Mindfulness and Yoga Peer Ambassador Intervention to Reduce Violence in the Networks of Homeless Youth
Robin Petering, Nicholas Barr + Ajitesh Srivastava
Violence and youth homelessness

Homeless youth at higher risk than housed peers because associated risk factors i.e. subsistence strategies, drug and alcohol abuse, childhood trauma, exposure to perpetrators, childhood experiences, subsistence survival strategies, and exposure to perpetrators during street tenure.
In the previous month...

60% had been in a physical fight

30% had been injured from a fight

20% had to seek medical attention
In the previous month...

63% in a verbal conflict that they thought would escalate to a physical fight.

46% tried to stop a physical fight between two people.

26% have been in a physical fight with someone in their immediate social network.
Youth Perceptions of Violence

Little to no positive outcome related to violence engagement

- Physical health impacts
- Mental health impacts
- Legal law enforcement involvement
- Barrier for exiting homelessness
- Spreads like a contagion
If violence is contagious, how do we make “non violence” spread through a network?
Extending the reactivity timeline

- Stimulus
- Feelings
- Behavior
- Thoughts
- Judgmental Awareness
- Consequences
- Body changes
- Urges

**0-5 seconds**
Extending the reactivity timeline

- Stimulus
- Feelings
- Thoughts
- Behavior
- Judgmental Awareness
- Consequences
- Mindfulness Awareness

Body changes
Urges
Habits are like freeways

Mindfulness can provide freeway exits to alternative behaviors

These will be hard to see at first, but with practice they’ll get easier to spot. Eventually, these alternatives can become stronger than the original behavioral path.
Mindfulness can provide psychological armor. By providing a cognitive/emotional buffer and helping reduce reactivity to thoughts, feelings and urges.
How do we introduce mindfulness in the network to have the greatest impact on reducing violence in a network?
Towards Violence Minimization - Modeling

- Violent individuals tend to be connected to other violent individuals
- Violent individuals may become non-violent, and vice-versa
- Violence is a non-progressive diffusion process
- Challenge: Uncertainty in network structure obtained from survey
Problem Definition

- **Assumption:** Violence is a non-progressive diffusion process

- **Given**
  - Current state of violence: a graph $G(V, E)$ and a set of nodes $S$ that are violent
  - Intervention resources: an integer $k$

- **To find**
  - Best $k$ individuals for performing intervention: $T \subseteq S$ such that $|T| = k$, and turning the nodes in $T$ into non-violent (deterministic/probabilistic) minimizes expected number of violent nodes.

- **Assuming**
  - Diffusion is dictated by “Uncertain Voter Model” ...
Uncertain Voter Model

- At every time step a node $u$ picks a node $v$ and takes its state.
- With probability $\theta$: $v$ is randomly selected from neighborhood of $u$ [Classic Voter Model]
- With probability $1-\theta$: $v$ is randomly selected from outside of the neighborhood [Based on link prediction: Katz similarity]
Uncertain Voter Model (2)

- Probability of $v$ adopting the state of $u$
  \[ q_\theta(v, u) = \begin{cases} \theta p_{v,u} & \text{if } p_{v,u} > 0 \\ (1 - \theta) K'(u, v) & \text{if } p_{v,u} = 0 \end{cases} \]

- Probability of $u$ being violent
  \[ x_{u,t} = \sum_v q(v, u)x_{v,t-1} \text{ or } x_t = Q_\theta x_{t-1} \]

- Uncertainty in time
  \[ \mathbb{E}(I_V^T x'_t) = \sum_{\tau} P(t = \tau)I^T_V Q^\tau_\theta x'_0 = I^T_V \left( \sum_{\tau} P(t = \tau)Q^\tau_\theta \right) x'_0 \]

- Objective: Select $k$ nodes and flip them to 0 to maximize
  \[ Q_\theta^t \]
  \[ I^T_V \Delta x_t = I^T_V Q^t_\theta \Delta x_0 = \sum_{\{u|\Delta x_0(u) = 1\}} I^T_V Q^t_\theta I_u \]
Modeling Intervention Response

- New probability of violence after intervention at $t = 0$: $x_{u,0} \leftarrow x_{u,0}(1 - s_u(z_u))$

  $s_u(z_u)$: success probability (response) of intervention after applying $z_u$ resources to node $u$

- Examples:
  - $s_u(z_u) = 1$, if $z_u > 0$
  - $s_u(z_u) = 1 - r_u^{z_u}$ for a constant $0 \leq r_u \leq 1$.

