

BRIEF REPORT

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Hospital admissions among people who inject opioids following syringe services program implementation

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Abstract

Background: Syringe services programs (SSPs) are an evidence-based harm reduction strategy that reduces dangerous sequelae of injection drug use among people who inject drugs (PWID) such as overdose. SSP services include safer injection education and community-based naloxone distribution programs. This study evaluates differences in overdose-associated hospital admissions following the implementation of the first legal SSP in Florida, based in Miami-Dade County.

Methods: We performed a retrospective analysis of hospitalizations for injection drug-related sequelae at a county hospital before and after the implementation of the SSP. An algorithm utilizing ICD-10 codes for opioid use and sequelae was used to identify people who inject opioids (PWIO). Florida Department of Law Enforcement Medical Examiners Commission Report data was used to analyze concurrent overdose death trends in Florida counties.

Results: Over the 25-month study period, 302 PWIO admissions were identified: 146 in the pre-index period vs. 156 in the post-index period. A total of 26 admissions with PWIO overdose were found: 20 pre-index and 6 post-index ($p = 0.0034$).

Conclusions: Declining overdose-associated admissions among PWIO suggests early impacts following SSP implementation. These results indicate a potential early benefit of SSP that should be further explored for its effects on future hospital admission and mortality.

Keywords: Syringe services program, Take-Home Naloxone, Overdose, Opioid epidemic

Introduction

In 2018, the Centers for Disease Control and Prevention announced drug overdose mortality hit a record high, with at least 70,237 Americans dying from an overdose [1]. The impact of the overdose crisis is felt heavily in Florida: opioid-related deaths increased 35% between 2015 and 2016 statewide [2]. Heroin-associated deaths in Miami-Dade County rose 826% between 2011 and 2016 [2]. As Miami-Dade County consistently ranks first in HIV incidence nationwide, implementation of

evidence-based HIV prevention coupled with overdose prevention was imperative [3].

In 2016, Florida enacted the *Infectious Disease Elimination Act*, allowing a pilot syringe services program (SSP) but restricted to operate only in Miami, Florida: the University of Miami IDEA SSP. The World Health Organization, the Centers for Disease Control, and the United Nations have found SSPs to be cost-effective in reducing infectious disease burden [4–6]. In the year following the establishment of IDEA in Miami, approximately 518 PWID enrolled in services, and 795 kits of two 4 mg dose naloxone were distributed to participants. In addition to sterile needles and injection supplies,

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50 IDEA-SSP participants are provided with education on
51 safer injection practices. This education includes instruction
52 on the use of tester shots, using drugs with trusted
53 friends, awareness of locations of previous overdoses,
54 and unusually potent or otherwise toxic effects of com-
55 monly used drugs [7].

56 Importantly, SSP services include community distribu-
57 tion of take-home naloxone kits [8]. Take-home nalox-
58 one is an effective strategy for mitigating poor overdose
59 outcomes as it reduces the time to administration versus
60 activation of emergency medical services [9]. Commu-
61 nity naloxone distribution removes barriers to naloxone
62 access, a critical feature for populations that experience
63 significant hesitation when seeking medical care, parti-
64 tially due to uninsured status, systemic bias, and stigma
65 associated with drug use. PWID are often first re-
66 sponders to overdoses and reverse an overwhelming ma-
67 jority of community overdoses. A national survey from
68 1996 to 2014 reported over 26,400 overdose reversals
69 with PWID conducting 82.8% of reversals [10]. Other re-
70 search shows that PWID deploy take-home naloxone
71 nearly ten times as frequently versus laypersons who do
72 not use drugs—emphasizing the need to prioritize PWID
73 in naloxone distribution efforts [11].

74 Multiple systematic reviews have found take-home na-
75 loxone programs to be both safe and effective, leading to
76 increased survival rates among participants as well as de-
77 creases in community overdose mortality rates [12–14].
78 Although systematic analyses have found take-home na-
79 loxone programs are effective in reducing overdose
80 deaths among participants, few studies assess the impact
81 of take-home naloxone programs on hospitalizations
82 [13–15]. We present a study analyzing early effects of
83 the IDEA-SSP on the incidence of opioid overdose-
84 associated admissions at a county safety-net hospital in
85 south Florida.

