
<th>Employer savings by employee/year (2018$US) at average adherence</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diabetes</td>
<td>61%</td>
<td>16.1</td>
<td>$3,306</td>
</tr>
<tr>
<td>Hypertension</td>
<td>63%</td>
<td>3.5</td>
<td>$714</td>
</tr>
<tr>
<td>Depression</td>
<td>43%</td>
<td>9.1</td>
<td>$1,870</td>
</tr>
</tbody>
</table>

**Methodology:** Findings from a US econometric study on the impact of drug adherence and number of days lost per year for 3 chronic conditions. Study used the employed respondents of the 1987 Medical Expenditure Survey (approx. 10,000 respondents).

**Sources**
An increase of drug treatment adherence to 80% optimizes outcomes for patients and generates additional net savings (factoring in the additional cost of medicines) between $300 and $2,200 per employee per year.

<table>
<thead>
<tr>
<th>Chronic Condition</th>
<th>Average days saved/year at 80% adherence</th>
<th>Employer savings by employee/year (2018 $US) at 80% adherence</th>
<th>Additional savings per employee/year (2018 $US) from achieving 80% adherence</th>
<th>Net savings of adherence</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diabetes</td>
<td>26.2</td>
<td>$5,420</td>
<td>$2,114</td>
<td>$2,005</td>
</tr>
<tr>
<td>Hypertension</td>
<td>5.3</td>
<td>$1,134</td>
<td>$420</td>
<td>$286</td>
</tr>
<tr>
<td>Depression</td>
<td>21.2</td>
<td>$4,350</td>
<td>$2,480</td>
<td>$2,216</td>
</tr>
</tbody>
</table>

There is clearly an opportunity to generate additional savings and optimize outcomes for patients by improving adherence.

**Methodology:** Findings from a US econometric study on the impact of drug adherence and number of days lost per year for 3 chronic conditions. Study used the employed respondents of the 1987 Medical Expenditure Survey (approx. 10,000 respondents).

**Sources:**
Conclusion

• Beyond health outcomes of drug treatments confirmed in several studies, the key findings of this literature review show clear value of drug treatment in terms of impact on improved productivity, low pharmacologic treatment adherence among employees and an opportunity to generate additional savings for employers by improving adherence.

• Governments and health networks are focused on the need for improved adherence and seeking innovative solutions with stakeholders to achieve better results for the benefit of patients, the health system and the economy. These solutions include better access to data in real-life settings, care pathways that promote better patient care, improved communication and awareness patient programs, and technological tools to monitor patient treatments.

• But beyond the interventions of public networks, an increased dialogue between pharmaceutical companies, insurers, employers and patient associations is needed to identify additional initiatives to improve employee adherence rates to pharmacological treatments.

• The benefits to employers and employees are numerous and this literature review provides concrete data on low adherence rates in important therapeutic areas and underscores the return on investment from improved adherence stemming in terms of improved productivity.

• Thus, building on this evidence, the private sector should be encouraged to continue to act even more effectively in terms of adherence to treatment.

• But many questions remain and additional data, particularly data collected in the Canadian environment would better promote and target promising initiatives for employees and employers: What are the rates of adherence to treatment in Canadian employers? What programs exist and what results are they yielding? What are some current best practices? What are the benefits in real Canadian settings of a treatment adherence program?

• The stakeholders involved in the Canadian private sector have an opportunity to take leadership role in advancing research in Canada on the impact of medicines of productivity as well as documenting the return on investment of better adherence to treatment.
2. Literature Review

Refer to:
Appendix 1: Individual Case Studies
Appendix 2: Methodology & Terminology
26 publications reviewed…

… covering 55 cases of therapeutic field…

… with an average of 41,461 patients per observational study (retrospective) (n = 34)

… and 439 for per clinical/real world trial studies (prospective) (n = 6)

- Primarily large retrospective econometric studies using national database to measure employer economic impact and treatment metrics, such as:
  1. Medical Expenditure Panel Survey by the US Government provides survey information on health status, health care utilization and cost, prescription drug usage, work, disability and other sociodemographic characteristics and is widely used for scholarly research.
  2. The Truven Health MarketScan Research Databases are a family of research data sets that fully integrate de-identified patient-level health data (medical, drug and dental), productivity (workplace absence, short- and long-term disability, and workers’ compensation), laboratory results, health risk assessments (HRAs), hospital discharges and electronic medical records (EMRs) into data sets available for healthcare research.
- Some prospective studies that rely largely on questionnaires
- Use of statistical regression to establish correlation between treatment and employer economic impact
- Limited studies in a given employer setting (aggregated employer data used)
- The studies were published between 2009 and 2017. The seminal 1985 study that first demonstrated the link between medication adherence and work productivity was also included.
- The studies did not include how adherence was or could be improved.
- The majority of studies was conducted in the US and published in the American Journal of Occupation and Environmental Medicine and the American Journal of Managed Care

1. Refer to the Methodology section for all sources of data used in the studies
73% of studies (40) found a positive correlation between treatment and employer economic impact (EEI)

Conclusion breakdown of 55 reviewed studies

- Positive correlation 73%
- No correlation 27%

Studies' conclusion by therapeutic field
40 positive cases only, therapeutic field studied between 1985-2017

<table>
<thead>
<tr>
<th>Therapeutic Field</th>
<th>No correlation</th>
<th>Positive correlation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Asthma</td>
<td>7</td>
<td>12</td>
</tr>
<tr>
<td>Type 2 Diabetes</td>
<td>10</td>
<td>12</td>
</tr>
<tr>
<td>Hypertension</td>
<td>6</td>
<td>8</td>
</tr>
<tr>
<td>Depression</td>
<td>7</td>
<td>9</td>
</tr>
<tr>
<td>Arthritis</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>CHF</td>
<td>1</td>
<td>11</td>
</tr>
<tr>
<td>Dyslipidemia</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Chronic Back Pain</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>Hepatitis C</td>
<td>1</td>
<td>1</td>
</tr>
</tbody>
</table>

Total = 55
For the 40 cases with positive results, adherence to medication was the indicator most commonly used to measure treatment.

Breakdown of treatment metric for 40 positive cases:
- Adherence to medication: 77%
- Introduction to medication: 10%
- Introduction to therapy: 3%
- Adherence to therapy: 10%

Treatment metric by therapeutic field:

<table>
<thead>
<tr>
<th>Therapeutic Field</th>
<th>Most common treatment metric in positive cases</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type 2 Diabetes</td>
<td>Adherence to medication</td>
</tr>
<tr>
<td>Asthma</td>
<td>Adherence to medication</td>
</tr>
<tr>
<td>Hypertension</td>
<td>Adherence to medication</td>
</tr>
<tr>
<td>Depression</td>
<td>Adherence to medication</td>
</tr>
<tr>
<td>Arthritis</td>
<td>Adherence to medication</td>
</tr>
<tr>
<td>Chronic</td>
<td>Adherence to medication</td>
</tr>
<tr>
<td>Hepatitis C</td>
<td>Introduction to therapy</td>
</tr>
<tr>
<td>Dyslipidemia</td>
<td>Adherence to medication</td>
</tr>
<tr>
<td>CHF</td>
<td>Adherence to medication</td>
</tr>
</tbody>
</table>

- Adherence to medication: Measures the level of compliance with existing medication.
- Adherence to therapy: Measures the level of compliance with existing medication and non-medical interventions, such as lifestyle changes and educational & awareness initiatives.
- Introduction to medication: Measures the effect of a new medication on patient outcomes.
- Introduction to treatment: Measures the effect of a new therapy on patient outcomes. Only those studies that included an optimization of patient use of medications were included in the literature review.
For the 40 cases with positive results, absenteeism was the indicator most commonly used to measure the economic impact on employer.

**Breakdown of Employer Economic Impact (EEI) for 40 positive cases**

- Absenteeism: Hours of missed work converted into number of workdays on the basis of an 8-hour workday. Employees are paid their full wages for absenteeism.
- Presenteeism: Percentage of impairment while working due to health reasons.
- Short-term disability: Number of missed workdays due to sickness during which employees are paid a portion of their income.
- Work Productivity: Absenteeism + Presenteeism.

**Most common indicator in positive cases**

<table>
<thead>
<tr>
<th>Therapeutic Field</th>
<th>Most common indicator in positive cases</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type 2 Diabetes</td>
<td>N/A</td>
</tr>
<tr>
<td>Asthma</td>
<td>Absenteeism</td>
</tr>
<tr>
<td>Hypertension</td>
<td>N/A</td>
</tr>
<tr>
<td>Depression</td>
<td>Short-Term Disability</td>
</tr>
<tr>
<td>Arthritis</td>
<td>N/A</td>
</tr>
<tr>
<td>Chronic</td>
<td>Absenteeism</td>
</tr>
<tr>
<td>Hepatitis C</td>
<td>Presenteeism and Work Productivity</td>
</tr>
<tr>
<td>Dyslipidemia</td>
<td>Absenteeism and Short-Term Disability</td>
</tr>
<tr>
<td>CHF</td>
<td>Short-Term Disability</td>
</tr>
</tbody>
</table>

**Employer economic impact measured by therapeutic field**

40 positive cases only, therapeutic field studied between 1985-2017.
Therapeutic areas retained for study: Diabetes, Hypertension, Depression, Asthma

- Total number of cases: 55
  - Positive Correlation: 40
  - No correlation: 15

Correlation between treatment metric and Employer Economic Impact (EEI):

Therapeutic field to deep dive:

- Asthma: 8
- Type 2 diabetes: 9
- Depression: 7
- Hypertension: 6
  - Total: 30

Treatment measure breakdown:

- Adherence to medication: 77%
- Introduction to treatment: 3%
- Adherence to therapy: 18%

Employer Economic Impact (EEI) breakdown:

- Absenteeism: 53%
- Short term disability: 7%
- Presenteeism: 27%
- Work Productivity: 8%

- Total Adherence to medication: 64%
- Total Adherence to therapy: 18%
- Total Introduction to treatment: 10%
- Total Introduction to medication: 10%
Overview of studies: Diabetes

<table>
<thead>
<tr>
<th>Results Outcome</th>
<th>Grand Total</th>
<th>Treatment Metric</th>
<th></th>
<th></th>
<th></th>
<th>Employer Economic Impact (EEI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Positive correlation</td>
<td>9</td>
<td>Adherence to medication</td>
<td>7</td>
<td>2</td>
<td>0</td>
<td>Absenteeism</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Introduction to medication</td>
<td>2</td>
<td>0</td>
<td>0</td>
<td>Presenteeism</td>
</tr>
<tr>
<td>No positive correlation</td>
<td>2</td>
<td>Adherence to therapy</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>Short term disability</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Introduction to therapy</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>Work Productivity</td>
</tr>
<tr>
<td>Total</td>
<td>11</td>
<td></td>
<td>9</td>
<td>2</td>
<td>0</td>
<td></td>
</tr>
</tbody>
</table>

1. 9 of 11 studies yielded positive results
2. The metric used to measure treatment was adherence to medication in 7 of the 9 cases
3. The metric for employer economic impact included all four measures but absenteeism and disability were the most frequently-used metrics for employer economic impact
4. Adherence ranged from 53% to 75%
5. Employer Economic Impact

<table>
<thead>
<tr>
<th>Metric</th>
<th>Days saved per employee/year</th>
<th>$ Savings per employer/year (2018$)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Absenteeism</td>
<td>1.5 to 4</td>
<td>$360-$700</td>
</tr>
<tr>
<td>Disability</td>
<td>2 to 9</td>
<td>$400-$3,300</td>
</tr>
<tr>
<td>Presenteeism</td>
<td>3.5</td>
<td>$840</td>
</tr>
</tbody>
</table>

The opportunity: Illustration of optimizing compliance at Ford and reducing disability for approx. 5,000 employees with prescription for hypoglycemic drug (Case #3)

- Current situation: 60% adherence = $2,700 (2018$) savings/employee/year
- Pivot/Concerto hypothesis: Achieving 80% adherence = $3,800 (2018$) savings/employee/year

Note: Conversion into 2018 dollars carried by Pivot/Concerto
Overview of studies: Hypertension

<table>
<thead>
<tr>
<th>Results Outcome</th>
<th>Grand Total</th>
<th>Treatment Metric</th>
<th>Employer Economic Impact (EEI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Positive correlation</td>
<td>6</td>
<td>Adherence to medication</td>
<td>Absenteeism</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Introduction to medication</td>
<td>Presenteeism</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Adherence to therapy</td>
<td>Short term disability</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Introduction to therapy</td>
<td>Work Productivity</td>
</tr>
<tr>
<td>No positive correlation</td>
<td>2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>8</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

