


Drug Story Theater: A Mixed-Methods Study of a Peer-to-Peer Approach to Substance Abuse Education

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Objective: Drug Story Theater (DST) is a peer-to-peer intervention that engages teenagers in the early stages of their recovery to develop shows about the seduction of, addiction to, and recovery from drugs and alcohol. **Methods:** We analyzed anonymous surveys completed by students before and after attending a DST performance, and transcripts of focus group interviews conducted with (1) program developers, (2) stakeholders, (3) performers, and (4) audience members. **Results:** Students (N = 871) from 5 schools attended one of 2 DST performances. Participants demonstrated increased knowledge on 5 fact-based questions (mean improvement range, 19%-35%; $p < .001$ for all), and favorable changes on 10 items addressing perceptions regarding substance use risk (paired t test range, 3.9-9.4; $p < .001$ for all). Through iterative thematic analysis we developed an alliterative “7P” model spanning 2 domains: (1) *Participants (Performers and Peers)*; and (2) *Program (Partnerships, Practicalities, and Prevention)*. **Conclusions:** Exposure to a DST performance improved knowledge and risk perceptions about addiction among middle and high school students. It remains to be seen if those changes can have an effect on the prevention of substance use and dependence among vulnerable youth, and whether the active components of DST can be replicated in other school environments.

Key words: addiction; adolescent health; drug use; health education; school health; stigma

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The 2018 National Survey on Drug Use and Health¹ reported large number of “initiates,” or first-time substance users among people aged 12 to 17: marijuana (3.1 million new users), prescription pain relievers (1.9), prescription tranquilizers (1.2), hallucinogens (1.1), prescription stimulants (1.0), and cocaine (874,000). In addition, there were in this age bracket 4.9 million new users of alcohol and 1.8 million youths who tried a cigarette for the first time during the previous year. Similar data from

the prior decade was reported in the watershed report entitled *Adolescent Substance Abuse: America's #1 Public Health Problem*, published in 2011 by the National Center on Addiction and Substance Abuse (CASA) at Columbia University.² Among its sobering findings was an alarming developmental fact reported for the first time: if a person starts using drugs or alcohol after the age of 21, one out of 25 are at risk for developing a substance use disorder (SUD); but if a person starts using before the age of 18, that number jumps from one in 25

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to one in 4.² One out of every 4 teens who uses drugs or alcohol before the age of 18 is at risk for developing a SUD simply because of the way their brains are developing.³

Adolescent substance use continues to be a national problem, but despite the alarming statistics, less than 10% of people diagnosed with a SUD actually obtain treatment.² Although this may be related to limited access to evidence-based treatments, it is partly due to the stigma surrounding addiction^{4,5} and the veil of secrecy surrounding it that still dominates communities and schools. However, with the increase in overdose deaths from heroin and other opiates,^{6,7} substance use is being viewed as a public health crisis rather than a crisis of morality, a change in perception that may provide new opportunities for prevention efforts. Stated simply, addiction is a chronic illness. Addiction is not about morality – it is about mortality.

Different treatment approaches have been initiated to decrease substance use in adolescents. Some try to scare youths out of using drugs or alcohol,^{8,9} some involve adults telling their stories to middle and high school students,¹⁰ and yet others have adults act in theatrical performances to middle schools and high schools.¹¹ None of these have had overwhelming success. This lack of efficacy was reflected in a report that revealed that the number of students exposed to prevention programs declined between 2002 and 2015, perhaps due to the ineffectiveness of the materials designed to mitigate the use of drugs and alcohol in teenagers.¹² The growing understanding of adolescent brain development, and its implications for developmental-specific vulnerability, invites incorporating a neuroscience-informed approach to adolescent drug use prevention and treatment.¹³

Originally developed in 2010, Drug Story Theater (DST) is a treatment and prevention modality that incorporates participatory theater to address the growing substance use epidemic among teenagers in the United States (US). DST invites adolescents in the early stages of recovery and teaches them theater techniques¹⁴ and psychodrama^{15,16} to craft personalized shows about the seduction of, addiction to, and recovery from drugs and alcohol which they then perform at middle and high schools. In contrast to other adolescent-

based performance interventions,¹⁷ DST features members stepping out of character between scenes to give brief presentations about adolescent brain development. Following the show, the audience engages in a talk-back with the DST performers, moderated by a professional with expertise in adolescent substance use.

