TRIO STUDIO: Can we use data-driven strategies to address urgent clinical and public health needs for individuals with substance misuse?

By Majid Afshar, M.D., M.S.
Loyola University Chicago

At IIT Institute of Design
Authors: Santosh Basapur, MS, Sherry Robison, MBA, Raj C. Shah, MD, and Prof. Keiichi Sato
Email for questions: basapur@id.iit.edu, srobison@bsd.uchicago.edu and/or raj_c_shah@rush.edu

September 25, 2019
**TRIO STUDIO: Can we use data-driven strategies to address urgent clinical and public health needs for individuals with substance misuse?**

---

**TABLE OF CONTENTS**

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Topic of Studio: Data Driven Strategies</td>
<td>3</td>
</tr>
<tr>
<td>Attendees:</td>
<td>3</td>
</tr>
<tr>
<td>Summary</td>
<td>3</td>
</tr>
<tr>
<td>Top 3 Actions Proposed by the Studio Participants</td>
<td>3</td>
</tr>
<tr>
<td>TRIO Studio Problem Description:</td>
<td>4</td>
</tr>
<tr>
<td>Main problem for the studio participants to solve:</td>
<td>7</td>
</tr>
<tr>
<td>Studio Methodology</td>
<td>7</td>
</tr>
<tr>
<td>Design Science Method</td>
<td>7</td>
</tr>
<tr>
<td>Design Thinking Based Solutions:</td>
<td>9</td>
</tr>
<tr>
<td>Problem visualized with Insights</td>
<td>9</td>
</tr>
<tr>
<td>High level insights:</td>
<td>11</td>
</tr>
<tr>
<td>Solutions Generated by Design Thinking Approach Team</td>
<td>12</td>
</tr>
<tr>
<td>Appendix 1</td>
<td>14</td>
</tr>
<tr>
<td>Appendix 2</td>
<td>14</td>
</tr>
<tr>
<td>Addendum 1 – Done at Grant Submission</td>
<td>18</td>
</tr>
</tbody>
</table>
TRIO STUDIO: Can we use data-driven strategies to address urgent clinical and public health needs for individuals with substance misuse?

By: Majid Afshar, M.D., M.S.
Loyola University Chicago

Facilitator: Santosh Basapur, IIT Institute of Design

Research Assistant: Washan Wu and Renjie Li, IIT Institute of Design

Attendees:
Hale Thompson, RUMC; Jessica Shore, Loyola; Katya Rlyachko, NWMH; Raj C. Shah, RUMC; Alan Simmons, RUMC; Cara Joyce, Loyola; Julie Johnson, UChicago; Gosia Labno, ITM UChicago; and Sherry Robison, ITM. Several online participants including Sam Volchenboum, UChicago; Colleen Fitzgerald, Loyola; and Ron Price, Loyola.

Summary
Majid Afshar, M.D., M.S., Loyola University Chicago, introduced his R01 grant he will be submitting in February of 2020. He is looking for feedback on how he can use data-driven strategies to address urgent clinical and public health needs for individuals with substance misuse across several ITM Institutions and the City of Chicago. Majid requested the studio audience to ideate solutions on building a learning health care system that will harmonize data across hospitals, fire and police data systems to accurately identify substance misuse, capture important risk factors, and prioritize patients that are at highest risk for poor health outcomes.

Design Thinking Methodology approach was used to solve the problems faced by Majid.

Top 3 Actions Proposed by the Studio Participants to Majid Afshar, M.D., M.S.:

1. **Map Out Governance Map** - In addition to mapping out the technology needed to carry out this project, the team needs to map out the governance and stakeholders to better understand and protect the interests of people and entities involved.

2. **Reframe the Objectives into Cohort Discovery and Follow Them More Closely** - Clear objectives will help prevent misunderstanding with the purpose of this project. What the project will and will not do along with the intention and methods of the project will help people join the mission.

3. **Create Ontology for non-EHR Datasets** - This is necessary to start building the bridges/mapping across electronic health records (EHR) and non-EHR data. This is, in a sense, foundational work that will enable collaborations and co-working.
TRIO Studio Problem Description:

Majid Afshar, M.D., M.S., Loyola University Chicago introduced his R01 grant application he plans to submit in February of 2020. Majid will also utilize the R01 workshops offered by the ITM. His goal is to build a learning healthcare system that will harmonize data across hospitals, fire, and police data to accurately identify substance misuse, capture important risk factors and prioritize patients who are at highest risk for poor health outcomes.