1. 6 of 8 studies yielded positive results
2. The metric used to measure treatment was adherence to medication in all cases
3. The metric for employer economic impact included all four measures but absenteeism was the most frequently-used metric
4. Adherence ranged from 30% to 65%
5. Employer Economic Impact

- **Days saved per employee/year (adherent vs. non adherent employees)**
  - Absenteeism: 2 to 4 days
  - Disability: 2 to 5 days
  - Presenteeism: 4 to 7 days
- **$ Savings per employer/year (2018$)**
  - Absenteeism: $450-$1,300
  - Disability: $330-$1,130
  - Presenteeism: $840-$1,600

**The opportunity of increased adherence on absenteeism (Case #10)**

- 63% adherence = Savings of $700 (2018$) per employee/year
- 100% compliance* = Total savings of $1,100 (2018$) per employer/year

- Note: Conversion into 2018 dollars carried by Pivot/Concerto
Overview of studies: Depression

1. 7 of 9 studies yielded positive results

Adherence to medication was the most widely used metric but adherence to therapy (including education and active follow-up with patients) was also used

2. The employer economic impacts included absenteeism, presenteeism and disability

3. Adherence to medication ranged from 25% to 54%

4. Employer Economic Impact

- Days saved per employee/year (adherent vs. non adherent employees)
- $ Savings per employer/year (2018$)

<table>
<thead>
<tr>
<th></th>
<th>Absenteeism</th>
<th>Presenteeism</th>
<th>Short term disability</th>
<th>Work Productivity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Days saved</td>
<td>3</td>
<td>2</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>$ Savings per year</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

5. The opportunity of achieving full adherence: Impact on absenteeism (Case #14)

<table>
<thead>
<tr>
<th></th>
<th>Average days saved at average compliance (43%)</th>
<th>Average days saved at 100% compliance</th>
<th>Employer savings (2018$) at average compliance</th>
<th>Employer savings (2018$) at full compliance</th>
<th>Incremental savings from achieving full compliance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Depression</td>
<td>9</td>
<td>21</td>
<td>$1,870</td>
<td>$4,350</td>
<td>$2,480</td>
</tr>
</tbody>
</table>

- Note: Conversion into 2018 dollars carried by Pivot/Concerto
Overview of studies: Asthma

<table>
<thead>
<tr>
<th>Results Outcome</th>
<th>Grand Total</th>
<th>Positive correlation</th>
<th>No positive correlation</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adherence to medication</td>
<td>4</td>
<td>5</td>
<td>2</td>
<td>7</td>
</tr>
<tr>
<td>Introduction to medication</td>
<td>2</td>
<td>0</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Adherence to therapy</td>
<td>3</td>
<td>3</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>Introduction to therapy</td>
<td>0</td>
<td>0</td>
<td>2</td>
<td>2</td>
</tr>
</tbody>
</table>

1. Positive correlation
2. No positive correlation
3. Total

<table>
<thead>
<tr>
<th>Treatment Metric</th>
<th>Adherence to medication</th>
<th>Introduction to medication</th>
<th>Adherence to therapy</th>
<th>Introduction to therapy</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>4</td>
<td>2</td>
<td>3</td>
<td>0</td>
</tr>
</tbody>
</table>

The employer economic impacts included absenteeism, presenteeism, short-term disability, and work productivity.

- Absenteeism:
- Presenteeism:
- Short-term disability:
- Work productivity:

1. 8 of 13 studies yielded positive results (no correlations were likely due to:
   1. Small samples sizes: n = 87 and n = 385
   2. Self-reported data

2. Adherence to medication was the most widely used metric but adherence to therapy (including education and active follow-up with patients) was also used.

3. The employer economic impacts included absenteeism, presenteeism, and work productivity.

4. Adherence to medication ranged from 23% to 50%.

5. Presenteeism was the major source of employer economic impact at over $7,000/employee/year.

### Impact of asthma control on presenteeism (Case #21)

- Hours of productivity lost per week/employee: 3.7
- Dollars lost per week/employee (2010 CDN$): $167
- Dollars lost per week/employee (2018 CDN$): $192
- Annual savings per employee (2018 CDN$): $10,000
Conclusions

- Clear & demonstrated link between adherence to treatment and economic impact for employees (absenteeism, presenteeism, disability) in terms of days and dollars saved
- Overall, very low levels of adherence: in the range of 50% but below 30% for some studies with patients with asthma, hypertension and depression
- There is clearly an opportunity to generate additional savings by improving adherence as illustrated in the table below for one study which looked at employees with hypertension, diabetes and depression

<table>
<thead>
<tr>
<th>Chronic Condition</th>
<th>Average adherence rate</th>
<th>Average days saved/year at average adherence</th>
<th>Average days saved/year at 100% adherence</th>
<th>Employer savings by employee/year (2018$) at average adherence</th>
<th>Employer savings by employee/year (2018$) at full adherence</th>
<th>Additional savings per employee/year (2018$) from achieving full adherence</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hypertension (Case #10)</td>
<td>63%</td>
<td>3.5</td>
<td>5.5</td>
<td>$714</td>
<td>$1,134</td>
<td>$420</td>
</tr>
<tr>
<td>Diabetes (Case #2)</td>
<td>61%</td>
<td>16.1</td>
<td>26.5</td>
<td>$3,306</td>
<td>$5,420</td>
<td>$2,100</td>
</tr>
<tr>
<td>Depression (Case #14)</td>
<td>43%</td>
<td>9.1</td>
<td>21.2</td>
<td>$1,870</td>
<td>$4,350</td>
<td>$2,480</td>
</tr>
</tbody>
</table>

- Note: Conversion into 2018 dollars carried by Pivot/Concerto
Appendix 1

Literature Review:
Detailed Case Studies
Studies

Top four therapeutic areas

➢ Type 2 Diabetes
➢ Hypertension
➢ Depression
➢ Asthma
### Economic Impacts for diabetes: Savings from $360 to $3,300 per employee/year

<table>
<thead>
<tr>
<th>Study</th>
<th>Economic metric</th>
<th># Days saved per year</th>
<th>Average adherence</th>
<th>% of Adherent Subjects</th>
<th>Annual savings per employee in 2018 dollars at adherence as per column 3 &amp; 4</th>
<th>Annual additional savings per employee in 2018$ at full compliance&lt;sup&gt;2&lt;/sup&gt;</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>#1A</td>
<td>Absenteeism</td>
<td>3</td>
<td></td>
<td>59%</td>
<td>$700 ($36/h)</td>
<td>$700/person for 41% of non-adherent subjects</td>
<td>Total savings not relevant as multi-employer databases</td>
</tr>
<tr>
<td>#1B</td>
<td>Short-term disability</td>
<td>2</td>
<td></td>
<td>59%</td>
<td>$385 ($25/h)&lt;sup&gt;3&lt;/sup&gt;</td>
<td>$385/person for 41% of non-adherent subjects</td>
<td>Total savings not relevant as multi-employer databases</td>
</tr>
<tr>
<td>#2</td>
<td>Absenteeism and Short-term disability (not separated)</td>
<td>16</td>
<td></td>
<td>61%</td>
<td>$3,300 ($20/h)</td>
<td>$2,055 additional benefits of achieving full compliance</td>
<td>Can calculate a meaningful total because have average adherence rate</td>
</tr>
<tr>
<td>#3</td>
<td>Short-term disability</td>
<td>7</td>
<td></td>
<td>57%</td>
<td>$2,700 ($48/h) Ford</td>
<td>By achieving 80% adherence for all its employees Ford could save up to $3,800</td>
<td>Can calculate a meaningful total because have a single employer database</td>
</tr>
<tr>
<td>#4</td>
<td>Absenteeism</td>
<td>4</td>
<td>Initiation to medication</td>
<td></td>
<td>$540 ($17/h)</td>
<td>$540/person by introducing to medication</td>
<td>Total savings not relevant as multi-employer databases</td>
</tr>
</tbody>
</table>

1. Average wage of $30 was obtained using diabetes averages cited by the authors, stated in 2018 dollars
2. Ignoring the cost of achieving that level of compliance and assuming that compliance can be increased to full compliance for all employees
3. Disability was calculated as 70% of $36/h wage
### Economic Impacts for diabetes: Savings from $360 to $3,300 per employee/year (2/2)

<table>
<thead>
<tr>
<th>Study</th>
<th>Economic metric</th>
<th># Days saved per year</th>
<th>Average adherence</th>
<th>% of Adherent Subjects</th>
<th>Annual savings per employee in 2018 dollars at adherence as per column 4</th>
<th>Annual additional savings per employee in 2018$ at full compliance</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>#5</td>
<td>Absenteeism</td>
<td>1.5</td>
<td></td>
<td>66%</td>
<td>$360 ($30/h)</td>
<td>$360/person for 34% of non-adherent subjects</td>
<td>Total savings not relevant as multi-employer databases</td>
</tr>
<tr>
<td>#6</td>
<td>Absenteeism</td>
<td>4% reduction in employees with absence days</td>
<td>Initiation to medication</td>
<td>NA</td>
<td></td>
<td></td>
<td>Could not be calculated as # of days of absence as # of days was not specified but rather # of employees for ranges of absences</td>
</tr>
<tr>
<td>#7</td>
<td>Short-term disability</td>
<td>4-9</td>
<td></td>
<td>75%</td>
<td>$960-$2,160 ($30/h)</td>
<td>$800-$1,800/person for 25% of non-adherent subjects</td>
<td>Total savings not relevant as multi-employer databases</td>
</tr>
<tr>
<td>#8</td>
<td>Presenteeism</td>
<td>3.5</td>
<td></td>
<td>53%</td>
<td>$840 ($30/h)</td>
<td>$840/person for 47% of non-adherent subjects</td>
<td>Total savings not relevant as multi-employer databases</td>
</tr>
</tbody>
</table>

1. Average wage of $30 was obtained using diabetes averages cited by the authors, stated in 2018 dollars
2. Ignoring the cost of achieving that level of compliance and assuming that compliance can be increased to full compliance for all employees
3. Disability was calculated as 70% of $36/h wage
#1 Impact of Medication Adherence on Absenteeism and Short-Term Disability for Five* Chronic Diseases (2012)

**Treatment Measure**
- Adherence to Medication
  - Variable
  - Medication Possession Ratio (MPR) Dichotomous

**Chronic Diseases studied**
- Diabetes
- Hypertension
- Asthma

**EEI measure**
- Absenteeism
- Short-Term Disability

**Population studied**
- Diabetes = 7,817
- Hypertension = 33,245
- Asthma = 5,416
  - (US)

### Results

#### Annual savings in absenteeism by adherent employees

<table>
<thead>
<tr>
<th>Chronic Disease</th>
<th>Days saved</th>
<th>Cost savings¹ 2012$</th>
<th>Cost Savings² 2018$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hypertension</td>
<td>1.7</td>
<td>$408</td>
<td>$444</td>
</tr>
<tr>
<td>Diabetes</td>
<td>2.8</td>
<td>$672</td>
<td>$703</td>
</tr>
<tr>
<td>Asthma</td>
<td>3.0</td>
<td>$720</td>
<td>$783</td>
</tr>
</tbody>
</table>

#### Annual savings in short term disability by adherent employees

<table>
<thead>
<tr>
<th>Chronic Disease</th>
<th>Days saved</th>
<th>Cost savings³ 2012$</th>
<th>Cost Savings² 2018$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hypertension</td>
<td>1.8</td>
<td>$302</td>
<td>$328</td>
</tr>
<tr>
<td>Diabetes</td>
<td>2.1</td>
<td>$353</td>
<td>$384</td>
</tr>
<tr>
<td>Asthma</td>
<td>0.7</td>
<td>$118</td>
<td>$128</td>
</tr>
</tbody>
</table>

1. Cost savings for absenteeism were calculated in 2012 dollars using an average daily wage of $240
2. Conversion made using officialdata.org
3. Cost savings for short term disability were calculated in 2012 dollars using 70% of daily wage of $240

### Observation

- Prospective study
- Retrospective Study

### Sources:

<table>
<thead>
<tr>
<th>Treatment Measure</th>
<th>Data Type</th>
<th>Data Source</th>
<th>Duration</th>
</tr>
</thead>
<tbody>
<tr>
<td>EEI Measure</td>
<td>Prescription claims data</td>
<td>MarketScan</td>
<td>4 years</td>
</tr>
<tr>
<td></td>
<td>Payroll Data</td>
<td>MarketScan</td>
<td>4 years</td>
</tr>
</tbody>
</table>

