Why Tabula Rasa Healthcare?

The Application of Personalized Medication Science has Advanced...
And, using Personalized Medication reduces:

Adverse Drug Events, Falls, CNS Impairment, Heart Arrhythmias, Hospitalizations, Re-hospitalizations, Morbidity / Mortality and...

Total Healthcare Costs
Background on TRHC

Our Outcomes

How do we harvest these Outcomes?
  Our Science
  Our Patient Healthcare Literacy Aids
  Our Synchronized Reminder Packaging

How At-risk are Severn Trent’s employees, dependents and retirees?
"Tabula rasa" means "blank slate" in Latin. Roman wax tablet used for notes were blanked by heating the wax and then smoothing it, to give a tabula rasa.

Contemporary translation includes "fresh start" or "new beginning."
Using the TRHC’s Medication Risk Identification and Mitigation platform and services:

• **Clients** reduce downstream medical expenditures (e.g., costs for falls, ER visits, and hospitalizations),

• **Patients** see a decrease in the number of chronic medications, the number of trial and error medication regimen changes, and increased concordance and adherence with their medication regimen.
1. Programs for All-inclusive Care of the Elderly (solely, 2011 to 2014)

2. CMS “enhanced Medication Therapy Management” (eMTM), due to an invitation from the ClearStone and the Northern Plains Alliance (i.e., six Blue Cross program surrounding Minnesota)

3. At-risk (e.g., financial risk) Health Plans, Health Systems, Healthcare Payers
1. Market Leader in PACE

Decades of experience, five years+ solely focused on PACE, today serving >60 PACE Centers in 20 States
Approximately 10,000 participants served on daily census
Growing Organically >25% / yr
2. CMS Enhanced MTM (eMTM) 5-YR PILOTS

- Region 7 (Virginia)
- Region 11 (Florida)
- Region 21 (Louisiana)
- Region 28 (Arizona)
- Region 25 (Iowa, Minnesota, Montana, Nebraska, North Dakota, South Dakota, Wyoming), 240,000 patients, staring 1/1/2017
For immediate release

Tabula Rasa HealthCare and NJHA Form Strategic Alliance
NJHA Member Organizations now have Access to Medication Risk Mitigation™

Mooresstown and Princeton, NJ (March 20, 2016) – Tabula Rasa HealthCare, Inc. (TRHC), a healthcare technology company providing patient-specific, data-driven technology and solutions for health care organizations, and NJHA Healthcare Business Solutions Inc. (HBS), a wholly owned subsidiary of the New Jersey Hospital Association (NJHA), have entered into a strategic alliance to deliver TRCH’s Medication Risk Mitigation products and services to NJHA member organizations. The strategic alliance will continue for three years, commencing March 2016.

Tabula Rasa HealthCare and The Greater Philadelphia Business Coalition on Health
To Study Medication Risk in Workforce Populations

Mooresstown, NJ, and Philadelphia, PA, (February 1, 2016) - Tabula Rasa HealthCare (TRCH), a healthcare technology company that is a leader in providing patient-specific, data-driven technology and solutions for health care organizations, and The Greater Philadelphia Business Coalition on Health (GPBCH), an employer organization focused on healthcare benefits best practices, have entered into a collaboration to underscore the importance to employers of workforce medication safety.
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How At-risk are Severn Trent’s employees, dependents and retirees?
A Large PA PACE Client

Reducing ER Visits, Number of Meds, Number of Med Changes and/or Hospitalizations is a QOL and an ROI matter.

*CareKinesis’ Medication Risk Mitigation
Reducing ER Visits, Number of Meds, Number of Med Changes and/or Hospitalizations is a QOL and an ROI matter.
Impact of Personalized Medication Risk Mitigation

Hospital Admission Reduction
Southern NJ PACE Plan

<table>
<thead>
<tr>
<th>Year</th>
<th>% Admitted to Hospital</th>
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</thead>
<tbody>
<tr>
<td>Q3 2010</td>
<td>8%</td>
</tr>
<tr>
<td>Q3 2011</td>
<td>11%</td>
</tr>
<tr>
<td>Q3 2012</td>
<td>9%</td>
</tr>
<tr>
<td>Q3 2013</td>
<td>11%</td>
</tr>
<tr>
<td>Q3 2014</td>
<td>6%</td>
</tr>
<tr>
<td>Q3 2015</td>
<td>6%</td>
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</table>