For this study we assessed 2 different DST shows, based on real-life stories and crafted with the direct input of adolescents in recovery. The first show, “The Price You Pay,” outlined the influence of peer pressure on a student who wanted to smoke cannabis but quickly progressed to other substances. The DST troupe taught the audience about adolescent brain development and why it is at such risk for addiction, focusing on the differential timing of the maturing of the limbic system in comparison to the pre-frontal cortex (PFC).^{18–21} The audience learned that the “impulsive” limbic system is relatively more developed in adolescents than the “planning” PFC; as the PFC is designed to anticipate the repercussions of an action, teens may start using drugs without being able to consider future consequences. Performers taught audience members about the interaction between dopamine and oxytocin (the “brain chemical of trust”), concluding that using drugs highjacks underlying brain mechanisms, such that “the price you pay is trust”.

A second show, “Second Chances,” focuses on low self-esteem as a driving force behind substance use. One of the greatest risk factors for first-time substance use is low-self-esteem; high self-esteem is a protective factor against first-time drug and alcohol use;²² low self-esteem is a significant factor associated with lifetime substance use,²³ and first-time cannabis use places a teen at increased risk for moving on to other drugs, including opioid prescription pain medications.²⁴ In turn, positive self-esteem is a protective factor against the initiation of tobacco, alcohol, and marijuana use.²⁵

In this report we describe a mixed-methods study we conducted to evaluate: (1) the educational impact of the performance on student members in the audience, using a quantitative approach; and (2) the development and implementation process from the varied perspectives of individuals connected to DST, including its performing troupe, using a qualitative approach.

METHODS

Theoretical Context

Our approach is theoretically informed by the Strategic Prevention Framework (SPF) developed by the US Substance Abuse and Mental Health Services Administration (SAMHSA) as a structured guide for the process of community change.²⁶ The SPF provides a foundation for developing and implementing evidence-based prevention strategies. The framework emphasizes the use of epidemiological data and the development of sustainable, community-based coalitions to implement local environment strategies. DST can be conceptualized as one such coalition, which emphasizes the recruitment of multi-sector representatives, responds to complex community needs, counts on the active participation of community members, and is guided by grassroots planning and decision-making.²⁷ Coalition-building such as that embodied by DST's school and community partnerships is an important step to improve quality of life through community-level interventions.²⁸

Participants

DST has performed for over 25,000 middle and high students across 72 different schools throughout the Commonwealth of Massachusetts since 2015. For this study, we included student audiences from 5 public schools that agreed to participate in a DST research component. These 5 were among the 7 schools approached, in which one of the 2 DST shows had been performed during the preceding 12 months. We collaborated with school principals or superintendents at each school, who provided institutional approval and notified parents or guardians of the date and time of the performance, and that their children could opt out of attending the performance or of completing the anonymous survey associated with it.

Instruments

We designed a 16-item survey consisting of: (1) a single demographic question (school grade); (2) 5 fact-based knowledge questions pertinent to substance use disorders (SUDs), the target audience, and the content of the DST performances; and (3) 10 questions about perceptions, attitudes, and risks regarding SUDs. All questions were written

in developmentally appropriate language and were informed by relevant neurobiological^{18–21} and epidemiological^{2,3,29} research findings.

Procedure

For the quantitative component, we analyzed surveys completed by participating students before and after attending one of the 2 DST performances in 2019 and early 2020. The shows were performed at school auditoriums during 90 minutes of designated class time, including performance (40 minutes), talk-back (40), and survey completion (5 minutes at the beginning and at the end of the session). For the qualitative component, we conducted focus group interviews in the fall of 2020 via synchronized videoconferencing using Zoom (San Mateo, CA). Focus groups spanned 4 different types of DST stakeholders: (1) program developers; (2) stakeholders, including representatives from state authorities, school districts, and funding agencies; (3) adolescent performers; and (4) audience members.