- Percentage of adherent subjects (MPR>80%):
  - Diabetes: 59%
  - Hypertension: 65%
  - Asthma: 23%

*The 2 conditions not included in the case study are congestive heart failure and dyslipidemia

**Authors:** Ginger Carls, Christopher Roebuck and Teresa Gibson (Journal of Occupational and Environmental Medicine)

ID: 201207
Results

Estimated days lost per year

<table>
<thead>
<tr>
<th>Chronic Condition</th>
<th>Average days saved at 100% compliance</th>
<th>Average days saved at average compliance</th>
<th>Employer savings (1987$) at average adherence</th>
<th>Employer savings (2018$) at average adherence</th>
<th>Employer savings (1987$) at full adherence</th>
<th>Employer savings (2018$) at full adherence</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hypertension</td>
<td>5.5</td>
<td>3.5</td>
<td>$325</td>
<td>$714</td>
<td>$516</td>
<td>$1,134</td>
</tr>
<tr>
<td>Diabetes</td>
<td>26.5</td>
<td>16.1</td>
<td>$1,505</td>
<td>$3,306</td>
<td>$2,467</td>
<td>$5,420</td>
</tr>
<tr>
<td>Depression</td>
<td>21.2</td>
<td>9.1</td>
<td>$851</td>
<td>$1,870</td>
<td>$1,979</td>
<td>$4,350</td>
</tr>
</tbody>
</table>

- Females have significantly more absence days (1 more day/year)
- Heavy smokers have more days off
- Educated workers have significantly fewer days off
- Unionized workers and workers in large firms use more disability days potentially because they have greater discretion to use sick days without fears about job security

**Prospective study**

- Females have significantly more absence days (1 more day/year)
- Heavy smokers have more days off
- Educated workers have significantly fewer days off
- Unionized workers and workers in large firms use more disability days potentially because they have greater discretion to use sick days without fears about job security

**Observation**

- **Sources:**
  - Treatment Measure
    - Data Type: Prescription claims data
    - Data Source: MEPS
    - Duration: 1 year
  - EEI Measure
    - Data Type: Self-Reported (structured survey)
    - Data Source: MEPS
    - Duration: 1 year

- **Average adherence rate:**
  - Hypertension: 63%
  - Diabetes: 61%
  - Depression: 43%

**Authors:** John Rizzo, Tomas Abbott and Steven Pashko (Health Economics)

ID: 199602
#3 Impact of Compliance to Oral Hypoglycemic Agents on Short-Term Disability Costs in an Employer Population (2014)

**Results**

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Adherent Employees In 2007$</th>
<th>Adherent Employees In 2018$²</th>
<th>Non-Adherent Employees In 2007$</th>
<th>Non-Adherent Employees In 2018$²</th>
<th>% Difference³</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean healthcare costs per employee</td>
<td>$7,782</td>
<td>$9,366</td>
<td>$7,642</td>
<td>$9,198</td>
<td>+1.8%</td>
</tr>
<tr>
<td>Mean pharmacy costs</td>
<td>$3,155</td>
<td>$3,797</td>
<td>$1,668</td>
<td>$2,008</td>
<td>+89.1%</td>
</tr>
<tr>
<td>Mean medical costs</td>
<td>$4,627</td>
<td>$5,569</td>
<td>$5,974</td>
<td>$7,190</td>
<td>-22.6%</td>
</tr>
<tr>
<td>Mean STD costs per employee</td>
<td>$7,667</td>
<td>$9,228</td>
<td>$9,913</td>
<td>$11,931</td>
<td>-22.7%</td>
</tr>
<tr>
<td>Mean short-term disability duration¹</td>
<td>10.5 weeks</td>
<td>11.9 weeks</td>
<td></td>
<td></td>
<td>-11.8%</td>
</tr>
<tr>
<td>Total costs per employee (STD + Healthcare)</td>
<td>$15,449</td>
<td>$18,594</td>
<td>$17,555</td>
<td>$21,129</td>
<td>-12.0%</td>
</tr>
</tbody>
</table>

1. Mean short-term disability was only calculated with individuals who had reported short-term disability
2. Conversion made using officialdata.org
3. (Adherent Employees - Non Adherent Employees / Non-Adherent Employees)*100

- While adherent employees have higher healthcare cost due to higher drug spending, the reduction in short-term disability cost is large enough to decrease total cost of employees by 12%

**Prospective study**

- Sources:

<table>
<thead>
<tr>
<th>Treatment Measure</th>
<th>Data Type</th>
<th>Data Source</th>
<th>Duration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prescription claims data</td>
<td>Ford</td>
<td>3 years</td>
<td></td>
</tr>
</tbody>
</table>

- EEI Measure

<table>
<thead>
<tr>
<th>Data Type</th>
<th>Data Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>Claims Data</td>
<td>Ford</td>
</tr>
</tbody>
</table>

- Key Findings:
  - Duration: 3 years
  - As in other studies, total healthcare cost was higher for adherent employees, fueled by higher pharmacy costs
  - However, STD was lowered by 11.8% resulting in net savings in total costs (STD + Healthcare) of 12%

- Percentage of adherent subjects:
  - 57%

**Authors:** Susan Hagen, Douglas Wright, Ron Fich and Walter Talamonti (Population Health Management)

**Observation**

- Adherence to Medication Variable
- Percentage Days Covered

**Chronic Diseases studied**

- Diabetes

**EEI measure**

- Short-Term Disability

**Population studied**

- 4,978 Ford employees with prescription for an hypoglycemic agent (US)
Results

Impact of Vildagliptin in the treatment of Type 2 Diabetes on Employee Absenteeism

<table>
<thead>
<tr>
<th>EEI Measure</th>
<th>Before introduction to Vildagliptin</th>
<th>1 year after introduction of Vildagliptin</th>
<th>Cost savings (in euros)$\text{1}$</th>
<th>Cost savings (in euros)$\text{1}$ converted in (2018)$\text{2}$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average hours of work missed per year</td>
<td>59</td>
<td>26</td>
<td>400.15</td>
<td>463.81</td>
</tr>
</tbody>
</table>

- The addition of Vildagliptin yielded major improvement in absenteeism even 6 months after the beginning of the treatment. After a year, absenteeism decreased by 53%.

1. Cost savings were calculated using the average wage of the patients
2. Conversion made using officialdata.org

Prospective study

- Sources:
  - Study design: Patients were chosen on the basis that they were no longer responding to metformin based on a new medication prescription

Authors: Stefano Genovese and Donatella Tedeschi (Journal of Advanced Therapy)

ID: 20130220
#5 The Association of Insulin Medication Possession Ratio, Use of Insulin Glargine, and Health Benefit Costs in Employees and Spouses with Type 2 Diabetes (2008)

**Results**

Average Annual Sick Days Leave for Adherent and Non-Adherent Insulin Glargine Users

<table>
<thead>
<tr>
<th>EEI Measure</th>
<th>Adherent</th>
<th>Non-Adherent</th>
<th>% Difference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Absence days</td>
<td>4.1</td>
<td>5.4</td>
<td>-24%</td>
</tr>
</tbody>
</table>

1. Percentage difference calculated as (Adherent – Non-Adherent/ Non-Adherent)*100

**Observation**

Prospective study ✔ Retrospective Study

**Sources:**

<table>
<thead>
<tr>
<th>Treatment Measure</th>
<th>Data Type</th>
<th>Data Source</th>
<th>Duration</th>
</tr>
</thead>
<tbody>
<tr>
<td>EEI Measure</td>
<td>Prescription claims data</td>
<td>HCMS</td>
<td>1 year</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Data Type</th>
<th>Data Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>Claims and Payroll Data</td>
<td>HCMS</td>
</tr>
</tbody>
</table>

**Key Findings:**

- Study found an estimated $450 savings per employee in total medical and prescription drug cost per each 10% increase in MPR.
- Because this type of insulin requires only one dose a day, rather than multiple injections, patients taking insulin glargine had significantly higher MPRs than patients taking other forms of insulin

**Average adherence:**

- 66%

**Authors:** Nathan Kleinman, Justin Schaneman and Wendy Lynch (Journal of Occupational and Environmental Medicine)

ID: 200812
Difference in Percentage of Patient Absenteeism Between Placebo and Treatment Group

<table>
<thead>
<tr>
<th>Treatment Measure</th>
<th>Chronic Diseases studied</th>
<th>EEI measure</th>
<th>Population studied</th>
</tr>
</thead>
<tbody>
<tr>
<td>Glipizide GITS¹</td>
<td>Diabetes</td>
<td>Absenteeism</td>
<td>569 patients with Type 2 Diabetes (US)</td>
</tr>
</tbody>
</table>

**Results**

- **Positive correlation**
- **No correlation**

### Treatment Measure

- **Introduction to medication**
- **Medication**
- **Glipizide GITS¹**

### Chronic Diseases studied

- **Diabetes**

### EEI measure

- **Absenteeism**

### Population studied

- **569** patients with Type 2 Diabetes (US)

#### Prospective study

- **Sources:**

<table>
<thead>
<tr>
<th>Study Type</th>
<th>Study Design</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clinical Trial</td>
<td>Double-blind control experiment (GITS vs Placebo); with 3 week-period to wash prior treatment</td>
</tr>
</tbody>
</table>

| Duration: 15 weeks |

#### EEI Measure

<table>
<thead>
<tr>
<th>Data Type</th>
<th>Data Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>Self-reported Data</td>
<td>Study Questionnaire</td>
</tr>
</tbody>
</table>

| Duration: 12 weeks |

#### Observation

- **Prospective study**

#### Key Findings:

- **Study Duration:** the treatment and EEI measure overlapped during the last 12 weeks

#### Key Findings:

- **Both groups were subject to a diet, suggesting that the presence of medication can assume to have been a real predictor of absenteeism**

### Positive correlation

- **Difference in Percentage of Patient Absenteeism Between Placebo and Treatment Group**

<table>
<thead>
<tr>
<th>% of employees with absence days before introduction of treatment¹</th>
<th>% of employees with absence days after 15 weeks of treatment</th>
<th>% Difference²</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.4%</td>
<td>10.5%</td>
<td>+77%</td>
</tr>
<tr>
<td>5.6%</td>
<td>4.8%</td>
<td>-4%</td>
</tr>
</tbody>
</table>

- **Employees initiated on GITS reduced absenteeism slightly while the % of non-controlled employees with diabetes rose sharply potentially because they were taken off their medication**

1. The study only reported the amount of patients experiencing absence days, without taking into account the duration of those absences.
2. Percentage difference calculated as (Absence days after treatment – Absence days before treatment / Absence days after treatment )*100

---

1. Refers to glipizide gastrointestinal therapeutic system

**Authors:** Marcia Testa & Donald Simonson (Journal of American Medical Association) **ID: 19981104**
#7 Cost Sharing, Adherence, and Health Outcomes in Patients with Diabetes (2010)

## Results

Relationship between adherence with oral hypoglycemic agents and costs in a 2 year time frame

<table>
<thead>
<tr>
<th>EEI Measure</th>
<th>OAD(^1)-only users/year</th>
<th>OAD users with or without insulin(^2)/year</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Adherent</td>
<td>Non-Adherent</td>
</tr>
<tr>
<td>STD days</td>
<td>8</td>
<td>12</td>
</tr>
<tr>
<td>Absence days</td>
<td>Mixed Effects(^4)</td>
<td>N/A</td>
</tr>
</tbody>
</table>

1. OAD refers to orally administered agents
2. Database for this group did not specify that patients were taking only OAD
3. Percentage difference calculated as (Adherent – Non-Adherent/ Non-Adherent)\(^*\)100
4. Study found slightly higher rates of absence among patients who were adherent for the full sample. This may be due to non-adherent patients slipping into disability as opposed to taking absence days. OAD-only users had the same rates of absence as those who were non-adherent.