- New Objective: $I^T_v Q_\theta \Delta x = \sum_u I^T_v Q_\theta I_u s_u(z_u)$

- Theorem: If intervention response is a concave function, greedy algorithm is the optimal intervention strategy.
Experiments on Real Homeless Network

- **Deterministic Intervention**

- **Probabilistic Intervention**
  - $s_u(z_u) = 1 - r_u^{z_u}$
  - $r_u$ selected at random
Experiments on Real Homeless Network

- 369 nodes, 558 edges. 55% nodes violent

### TABLE I
**TOP 10 SEEDS FOR VARIOUS VALUES OF $\theta$ OUTPUT BY GREEDY MINIMIZATION**

<table>
<thead>
<tr>
<th>$\theta$</th>
<th>Selected Seeds</th>
<th>$\mathbb{E}(I_x^T \times_t^L)$</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>47  4  2156  51  13  2086  169  2115  2099  2056</td>
<td>179.43</td>
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<td>0.9</td>
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<td>183.327</td>
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<td>187.54</td>
</tr>
<tr>
<td>0.6</td>
<td>47  4  2086  2115  2156  51  169  13  2056  2125</td>
<td>188.66</td>
</tr>
<tr>
<td>0.5</td>
<td>47  4  2086  2115  2156  51  169  13  2056  2125</td>
<td>189.43</td>
</tr>
</tbody>
</table>

### TABLE II
**TOP 10 SEEDS FOR VARIOUS VALUES OF $t$ OUTPUT BY GREEDY MINIMIZATION**

<table>
<thead>
<tr>
<th>$t$</th>
<th>Selected Seeds</th>
<th>$\mathbb{E}(I_x^T \times_t^L)$</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>47  2086  4  2115  51  2156  169  13  2056  2125</td>
<td>189.92</td>
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<tr>
<td>4</td>
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<td>10</td>
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<td>186.79</td>
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<tr>
<td>12</td>
<td>47  4  2086  2156  51  13  2115  169  2056  2125</td>
<td>186.45</td>
</tr>
</tbody>
</table>

Same nodes appear multiple times for different parameter settings.
Transition to Practice

- SPY: 96 nodes, 58 overlapped in the follow-up
- Need to “measure” probabilities of influence: assumed uniform
- Need to “measure” $x_{u,0}$, given $X_u$: number of violent incidents for $u$
  \[ x_{u,0} = \text{sigmoid} \left( \frac{X_u - \mu(X_u)}{\text{std}(X_u)} \right) \]
- Need to “measure” response to intervention
  \[ s_u = \text{sigmoid} \left( \frac{S_u - \mu(S_u)}{\text{std}(S_u)} \right) \]
Methods

- Purposive sample of 58 young adults experiencing homelessness or housing instability (YAEH)
- Quasi experimental pre-post-test.
- Enrollment → MyPath → T2 assessment
- Self-administered survey: recent violence, trait mindfulness, impulsivity, demographics, mindfulness and yoga practice.
- Sociometric network data collected
**MyPath Peer Ambassadors**

14 Mindfulness and Yoga Peer Ambassadors trained in one-day MyPath workshop.

8 attended 100% of the follow up sessions.

<table>
<thead>
<tr>
<th></th>
<th>Mean</th>
<th>Std Dev.</th>
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<tbody>
<tr>
<td>Violmin non-MYP</td>
<td>0.228</td>
<td>0.237</td>
</tr>
<tr>
<td>Violmin MYPA</td>
<td>0.661</td>
<td>0.538</td>
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</table>
Mypath intervention

1 day workshop using a train-the-trainer approach: Mindfulness and Yoga

Ambassadors

What is violence? What are the causes and consequences?

Heavy on bio-psycho education

Experiential learning on how to practice mindfulness and mindfulness in motion (yoga) to regulate emotions and physiology

Continued the program 10 weeks. Each week Ambassadors encouraged their friends to attend

8 of 12 ambassadors attended 100% of the workshops
Have been in a physical fight in the past month

- Significant decrease overall at time 2, 1 month after MyPath Peer Ambassador workshop trainings complete.
Have been in a verbal fight that felt like it might escalate to a physical fight in the past month

- Significant decrease overall at time 2, 1 month after MyPath Peer Ambassador workshop trainings complete.
On being a MyPath Ambassador

“It was a good experience, it got me out of comfort zone, never thought about doing yoga that’s for sure. It started helping me in my everyday life from my anger, to becoming more humble. It helped me a lot.”