Data Analysis

Quantitative component. We compared knowledge and perception items before and after students' attendance to one of 2 DST shows. We used the McNemar test for the 5 knowledge items with a correct answer,³⁰ and paired t-tests for the 10 perception and attitude items rated on an ordinal Likert scale. We examined the effect on outcomes of interest across 3 independent variables: (1) School (A through E); (2) DST show ("The Price You Pay" vs "Second Chances"); and (3) Grade (6th through 8th vs 9th through 11th). We used chi-square tests for the categorical knowledge outcomes, and multiple regression analysis for the continuous perception outcomes. We used Bonferroni correction for multiple comparisons and conducted all analyses using SPSS version 25 (Armonk, NY).

Qualitative component. A co-author not directly involved in DST (AM) conducted semi-structured interviews during 4 focus group sessions. Participants provided verbal consent for the digital recording of the sessions. Digital audio files were then transcribed and de-identified prior to analysis aided by NVivo 12 software (QSR International, Melbourne, Australia).

Table 1
Students' Grades and Schools across DST Performance (N = 871)

	The Price You Pay N = 282		Second Chances N = 589	
	N	Percentage	N	Percentage
Grade				
6 and 7	123	44	301	51
8 and 9	159	56	158	27
10 and 11	0	0	130	22
School				
A	123	44	0	0
B	159	56	0	0
C	0	0	197	33
D	0	0	192	33
E	0	0	200	34

We used a thematic-phenomenological approach to examine the stakeholders' experiences.³¹ We analyzed the transcripts using thematic analysis,^{32,33} which provides theoretical freedom and flexibility to identify commonalities, and in which writing and analyzing data occur recursively alongside each other. Thematic analysis includes a rich and detailed account of the data and welcomes attention to the investigators' reflexivity. Three of the authors (MD, DL, AK) worked independently to identify and organize codes before sharing them with the other investigators for further refinement and finalization into a streamlined codebook and set of overarching themes. Each key theme was supported by multiple quotes. We analyzed transcripts iteratively until we reached theoretical sufficiency³⁴ and followed best practice guidelines for the analysis, drafting, and submission of qualitative studies.^{35,36} In keeping with the tenets of participatory research,³⁷ we value stakeholders as co-investigators, and invited all focus group participants to review and comment on our final codes, overarching conclusions, and draft manuscript.

RESULTS

Quantitative Component

Students (N = 871) from 5 public middle and

high schools in Massachusetts attended one of 2 different DST performances (mean attendance per school = 174, range, 123-200; Table 1). Participants demonstrated increased knowledge on the 5 fact-based questions (mean improvement range, 19%-35%; $p < .001$ for all; Table 2), and favorable changes on the 10 items addressing perceptions regarding substance use risk (paired t-test range, 3.9-9.4; $p < .001$ for all; Table 3). Compared to students in 8th through 11th grades, younger students in 6th and 7th grades were more likely to perceive marijuana as addictive and were more responsive to the educational message of the performance ($p < .001$; Table 4). We found no other statistically significant differences, and specifically, none across the 5 schools or the 2 different shows.

Qualitative Component

Focus group participants (N = 23) contributed during 4 stratified sessions: (1) program developers; (2) stakeholders from state authorities, school districts, and funding agencies; (3) adolescent performers; and (4) audience members (7th and 8th grade students). Through iterative thematic analysis of the resulting transcripts, we developed an alliterative "7P" model divided across 2 domains, each with underlying component themes: (1) *Participants* (*Performers*, and *Peers*);

Table 2
Change in Factual Knowledge Items after Viewing DST Performance

Item (correct answer)	N	Before		After		Change ^a
		N	%	N	%	Mean (95% CI)
Involved in future planning and problem-solving (prefrontal cortex)	871	178	20	343	39	19 (14, 23)
Involved in trust-building (oxytocin)	871	163	19	448	51	33 (28, 37)
Relevant to feelings, impulses, and pleasure (dopamine)	871	163	19	287	33	14 (10, 18)
Risk for lifelong addiction if first drug use...						
below age 18? (1 in 4)	192	90	47	152	79	32 (23, 41)
after age 21? (1 in 25)	192	82	43	149	78	35 (26, 44)

Note.