## Population studied

- Absenteeism = 2,869
- Short-term disability = 4,780
  (US)

## Treatment Measure

- Adherence to Medication
  - Variable: Percentage Days Covered

## Chronic Diseases studied

- Diabetes

## EEI measure

- Absenteeism
  - Short-Term Disability

## Observation

- Prospective study ✔
- Retrospective Study ✔

### Sources:

<table>
<thead>
<tr>
<th>Data Type</th>
<th>Data Source</th>
<th>Duration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prescription claims data</td>
<td>MarketScan</td>
<td>1 year</td>
</tr>
<tr>
<td>Claims Data</td>
<td>MarketScan</td>
<td>1 year</td>
</tr>
</tbody>
</table>

### Treatment Measure

- Percentage of adherent subjects (MPR>80%):
  - OAD only: 73%
  - On OAD with or without insulin: 75%

**Authors:** Teresa Gibson, Xue Song, Berhanu Alemayehu and Sara Wang (American Journal of Managed Care)
#8 Medication Adherence, Comorbidities, and Health Risk Impacts on Workforce Absence and Job Performance (2011)

**Results**

**Effect of Medication Adherence on Job Performance and Absenteeism**

<table>
<thead>
<tr>
<th>Chronic Condition</th>
<th>Sample Average MPR</th>
<th>Absenteeism for adherent employees (MPR &gt; 80%)</th>
<th>Job performance¹ for adherent employees (MPR &gt; 80%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hypertension</td>
<td>79%</td>
<td>Did not find significant results</td>
<td>Did not find significant results</td>
</tr>
<tr>
<td>Diabetes</td>
<td>77%</td>
<td>Did not find significant results</td>
<td>+3.5 days per year</td>
</tr>
<tr>
<td>Depression</td>
<td>70%</td>
<td>Did not find significant results</td>
<td>Did not find significant results</td>
</tr>
</tbody>
</table>

¹. Hours of improved work performance were transformed into days per year assuming an 8 hour work day and 262 work days per year

**Chronic Diseases studied**
- Diabetes
- Depression
- Hypertension

**EEI measure**
- Absenteeism
- Presenteeism

**Population studied**
- Hypertension = 5,449
- Diabetes = 1,312
- Depression = 2,120

Employees from 5 major undisclosed companies (US)

**Prospective study**

- Sources:
  - Data Type: Prescription claims data
  - Data Source: Insurance Company
  - Duration: 29 months

- EEI Measure
  - Data Type: Self-Reported
  - Data Source: Health Productivity Questionnaire
  - Duration: 28 days

**Observation**

- Positive correlation ✔
- No correlation ✗

**Study Limitations**:
- Use of self reported data on absence and job performance
- Percentage of adherent subjects (MPR > 80%):
  - Diabetes: 53%
  - Hypertension: 65.6%
  - Depression: 63.1%

**Authors**: Ronald Loeppke, Vince Haufle, Kim Kinnett and Thomas Parry (Journal of Occupational and Environmental Medicine)

ID: 201106
Top four therapeutic areas

- Type 2 Diabetes
- Hypertension
- Depression
- Asthma
Economic Impacts for hypertension: Savings from $330 to $1,600 per employee/year

<table>
<thead>
<tr>
<th>Study</th>
<th>Economic metric</th>
<th># Days saved per year</th>
<th>Average adherence</th>
<th>% of Adherent Subjects</th>
<th>Annual savings per employee in 2018 dollars* at adherence as per column 3 &amp; 4</th>
<th>Annual additional savings per employee in 2018$ at full compliance²</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>#9 A</td>
<td>Absenteeism</td>
<td>1.7</td>
<td></td>
<td>65%</td>
<td>$450 ($33/h)</td>
<td>450$/ person for remaining 35% of non-adherent employees</td>
<td>Total savings not relevant as multi-employer databases</td>
</tr>
<tr>
<td>#9 B</td>
<td>Short-term disability</td>
<td>1.8</td>
<td></td>
<td>65%</td>
<td>$330 ($33/h)</td>
<td>$330/person for 35% of non-adherent subjects</td>
<td>Total savings not relevant as multi-employer databases</td>
</tr>
<tr>
<td>#10</td>
<td>Short-term disability</td>
<td>5.3</td>
<td>63%</td>
<td></td>
<td>$1,130 ($20/h)</td>
<td>$830 benefits of achieving full compliance</td>
<td>Can calculate a meaningful total because have average adherence rate</td>
</tr>
<tr>
<td>#11 A</td>
<td>Presenteeism</td>
<td>6.7</td>
<td></td>
<td>40%</td>
<td>$1,600 ($30/h)¹</td>
<td>$1,400/person for 60% of non-adherent subjects</td>
<td>Total savings not relevant as multi-employer databases</td>
</tr>
<tr>
<td>#11 B</td>
<td>Work productivity</td>
<td>6.9</td>
<td></td>
<td>40%</td>
<td>$1,660 ($30/h)¹</td>
<td>$1,400/person for 60% of non-adherent subjects</td>
<td>Total savings not relevant as multi-employer databases</td>
</tr>
<tr>
<td>#12</td>
<td>Absenteeism</td>
<td>4.3</td>
<td></td>
<td>30%</td>
<td>$1,300 ($30/h)¹</td>
<td>$870/person for 70% of non-adherent subjects³</td>
<td>Total savings not relevant as multi-employer databases</td>
</tr>
<tr>
<td>#13</td>
<td>Presenteeism</td>
<td>3.5</td>
<td></td>
<td>66%</td>
<td>$840 ($30/$)¹</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

1. Average wage of $30 was obtained using diabetes averages cited by the authors, stated in 2018 dollars
2. Ignoring the cost of achieving that level of compliance and assuming that compliance can be increased to full compliance for all employees
#9 Impact of Medication Adherence on Absenteeism and Short-Term Disability for Five* Chronic Diseases (2012)

Treatment Measure
- Adherence to Medication
  - Variable
- Medication Possession Ratio
  - Dichotomous

Chronic Diseases studied
- Diabetes
- Hypertension
- Asthma

EEI measure
- Absenteeism
- Short-Term Disability

Population studied
- Diabetes = 7,817
- Hypertension = 33,245
- Asthma = 5,416
  (US)

Results

<table>
<thead>
<tr>
<th>Chronic Diseases</th>
<th>Days saved</th>
<th>Cost savings(^1) 2012$</th>
<th>Cost savings(^2) 2018$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hypertension</td>
<td>1.7</td>
<td>$408</td>
<td>$444</td>
</tr>
<tr>
<td>Diabetes</td>
<td>2.8</td>
<td>$672</td>
<td>$703</td>
</tr>
<tr>
<td>Asthma</td>
<td>3.0</td>
<td>$720</td>
<td>$783</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Chronic Diseases</th>
<th>Days saved</th>
<th>Cost savings(^3) 2012$</th>
<th>Cost savings(^2) 2018$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hypertension</td>
<td>1.8</td>
<td>$302</td>
<td>$328</td>
</tr>
<tr>
<td>Diabetes</td>
<td>2.1</td>
<td>$353</td>
<td>$384</td>
</tr>
<tr>
<td>Asthma</td>
<td>0.7</td>
<td>$118</td>
<td>$128</td>
</tr>
</tbody>
</table>

1. Cost savings for absenteeism were calculated in 2012 dollars using an average daily wage of $240
2. Conversion made using officialdata.org
3. Cost savings for short term disability were calculated in 2012 dollars using 70% of daily wage of $240

Prospective study
- Sources:
  - Population studied
  - EEI measure

Retrospective Study
- Sources:
  - EEI measure

Observation

- Prospective study
- Retrospective Study

<table>
<thead>
<tr>
<th>Treatment Measure</th>
<th>Data Type</th>
<th>Data Source</th>
<th>Duration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adherence to Medication</td>
<td>Prescription claims data</td>
<td>MarketScan</td>
<td>4 years</td>
</tr>
</tbody>
</table>
| Medication Possession Ratio | EEI Measure
  - Data Type: Payroll Data
  - Data Source: MarketScan
  - Duration: 4 years

- Sources:
  - Population studied
  - EEI measure

- Percentage of adherent subjects:
  - Diabetes: 59%
  - Hypertension: 65%
  - Asthma: 23%

ID: 201207

*The 2 conditions not included in the case study are congestive heart failure and dyslipidemia

Authors: Ginger Carls, Christopher Roebuck and Teresa Gibson (Journal of Occupational and Environmental Medicine)
#10 Labour Productivity Effects of Prescribed Medicines for Chronically Ill Workers
(1996)

**Treatment Measure**
- Adherence to Medication
  - Variable

**Chronic Diseases studied**
- Diabetes
- Hypertension
- Depression

**Productivity measure**
- Absenteeism

**Population studied**
- Respondents of the 1987 National Medical Expenditure Panel Survey (MEPS) in the (US)

## Results

### Estimated days lost per year

<table>
<thead>
<tr>
<th>Chronic Condition</th>
<th>Average days saved at 100% compliance</th>
<th>Average days saved at average compliance</th>
<th>Employer savings (1987$) at average adherence</th>
<th>Employer savings (2018$) at average adherence</th>
<th>Employer savings (1987$) at full adherence</th>
<th>Employer savings (2018$) at full adherence</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hypertension</td>
<td>5.5</td>
<td>3.5</td>
<td>$325</td>
<td>$714</td>
<td>$516</td>
<td>$1,134</td>
</tr>
<tr>
<td>Diabetes</td>
<td>26.5</td>
<td>16.1</td>
<td>$1,505</td>
<td>$3,306</td>
<td>$2,467</td>
<td>$5,420</td>
</tr>
<tr>
<td>Depression</td>
<td>21.2</td>
<td>9.1</td>
<td>$851</td>
<td>$1,870</td>
<td>$1,979</td>
<td>$4,350</td>
</tr>
</tbody>
</table>

- Females have significantly more absence days (1 more day/year)
- Heavy smokers have more days off
- Educated workers have significantly fewer days off
- Unionized workers and workers in large firms use more disability days potentially because they have greater discretion to use sick days without fears about job security

1. Conversion made using officialdata.org

## Prospective study

### Sources:

<table>
<thead>
<tr>
<th>Treatment Measure</th>
<th>Data Type</th>
<th>Data Source</th>
<th>Duration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prescription claims data</td>
<td>MEPS</td>
<td>1 year</td>
<td></td>
</tr>
</tbody>
</table>

### EEI Measure

<table>
<thead>
<tr>
<th>Data Type</th>
<th>Data Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>Self-Reported (structured survey)</td>
<td>MEPS</td>
</tr>
</tbody>
</table>

### Observation

- **Prospective study**
- **Retrospective Study**

- **Average adherence rate:**
  - Hypertension: 63%
  - Diabetes: 61%
  - Depression: 43%
#11 Impact of Medication Adherence on Work Productivity in Hypertension (2012)

**Results**

Time lost at work by level of hypertensive medication adherence (% per period of 7 days)

<table>
<thead>
<tr>
<th>EEI Measure</th>
<th>Average for full sample (n = 3,041)</th>
<th>Low Adherence (n = 1,355)</th>
<th>High Adherence (n = 1,686)</th>
<th>Percentage Difference¹</th>
</tr>
</thead>
<tbody>
<tr>
<td>Percentage Work Productivity Loss (absenteeism + presenteeism)</td>
<td>21.4%</td>
<td>23.8%</td>
<td>19.5%</td>
<td>-18% (6.7 days)</td>
</tr>
<tr>
<td>Percentage time lost due to Presenteeism only</td>
<td>18.4%</td>
<td>20.5%</td>
<td>16.7%</td>
<td>-19% (6.9 days)</td>
</tr>
</tbody>
</table>

¹ Percentage difference calculated as (High Adherence - Low Adherence / Low Adherence) *100

**Prospective study**

- **Sources:**
  - Data Type: Self-reported data (structured survey)
  - Data Source: NHWS
  - Duration: 1 year

- **EEI Measure**
  - Data Type: Self-reported Data (structured survey)
  - Data Source: NHWS
  - Duration: 7 days

- **Chronic Diseases studied**
  - Hypertension

- **Population studied**
  - 3,041 National Health and Wellness Survey (NHWS) respondents employed and with hypertensive medication (US)

- **EEI measure**
  - Presenteeism
  - Work Productivity

- **Treatment Measure**
  - Adherence to Medication
  - Morisky Medication Adherence Scale (MMAS)

- **Variable**

**Observation**

- **Prospective study**
- **Retrospective Study**

**Key Findings:**
- Comorbidities like depression, high cholesterol and obesity had significant impact on work productivity losses
- Adherent patients were more likely to be Caucasian, married and non-smokers

- **% of adherent subjects (MMAS = 1-4):**
  - 34%
- **% of low adherent subjects (MMAS = 0):**
  - 66%

**Study Limitations:** Use of self reported data

**Authors:** Samuel Wagner, Helen Lau, Feride Frech-Tamas and Shaloo Gupta (American Journal of Pharmacy Benefits)
#12 Effect of Antihypertensive Medication Adherence Among Employees With Hypertension (2009)

## Results

Annual number of work absence days per level of medication adherence

<table>
<thead>
<tr>
<th>Absence days</th>
<th>Percentage Days Covered, %</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>25</td>
</tr>
<tr>
<td>50</td>
<td>21.6</td>
</tr>
<tr>
<td>75</td>
<td>15.4</td>
</tr>
<tr>
<td>100</td>
<td>11.0</td>
</tr>
</tbody>
</table>

### Hypertension-specific high prior cost

- While the “high prior cost” group showcased a negative correlation between medication adherence and days missed from work, the “low prior cost group” had more absence days as their medication adherence increased. A potential explanation could be the secondary effect associated with the medication leading to higher impairment for employees.
- Thus, an increase in adherence will have significant positive outcomes for high prior medical costs patients, but not for low prior medical costs patients.