CK’s MRM: 45%

Hospital Admission Reduction
Northern NJ PACE Plan

<table>
<thead>
<tr>
<th>Quarter</th>
<th>Hospitalizations per 100 member per month</th>
</tr>
</thead>
<tbody>
<tr>
<td>Q1 2012</td>
<td>8</td>
</tr>
<tr>
<td>Q1 2013</td>
<td>10</td>
</tr>
<tr>
<td>Q1 2014</td>
<td>10</td>
</tr>
<tr>
<td>Q1 2015</td>
<td>6</td>
</tr>
<tr>
<td>Q2 2015</td>
<td>4</td>
</tr>
<tr>
<td>Q3 2015</td>
<td>3</td>
</tr>
<tr>
<td>Q4 2015</td>
<td>2</td>
</tr>
</tbody>
</table>

CK’s MRM: > 50%

Reducing ER Visits, Number of Meds, Number of Med Changes and/or Hospitalizations is a QOL and an ROI matter.
A large CO PACE Client

Hospitalization Usage Reduction from $623 PMPM to $224 PMPM

$1.2 mln Increase Bottom Line, or 5.7%

Reducing ER Visits, Number of Meds, Number of Med Changes and/or Hospitalizations is a QOL and an ROI matter.
“Indeed, the medication risk strategies, and the front line tolls like ACB and sedative burden definitely are an important part of our cost reduction and care optimization strategies. As always, I appreciate the help of the entire CareKinesis team.”

Medical Director
Impact of pMRM on ER Visits and Part D Cost

Reducing ER Visits, Number of Meds, Number of Med Changes and/or Hospitalizations is a QOL and an ROI matter.
Pharmacist-directed medication reconciliation and regimen review for Clients discharged from *Acute Care hospital to home with Home Health Care*

- 3 Month Project
- 57 Clients in Intervention Group; 457 Control Group
- 191 Recommendations (3.4/patient)

The control group consists of clients who met pilot criteria but who were in non-pilot offices.

<table>
<thead>
<tr>
<th>Re-Hospitalizations</th>
<th>Falls</th>
<th>LUPAs*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pilot: 14.0%</td>
<td>Pilot: 3.5%</td>
<td>Pilot: 13.0%</td>
</tr>
<tr>
<td>Control: 20.4%</td>
<td>Control: 4.4%</td>
<td>Control: 20.8%</td>
</tr>
<tr>
<td>31% Reduction</td>
<td>20% Reduction</td>
<td>37.5% Reduction</td>
</tr>
</tbody>
</table>

*Low Utilization Payment Adjustment*
Why Personalized Medication Risk Mitigation?

- **$374B** U.S. spending on prescriptions in 2014
- **4.3B** prescriptions filled in 2014
- **15%** of Americans take **five** prescription medications in any given month
- **50%** of individuals aged 65+ take **five** or more medications/month
- **82%** risk of an adverse drug event (ADE) with **seven** or more medications

- **45 – 50 million ADEs** from prescription medications per year in the United States
- ADEs represent the **4th** leading cause of death in the United States

- **> 40%** of nursing home admissions are associated with medication misadventuring
Impact of adverse drug events annually in the United States

- **RIP**
  - >100,000
  - Deaths

- **Emergency department visits**
  - 1 million

- **Affected hospital stays**
  - 2 million

- **Hospitalizations**
  - 125,000

- **Physician office visits**
  - 3.5 million

- **Increased days per affected hospital stay**
  - 1.7 to 4.6

CMS Nov 2014
What are the Implications with Adverse Drug Events for You?

Quality of Life?

Presenteeism?
Absenteeism?
Productivity?

Pharmacy costs?
Medical costs?
Background on TRHC

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How At-risk are Severn Trent’s employees, dependents and retirees?
• New study reveals **link between ACh medication use and community-acquired pneumonia (CAP) in elderly**

• **Possible mechanism**
  — Central effects of ACh medications – sedation & altered mental status
  — May contribute to poor pulmonary hygiene, atelectasis, & aspiration
Risk of Injury in Older Adults Using Gastrointestinal Antispasmodic and Anticholinergic Medications

Michele M. Spence, PhD, * Fatima A. Karim, PharmD, † Eric A. Lee, MD, ‡ Rita L. Hui, PharmD, § and Nancy E. Gibbs, MD ‡‡


**PARTICIPANTS:** Healthcare system members aged 65 and older (N = 260,010; 54,152 cases, 205,858 controls).

**MEASUREMENTS:** Cases were identified as individuals with an injury resulting in a hospitalization, emergency department, or urgent care visit (index date) from January 2009 through December 2010.

