

1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29

Article type : Original Contribution

Abstract

Objectives: Violence is one of the leading causes of death among youth ages 14-24. Hospital- and ED-based violence prevention programs are increasingly becoming a critical part of public health efforts; however, evaluation of prevention efforts is needed to create evidence-based best practices. Retention of study participants is key to evaluations, though little literature exists regarding optimizing follow-up methods for violently-injured youth. This study aims to describe the methods for retention in youth violence studies and the characteristics of hard-to-reach participants.

Methods: The Flint Youth Injury (FYI) Study is a prospective study following a cohort of assault-injured, drug-using youth recruited in an urban ED, and a comparison population of drug-using youth seeking medical or non-violence-related injury care. Validated survey instruments were administered at baseline and four follow-up time points (6, 12, 18, 24 months). Follow-up contacts used a variety of strategies and all attempts were coded by type and level of success. Regression analysis was used to predict contact difficulty and follow-up interview completion at 24 months.

Results: 599 patients (ages 14-24) were recruited from the ED (mean age=20.1 years, 41.2% female, 58.2% African American), with follow-up rates at 6, 12, 18, and 24 months of 85.3%, 83.7%, 84.2%, and 85.3%, respectively. Participant contact efforts ranged from 2 to 53 times per follow-up timeframe to complete a follow-up appointment, and more than 20% of appointments

This is the author manuscript accepted for publication and has undergone full peer review but has not been through the copyediting, typesetting, pagination and proofreading process, which may lead to differences between this version and the [Version of Record](#). Please cite this article as [doi: 10.1111/acem.13495-18-139](https://doi.org/10.1111/acem.13495-18-139)

30 were completed off-site at community locations (e.g., participants' homes, jail/prison).
31 Participants who were younger ($p<.05$) and female ($p<.01$) were more likely to complete their
32 24-month follow-up interview. Participants who sought care in the ED for assault injury ($p<.05$)
33 and had a substance use disorder ($p<.01$) at baseline required fewer contact attempts to complete
34 their 24-month follow-up, while participants reporting a fight within the immediate 3 months
35 before their 24-month follow-up ($p<.01$) required more intensive contact efforts.

36

37

38 **Conclusions:** The FYI study demonstrated that achieving high follow-up rates for a difficult-to-
39 track, violently-injured ED population is feasible through the use of established contact strategies
40 and a variety of interview locations. Results have implications for follow-up strategies planned
41 as part of other violence prevention studies.

42

43

44

45

46

47

48

49

50

51

52

53

54

55 **Introduction**

56

57 Violence is an important public health issue in the United States. Homicide is currently
58 the third leading cause of death for youth between the ages of 14-24 years, and results in over
59 \$8.9 billion in medical and work lost costs a year in the United States (not accounting for non-
60 fatal assault injuries).¹ In addition to fatal injuries, more than 400,000 youth (14-24 years old)

61 seek emergency department (ED) care annually for non-fatal assault injuries.¹ Many of these
62 youth are not regularly attending school² or accessing primary care clinicians,^{2,3} which often
63 serve as traditional sites for violence prevention programs. As a result, EDs have become the
64 primary setting for many violence prevention programs, especially those that provide behavioral
65 counseling and wrap around care management interventions,^{4,5} aimed at reducing the risk of
66 future violence, especially for the hardest to reach, most at-risk youth.

67
68 While several promising ED- and hospital-based interventions for reducing violence have
69 been described in prior studies,⁶⁻¹¹ their effectiveness has been limited by high attrition rates.
70 Violently-injured patients are particularly difficult to retain in longitudinal research, often due to
71 increased environmental (home/family) instability and co-occurring alcohol and drug use
72 disorders.¹²⁻¹⁴ High attrition rates are associated with compromised internal study validity.¹⁵
73 While statistical techniques exist to compensate for the inevitability of attrition, such techniques
74 are less preferable to achieving high follow-up rates that allow for complete understanding of the
75 outcome data.^{12-14,16,17} Further, external validity is compromised by attrition rates that are
76 unequal across patient populations.^{13-16,18,19} While the literature has identified a series of
77 successful follow-up strategies for tracking and retention of hard-to-reach substance use
78 populations,^{12-16,20-23} such techniques have not been fully examined among assault-injured youth
79 populations.