1. Employees with high medical costs 6 months prior to study

### Sources:

- **Treatment Measure**
  - **Data Type**: Prescription claims data
  - **Data Source**: Human Capital Management Services
  - **Duration**: 2 years

- **EEI Measure**
  - **Data Type**: Claims and Payroll Data
  - **Data Source**: Human Capital Management Services
  - **Duration**: 1 year

### Key Findings:

- Each 10% increase in PDC results, on average, in:
  - +7.4 absence days for employees with low prior costs
  - -12.5 absence days for employees with high prior cost

- % of adherent subjects (PDC>90%): 30%
- % of low adherent subjects (PDC between 1% and 60%): 40.3%

**Authors**: Wendy Lynch, Karine Markosyan, et al. (American Journal of Managed Care)  
**ID**: 200912
#13 Medication Adherence, Comorbidities, and Health Risk Impacts on Workforce Absence and Job Performance (2011)

## Results

**Effect of Medication Adherence on Job Performance and Absenteeism**

<table>
<thead>
<tr>
<th>Chronic Condition</th>
<th>Sample Average MPR</th>
<th>Absenteeism for adherent employees (MPR &gt; 80%)</th>
<th>Job performance¹ for adherent employees (MPR &gt; 80%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hypertension</td>
<td>79%</td>
<td>Did not find significant results</td>
<td>Did not find significant results</td>
</tr>
<tr>
<td>Diabetes</td>
<td>77%</td>
<td>Did not find significant results</td>
<td>+3.5 days per year</td>
</tr>
<tr>
<td>Depression</td>
<td>70%</td>
<td>Did not find significant results</td>
<td>Did not find significant results</td>
</tr>
</tbody>
</table>

1. Hours of improved work performance were transformed into days per year assuming an 8 hour work day and 262 work days per year

### Sources:

**Treatment Measure**

- **Data Type**: Prescription claims data
- **Data Source**: Insurance Company
- **Duration**: 29 months

**EEI Measure**

- **Data Type**: Self-Reported
- **Data Source**: Health Productivity Questionnaire
- **Duration**: 28 days

### Study Limitations:

- Use of self reported data on absence and job performance

### Percentage of adherent subjects:

- Diabetes: 53%
- Hypertension: 66%
- Depression: 63%

### Authors:

Ronald Loeppke, Vince Haufle, Kim Kinnett and Thomas Parry (Journal of Occupational and Environmental Medicine)
Top four therapeutic areas

- Type 2 Diabetes
- Hypertension
- Depression
- Asthma
## Economic Impacts for depression: Savings from $860 to over $10,000 per employee/year

<table>
<thead>
<tr>
<th>Study</th>
<th>Economic metric</th>
<th># Days saved per year</th>
<th>Average adherence</th>
<th>% of adherent subject</th>
<th>Annual savings per employee in 2018 dollars</th>
<th>Annual additional savings per employee in 2018$ at full compliance</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>#14</td>
<td>Absenteeism</td>
<td>9</td>
<td>43%</td>
<td></td>
<td>$1,870 ($20.5/h)</td>
<td>$2,480 additional benefits of achieving full compliance</td>
<td>Can calculate a meaningful total because have average adherence rate</td>
</tr>
<tr>
<td>#15A</td>
<td>Absenteeism</td>
<td>10¹</td>
<td>25% (&gt;95%)</td>
<td></td>
<td>$2,400 ($30/h)²</td>
<td>$2,380/person for 75% of non-adherent subjects</td>
<td>Total savings not relevant as multi-employer databases</td>
</tr>
<tr>
<td>#15B</td>
<td>Presenteeism</td>
<td>22¹</td>
<td>25% (&gt;95%)</td>
<td></td>
<td>$5,280 ($30/h)²</td>
<td>$5,327/person for 75% of non-adherent subjects</td>
<td>Total savings not relevant as multi-employer databases</td>
</tr>
<tr>
<td>#16A</td>
<td>Absenteeism</td>
<td>6.1</td>
<td>N/A: adherence to therapy</td>
<td></td>
<td>$860</td>
<td></td>
<td>Total savings not relevant as multi-employer databases</td>
</tr>
<tr>
<td>#16B</td>
<td>Presenteeism</td>
<td>N/A</td>
<td>N/A: adherence to therapy</td>
<td></td>
<td>$2,372</td>
<td></td>
<td>Total savings not relevant as multi-employer databases</td>
</tr>
<tr>
<td>#17</td>
<td>Short-term disability</td>
<td>43</td>
<td>54% after 3 months</td>
<td></td>
<td>$10,320 ($30/h)²</td>
<td>$520,000/person for 46.3% of non-adherent subjects</td>
<td>Can calculate a meaningful total because have a single employer database</td>
</tr>
<tr>
<td>#18</td>
<td>Absenteeism</td>
<td>N/A</td>
<td>85% patients initiate treatment</td>
<td></td>
<td>N/A</td>
<td></td>
<td># of days not calculated but rather number of people on ranges of sick leave</td>
</tr>
</tbody>
</table>

1. Annual savings given by authors divided by estimated daily wage of $240 (2018$)
2. Average wage of $30 was obtained using diabetes averages cited by the authors, stated in 2018 dollars
3. Ignoring the cost of achieving that level of compliance and assuming that compliance can be increased to full compliance for all employees
### Results

**Estimated days lost per year**

<table>
<thead>
<tr>
<th>Chronic Condition</th>
<th>Average days saved at 100% compliance</th>
<th>Average days saved at average compliance</th>
<th>Employer savings (1987$) at average adherence</th>
<th>Employer savings (2018$) at average adherence</th>
<th>Employer savings (1987$) at full adherence</th>
<th>Employer savings (2018$) at full adherence</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hypertension</td>
<td>5.5</td>
<td>3.5</td>
<td>$325</td>
<td>$714</td>
<td>$516</td>
<td>$1,134</td>
</tr>
<tr>
<td>Diabetes</td>
<td>26.5</td>
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<td>$3,306</td>
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<tr>
<td>Depression</td>
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<td>$851</td>
<td>$1,870</td>
<td>$1,979</td>
<td>$4,350</td>
</tr>
</tbody>
</table>

- Females have significantly more absence days (1 more day/year)
- Heavy smokers have more days off
- Educated workers have significantly fewer days off
- Unionized workers and workers in large firms use more disability days potentially because they have greater discretion to use sick days without fears about job security

---

**Sources:**

- **Data Type:** Prescription claims data
- **Data Source:** MEPS
- **Duration:** 1 year

**EEI Measure**

- **Data Type:** Self-Reported (structured survey)
- **Data Source:** MEPS
- **Duration:** 1 year

**Average adherence rate:**
- Hypertension: 63%
- Diabetes: 61%
- Depression: 43%

---

**Authors:** John Rizzo, Tomas Abbott and Steven Pashko (Health Economics)

ID: 199602
#15 Assessing the relationship between compliance with antidepressant therapy and employer costs among employees in the United States* (2010)

**Results**

Direct & Indirect costs\(^1\) per employee with depression

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>MPR &lt; 0.26(^1)</th>
<th>2018(^2)</th>
<th>0.26 &lt; MPR &lt; 0.95(^1)</th>
<th>2018(^2)</th>
<th>MPR &gt; 0.95(^1)</th>
<th>2018(^2)</th>
<th>% Difference(^3)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean direct cost per employee</td>
<td>610</td>
<td>755</td>
<td>844</td>
<td>1,045</td>
<td>1,450</td>
<td>1,795</td>
<td>58%</td>
</tr>
<tr>
<td>Mean pharmacy costs</td>
<td>194</td>
<td>240</td>
<td>525</td>
<td>650</td>
<td>1,086</td>
<td>1,344</td>
<td>82%</td>
</tr>
<tr>
<td>Mean medical costs</td>
<td>480</td>
<td>594</td>
<td>306</td>
<td>379</td>
<td>396</td>
<td>490</td>
<td>-22%</td>
</tr>
<tr>
<td>Mean indirect cost per employee</td>
<td>25,542</td>
<td>31,617</td>
<td>21,702</td>
<td>26,864</td>
<td>19,315</td>
<td>23,909</td>
<td>-24%</td>
</tr>
<tr>
<td>Mean absenteeism costs</td>
<td>5,899</td>
<td>7,302</td>
<td>4,477</td>
<td>5,542</td>
<td>3,976</td>
<td>4,922</td>
<td>-33%</td>
</tr>
<tr>
<td>Mean presenteeism costs</td>
<td>19,643</td>
<td>24,315</td>
<td>17,225</td>
<td>21,322</td>
<td>15,339</td>
<td>18,988</td>
<td>-22%</td>
</tr>
</tbody>
</table>

1. Annualized 2006 Dollars during the 6-month study period
2. Conversion made using officialdata.org
3. \((\text{MPR} > 0.95) - (\text{MPR} < 0.26)\)/ (\text{MPR} < 0.26)

*The subset of employees with depression was used since the category of employees with antidepressant may be too broad to observe impact on costs as patients may receive antidepressants for conditions other than depression (bipolar, pain, etc)

**Authors:** Howard Birnbaum, Rym Ben-Hamadi et al. ((Journal of Occupational and Environmental Medicine)

**Observation**

- Prospective study
- Retrospective Study

**Sources:**

- Treatment Measure
  - Chronic Diseases studied: Depression
  - Productivity measure: Absenteeism, Presenteeism

- Population studied:
  - 488 employees from 2 US employers’ privately insured medical and prescription claims databases (US)

**Data Type**

- Prescription claims data
- Employer databases
- Health Performance Questionnaire (HPQ) was given to employees when they signed up for benefits
- Salary data in the database was used to transform measures of lost work performance into dollars

**EEI Measure**

- Duration: 114 days before survey (3 months plus buffer)
- Duration: 1 year (6 months prior to and after the survey)
#16 The effect of improving primary care depression management on employee absenteeism and productivity (2004)

**Chronic Diseases studied**
- Depression

**Treatment Measure**
- Adherence to Therapy

**EEI measure**
- Absenteeism
- Presenteeism

**Population studied**
- 326 patients in 12 community primary care practices across the US who reported being employed during the study (US)

---

### Results

**Impact of treatment on absenteeism and presenteeism**

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Employees impact</td>
<td>-23%</td>
<td>$539</td>
<td>$857</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Employees impact</td>
<td>6.1%</td>
<td>$1,491</td>
<td>$2,372</td>
</tr>
</tbody>
</table>

- Depression management, including medication therapy, improved presenteeism by 6%, translating into $1,500 (in 1996$) per year per FTE suffering from depression and reduced absenteeism by 23% at an annual value of $539

1. Conversion made using officialdata.org

---

**Observation**

- Prospective study
- No correlation

**Sources:**

**EEI Measure**

### Treatment Measure

<table>
<thead>
<tr>
<th>Data Type</th>
<th>Data Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>Real-world trial/self-reported data</td>
<td>Study questionnaire asking patients their medication use and whether they had any counselling</td>
</tr>
</tbody>
</table>

Duration: 2 years

<table>
<thead>
<tr>
<th>Data Type</th>
<th>Data Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>Self-reported</td>
<td>Study questionnaire</td>
</tr>
</tbody>
</table>

Duration: 2 years

---

**Authors:** Kathryn Rost, Jeffrey Smith and Miriam Dickinson (Journal of Medical Care) ID: 20041210
#17 The association of antidepressant medication adherence with employee disability absences (2007)

## Results

### Relationship between STD absences and HEDIS

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Non adherent</th>
<th>Adherent</th>
<th>% Difference</th>
</tr>
</thead>
<tbody>
<tr>
<td>For acute phase, % of employees that had STD in follow-up period (%)</td>
<td>12.7%</td>
<td>8.8%</td>
<td>-31%</td>
</tr>
<tr>
<td>For continuation phase, % of employees that had STD in follow-up period (%)</td>
<td>12.0%</td>
<td>8.4%</td>
<td>-30%</td>
</tr>
</tbody>
</table>