86 **Methods**

87 We conducted a 25-month retrospective review of hos-
88 pitalized patients' data at Jackson Memorial Hospital
89 (JMH), a public hospital in Miami, Florida, that serves
90 people without regard for insurance status. The period
91 of review encompassed December 1, 2015, to January 1,
92 2018. JMH is the only safety-net hospital in Miami-Dade
93 County and is within a half-mile proximity of the IDEA-
94 SSP. Data were separated into two periods, with Decem-
95 ber 1, 2016—the establishment of the IDEA-SSP—as an
96 index date. To increase the specificity of the query, data
97 from December 1, 2016, to January 1, 2017, was ex-
98 cluded to allow time for sufficient community enroll-
99 ment. An algorithm used by Tookes et al. was adapted
100 using International Classification of Diseases, Tenth Re-
101 vision (ICD-10) codes to query the JMH electronic dis-
102 charge and billing records for patients aged 18–85 (see

Supplemental Table 1) [16]. A combination of ICD-10 103
codes for opioid use and injection-related infections 104
(IRI) was used to identify people who inject opioids 105
(PWIO). Opioid codes included ICD-10 diagnoses re- 106
lated to opioids (see Supplemental Table 2). IRI included 107
endocarditis, bacteremia/sepsis, osteomyelitis, abscesses, 108
and/or cellulitis diagnoses. 109

Medical records were abstracted for demographic infor- 110
mation, length of stay (LOS), insurance status, and dis- 111
charge status. Additionally, we independently analyzed 112
publicly available Florida Department of Law Enforcement 113
Medical Examiner Commission reports from 2012 to 2017 114
to identify regional and statewide trends in opioid-related 115
mortality to compare to local findings (Fig. 1). 116

117 **Analysis**

Descriptive statistics and frequency distributions for 118
demographics, insurance status, and hospital use vari- 119
ables were utilized. Hospital use variables included dis- 120
charge status and LOS for each hospitalization. 121
Categorical data were described with numbers and per- 122
centages. Comparisons between pre- and post-index in 123
frequencies of clinical and social demographic charac- 124
teristics were analyzed by chi-square or Fisher's exact test. 125
The chi-square test and Fisher's exact test can assess for 126
independence between two variables when the compar- 127
ing groups are independent and not correlated. Fisher's 128
exact test was used for the analysis of demographic fac- 129
tors including race, age in year, and insurance status. 130
Chi-square was used for the analysis of PWID overdose- 131
associated admissions. Because some continuous vari- 132
ables, such as age and LOS, were not normally distrib- 133
uted, the Wilcoxon rank-sum test was used for the 134
comparisons. The results were reported as median and 135
interquartile range. All analyses were performed in SAS 136
9.4 (SAS Institute Inc., Cary, NC). 137

138 **Results**

139 **Demographics**

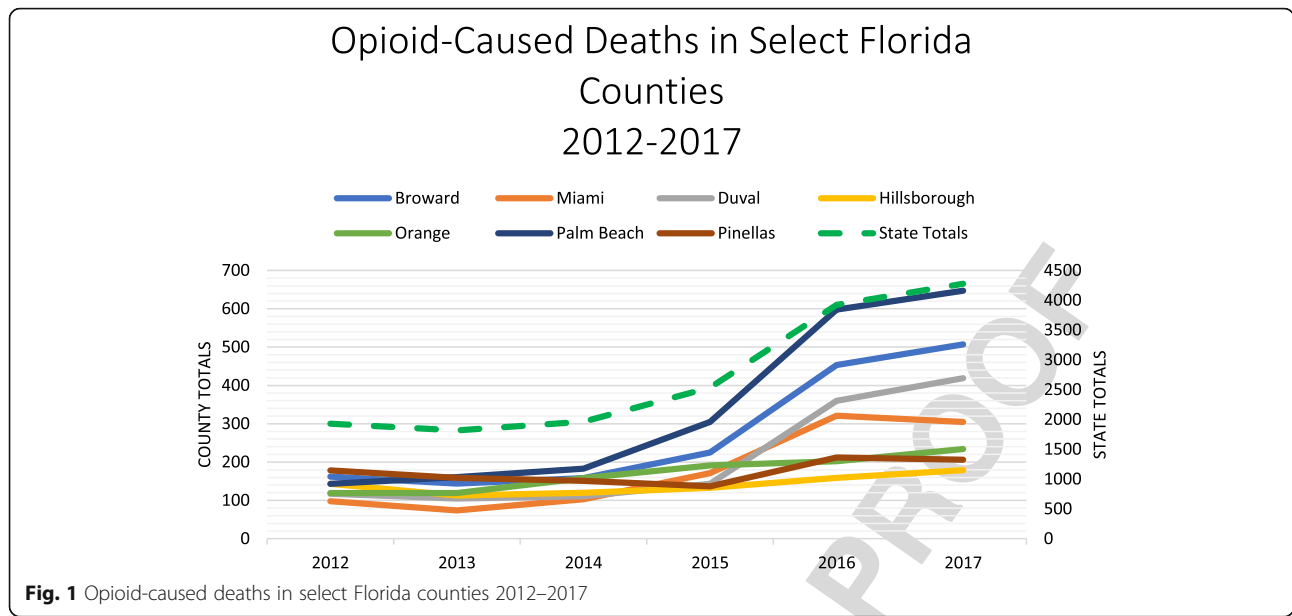
Three hundred two PWIO admissions were identified: 140
146 pre-index vs. 156 post-index ($p = 0.12$) (Table 1). 141
Race, sex, age, and insurance did not differ across pre- 142
and post-index cohorts. Only 3% of PWIO had private 143
insurance across the 2-year timespan. Approximately 144
60% of PWIO were uninsured, with no significant differ- 145
ence between cohorts ($p = 0.88$). Hospital mortality rates 146
were not significantly different between the pre- and 147
post-index cohorts. Nine (3%) patients died during the 148
hospital stay as determined by an "expired" discharge 149
status: five pre-index vs. four post-index ($p = 0.74$). 150