Majid explained the background which includes creating a health systems and data networks with Loyola, Rush, University of Chicago, and CAPriCORN. Data sets would include CDWs with OMOP common data models, IDPH cause-specific death data, American Community Survey, and University of Chicago Urban Lab records from Chicago Police and Fire. CAPriCORN will be used for aggregation, deduplication and healthcare utilization across the City of Chicago. Linkage of EHR and non-EHR datasets will also be created as part of the R01.

Problems of creating this data set include substance misuse is common in hospitalized patients but underrecognized and not prioritized in care. Electronic health records lack social and behavioral determinants of health. There is fragmented access to care across sites as patients visit multiple hospitals which have led to fragmented data. There is also paucity of computable phenotypes to reliably and automatically identify substance misuse.

Current efforts include electronic health records computable phenotypes using supervised machine learning and natural language processing to identify individuals with substance misuse for public health and clinical interventions. Unsupervised approaches to naturally cluster patients into previously undescribed subsets that have different risks for a poor outcome and may respond differently to treatments (EHR and non-EHR data). Prediction model for re-hospitalization or death to allocate resources for patients likely to derive the greatest benefit from an intervention (EHR and non-EHR data).

Majid presented the following data flow diagram wondering if it was feasible for a research proposal to NIH (NIDA R01):
TRIO STUDIO: Can we use data-driven strategies to address urgent clinical and public health needs for individuals with substance misuse?

Is this feasible for research proposal to NIH (NIDA R01)?

<table>
<thead>
<tr>
<th>Data Source</th>
<th>Data Warehouse</th>
<th>Code Repository of Trained NLP Classifiers (Aim 3)</th>
<th>Public available community-level software (Hash) with de-identification</th>
<th>Aggregate, de-duplicate, and validate final dataset for analytics</th>
</tr>
</thead>
<tbody>
<tr>
<td>HOSPITALS</td>
<td>CDW-Rush</td>
<td>MLP Classifier</td>
<td>Community-Level Data</td>
<td>HASHING</td>
</tr>
<tr>
<td>LOYOLA FIREWALL</td>
<td>CDW-Loyola</td>
<td>MLP Classifier</td>
<td>Community-Level Data</td>
<td>HASHING</td>
</tr>
<tr>
<td>CHICAGO FIRE</td>
<td>CDW-UChicago</td>
<td>MLP Classifier</td>
<td>Community-Level Data</td>
<td>HASHING</td>
</tr>
<tr>
<td>CHICAGO POLICE</td>
<td>URBAN LAB-UC</td>
<td>MLP Classifier</td>
<td>Community-Level Data</td>
<td>HASHING</td>
</tr>
</tbody>
</table>

Figure 1 System Architecture as presented by Dr Afshar.
TRIO STUDIO: Can we use data-driven strategies to address urgent clinical and public health needs for individuals with substance misuse?
TRIO STUDIO: Can we use data-driven strategies to address urgent clinical and public health needs for individuals with substance misuse?

Main problem for the studio participants to solve:
Majid Afshar’s call to action: Can we use data driven strategies to address urgent clinical and public health needs for individuals with substance misuse?

Studio Methodology
Design Science approach was used to solve this problem.

Design Science Method
We used the Design Science approach with five steps:

1. Created a free form mind map of the problem and identification of issues – Mind Mapping technique
2. Actionable insights were identified
3. Generated ideas to address issues
4. Synthesized solutions from the smaller ideas – Creative integration of smaller ideas led by Design Thinking Expert facilitator was done using white boards.
5. Solutions were proposed and were rated by the team on implement-ability (0-4 scale)
TRIO STUDIO: Can we use data-driven strategies to address urgent clinical and public health needs for individuals with substance misuse?

Image 2. Design Science Group Discussion
TRIO STUDIO: Can we use data-driven strategies to address urgent clinical and public health needs for individuals with substance misuse?

Design Thinking Based Solutions:

Problem visualized with Insights

The group first discussed the problem and its context yielding the following context diagram:

![Mind Map of Context and issues identified](image)

*Figure 2 Mind Map of Context and issues identified*
TRIO STUDIO: Can we use data-driven strategies to address urgent clinical and public health needs for individuals with substance misuse?
TRIO STUDIO: Can we use data-driven strategies to address urgent clinical and public health needs for individuals with substance misuse?