For the continuation phase, the authors calculated $ savings:
- # of employees non-adherent: 1146
- % with probability of STD: 12% or 137 employees
- # with STD: 94
- # of employees saved from STD: 43
- Average duration of disability claim: 46 days
- @ $200/day: $396,000 in 2007
- In 2018 $: $520,000

1. Values represent the % of subjects with a given STD status, except where indicated
2. (Adherent – Non adherent) / Adherent
3. Conversion made using officialdata.org

### Sources:

#### Treatment Measure

- **Data Type**: Prescription claims data
- **Data Source**: Employer’s database
- **Duration**: Acute treatment: 3 months + buffer for refills gaps or washout when changing medication=114 days
  Continuation phase: 231 days ensuring medication for 180 days

#### EEI Measure

- **Data Type**: STD claims
- **Data Source**: Employer’s database
- **Duration**: 1 year (after initial antidepressant prescription)

### Observations

- Positive correlation
- Retrospective study

### Authors:
Wayne Burton et al. (American Journal of Managed Care)

**ID**: 20070511
#18 Impact of initial medication non-adherence to Selective Serotonin Reuptake Inhibitors (SSRI) on sick leaves (2007)

Results

<table>
<thead>
<tr>
<th>Days on Sick Leave</th>
<th>0 days</th>
<th>1-30 days</th>
</tr>
</thead>
<tbody>
<tr>
<td>Initially non adherent (17%)</td>
<td>66% of these patients had 0 sick days</td>
<td>12% of these patients had between 1-30 sick days</td>
</tr>
<tr>
<td>Initially adherent patients (83%)</td>
<td>75% of these patients had 0 sick days</td>
<td>9% of these patients had 1-30 sick days</td>
</tr>
<tr>
<td>Initial adherence gain</td>
<td>9% more patients with 0 sick days</td>
<td>3% fewer patients with 1-30 sick days</td>
</tr>
</tbody>
</table>

### Chronic Diseases studied
- Depression

### Productivity measure
- Absenteeism

### Population studied
- 79,642 patients with a diagnosis of depression with a prescription for SSRIs (Spain)

### Treatment Measure
- Adherence to Medication
- Variable
- IMNA: Initial Medication Non-Adherence

### Observation
- Prospective study
- Retrospective Study

### Sources:
- Prospective study:
  - Data Type: Prescription claims data to see if medication claim was filed
  - Data Source: Public payer database (Catalan Health Institute)
  - Duration: 4 year

- Retrospective Study:
  - Data Type: Public payer database (Catalan Health Institute)**
  - Data Source: Public payer database (Catalan Health Institute)**
  - Duration: 1 year (6 months prior to and after the index prescription)

* The patient had to not have a prescription for 30 days prior to initiation to SSRI

** The system was able to capture sick days as a medical authorization is required for a sick leave

### Authors
- Ignacio Aznar-Lou et al. (Journal of Affective Disorders)

ID: 20070202
#19 Medication Adherence, Comorbidities, and Health Risk Impacts on Workforce Absence and Job Performance (2011)

### Results

#### Effect of Medication Adherence on Job Performance and Absenteeism

<table>
<thead>
<tr>
<th>Chronic Condition</th>
<th>Sample Average MPR</th>
<th>Absenteeism for adherent employees (MPR &gt; 80%)</th>
<th>Job performance(^1) for adherent employees (MPR &gt; 80%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hypertension</td>
<td>79%</td>
<td>Did not find significant results</td>
<td>Did not find significant results</td>
</tr>
<tr>
<td>Diabetes</td>
<td>77%</td>
<td>Did not find significant results</td>
<td>+3.5 days per year</td>
</tr>
<tr>
<td>Depression</td>
<td>70%</td>
<td>Did not find significant results</td>
<td>Did not find significant results</td>
</tr>
</tbody>
</table>

1. Hours of improved work performance were transformed into days per year assuming an 8 hour work day and 262 work days per year

### EEI Measure

- **Absenteeism**
- **Presenteeism**

### Population studied

- **Hypertension** = 5,449
- **Diabetes** = 1,312
- **Depression** = 2,120

Employees from 5 major undisclosed companies (US)

### Authors

Ronald Loeppke, Vince Haufl, Kim Kinnett and Thomas Parry (Journal of Occupational and Environmental Medicine)
Top four therapeutic areas

- Type 2 Diabetes
- Hypertension
- Depression
- Asthma
Economic impacts for asthma: Impact very high for losses due to presenteeism, in the range of $7,000 per employee per year

<table>
<thead>
<tr>
<th>Study</th>
<th>Economic metric</th>
<th># Days saved per year</th>
<th>% of adherent subject</th>
<th>Annual savings per employee in 2018 dollars</th>
</tr>
</thead>
<tbody>
<tr>
<td>#20A</td>
<td>Absenteeism</td>
<td>3</td>
<td>23%</td>
<td>$780 ($30/h)</td>
</tr>
<tr>
<td>#20B</td>
<td>Disability</td>
<td>0.5</td>
<td>23%</td>
<td>$130 ($30/h)</td>
</tr>
<tr>
<td>#21</td>
<td>Presenteeism</td>
<td>24</td>
<td>Asthma control was used as proxy for medication adherence</td>
<td>$7,800 ($45 CDN/h)</td>
</tr>
<tr>
<td>#22</td>
<td>Work productivity</td>
<td>30</td>
<td>51%¹</td>
<td>$7,200 ($30/h)²</td>
</tr>
<tr>
<td>#23</td>
<td>Work productivity</td>
<td></td>
<td>44%¹</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(presenteeism)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

1. Percentage of patients with controlled asthma (ACT> 20)
2. Average wage of $30 was obtained using diabetes averages cited by the authors, stated in 2018 dollars
#20 Impact of Medication Adherence on Absenteeism and Short-Term Disability for Five* Chronic Diseases (2012)

### Treatment Measure
- **Adherence to Medication**
  - Variable
  - Medication Possession Ratio Dichotomous

### Chronic Diseases studied
- **Diabetes**
- **Hypertension**
- **Asthma**

### EEI measure
- **Absenteeism**
- **Short-Term Disability**

### Population studied
- **Diabetes** = 7,817
- **Hypertension** = 33,245
- **Asthma** = 5,416 (US)

### Results

**Annual savings in absenteeism by adherent employees**

<table>
<thead>
<tr>
<th>Chronic Disease</th>
<th>Days saved</th>
<th>Cost savings¹ 2012$</th>
<th>Cost Savings² 2018$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hypertension</td>
<td>1.7</td>
<td>$408</td>
<td>$444</td>
</tr>
<tr>
<td>Diabetes</td>
<td>2.8</td>
<td>$672</td>
<td>$703</td>
</tr>
<tr>
<td>Asthma</td>
<td>3.0</td>
<td>$720</td>
<td>$783</td>
</tr>
</tbody>
</table>

**Annual savings in short term disability by adherent employees**

<table>
<thead>
<tr>
<th>Chronic Disease</th>
<th>Days saved</th>
<th>Cost savings³ 2012$</th>
<th>Cost Savings² 2018$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hypertension</td>
<td>1.8</td>
<td>$302</td>
<td>$328</td>
</tr>
<tr>
<td>Diabetes</td>
<td>2.1</td>
<td>$353</td>
<td>$384</td>
</tr>
<tr>
<td>Asthma</td>
<td>0.7</td>
<td>$118</td>
<td>$128</td>
</tr>
</tbody>
</table>

1. Cost savings for absenteeism were calculated in 2012 dollars using an average daily wage of $240
2. Conversion made using officialdata.org
3. Cost savings for short term disability were calculated in 2012 dollars using 70% of daily wage of $240

### Observation

- **Prospective study**
- **Retrospective Study**

### Sources:
- **Treatment Measure**
  - Data Type: Prescription claims data
  - Data Source: MarketScan
  - Duration: 4 years
- **EEI Measure**
  - Data Type: Payroll Data
  - Data Source: MarketScan
  - Duration: 4 years

### Percentage of adherent subjects:
- Diabetes: 59%
- Hypertension: 65%
- Asthma: 23%

*The 2 conditions not included in the case study are congestive heart failure and dyslipidemia

**Authors:** Ginger Carls, Christopher Roebuck and Teresa Gibson (Journal of Occupational and Environmental Medicine)
#21 The Preventable Burden of Productivity Loss Due to Suboptimal Asthma Control (2014)

Chronic Diseases studied

**Asthma**

EEI measure

**Absenteeism**

**Presenteeism**

Population studied

300 Employed adults (Canada)

Treatment Measure

**Adherence to Therapy**

Variable

Global Initiative for Asthma (GINA)

Impact of Asthma Control on Absenteeism and Presenteeism (Hours in a Week)

<table>
<thead>
<tr>
<th>Variable</th>
<th>Global Initiative for Asthma (GINA)</th>
</tr>
</thead>
<tbody>
<tr>
<td>EEI measure</td>
<td>Absenteeism</td>
</tr>
<tr>
<td>Population studied</td>
<td>300</td>
</tr>
</tbody>
</table>

Prospective study

- Sources:
  - Data Type: Real world trial
  - Data Source: GINA
  - Duration: 1 year

Prospective study

- Sources:
  - Data Type: Self-reported + lung function test
  - Data Source: GINA
  - Duration: 1 year

Prospective study

- Sources:
  - Data Type: Self-reported
  - Data Source: Work Productivity Activity Impairment questionnaire, VLP
  - Duration: 1 year

Prospective study

- Study Design: Asthma control was measured as opposed to adherence to treatment

Key Findings:

- Presenteeism was statistically significant, accounting for almost 80% (7.6/10.1) of lost work hours in those with uncontrolled asthma and almost 3 times more days lost than those with controlled asthma

Results

Impact of Asthma Control on Absenteeism and Presenteeism (Hours in a Week)

<table>
<thead>
<tr>
<th>Uncontrolled vs. controlled</th>
<th>Absenteeism</th>
<th>Presenteeism</th>
<th>Overall Productivity Loss</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adjusted incremental effect on hours of productivity loss per week</td>
<td>0.42</td>
<td>3.68</td>
<td>4.10</td>
</tr>
<tr>
<td>Adjusted incremental effect on productivity loss (CAD$2010) per week</td>
<td>$17.4</td>
<td>$167.4</td>
<td>$184.8</td>
</tr>
<tr>
<td>Adjusted incremental effect on productivity loss (CAD$2018) per week</td>
<td>$19.9</td>
<td>$191.6</td>
<td>$211.5</td>
</tr>
</tbody>
</table>

- In 2018 US dollars, savings = $7,800

1. Hourly wage was calculated by matching stated job titles to National Occupation Classification Codes from Statistics Canada
2. Conversion made using officialdata.org

Authors: Mohsen Sadatsafavi, Roxanne Rousseau, et al (CHEST Journal)

ID: 201404
#22 The Association Between Asthma Control and Health Care Utilization, Work Productivity Loss and Health-Related Quality of Life (2009)

## Results

### Effects of Uncontrolled Asthma on Employer Economic Impact

<table>
<thead>
<tr>
<th>EEI Measure</th>
<th>Controlled Asthma (n = 2,912)</th>
<th>Uncontrolled Asthma (n = 2,767)</th>
<th>% Difference²</th>
</tr>
</thead>
<tbody>
<tr>
<td>Level of Absenteeism (%)</td>
<td>4.7%</td>
<td>10.4%</td>
<td>-4.1%</td>
</tr>
<tr>
<td>Level of Presenteeism (%)</td>
<td>19.0%</td>
<td>34.3%</td>
<td>-13.3%</td>
</tr>
<tr>
<td>Overall Work Productivity Impairment (%)</td>
<td>15.4%</td>
<td>27.6%</td>
<td>-10.8%</td>
</tr>
</tbody>
</table>

1. Metrics are expressed as percent impairment, with higher values indicating a greater proportion of impairment at work (less productivity).
2. Percentage difference calculated as (Controlled - Uncontrolled / Uncontrolled) * 100

- The authors calculated the well-controlled asthma can save up to 229 hours of productivity per year, or 6 weeks of productivity.