^a All changes statistically significant at $p < .001$ (McNemar, Bonferroni corrected)

and (2) Program (Partnerships, Practicalities, and Prevention). All verbatim quotations that follow are attributed according to their focus group of origin: Developer, Stakeholder, Performer, or Audience.

Qualitative Domain I- Participants, comprising the themes of performers

Rebuilding. DST troupe members were adolescents in recovery from their own addiction, or whose lives had been impacted by family members with SUDs. By committing to a theater-based intervention unfolding over several months, these youngsters embraced a venue through which to share their personal narratives, express themselves openly, not shy away from being vulnerable, buttress their sobriety, and consolidate their identity development. Moreover, they benefited from the positive feedback they received through spontaneous applause and through question-and-answer exchanges in which they became respected experts:

I respected the courage of the performers, because it takes a lot of courage to come out and share your story about being young and using drugs and alcohol. (Audience)

Belonging. All performers described DST as a community, a shared space in which relationship-building is integral to the model. Some referred to

the troupe as a second family, one to which they had affiliated deliberately. Much of the improvement and help they described came from being welcome and having their struggles validated and not judged. They described DST, not as a circumscribed add-on to their recovery, but rather an activity that turned theater into treatment:

This is like my one thing. It's my therapy every week. It's my check-in with people and it's a good anchor for me throughout the week. I guess it was just something that worked for me and I've stuck with it since. (Performer)

Challenges. The courage for students to put themselves 'out there' has much to do with confronting the stigma and judgment they might face, and with the potential consequences of being defined or ostracized by their SUD. Stigma from community and peers, as well as internalized stigma, became hurdles for all performers to clear, and a particular challenge when revealing disparate perspectives within a family regarding their child's participation:

My dad is ashamed to say what I do but my mom has no problem talking about it. She'll brag about it and say how proud she is of me. And my dad absolutely hates it. Because of everything that happened to him, he hates how I act about it. It's really weird seeing that difference. (Performer)

Table 3
Change in Perception/Attitude Items after Viewing DST Performance

	Before		After		Statistic ^a	
	M	SD	M	SD	t	df
How much do people risk harming themselves if they use...						
marijuana once or twice?	1.4	1.0	1.7	1.0	9.40	583
marijuana regularly?	2.1	1.1	2.3	1.0	6.94	579
five or more alcoholic drinks once or twice each weekend?	2.2	1.0	2.4	0.9	8.21	585
heroin occasionally?	2.5	0.9	2.6	0.8	3.92	527
pills occasionally in order to get high?	2.3	1.0	2.5	0.8	5.30	560
synthetic marijuana (spice, K2) occasionally?	2.2	1.0	2.5	0.8	7.57	501
stimulants occasionally in order to get high?	2.2	1.0	2.4	0.8	6.81	489
e-cigarettes or vape nicotine?	1.9	1.0	2.1	1.0	5.12	548
How much do people risk harming their...						
<i>relationships</i> by using alcohol and other drugs?	2.4	0.8	2.6	0.8	6.85	558
<i>school achievement</i> by using alcohol and other drugs?	2.5	0.8	2.4	0.9	4.31	564

Note.

Risk level: 0 = none; 1 = slight; 2 = moderate; 3 = great

^aAll changes significant at $p < .001$ (Bonferroni corrected)

Qualitative Domain I- Participants, comprising the themes of peers

Attendance. The story lines' authenticity contributed to an organic acceptance of the live performances:

It's been extremely rare to see kids who are bored or rolling their eyes; they get into the story very quickly, no matter which play we do – because it's real. (Developer)

Students had sufficient context about drugs for the subject matter to be of relevance to their lives. At the same time, they had limited factual knowledge, and no forum in which to discuss their questions other than those in which adults could come across as patronizing or remote. Instead, students were able to see themselves or their peers reflected in the DST narratives of children just a few years older than themselves. There was broad buy-in from student bodies given that performances were effective at holding a mirror back to their audience members.