High level insights:
Following the context discussions, insights were generated as follows:

<table>
<thead>
<tr>
<th>Research problem/Insights</th>
</tr>
</thead>
<tbody>
<tr>
<td>01 Substance Abuse Unrecognized</td>
</tr>
<tr>
<td>02 EHR ≠ Social &amp; Behavior determinants</td>
</tr>
<tr>
<td>03 Fragmented data</td>
</tr>
<tr>
<td>04 Paucity of algorithm to identify substance abuse computationally</td>
</tr>
</tbody>
</table>

Figure 4 Insights Generated during Discussion

<table>
<thead>
<tr>
<th>Reframing</th>
</tr>
</thead>
<tbody>
<tr>
<td>01 Relationship Mapping (OMOP)</td>
</tr>
<tr>
<td>02 Ontology Lacking</td>
</tr>
<tr>
<td>03 Relocus with governance</td>
</tr>
<tr>
<td>04 Is data truly representative of community?</td>
</tr>
<tr>
<td>05 Decenter from learning Healthcare system to “leaving community”</td>
</tr>
</tbody>
</table>

Figure 4 Reframed problem
Solutions Generated by Design Thinking Approach Team:
Nine relatively implementable solutions were created to solve the issues of recruitment. They are as follows:

1. **Map Out Governance Map** – In addition to mapping out the technology needed to carry out this project, the team needs to map out the governance to understand and protect the entities involved.

2. **Reframe the Objectives into Cohort Discovery and Follow Them More Closely** – Clear objectives will help prevent misunderstanding with the purpose of this project. What the project will and will not do along with the intention and methods of the project will help people join the mission.

3. **Create ontology for non-EHR datasets** – This is necessary to start building the bridges/mapping across electronic health records (EHR) and non-EHR data. This is, in sense, foundational work that will enable collaborations and co-working.

4. **True Community Stakeholders** – Have the input of community stakeholders that reflect the community. This is helpful when convening for ethical considerations of this project.

5. **Change to the Distributive Model then Collaborative Model**

6. **Local Optimization of Predictive Model** - This will help in the exploratory phase of this project.

7. **Define Comparators to use for Comparison of Current versus Future States**

8. **Use Federally Qualified Health Center Based Data with Socioeconomic Determinants (SDOH)** - The team needs metrics for the predictive model and to test it at hospitals.

9. **Matching EHR Data from Hospitals with Police/Fire Department Data**
**TRIO STUDIO: Can we use data-driven strategies to address urgent clinical and public health needs for individuals with substance misuse?**

<table>
<thead>
<tr>
<th>Ideas</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>01</strong></td>
</tr>
<tr>
<td><strong>02</strong></td>
</tr>
<tr>
<td><strong>03</strong></td>
</tr>
<tr>
<td><strong>04</strong></td>
</tr>
<tr>
<td><strong>05</strong></td>
</tr>
<tr>
<td><strong>06</strong></td>
</tr>
<tr>
<td><strong>07</strong></td>
</tr>
<tr>
<td><strong>08</strong></td>
</tr>
</tbody>
</table>

**Figure 4 Solutions as visualized on whiteboards**

<End of Document. Thank you.>
TRIO STUDIO: Can we use data-driven strategies to address urgent clinical and public health needs for individuals with substance misuse?

Appendix 1.
Slides used.

Appendix 2.
Session Pictures
TRIO STUDIO: Can we use data-driven strategies to address urgent clinical and public health needs for individuals with substance misuse?
TRIO STUDIO: Can we use data-driven strategies to address urgent clinical and public health needs for individuals with substance misuse?

Research Problem/Interests

1. Substance Abuse under-recognized
2. EHR ≠ Social & Behavioral determinants
3. Fragmented data
4. Paucity of algo to identify substance abuse computationally.

Reframe?

1. Relationship mapping (omop)
2. Ontology lacking?
3. Refocus w/ Governance?
4. Is data truly representative of community?
5. Decenter from learning health sys to “Learning Community”
TRIO STUDIO: Can we use data-driven strategies to address urgent clinical and public health needs for individuals with substance misuse?