### Observation

- Prospective study
- Retrospective Study

### Sources:

<table>
<thead>
<tr>
<th>Treatment Measure</th>
<th>Data Type</th>
<th>Data Source</th>
<th>Duration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adherence to Medication</td>
<td>Self-reported (structured survey)</td>
<td>NHWS</td>
<td>1 year</td>
</tr>
<tr>
<td>Asthma Control Test</td>
<td>Self-reported (structured survey)</td>
<td>NHWS</td>
<td>7 days</td>
</tr>
</tbody>
</table>

### Authors:
Setareh Williams, Samuel Wagner, Hema Kannan and Susan Bolge (Journal of Occupational and Environmental Medicine)
#23 Asthma Control in Patients Treated with Inhaled Corticosteroids and Long-Acting Beta Agonists: A Population-Based Analysis in Germany (2016)

**Results**

Impact of asthma control on patient related outcomes

<table>
<thead>
<tr>
<th>EEI Measure</th>
<th>Not Well-Controlled (n = 169)</th>
<th>Well-Controlled (n = 213)</th>
<th>Difference$^4$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Time missed from work$^1$</td>
<td>12.9%</td>
<td>4.3%</td>
<td>-8.6%</td>
</tr>
<tr>
<td>Impairments while at work$^2$</td>
<td>29.0%</td>
<td>14.9%</td>
<td>-14.1%</td>
</tr>
<tr>
<td>Overall Work Impairment$^3$</td>
<td>36.4%</td>
<td>17.3%</td>
<td>-19.1%</td>
</tr>
</tbody>
</table>

- The results show that well-controlled asthma results in less time missed from work, less impairment while at work and less overall work impairment (-19.1%) compared with not well-controlled.

**Prospective study**

- **Sources:**

<table>
<thead>
<tr>
<th>Treatment Measure</th>
<th>Data Type</th>
<th>Data Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adherence to Therapy</td>
<td>Prescription claims data</td>
<td>MarketScan</td>
</tr>
<tr>
<td></td>
<td>Duration: 1 year</td>
<td></td>
</tr>
</tbody>
</table>

- **Study Design:** Patients were separated between well-controlled asthma and not-well controlled asthma depending on their ACT score.

- **Key Findings:**
  - Found that self-reported medication adherence did not differ significantly between groups.
  - Patients with not-well controlled asthma reported more emergency visits and hospital visits than those with well-controlled asthma.

- **Patients with well-controlled asthma (ACT>20):**
  - 44%

**Observation**

- ID: 20160716

**Authors:** Anke Kondla, Thomas Glaab, et al (Journal of Respiratory Medicine)

**Treatment Measure**
- Introduction to Therapy

**Chronic Diseases studied**
- Asthma

**EEI measure**
- Absenteeism
- Presenteeism

**Population studied**
- 87 Employees of a large Southeastern public school system with asthma (US)

## Results

### Effects of Intervention Program on Patient-Reported Productivity

<table>
<thead>
<tr>
<th>EEI Measure</th>
<th>Baseline</th>
<th>End of Intervention</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Presenteeism Days¹</td>
<td>1.1</td>
<td>0.8</td>
<td>0.2021</td>
</tr>
<tr>
<td>Absence Days²</td>
<td>4.5</td>
<td>3.1</td>
<td>0.1442</td>
</tr>
</tbody>
</table>

1. Days less productive at work because of asthma
2. Days missed work at least a half-day because of asthma

**Observation**
- Prospective study
- Retrospective Study

**Prospective study**

**Sources:**
- Study Design: Participants identified as having asthma through claims data and were sent a letter to participate in study
- Key Findings: Study found that the intervention increased medication adherence of patients. This did not translate into statistically significant correlations, likely because of the too-small sample

**Retrospective Study**

**ID:** 20101101

**Authors:** Jinhee Park, James Jackson, et al (Journal of Asthma)
#25 Association of Medication Adherence with Workplace Productivity and Health-Related Quality of Life in Patients with Asthma (2006)

<table>
<thead>
<tr>
<th>Treatment Measure</th>
<th>Chronic Diseases studied</th>
<th>EEI measure</th>
<th>Population studied</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adherence to Medication</td>
<td>Asthma</td>
<td>Absenteeism</td>
<td>385 State employees with a diagnosis for asthma and completed the study (US)</td>
</tr>
<tr>
<td>Variable</td>
<td></td>
<td>Presenteeism</td>
<td></td>
</tr>
<tr>
<td>Morisky Medication Adherence Scale</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Results**

Effects of Patient Adherence to Asthma Medication on Absenteeism and Presenteeism in a Year

<table>
<thead>
<tr>
<th>EEI Measure</th>
<th>High Adherent</th>
<th>Medium Adherent</th>
<th>Low Adherent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Absence Days</td>
<td>5.64</td>
<td>5.42</td>
<td>4.23</td>
</tr>
<tr>
<td>Presenteeism Hours(^1)</td>
<td>0.9</td>
<td>1.4</td>
<td>1.1</td>
</tr>
</tbody>
</table>

1. Calculated as (days when patient was able to attend work despite experiencing lung/respiratory problems)\(^*\)(number of hours patient was unproductive while experiencing the disease during a typical 8-hour workday

**Observation**

- Prospective study

**Sources:**

<table>
<thead>
<tr>
<th>Treatment Measure</th>
<th>Data Type</th>
<th>Data Source</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Real world trial</td>
<td>Morisky Adherence Scale</td>
</tr>
<tr>
<td></td>
<td>Self-reported data</td>
<td></td>
</tr>
<tr>
<td>Duration: 2 years</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>EEI Measure</th>
<th>Data Type</th>
<th>Data Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>Absence Days</td>
<td>Self-reported</td>
<td>WPSI</td>
</tr>
<tr>
<td>Presenteeism Hours(^1)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Study Design:** After approval from health insurance provider, patients were mailed a 3-part questionnaire consisting of the Morisky Adherence Scale and the Work Productivity Short Inventory (WPSI)

**Study Limitations:**

- Use of self-reported data for adherence when it has been shown that patients with asthma tend to over report adherence with self-report measures and under report workdays missed.
- Small sample size coupled with low adherence

**Percentage of adherent subjects:** 39%

**Authors:** Ashish Joshi, Suresh Madhavan, et al (Journal of Asthma)
Appendix 2  Literature Review: Methodology & Terminology
## Treatment measures

### Definition and Methodology of Studies of Treatment Measures

<table>
<thead>
<tr>
<th>Treatment Measures</th>
<th>Definition</th>
<th>Methodology of Studies</th>
<th>Data Source</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Adherence</strong></td>
<td><strong>Medication</strong></td>
<td>Measures the level of compliance with prescribed medication</td>
<td>Most widely referenced treatment measure. Refer to slide 4 for details</td>
</tr>
<tr>
<td></td>
<td><strong>Therapy</strong></td>
<td>Measures the level of disease control</td>
<td>Referenced only in study # 16 in the case of asthma control. Asthma control is defined as the adequate management of asthma symptoms, including but not limited to medication adherence (other elements were not identified). Patients were grouped into controlled, partially-controlled or uncontrolled</td>
</tr>
<tr>
<td><strong>Introduction</strong></td>
<td><strong>Medication</strong></td>
<td>Measures the effect of a new medication on patient outcomes</td>
<td>Referenced only in 2 studies (#13, #14) for diabetes medications. In the first case, impact of placebo-treated patients vs medication-treated patients; in the second, baseline non-treated patients are compared to treated patients 6 and 12 months later</td>
</tr>
<tr>
<td></td>
<td><strong>Treatment</strong></td>
<td>Measures the effect of a new therapy on patient outcomes</td>
<td>Referenced in only 2 studies (#12, #15). In both cases, educational tools were provided to patients with asthma to stimulate overall asthma control</td>
</tr>
</tbody>
</table>
## Treatment measures
### Adherence to Medication Measures detailed (1/2)

<table>
<thead>
<tr>
<th>Type of data</th>
<th>Tool</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Database: Patient refill records via</td>
<td>Medication Possession Ratio (MPR) N = 12</td>
<td>MPR is the sum of the days’ supply for all fills of a given drug in a particular time period divided by the number of days in the time period.</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>MPR</strong> = \frac{\text{Sum of days supply for all fills in period}}{\text{Number of days in period}} \times 100%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>The major shortcoming of this measure is that it can overestimate adherence. Patients who routinely refill their medications early will have an inflated MPR, as the numerator in this equation will be larger than the denominator. MPR is thus usually capped at 100%. It can be continuous or dichotomous. When dichotomous, the cut of rate is usually 80% for determining adherence but this figure can be set higher for disease areas where greater levels of adherence are required.</td>
</tr>
<tr>
<td>Database: Percentage of Days Covered</td>
<td></td>
<td>Proportion of days covered (PDC) is a newer more conservative measure of refill-record based adherence. The formula is similar to MPR but instead of simply adding the days' supplied in a given period, the PDC considers the days that are “covered”, removing overlapping days.</td>
</tr>
<tr>
<td>(PDC) N = 4</td>
<td></td>
<td><strong>PDC</strong> = \frac{\text{Sum of days in period « covered »}}{\text{Number of days in period}} \times 100%</td>
</tr>
<tr>
<td>HEDIS (only for depression)</td>
<td></td>
<td>Dichotomous adherence method dividing treatment into two periods, an acute and a continuation phase of treatment. The acute phase lasts 114 days, during which an employee needs to fill a sufficient number of antidepressant prescriptions to provide medication for at least 84 days. The continuation phase lasts 231 days, during which an employee needs to fill a sufficient number of antidepressant prescription for at least 180 days. Employee who are non-adherent for the 3-month acute phase were automatically considered non adherent during the 6-month continuation phase. According to these adherence guidelines, employees are classified as either adherent or non adherent for both the acute phase and continuation phase of treatment</td>
</tr>
</tbody>
</table>
### Patient reported: Questionnaire-based self-reported evaluation

<table>
<thead>
<tr>
<th>Type of data</th>
<th>Tool</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Morisky Medication Adherence Scale (MMAS)</strong>&lt;br&gt;N = 4</td>
<td>4 questions using a 0/1 response scale.&lt;br&gt;Questions: 1. Do you ever forget to take your medicine? 2. Are you careless at times about taking your medicine? 3. When you feel better do you sometimes stop to take your medicine? 4. Sometimes when you feel worse when you take your medicine do you stop taking it?&lt;br&gt;Respondent score is calculated as the sum of the 4 question responses, high adherence: MMAS = 0, low adherence: MMAS = 1 - 4&lt;br&gt;An 8 question-version is more rarely used.</td>
<td></td>
</tr>
<tr>
<td><strong>Prescription Renewal</strong>&lt;br&gt;N = 1</td>
<td>Subjects are surveyed 4 times, each time they are asked for the start and stop date of their prescription. If individuals give a start date that coincides with the beginning of the period measured and an end date that coincides with the end of the period, they are judged compliant with their medication.</td>
<td></td>
</tr>
<tr>
<td><strong>Asthma Control Test (ACT)</strong>&lt;br&gt;N = 2</td>
<td>A validated instrument for assessment of asthma control in patients 12 years of age and older. The test consists of 5 questions and each question is worth 5 points. If a respondent’s score is 15 or less, asthma is considered poorly controlled. A score above 19 is considered well-controlled.</td>
<td></td>
</tr>
<tr>
<td><strong>Global Initiative for Asthma score (GINA)</strong>&lt;br&gt;N = 2</td>
<td>The GINA score is a measure that evaluates the level of asthma control. Asthma is categorized as controlled or uncontrolled based on measures of perceived impairment as well as the ratio of FEV&lt;sub&gt;1&lt;/sub&gt; (forced expiratory volume) to its predicted value.</td>
<td></td>
</tr>
</tbody>
</table>
### Employer Economic Impact (EEI) measures

#### Definition and Methodology of Studies of treatment measures

<table>
<thead>
<tr>
<th>EEI Measures</th>
<th>Definition</th>
<th>Data Source</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Self-reported N = 9</td>
</tr>
<tr>
<td>Absenteeism</td>
<td>Hours of missed work converted into number of workdays on the basis of an 8-hour workday. Employees are paid their full wages for absenteeism</td>
<td>✓</td>
</tr>
<tr>
<td>Presenteeism</td>
<td>Percentage of impairment while working due to health reasons</td>
<td>✓</td>
</tr>
<tr>
<td>Short-term disability</td>
<td>Number of missed workdays due to sickness during which employees are paid a portion of their income</td>
<td>✓</td>
</tr>
<tr>
<td>Work Productivity</td>
<td>Overall work impairment due to health (Absenteemeism + Presenteeism)</td>
<td>✓</td>
</tr>
</tbody>
</table>
## Data Sources for EEI and Treatment Measures