On what mindfulness means

“It’s the stage in the middle before going to 0 - 100 it’s that 50. Where you get to decide what you want to do. Let’s not entertain this nonsense, let me the bigger person and walk away, several occasions this happened to me. Mindfulness helped a lot in my life.”

On how it has impacted daily life on streets

“A guy stole some money from me 1 month ago. I ran into him 2 weeks ago, and I immediately wanted to start screaming at him. Instead I didn’t say anything to him. I used mindfulness to avoid an altercation. I saw my emotions for what they are before I reacted to them.”
Reducing violence imperative to successful exit out of homelessness

25% have had services interrupted because they have been in fight with other member

8% have had services interrupted because they have been in fight with a staff

23% have lost their housing situation (shelter, apartment, staying with friends or family) because you've gotten in a fight or conflict
Violence is a core problem in homeless young person’s social networks.

- A large proportion of young people experience high-frequency physical violence.
- Violence disrupts formal and informal support structures and services

Participants demonstrate interest in mindfulness and yoga based coping and emotion regulation strategies

- Ambassadors were highly engaged with the MyPath intervention
- Ambassadors demonstrated mastery of concepts and applied them in vivo

Increases in mindfulness and yoga practice behavior and decreases in violence within the network
Innovative modeling and approach for reducing violence is feasible.

Strategic selection of Peer Ambassadors works

Increases in mindfulness and yoga practice behavior and decreases in violence within the network
Next Steps

Randomized controlled trial to test efficacy + effectiveness
National Science Foundation
National Institute of Health

Research
Implementation

Dept. Of Mental Health
Los Angeles
Formalize manual
Facilitator training

safe place for youth
Future Work in Modeling

- **Incorporate Propensity for Violence**

  \[
  x_{u,t} = \frac{\alpha(u) \sum_j q_\theta(v,u)x_{v,t-1}}{\alpha(u) \sum_v q_\theta(v,u)x_{v,t-1} + (1 - \alpha(u)) \sum_v q_\theta(v,u)(1 - x_{v,t-1})}
  \]

- **Theorem:** \( U(T) \) is submodular, and so greedy algorithm admits a \((1 - \frac{1}{e})\)-approximation

- **Extend the approach to other issues**
CS+SW: How to Make this Marriage Work

Overcome Language Barriers

“Graph”

Social Work

Computer Science

“Tree”
CS+SW: How to Make this Marriage Work

Identify Complimentary Strengths

**Social Work**
- I have a list of problems to be addressed to improve society
- I have real world data
- I have domain expertise, valid/sensible assumptions
- Real-world implementation

**Computer Science**
- [Archimedes] Give me a place to compute and a large enough dataset and I will move the world ... w.h.p.
- I have the optimal solution ... but it only works for spherical chicken in vacuum
- I have the best possible solution based on the data and the assumptions

Real-world implementation
CS+SW: How to Make this Marriage Work

Get creative!
Explore different funding sources and resources!

Be passionate.
Find a social problem that you care about and a solution that you are EXCITED about and a team you get along with.

Stick with it.
Fields more at different paces. As junior scientists, we all have primary projects and work on this in our “extra” time.
"MyPath is the middle before going to 0-100. It's that 50. Where you get to decide what you want to do. It means thinking before you react to something, not letting your emotions get the best of you, practicing that and making it a skill that you could practice throughout life."

- MyPath Mindfulness + Yoga Ambassador
People think threatening and violence is the answer. If everyone did mindfulness we would be living in a semi-better world. I didn’t know anything about mindfulness, all I did know was violence, how to protect myself. When I got to SPY, I learned mindfulness and learned how to relax myself with yoga. I feel like a different person when I do it.
Reasons Not Practicing

- It's intimidating
- I don't need it in my life
- I have an injury
- I can't relate to the teachers
- It conflicts with my religion
- I do other physical activities
- Don't have access to materials I need
- I don't have the privacy
- I don't know what it is
- I'm not flexible enough
- I don't know where to start
- I have other things going on that...
- It seems boring
- I want to but don't have time
- It's too expensive
- I don't need it in my life
- It's intimidating
- Already using

Openness to Tools for Practicing

- Smartphone App
- Youtube Video
- Audio recordings or music

Bars represent different reasons and tools for practicing mindfulness and yoga.