Ripple effects. The reverberations of DST went beyond the immediate impact of the live performance and its subsequent talk-back/Q&A session. Long after the show's conclusion, students continued to process the information they received and the emotions they experienced. They did so among themselves, with their teachers, and at home with their families. Family discussions were especially robust when parents and guardians were able to attend the show, either alongside their child, or at a later time during a separate presentation specifically targeted for guardians:

We are a community coalition for substance use prevention and try to partner with schools. We also do parent programming. We have used DST for both. We've had performances where they performed for the kids in the school during the day, and then did a parent program in the evening. And we had a really good response to that. Really good attendance. (Stakeholder)

Challenges. Not all peers were moved by the

Table 4
Change in Perception of Marijuana's Addictive Potential by Grade, after DST Performance

Grade	N	Pre		Post		Change
		N	%	N	%	Mean (95% CI)
6 and 7	424	294	69	336	79	9 (4, 16) ^a
8 and 9	317	222	70	248	78	8 (-1, 15)
10 and 11	130	46	35	54	42	6 (-1, 18)

Note.

^a $p = .004$ (McNemar, Bonferroni corrected)

show, with an inevitable handful of those described by a stakeholder as the ones who “did not see themselves as that kind of kid and off they went.” Behind-the-scenes conflict between performers was inevitable; another aspect for which facilitation by an adult leader proved essential. Return to substance use (relapse) became a challenge specific to adolescents in early stages of their recovery, and during which the troupe had to adjust to a colleague's absence, facilitate their return, and provide unconditional support. A particular challenge was understudying for a troupe member who had relapsed – the member who relapsed would not perform, but at times attended the talk-back to explain why they were not in the play.

Qualitative Domain II- Program, comprising the themes of partnerships, practicalities, and prevention

Partnerships (opportunities). Strategic partnerships were essential in turning the idea of a theater-based, peer-to-peer prevention intervention into the reality of Drug Study Theater. We included representatives from core constituencies in our stakeholder focus group: (1) state authorities, such as district attorneys or public health officials; (2) funding agencies, both public and private; (3) education leaders at the state, regional, or local school district levels; and (4) community champions, such as theater, media, or public outreach experts. Opening revenue streams to keep the show afloat was among the group's many original contributions:

We were able to get some funding from our local cultural council because it was an artistic performance, which opens up an additional revenue stream. (Stakeholder)

Partnerships (challenges). DST shows have been performed widely across Massachusetts but have yet to be replicated elsewhere. Addressing the transportability and generalizability of the model have become new priorities:

We have a product that we can share, but we're also good at training people. The kids are there, we know the kids are there. And I know that that people are out there as well, who can be trained in DST. We could do this in Massachusetts, Michigan, or Morocco. And the most important part about that is it could then become culture- and location-specific. (Developer)

Practicalities (building the show). The construction of DST requires professionals from 2 complementary areas: (1) an adolescent substance use and mental health expert, such as a child and adolescent psychiatrist with additional board certification in addiction medicine; and (2) an expert in youth theater and performance, ideally someone with a strong background in playwriting. Their respective areas of expertise are distinct but at times overlap and synergize, as in the component of psychodrama, which is integral to the development of a new play. The SUD medical expert introduces the show, then moderates the after-show talk-back:

We let everyone in the audience know that they're dealing with a subject matter specialist. Someone who is uniquely qualified to answer any question,

Table 5
Domain I – Participants: Themes and Sample Quotes from Focus Group Sessions