### Databases

<table>
<thead>
<tr>
<th>Type of data</th>
<th>Data Source</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Patient survey databases</td>
<td>National Health and Wellness Survey by Kantar Health Consultancy (NHWS) N = 3</td>
<td>Largest international patient database based on primary research into health care attitudes, behaviors, disease status, adherence, treatment choices and outcomes in adults over 18. Data is available for Brazil, China, France, Germany, Italy, Japan, Russia, Spain, UK, and U.S.</td>
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<td></td>
<td>Medical Expenditure Panel Survey By US Government Agency (MEPS) N = 2</td>
<td>MEPS is the most complete source of data on the cost and use of health care in the United States and on U.S. health insurance coverage. It provides survey information on health status, health care utilization and cost, prescription drug usage, work, disability and other sociodemographic characteristics and is widely used for scholarly research.</td>
</tr>
<tr>
<td>Payer claims and employer record databases</td>
<td>MarketScan by Truven Health Analytics (MarketScan) N = 10</td>
<td>The Truven Health MarketScan Research Databases are a family of research data sets that fully integrate de-identified patient-level health data (medical, drug and dental), productivity (workplace absence, short- and long-term disability, and workers’ compensation), laboratory results, health risk assessments (HRAs), hospital discharges and electronic medical records (EMRs) into data sets available for healthcare research. Data are contributed by large employers, managed care organizations, hospitals, EMR providers, Medicare and Medicaid. Over the years, the original claims-centric databases have been enriched and integrated with the addition of absence, disability, workers’ compensation, health risk, lab, dental, EMR, hospital and mortality data. The Truven MarketScan used the be the Healthcare business of Thomson Reutters and is referred to the Thomas Reuters MarketScan in the studies reviewed.</td>
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<td></td>
<td>Research Reference Database by Human Capital Management Services (HCMS) N = 3</td>
<td>A database which includes employment, demographic, compensation, health care, disability, absence and workers’ compensation data sources from numerous large employers in the U.S.</td>
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</tbody>
</table>
Data Sources for EEI

Questionnaires

<table>
<thead>
<tr>
<th>Measure</th>
<th>Data Source</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Employer Economic Impact</strong></td>
<td>Work Productivity and Activity Impairment (WPAI) questionnaire N = 3</td>
<td>Four metrics are computed from the WPAI: absenteeism, presenteeism, overall work productivity loss (combination of absenteeism and presenteeism), and activity impairment due to health. The NHWS uses the WPAI survey to measure productivity impact. The WPAI measures are for a period of 7 days.</td>
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<td></td>
<td>Health and Performance Questionnaire (HPQ) N = 4</td>
<td>A survey for capturing self-reported data on health conditions, absence, and job performance. The survey consists of a brief self-reported questionnaire that obtains three types of information: 1. information about the prevalence and treatment of commonly occurring health problems; 2. information about of workplace consequences (sickness absence, presenteeism, and critical incidents) and; 3. basic demographic information.</td>
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<td></td>
<td>Work Productivity Short Inventory (WPSI) N = 2</td>
<td>The survey estimates decrements in productivity associated with 15 common disease conditions. The WPSI asks respondents to note the amount of time missed from work resulting from their medical conditions and the amount of unproductive time spent at work when affected by the condition.</td>
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<tr>
<td></td>
<td>Valuation of Lost Productivity (VLP) N = 2</td>
<td>A survey for the assessment of the impact of health conditions on productivity output. Doesn’t solely focus on the loss in wages, but also on the potential losses due to lower team production and time lost to find a substitute worker.</td>
</tr>
</tbody>
</table>
Appendix 3  Profile of Pivot Strategy & Concerto
Pivot’s expertise

Pivot is a boutique strategy & operations consulting firm specializing in the Life Sciences and Private Payer sectors

Experience working with pharma companies on a range of topics including **strategy, product launches, access, policy and government affairs**

In-depth understanding of the **private payer health benefits value chain**, including strategy development with PBMs, retail/specialty pharmacy, drug manufacturers and health and specialty service providers

Expertise in the development of data-driven, **value-based business models** for drug manufacturers and pharmacy

We work best in organizations that are looking for new growth avenues, to optimize operations or inspire the organization to evolve in a different way.
Pivot brings together a unique expertise that cuts across the different industries in the Private Payer market.

- The Private Payer market is going through fundamental changes, affecting all players in the ecosystem.
- While the structure and dynamics of the Canadian Private Payer market is unique, current changes in the US market are likely to have a significant impacts in Canada.
- Our consultants have a solid understanding of the market structure, business model, economics and potential future developments in all segments of the Health & Life Sciences sector.
- This places us in a unique position to help our clients take a broad view of the Health & Life Sciences sector, identify value migration patterns and new “white space” opportunities.
Pivot’s experience across the Private Payer value chain

<table>
<thead>
<tr>
<th>Drug Manufacturers</th>
<th>Retail &amp; Specialized Pharmacy</th>
<th>Health Service Providers/ Specialized Players</th>
<th>PBAs / PBMs</th>
<th>Payers/ insurance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Development and implementation support for a new payer-driven vision, business model and organization for a leading pharma</td>
<td>Development of an integrated PBM/HBM strategy, integrating existing and newly-acquired assets for a major retail and specialty pharmacy player</td>
<td>Creation of an intranet-based health and prevention solution offered directly to employees by a network of preventative health clinics</td>
<td>Development of a growth strategy for a PBA, focused on transitioning to a PBM</td>
<td>Development of a growth strategy for a major Canadian insurer</td>
</tr>
<tr>
<td>Development of integrated access strategies for product launches in oncology, cardiovascular and diabetes</td>
<td>Development of a business offering in support for value-based PLAs</td>
<td>Piloting of an e-prescribing solution with a major manufacturer</td>
<td>Development of a value-based PLA strategy for a major PBM and insurer</td>
<td>Review of the operating model for a major group insurer</td>
</tr>
<tr>
<td>Design and piloting of a chronic disease management program for a major pharma</td>
<td>Developing retail pharmacy offerings to support greater role of the pharmacist</td>
<td>Identification of expansion opportunities for private clinics</td>
<td>Development of new products based on health data analytics</td>
<td>Development of a customer-driven digital strategy for a major diversified insurer</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Development of a health strategy and 5-year product roadmap for a major Canadian insurer</td>
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</tbody>
</table>

Drug Manufacturer

Retail & Specialized Pharmacy

Health Service Providers/ Specialized Players

PBAs / PBMs

Payers/ insurance

SANOFI

R&D

MCKESSON

Canada

SANOFI

PASTEUR

Unipax

McGill University Health Center

Zoomed

Insititut de cardiologie de Montréal

Sun Life Financial

Empire Life

Bristol-Myers Squibb Company

Proxim

medisys

TELUS SANTÉ

Desjardins Sécurité financière

Manulife Financial

SSQ Groupe financier

PIVOT
Kathy Megyery has over 25 years of experience in strategy development and implementation both as a consultant and a pharmaceutical industry executive.

Over the last 10 years, she has held various roles within Sanofi Canada and Sanofi North America focused on developing and implementing strategies to foster the organization’s leadership in innovation, access and prevention. She was Vice-President Strategy & Policy and a member of the Canadian Executive Committee from 2006 to 2012. In this role, she led the annual planning exercise as well as spearheaded focused strategic initiatives to capture opportunities around the emergence of specialty pharma, the increased focus on wellness and prevention as well as the growing role of payers. In 2012, she was appointed Vice-President Public Affairs for North America.

Previously, during her 15-year tenure at Secor Consulting, she supported senior management of large organizations to define strategies via a formal planning process as well as with specific issues related to growth, diversification, changing market conditions and competitive threats with a strong focus on healthcare & life sciences.

Sample of relevant experiences include:

- Developed and implemented a payer-driven vision, business model and organization for Sanofi Canada
- Defined and implemented a pilot project to demonstrate healthcare savings and productivity improvements stemming from best-in-class management of patients with multiple chronic diseases, including optimal drug therapy
- Fostered collaborations with thought leaders notably the Milken Institute to ensure the sustainability of innovation in biosciences and the inclusion of the patient in drug development from R&D through to access
- Supported commercial teams with the launch of the vaccine against dengue through policy and advocacy initiatives to obtain registration and financing of vaccination campaigns
- At Secor Consulting, led its Life Sciences practice, providing strategic counsel and planning support

Kathy holds an MBA from McGill University and a Master’s degree in Economics from Concordia University.
Michel Bernier, Managing Partner

Michel Bernier is co-founder and Managing Partner of Pivot, a strategy & operations consulting boutique specializing in the Financial Services and Private Payers. Dr. Bernier is a senior strategic advisor with over 25 years of experience working in different segments of the private payers market, including Group Life & Health insurance, TPAs, PBM, retail & specialty pharmacy and drug manufacturers. A recognized senior advisor in the area of strategy and business transformation, he consults with CEOs, senior leaders and their executive teams in the area of business & growth strategies, M&A, digital strategies, organizational design and business model innovation. He has worked with major companies in the Private Payers industry in Canada, the US and Europe. An experienced strategy and organizational consultant, he integrates the disciplines of strategy development, organizational design and transformation management, bridging the gap between strategy and implementation.

Before founding Pivot in 2012, he was a Senior Partner and Canadian leader of Oliver Wyman’s Business Transformation Practice, a senior partner of SECOR, senior vice president of strategic initiatives at Bell Canada.

Sample of relevant experiences include:

- Developing a payer strategy for a major retail & wholesale pharmacy
- Developing a growth strategy for a major Canadian PBM
- Developed a customer-centric growth strategy for a diversified Group Benefits insurer strategy, including a digital platform, to enable cross-sell between the Group and Individual insurance platform
- Working with a FinTech fund, developed the prototype for a digital advice and distribution platform focusing on the Group market
- Assisted the new CEO of a major Canadian Group Life & Health insurance company in developing a growth strategy and implementing a major organizational and business transformation program
- Working with a major Canadian Group Benefits insurer, assisted in developing an innovative product strategy and product development roadmap, positioning the
- Developed a new structure and operating model for the Canadian subsidiary of a major pharmaceutical company with a focus on providing end-to-end solutions to payers and providers
- Developed a customer-based entry strategy for the launch of a new oncology and diabetes product for a major pharmaceutical company

Michel Bernier holds a PhD in Psychology (Industrial & Organizational) from the University of Montréal.
Concerto has developed 11 standardized care pathways that optimize interventions and patient’s adherence

Interdisciplinary care pathways

Implemented in real world: more than 2000 patients Enables better risk management

Diabetes
High blood pressure
Dyslipidemia
COPD
Asthma
Inflammatory joint disease
Chronic heart failure
Chronic renal failure
ADHD
Mental health

Based on best practices
Can be adapted for several concomitant pathologies in a single patient
Computerized for a front-line practice
With an optimal specialists support

Our innovation: Deliver optimally coordinated, world-class chronic disease patient care, improve health outcomes and lower costs

Confidential and restricted
With a BA in Psychosociology of Communication and a Master of Public Administration, Guylaine Chabot brings relevance and coherence to your internal and external communications.

20 years of experience in strategic communication and project management related to health care - In health and social service centers and regional health agencies.

Mandates involving planning and managing communications for emergency response, coordinating communications in matters involving service transformation and information system implementation; at the supraregional level and as a management consultant.

Communication Director at the Quebec Order of Nurses for 10 years, she has been Editor in chief of different publications. She has published articles and research reports concerning patient’s satisfaction in Health services and about different health professionals preoccupations for better practices and better results.

Her politic experience as Deputy chief of staff, Minister of State for Health and Social Services, gives her a solid strategic approach to manage heath matters in Quebec.
Dr. Larouche is thoroughly familiar with healthcare system and the organizations that comprise it, and with the legislative and professional environment surrounding it. For 10 years, he has been the senior medical advisor for Regional Health Authorities Association in Québec.

He has developed particular expertise on the impacts of chronic disease on the patients and the healthcare system and on ways of adapting the care and service response to those needs. As a consultant for healthcare authorities, he has promoted the importance of chronic care management, based on Chronic Care Model principles.

He has also conducted studies on frequent flyers of the healthcare system. He has given talks on the subject here in Canada and for stakeholders in France and Switzerland. He has several projects in hand related to those issues. Dr. Larouche is currently a member of the disciplinary board of the Collège des médecins du Québec (Quebec Medical Board), correspondant for the “Caisse d’assurance maladie de France”, columnist for “L’Actualité Médicale”, the Medical Post french counterpart and Santé Inc. owned by Joule a subsidiary of Canadian Medical Association.

He is also a member of Joule’s Innovation Council and trainer for the Quebec Medical Association Leadership program.