151 **Overdose sequela**

Overdose-associated admissions significantly changed in 152
the post-index cohort vs. the pre-index cohort. In the 153

F1

T1



f1.1
f1.2

t1.1 **Table 1** PWIO demographics

	Pre-index, n = 146; # (%)	Post-index, n = 156; # (%)	p value
Biological sex			0.46
t1.4 Male	103 (70.6)	103 (66.0)	
t1.5 Female	43 (29.5)	53 (34.0)	
Race			0.64
t1.7 White	118 (80.8)	124 (79.5)	
t1.8 Black	27 (18.5)	29 (18.6)	
t1.9 Others	1 (0.30)	3 (1.9)	
Ethnicity			
t1.11 Hispanic	65 (44.5)	57 (36.5)	0.16
t1.12 Non-Hispanic	81 (55.5)	99 (63.5)	
Age in years			0.17
t1.14 16–29	22 (15.1)	30 (19.2)	
t1.15 30–39	47 (32.2)	47 (30.1)	
t1.16 40–49	36 (24.7)	48 (30.8)	
t1.17 50–59	30 (20.6)	20 (12.8)	
t1.18 60–65	9 (6.2)	5 (3.2)	
t1.19 65–85	2 (1.4)	6 (3.9)	
Insurance status			0.90
t1.21 Uninsured	85 (58.2)	95 (60.9)	
t1.22 Medicaid	31 (21.2)	34 (21.8)	
t1.23 Medicare + Federal	24 (16.4)	21 (13.5)	
t1.24 Private	5 (3.4)	4 (2.6)	
t1.25 Others	1 (0.7)	2 (1.3)	
t1.26 Median length of stay	4	2	0.14
t1.27 Expired during study period	5 (3.4)	4 (2.6)	0.74
t1.28 PWIO overdose-associated admissions	20 (13.7)	6 (3.9)	0.0034

154 pre-index cohort, 14% of admissions involved an over-
155 dose diagnosis, vs. 4% in the post-index cohort ($p =$
156 0.0034).

157 Florida opioid-caused deaths

158 State medical examiner findings demonstrated overall
159 increasing opioid-related deaths in Florida between 2010
160 and 2017. From 2014 to 2016, opioid-caused deaths in-
161 creased. The rate of increase declined from 2016 to 2017
162 except in Pinellas and Miami-Dade counties, where
163 opioid-related mortality decreased.

164 Discussion

165 Opioid-caused deaths increased in Florida following le-
166 gislative efforts to close “pill mills” in 2012, with result-
167 ing increases seen in counterfeit opioid pills and heroin
168 use [15]. This data explores opioid epidemic-related
169 morbidity and mortality in south Florida through the
170 lens of hospital admissions following the implementation
171 of IDEA-SSP. With the introduction of fentanyl and
172 high-potency analogues into the drug supply, sharp in-
173 creases in opioid mortality were seen statewide between
174 2014 and 2016 [2, 17]. Given the heretofore unmitigated
175 statewide overdose crisis, it would be expected that hos-
176 pital data would reflect regional trends of increasing
177 overdose-associated admissions. However, following SSP
178 implementation, while the number of PWIO in our co-
179 hort did not change significantly, overdoses reported in
180 PWIO decreased significantly. The temporal association
181 suggests that the IDEA-SSP community distribution of
182 take-home naloxone may have produced early effects in
183 mitigating overdose-associated morbidity and mortality.