Theme	Representative quote(s) / (Focus group)
Performers	
Rebuilding	<i>It is delivered like no other. It's not force-fed through health class, it's not critical parent Nancy Reagan, or the cracking of the egg commercial. It's peer-to-peer. It's storytelling. And anything that's worth learning, that can be told by story, is in my opinion the way to go. They're telling their stories, peer-to-peer, with vulnerability that you can't script without real stories. (Stakeholder)</i>
Belonging	<i>We have had kids who have relapsed, we've have other kids who have stayed rock-solid, sober for years. And they will attribute some of it at least to DST, because they have a family here. Because there's a place where they feel safe and valued. (Developer)</i>
Challenges	<i>I originally shared with DST that my dad was an alcoholic and actually passed away because of that. I've had some experiences with addiction myself. But I think my main talking point or role when I'm at performances has been to talk about and shed light on the experience of living with an addict, especially for the students who are experiencing that in the audience. They are far from alone in this. (Performer)</i>
Challenges	<i>I do think that stigma is a valid concern, and what it means for you to put yourself out there in a way that shows the entire world that you did have addiction at one point, no matter what point in your life that was. That's always going to be a part of who you are. (Stakeholder)</i>
Peers	
Attendance	<i>Every single child in that space can relate to a situation that they're connected to, whether it's themselves, their family, somebody. There's a point in the presentation when there's interaction with the audience, and the majority of kids in this space respond that they have been impacted by opiate or drug addiction or some other connection to the presentation. (Stakeholder)</i>
Attendance	<i>In a lot of AA meetings it's mostly older people going. The whole thing about DST is the fact that it's kids teaching kids. It's kids speaking to kids, and that helps a lot more, because kids don't want to listen to adults, obviously; I don't want to listen to adults, and I'm not a kid anymore. I still don't like to listen to adults, because it just is more relatable coming from someone who's around your age group. (Performer)</i>
Ripple effects	<i>It's hard for parents to sit down and say to their kids, 'let's talk about drugs' and their kids are like, 'Oh, my gosh please, no, I can't do this.' But if they both can experience this production together, then they don't have to talk about drugs in the same old way. They can say this or that happened in the play. What do you think about it? It's an easier way to open that conversation, rather than just 'let's talk about drugs tonight.' So it really can open up that dialogue between parents and their children. (Developer)</i>
Ripple effects	<i>We generally don't talk after assembly. We just move on with our day. But this time, after the show, I feel like we all talked about it in recess, lunch, hallways. Whenever we could, we would talk about it, especially right after it. (Audience)</i>
Challenges	<i>My biggest concern for them is, when you feel the need for that audience clapping and they're all excited, well, what happens when the applause is no longer there? (Stakeholder)</i>

whether from a medical, storyline or patient standpoint. That expert helps facilitate and provide scientific grounding to the program. (Developer)

In addition to content experts, the development and roll-out of a DST show requires administrative and logistic support, as well as buy-in from the

performers' parents or guardians.

Practicalities (sustaining the show). As a non-profit organization supported by soft money and donations, the future of DST will partly hinge on achieving a solid financial footing. The collaborative efforts and advice of a broad and multifaceted

Table 6
Domain II – Program: Themes and Sample Quotes from Focus Group Sessions

Theme	Representative quote(s) / (Focus group)
Partnerships	
Opportunities	<i>We really have 2 offerings here. There's the virtual experience, the already created production that can be viewed and discussed. But then you have the other offering, of the actual kids who are suffering from substance abuse and have this as a therapeutic way through it, to act it out and to perform in these live shows. That is where I see a train-the-trainer model becoming really needed – to give others far away the tools to replicate the live performance aspect. (Developer)</i>
Challenges	<i>We can't replicate our exact experience, that would be impossible. But we certainly could put together a curriculum for that new lead person to learn from us and help put on these productions, because what we lose with the virtual-only approach is the kids who need the psychodrama piece of it, the being part of the creative troupe, of the live action and lived experience. (Developer)</i>
Practicalities	
Building the show	<i>Then she might play me and he might play a friend of mine or someone else in the story. That's how we kind of pieced together the play. But I think that's also part of the therapy because I remember the psychodrama was really emotional because you are, and you are not, a part of it. You are the director. So you're taking a step back and seeing what was happening to you in that story. (Performer)</i> <i>I thought it was a good amount of PowerPoint with brain science stuff in it. Because you can't just have the acting, then you're not going to learn the necessary information that you might need. I think it was a good amount. If you had too much, it would be boring. If you have too little, you wouldn't get the point across. (Audience)</i>
Challenges: sustaining the show	<i>Remember we are now working with kids in their early stages of recovery. These are kids who may have come right out of a treatment program with whom we are now meeting only once a week for 2 hours. The other model would be to work with kids later in recovery, who have a bit more sobriety under their belt and make more of a commitment because they can do that. Another option, of course, would be to have this in residential programs. (Developer)</i>
Prevention	
Opportunities	<i>By getting to them early, and to see stories through the lens of somebody who's lived it who they can believe and trust. I've taken my kids to see it. And I know that it's moved them in a way that you're not going to get in the hallways of a middle school. The play's 'take a sip of this beer, a bong toke, try this pill,' it was all a really quick transition. And it just scares me. I think if enough kids at this age were able to see this and consume it fully, then I think we could help stem the tide. (Stakeholder)</i> <i>The video of our performance with a front and back pre- and post-show survey is 35 minutes long, which is actually perfect for the age of the COVID pandemic. These kids can still see this amazing play and we are still in conformity with the Department of Education when it comes to prevention education for alcohol, tobacco, and substance abuse. (Developer)</i>
Challenges	<i>DST is not a perfect immunization against our kids relapsing. We've certainly had kids who have relapsed during their involvement with us, but they mostly come back. The door is always open, they know that there's a community and that they are a part of it. We stress that this is a marathon, not a sprint. (Developer)</i>