80
81 The objective of this study is to describe effective approaches for tracking and retaining
82 participants during a two-year longitudinal study of violently-injured and substance-using youth
83 that achieved 85% follow-up. The techniques described here could aid future study design for
84 interventions, especially in terms of retention of hard-to-reach participants, and support public
85 health efforts that address the high rates of violence among youth.

86 87 88 **Methods**

89 90 Study Design

91 This study is part of a larger two-year prospective longitudinal cohort study measuring
92 the prevalence of substance use and violent injury among a sample of youth (14-24 years old)
93 seeking ED care for assault-injuries and reporting past six-month drug use (AIG) and a
94 comparison group of youth (proportionally sampled by age/gender) who were seeking ED
95 treatment for non-assault reasons, but also reporting past 6-month drug-use (CG).^{2,24,25} The study
96 was approved by both the University of Michigan and Hurley Medical Center's Institutional
97 Review Boards, and an NIH Certificate of Confidentiality was obtained.

98

99 Study Setting and Population

100 Youth were recruited at a public urban Level 1 Trauma Center ED in Flint, MI. The ED
101 provides care for ~75,000 adult and ~25,000 pediatric patients (<20 years-old) annually. Flint
102 has high rates of violent crime (14.8/1000 population) that are comparable to other well-known
103 de-industrialized urban centers, including Detroit, Michigan; Camden, New Jersey; and Oakland,
104 California.²⁶

105

106 Sample Recruitment

107 Patients 14-24 years-old seeking care for an assault injury, as well as a consecutively
108 enrolled comparison group based on sex and age range (i.e. 14-17; 18-20; and 21-24), who
109 reported past-six-month drug use on a private, self-administered computerized screening survey
110 were eligible for inclusion in the longitudinal study. Youth were excluded if they were not able
111 to provide informed consent (e.g., altered mental status, psychosis, non-English speaking),
112 presented for child abuse, acute sexual assault, or suicidal ideation/attempt. Patients were
113 recruited seven days per week, for 21 hours per day (5 am–2 am) on Tuesday and Wednesday
114 and for 24-hours per day on Thursday through Monday between December 2009 and September
115 2011.

116

117 Study Protocol

118 Assault-injured youth were identified through electronic medical records, and approached
119 by trained research assistants (RAs) in treatment spaces or waiting rooms. Assaults were defined
120 as any injury intentionally caused by another person and included gunshot wounds, being struck
121 by/against (punching), and stab wounds. RAs assessed whether the injury complaint fit the

122 definition of assault when they approached potential participants. Youth agreeing to study
123 participation completed written consent (written assent with parental consent if they were <18
124 years-old), and self-administered a private computerized screening survey to assess eligibility
125 (i.e., past 6-month drug use).²⁴ Participants who completed the screen were compensated with a
126 dollar store gift worth \$1.00. The CG was enrolled consecutively with the AIG to limit seasonal
127 and temporal variation, and was proportionally balanced by age range (as above) and sex. For
128 example, after identifying a 20-year old female with an acute assault-related injury and past six-
129 month drug use on the screening survey, the RA would recruit sequentially, by time of triage, the
130 next 18-20-year-old female seeking ED care for a medical complaint or unintentional injury
131 (e.g., motor vehicle crash); those screening positive for any past six-month drug use would be
132 consented for inclusion in the longitudinal study. After consenting for the longitudinal study,
133 eligible participants completed a second written assent/consent (and parental consent < 18), and
134 completed a ~90-minute baseline survey, including both an RA-administered structured
135 interview and a computerized self-administered survey portion. This consent process included a
136 consent for the study team to review the patient's medical record. Remuneration was \$20 cash.
137 Additionally, any patient who was unstable while in the ED could be recruited on the hospital
138 floors if they stabilized within 72 hours from triage.