**CONCLUSION:** Older adults using GI antispasmodic and anticholinergic drugs have a 16% greater risk of injury. These findings support recommendations to limit the prescribing of GI antispasmodics and anticholinergics in elderly adults.
For Instance: High Anticholinergic Burden Effect on *Falls*

- **Use of Medications with Anticholinergic Activity and Self-Reported Injurious Falls in Older Community-Dwelling Adults**
  

- **N = 2,696**
- **Self-reported fall(s) 2 years after baseline interview**
- **Matched with Irish Health Service pharmacy dispensing records (N=1,553)**
- **Of the matched cohort, the adjusted relative risk for medications with anticholinergic activity dispensed in the month before baseline and a subsequent injurious fall(s) for men was 2.53 (95% CI = 1/15 -5/54).**

Common medications (doxepin, oxybutinin, diphenhydramine, antidepressants) taken for over three years in a study of 3,434 elderly found...

- 23% developed Dementia, majority Alzheimer’s type
- Highest doses of anti-cholinergic drugs 54% higher risk for Dementia and 64% for Alzheimer’s
Conclusions and Relevance  The use of AC medication was associated with increased brain atrophy and dysfunction and clinical decline. Thus, use of AC medication among older adults should likely be discouraged if alternative therapies are available.
In summary-
We help deliver improved clinical and economic outcomes for our clients

Patient outcomes

- Our clients have reported reduced:
  - Number of prescription medications
  - Hospital admission rates
  - Hospital re-admission rates
  - Emergency room visits

Financial outcomes

- Our clients have reported:
  - Reduced unnecessary healthcare utilization
  - Reduced pharmacy costs
  - Reduced hospital costs
  - Improved ROI
The Secret Sauce is accessed via Proprietary cloud-based software solutions

**EireneRx**

- E-Prescribing platform
- Patient risk evaluation
- EHR interoperability
- Secure messaging between prescriber and pharmacist
- Optional automated dispensing and delivery tracking
- Meaningful-use and EPCS certified

**Personalized Medication Risk Mitigation Matrix**

- Modular use of EireneRx components
- Applicable to broad healthcare audience
- Primary and Secondary Medication Risk Stratification
- Embedded pMRM
- **My MedWise Advisor** (patient engagement tool)

**Highly scalable AWS technology platform**
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How At-risk are Severn Trent’s employees, dependents and retirees?
Risk Stratification Strategy for Members of

May 2016
We received medication data for 2540 individuals, and successfully analyzed 2528.

In total, 15911 medications were identified in the data.

The average number of Medications per person was 6 meds/member.

The median number of Medications per person was 5.

- The number of Medications per person ranged from 1 to 48 Meds/member.

For the members in the data, the average age was 40.

- The median age was 43.
- The ages ranged from 1 to 85 years old.

This was aggregate data, spanning 15 months.
Number of Medications Based on Age

Average Number of Medications by Age

Average Number of Medications

Age
Medication Distribution

**Top 10 Medications**

- **Acetaminophen**
- **Amoxicillin**
- **Hydrocodone**
- **Hydrochlorothiazide**
- **Lisinopril**
- **Metformin**
- **Azithromycin**
- **Clavulanic acid**
- **Codeine**
- **Estriol**

**Top 25 Medications**

- **Acetaminophen**
- **Amoxicillin**
- **Hydrocodone**
- **Hydrochlorothiazide**
- **Lisinopril**
- **Metformin**
- **Azithromycin**
- **Clavulanic acid**
- **Codeine**
- **Estriol**
- **Ibuprofen**
- **Citalopram**
- **Trazodone**
- **Amphetamine**
- **Cyclobenzaprine**
- **Albuterol**
- **Oxycodeone**
- **Prednisolone**
- **Methylprednisolone**
- **Atorvastatin**
- **Fluticasone**
- **Prednisone**
- **Omeprazole**
- **Thyroxine**
There are many ways to stratify patients in order to assess the highest medication risk segment

- Dispensed Medication History
- Frequent-flyers for Falls, ED visits, and/or Hospitalizations/Re-hospitalizations
- High medication cost patients
- High medical cost patients
- ??
324 members, 13% of the population, have a total risk score of 20 or higher.
Risk Score Distribution by Age Groups

Total Risk Score Distribution **Ages 1-20**

16 Members, 3% of the population, have a risk score of 20 or higher

Risk Score

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**Risk Score Distribution by Age Groups**
Risk Score Distribution by Age Groups