group of stakeholders does not always result in direct funding. DST has to adapt to such clinical and fiscal realities:

We don't charge anything for participation. But DST could become a perfectly billable service if provided within an intensive outpatient or residential setting, which could also provide kids in recovery much-needed clinical continuity over weeks or months. (Developer)

Alternative and innovative funding streams such as the one proposed may become critical to the program's longevity, as will be an ability to replicate its approach with fidelity.

Prevention (opportunities). The promise of DST lies in its potential as a preventive intervention to reduce illicit substance use among youths. By engaging similar-aged peers in a theater-based intervention, the DST approach represents a paradigm shift with ready resonance and appeal:

The fact that they came up on stage and talked about it really showed me that they want to instill it, to stick it into kids' brains that using drugs and alcohol at a young age is nothing but bad for you. (Audience)

It remains to be seen whether the conversations that start and evolve after the show can result in purposeful momentum to create a lasting impact. Additional prevention opportunities to explore include incorporating synchronous videoconferencing for delivery of the show, or developing videos and other enduring materials to use asynchronously with distant audiences.

Prevention (challenges). Recruiting and retaining youths in the early stages of their recovery is inherently difficult. For the show to keep its freshness and legitimacy, it is crucial for the performers to be near enough in age to the audience members. This results in a narrow window of opportunity during which performers can contribute most meaningfully, although older DST troupe members can remain involved as mentors and recruiters. An additional and pervasive challenge is that of stigma:

One of the real bottlenecks is getting kids in to perform in the show. We know that the kids are out there, that there are kids trying to get into recovery. But, this has been a real challenge, and I think it has to do with stigma. We still have deeply ingrained stigma to confront. (Developer)

DISCUSSION

Through this mixed-methods study we were able to evaluate: (1) DST's educational impact on middle and high school audience members; and (2) the intervention's implementation process and salutary effects on its performers.

Regarding DST's educational impact on students, exposure to a DST performance improved knowledge and risk perceptions about addiction among middle and high school students. Specifically, the show increased audience members' factual knowledge about risk pathways to SUDs (low self-esteem, negative peer pressure); the mechanisms underlying such risks (including brain-based circuitry); the "cost" of substance use (sacrificing the trust of others); and ways of proactively countering the pernicious influence of substance use. DST accomplishes these goals by incorporating scientific content into human-interest personal stories told by age-proximal peers with whom the students can naturally relate.

Parental disapproval of substance use may also mitigate the negative influence of drug-using peers.³⁸ Whereas negative peer influence increases risk of substance use, positive parenting decreases risk.³⁹ The perception of one's peers has an influence on whether a student will use or abstain from first-time substance use; friends of those who do not see risk of using are significantly more likely to use themselves.⁴⁰ A cohort study of over 12,000 students in grades 6-12 suggests that preventing substance use should start prior to middle school, stressing the need for efforts to "counter peer normative pressures"^{39,41} regarding substance use.