IDEAS

3. Create ontology for non-CHE datasets to start building the bridges/mapping across EMR=NonEMR

7. Comparators need to be defined for comparison of current vs future states

8. FQHC based data w/ socioeconomic determinants (SDH) - Alliance

Need Metrics for the predictive model and testing it @ HAPI?

1. Map out governance on top of Tech map (in slides)

4. Community stakeholders that truly reflect the community

5. Changing to the distributive model then collaborative model

2. Reframe the objectives w/ cohort discovery and forecasting

6. Local optimization of predictive model (within UCSF system)

(Simplifying model)
TRIO STUDIO: Can we use data-driven strategies to address urgent clinical and public health needs for individuals with substance misuse?

Addendum 1 – Done at Grant Submission

Actions proposed by Design Science team:

1. **Map Out Governance Map** - In addition to mapping out the technology needed to carry out this project, the team needs to map out the governance and stakeholders to better understand and protect the interests of people and entities involved.

   **Implementation and results:**

   Majid had meetings with Datavant, CAPriCORN, and legal counsel at UChicago to map out the governance and protect all the entities involved.

2. **Reframe the Objectives into Cohort Discovery and Follow Them More Closely** – Clear objectives will help prevent misunderstanding with the purpose of this project. What the project will and will not do along with the intention and methods of the project will help people join the mission.

   **Implementation and results:**

   During the writing of the grant, Majid revised the Six Sigma workflow and re-wrote aims.

3. **Create ontology for non-EHR datasets** – This is necessary to start building the bridges/mapping across electronic health records (EHR) and non-EHR data. This is, in a sense, foundational work that will enable collaborations and co-working.

   **Implementation and results:**

   Majid completed the first step, which was to build the problematic patient identifiers. The rest will be completed upon funding.

4. **True Community Stakeholders** – Have the input of community stakeholders that reflect the community. This is helpful when convening for ethical considerations of this project.

   **Implementation and results:**

   Majid received letters of support from Chicago police and fire departments, the mayor’s office, the City of Chicago health commissioner, and from research ethics counsel with UChicago and HMPRG for patient advocacy.
5. Change to the Distributive Model then Collaborative Model

Implementation and results:
Not Applicable

6. Local Optimization of Predictive Model - This will help in the exploratory phase of this project.

Implementation and results:
Majid did an external validation at Rush which will help in the exploratory phase of his grant.

7. Define Comparators to use for Comparison of Current versus Future States

Implementation and results:
Majid determined that no comparative group was needed.

8. Use Federally Qualified Health Center Based Data with Socioeconomic Determinants (SDOH) - The team needs metrics for the predictive model and to test it at hospitals.

Implementation and results:
Once the study is funded, they will use federally qualified health center-based data with socioeconomic determinants.

9. Matching EHR Data from Hospitals with Police/Fire Department Data

Implementation and results:
Once the study is funded, they will match the EHR data from hospitals with police and fire department data.

Misc.: The grant was submitted in early February and a funding decision will be made in approximately six months. Once a funding decision is made another update will be done.
TRIO STUDIO: Can we use data-driven strategies to address urgent clinical and public health needs for individuals with substance misuse?

About the Institute for Translational Medicine (ITM)

The ITM is a partnership between the University of Chicago and Rush in collaboration with Advocate Health Care, the Illinois Institute of Technology (Illinois Tech), Loyola University Chicago, and NorthShore University HealthSystem that’s fueled by about $35 million in grants from the National Center for Advancing Translational Sciences at the National Institutes of Health through its Clinical and Translational Science Awards (CTSA) Program.

We’re part of a network of more than 55 CTSA Program-supported hubs across the country working to slash the time it takes to develop and share new treatments and health approaches. We work with you and for you to make participating in health research easy, so that together we improve health care for all.

Join the movement and learn more about how we help researchers, physicians, community members, industry, government organizations, and others. Visit us at [chicagoitm.org](http://chicagoitm.org) and connect with us on Facebook, Twitter, Instagram, YouTube, and LinkedIn @ChicagoITM.

TRIO is supported by the National Center for Advancing Translational Sciences (NCATS) of the National Institutes of Health (NIH) through Grant Number UL1TR002389 that funds the ITM. The content is solely the responsibility of the authors and does not necessarily represent the official views of the NIH. Please cite the grant in your publications to ensure TRIO can continue helping researchers like you.