184 Several statewide opioid epidemic interventions were
185 implemented before and directly following the study
186 period, including a concerted law enforcement effort to
187 close “pill mills” [17]. However, these statewide policies
188 should theoretically affect all counties equally and thus
189 do not temporally explain Miami-Dade’s decline in over-
190 dose deaths as reported by the Florida Department of
191 Law Enforcement Medical Examiners Commission (Fig.
192 1). During the study period, the IDEA-SSP distributed
193 795 naloxone kits to participants and 387 reversals were
194 reported. Between 2016 and 2017, opioid-related mortal-
195 ity in Miami-Dade County declined 5%, from 321 deaths
196 to 305 deaths. Similar declines were not seen in neigh-
197 boring counties. Considered together, these data suggest
198 early impacts of the first legal SSP in the state, operating
199 in Miami-Dade County.

200 More low-barrier SSPs are needed across Florida to in-
201 crease naloxone access among PWID and reduce state-
202 wide opioid-related morbidity and mortality. Due to
203 negative experiences PWID have when receiving services
204 in traditional health care settings, they may be less likely
205 to visit such settings to access naloxone, highlighting the

importance of establishing naloxone distribution pro- 206
grams in low-barrier settings where PWID may feel 207
more comfortable—namely SSPs and other harm reduc- 208
tion modalities. Recent modeling simulating the impact 209
of 13 naloxone distribution modalities on overdose 210
deaths estimated expanding naloxone distribution 211
through a single SSP can reduce a community’s overdose 212
deaths by 65% [18]. 213

Limitations to this study exist. The ICD-10 does not 214
have diagnosis codes for injection drug use or sequelae. 215
This study relied on a novel ICD-10 adaptation of an 216
ICD-9-based algorithm using codes for drug use and in- 217
fectious consequences [16]. Additionally, the stigma as- 218
sociated with injection drug use remains widespread, 219
and patients may not have reported use, resulting in 220
under-documentation. Most importantly, our data do 221
not imply causality between the establishment of the 222
SSP and the decrease in opioid-associated admissions. 223
Previous epidemiologic evaluations of SSPs describe lag 224
times between community SSP implementation and decl- 225
ine in chronic infections [19]. An analysis of HIV rates 226
among PWID in Baltimore only noted a significant decl- 227
ine after 5 years of increasing SSP service coverage, 228
with sustained decline demonstrated thereafter [19]. Fu- 229
ture research should explore longitudinal effects of the 230
IDEA-SSP. 231

Despite these limitations, this study reveals a signifi- 232
cant decrease in overdose-associated admissions among 233
PWIO at a county safety-net hospital following the im- 234
plementation of the IDEA-SSP in the setting of the con- 235
temporary Florida overdose crisis. Taken alongside 236
medical examiner data, this study demonstrates trends 237
of decreasing opioid overdose-related morbidity and 238
mortality in Miami-Dade County. SSPs and take-home 239
naloxone may impact the number of overdose-associated 240
hospital admissions and warrant further study. 241

Supplementary information

Supplementary information accompanies this paper at <https://doi.org/10.1186/s12954-020-00376-1>.

Additional file 1: Supplementary Table 1. JMH PWIO. This data consists of the 302 admission of people who inject opioids that we analyzed in this manuscript.

Additional file 2: Supplementary Table 2. JMH PWIO ICD-10 Codes. This table contains the complete list of ICD-10 codes used for inclusion in the study as described in the Methods section.

Abbreviations

IDEA-SSP: University of Miami IDEA Syringe Services Program; PWID: People who inject drugs; JMH: Jackson Memorial Hospital; ICD-10: International Classification of Diseases, Tenth Revision; IRI: Injection-related infections; PWIO: People who inject opioids; LOS: Length of stay

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264 Authors' contributions

265 KB, AC, AM, HT, and JES all contributed to the design and interpretation of
266 the study. HL and TB performed the statistical analysis. KB and AC were the
267 major and equal contributors in writing the manuscript, aided by AM, TB, HT,
268 and JES. The author(s) read and approved the final manuscript.

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278 Availability of data and materials

279 The de-identified dataset is available as Supplementary Table 1. Florida De-
280 partment of Law Enforcement Medical Examiners Commission Reports are
281 publicly available data.

282 Ethics approval and consent to participate

283 The study was approved by the University of Miami Institutional Review
284 Board (IRB #20180242) and the Jackson Health System Clinical Research
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287 Consent for publication

288 Not applicable

289 Competing interests

290 The authors declare that they have no competing interests.

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