With respect to acting out and salutary effects on performers, positive peer pressure has been a largely untapped resource in previous efforts to prevent first-time substance use. In essence, DST can be conceptualized as an organized, performance-based approach to harness the power of positive peer pressure. Its impact is on those attending the show, as noted above, as well as on those performing on stage.

Members of the DST troupe have an opportunity to move from self-endangering *acting out* (epitomized by substance use and its attendant consequences) to *acting out* their lived experiences in a prosocial, personally supportive, and peer-educational setting. They are able to embrace their

unique narratives and individual struggles with addiction and recovery, transforming them through theater toward a greater good. In so doing, they are able to gain a sense of mastery, competence, and altruism, and to embody DST's core belief: the treatment and recovery of one adolescent struggling with addiction can result in the prevention of others going down a similar path. Guided by professionals and through a deeply shared sense of mission, troupe members are able to pay it forward, as aptly encapsulated in the program's slogan: *Contribute to society to help with your sobriety.*

Education about SUDs and their prevention are priority areas to address during the high-risk years of early adolescence. Middle and high schools are placed at a strategic and developmentally optimal crossroad to provide such content "just in time." Educational initiatives to address this pressing need have so far missed the mark and proven to have limited effect. DST is a peer-to-peer, theater-based approach that holds promise as an innovative approach to harnesses positive peer pressure to reach young audience members. DST's use of neuroscience education is another paradigm shift, not imploring students to never use substances, but rather asking them to wait until their brains are more developed, should they choose to use substances. This is a unique message, empowering the decision-making ability of a student educated in the basic neuroscience of addiction while exercising their developing PFC.

Limitations

We recognize several limitations to our study. First, by measuring outcomes following attendance to the DST performance, results may largely represent immediate recall; follow-up surveys after several weeks could have addressed longer-term retention. Second, we acknowledge the possibility of a social desirability bias; students may have answered the surveys more favorably at the second time point. Third, we did not have a control group of students exposed to the show but not to the talk-back, which could have helped identify active components of the intervention. Fourth, we do not know whether effects will prove to be durable and ultimately translate into a reduction of incident substance use among adolescents. Finally, a single exposure to DST may not be sufficient to have an enduring effect;

a spiral curriculum could be beneficial, wherein repeat encounters with substance use content could reinforce previous learning.

Conclusion

Despite these limitations, we found that exposure to a DST performance improved knowledge and risk perceptions about addiction among middle and high school students. It remains to be seen if those changes can have a salutary effect on longer-term prevention of substance use and dependence among vulnerable youth, and whether the active components of DST can be replicated in other school environments.

IMPLICATIONS FOR HEALTH BEHAVIOR OR POLICY

In this study, we demonstrated the feasibility and short-term educational impact of an intervention that has been incorporated into the health and/or art curricula of over 70 schools in Massachusetts. Although studies addressing the longer-term impact of DST on substance use initiation are yet to come, the intervention has so far proven to be cost-effective and well received by over 25,000 students. Future studies will need to examine the reproducibility, exportability, and generalizability of what is a promising approach to combat adolescent substance use, an epidemic first labeled a decade ago as "America's #1 public health problem."²

DST is well-aligned to address some of the priority areas identified by Healthy People 2030 for substance use disorders among adolescents (SU04 – SU- 09; SU - R01).⁴² Indeed, the first such goal has already been documented in this study, and future studies could empirically address the second 2, for which DST appears promising. Specific actions include:

- Increase the proportion of adolescents who think substance abuse is risky;
- Reduce the proportion of adolescents who drank alcohol in the past month, used drugs in the past month, or who used marijuana in the past month; and
- Increase the number of admissions to substance use treatment for injection drug use, and of connection to care for adolescents in clinical need.

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Human Subjects Approval Statement

We obtained institutional review board approval from the Yale Human Investigations Committee (Protocol # 2000029007) to analyze de-identified data and transcripts.

Conflict of Interest Disclosure Statement

The authors have no conflicts of competing interests to disclose.

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