Total Risk Score Distribution **Ages 21-65**

278 Members, 15% of the population, have a total risk score of 20 or higher
Risk Score Distribution by Age Groups

Total Risk Score Distribution **Ages 65+**

30 Members, 23% of the population, have a total risk score of 20 or higher
Factor 1: Number of Medications

420 members, 17% of the population, are taking 11 Medications or more

Of this 420,
4.8% (25) are between the ages of 1-20,
18.9% (357) are in the working age of 21-64, and
29.2% (38) are older than 65
Risk Factor 2: Acetylcholine Burden

Actual AChB Distribution

265 Members, 11% of the population, have an AC Burden of 4 or higher

AChB Risk Score Distribution

Of this 265, 3.5% (18) are between the ages of 1-20, 12.3% (231) are in the working age of 21-64, and 12.3% (16) are older than 65
Risk Factor 3: Sedative Burden

Acutal SB Distribution

445 Members, 18% of the population, have a Sedation Burden of 3 or higher

Of this 445,
3.3% (17) are between the ages of 1-20,
21.2% (399) are in the working age of 21-64, and
22.3% (29) are older than 65

SB Risk Score Distribution
To review: Why it Matters?

– The human heart pumps blood via a series of electrical signals.
– We measure these signals using an ElectroCardioGram (ECG).
– Many medications affect the T wave (potassium channel).
– This is the leading cause of FDA withdrawing medications from the market.

A Prolonged QT interval leads to a sudden quick and chaotic Heart Rate, which can result in:

• Dizziness
• Fainting
• Seizure
• Death
Risk Factor 4: Long QT Interval Risk

181 members, 7.2% of the population, have a Long QT interval risk of 5 or higher

181 members, 2.3% (12) are between the ages of 1-20, 8.1% (152) are in the working age of 21-64, and 13.1% (17) are older than 65

Of this 8%, 108 members, 60%, are Female
Risk Factor 4: Long QT Interval Risk

LQTS Score Distribution 1/1/16

Histogram of LQTS Score 1/1/16
Risk Factor 5: Competitive Inhibition

Combined CI Score Distribution

362 Members, 14% of the population, have a Competitive Inhibition score of 7 or higher

Of this 362, 3.5% (18) are between the age of 1-20, 16.8% (316) are in the working ages of 21-64, and 21.5% (28) are older than 65
To identify members who are most at risk, we perform an aggregate analysis of all risk factors.

We use the analysis to identify members most at risk for each risk factor.

Following this analysis, we perform another screening to see how many members, if any, are included in all 5 high risk groups.

Based on this analysis for the data provided:

- We identified a total of 61 members who are most at risk.
• Whether **Unintentional Overdose Risk** (e.g., can not excrete the medications) or **Additive Side Effects Risk** (e.g., too sedative, too anticholinergic, too Long QT Risk), these factors can significantly contribute to employee behavior.
  – Affecting Attentiveness, Productivity, and Safety while operating in the workplace.
  – Leading to Falls, ER visits, Hospitalizations, and Death.
Process Measures

1. Static Descriptive Analytics
2. Business Intelligence, **Dynamic Analytics**—may be crossed-walked with Medical data (e.g., cost, utilization)
3. Personalization, Medication Risk Mitigation Interventions—Comprehensive Medication Reviews
   - May include optional robotic reminder packaging for high-risk, multi-comorbid clients
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2. Business Intelligence, Dynamic Analytics—may be crossed-walked with Medical data (e.g., cost, utilization)
3. Personalization, Medication Risk Mitigation Interventions—Comprehensive Medication Reviews
   - May include optional robotic reminder packaging for high-risk, multi-comorbid clients
4. Personalization, Patient Empowerment, My MedWise Advisor app
   - Includes web-based Health Literacy, Videos, Refrigerator Sheets, etc.

Endpoints / Outcomes Metrics

• Decrease and/or prevent negative health downstream effects (Presenteeism, etc.)
• Improve the quality of life for the individual
• Lower medical / pharmacy costs
• Avoid Falls, ER Visits, Hospitalizations
To Summarize the Elephant-in-the-room Issue:
What are the Implications of Adverse Drug Events for Your Team?

Quality of Life?
Presenteeism?
Absenteeism?
Productivity?
Pharmacy costs?
Medical costs?

As we move toward “Population-based, Value-based Pricing of Medications,” Personalization of the Regimen will Remain the Predictive Key to Optimizing each Individual’s Medication Regimen.
Thanks for the Interest!

May 2016

MOORESTOWN, NJ | BOULDER, CO | CHARLESTON, SC | SAN FRANCISCO, CA | ST LOUIS, MO | PHOENIX, AZ