139
140 Follow-up assessments were conducted at 6, 12, 18, and 24 months at a location
141 convenient for the participant, including the study ED, community locations (e.g., library,
142 restaurant, their homes), via telephone, or in jail/state prison (process described below) if the
143 participant was incarcerated during the follow-up period. If needed, transportation to follow-up
144 appointments was provided. Remuneration included \$30 for the 6-month interview, \$35 for the
145 12-month interview, \$35 for the 18-month interview, and \$45 for the 24-month interview. Cash
146 payments were provided at each follow-up. Participants were also provided with a toll-free
147 phone number to contact study offices and were remunerated \$5 per interview if they telephoned
148 the study office within 2 weeks of their scheduled interview date and confirmed or rescheduled
149 their appointment. Incarcerated participants were not allowed compensation. Participants who
150 turned 18 during the follow-up timeframe were consented as adults at their next appointment.
151 Family and friends accompanying the patient were not allowed to observe or participate during
152 survey administration.²⁵

153

154 Participant Tracking Protocol

155 At the index ED visit, participants completed a locator form providing information for
156 study personnel to contact them for follow-up interviews. Specific data collected included: 1)
157 date of birth; 2) social security number; 3) telephone numbers (e.g., cellular, home, others;
158 including optimal contact number and times of day); 4) living and mailing address, including any
159 plans to move; 5) email address; 6) social media account information (e.g., Facebook); 7) work
160 address/phone number with associated permission to contact; 8) school information (if relevant);
161 9) organized extracurricular activity involvement; and, 10) information regarding legal status
162 (i.e., whether the participant anticipates being in jail or state prison at the time of follow-up).
163 Study RAs also gathered contact information (e.g., names, telephone number, addresses) for at
164 least two people (e.g., a spouse, family member, or friend) who would know the patient's
165 whereabouts during the study period. Participants were also asked to provide the names for
166 locations they frequented (e.g., churches, shelters).

167

168 Participant Follow-up and Contact Protocol

169 See Table 1, for a timetable of contacts. At the time of their ED visit, participants were
170 given business cards with the project logo, phone numbers to the study office, date of next
171 interview, and potential payment amounts. Additionally, participants were given small gifts (e.g.,
172 pens) that contained both the project logo and contact information. The project business card and
173 gifts were given to participants at each follow-up interview and at every home visit attempt.

174 Participants were called 48 hours after their index ED visit to confirm their contact
175 information and that their 6-month appointment had been scheduled. Between each longitudinal
176 follow-up time point, RAs contacted participants a minimum of four times. First, approximately
177 3 months prior to each scheduled 6-, 12-, 18-, and 24-month follow-up appointment, a post card
178 was sent to the participant, which included information on their scheduled date, time, and
179 location of the appointment. The postcard also contained information on the remuneration for
180 participation in the follow-up, and provided study contact information for the participant to
181 reschedule their appointment if necessary. Next, a "reminder" letter was sent to each participant
182 4 weeks before their intended appointment. This letter included the same information as the
183 postcard that was sent prior, if information had not been updated. Third, two weeks prior to each

184 follow-up appointment, a reminder post card was sent to the participant. Finally, RAs contacted
185 participants by phone the day prior to their appointment to confirm the date/time.

186 In addition to these four scheduled contacts, RAs also sent a “thank you” letter or post
187 card after each follow-up appointment to remind participants of their next scheduled
188 appointment, and would send holiday cards to participants mid-December to keep them engaged
189 with the study.

190 For participants who had letters returned due to wrong mailing address, RAs would
191 attempt phone contact with the participant and/or complete appropriate searches through the
192 medical record (consent granted in initial consent document) or public search databases to obtain
193 new contact information. For appointments where the participant missed their scheduled date and
194 time, RAs would attempt to contact participants within 15-30 minutes to assess if they were
195 planning to arrive late or needed to reschedule. If participants failed to arrive for their
196 appointment, RAs would send a missed appointment letter encouraging them to reschedule.

197 For participants who missed their scheduled follow-up, multiple additional attempts at
198 contact were made. In addition to the contact attempts detailed above, participants that did not
199 show up for appointments were sent texts, emails, and Facebook messages. These methods of
200 contact were noted as part of the consent signed at time of study enrollment. If participants were
201 unable to be reached via the contact information provided at the time of the ED visit, a search of
202 their medical record and public databases was conducted, and more intensive contact attempts
203 were made. First, a review of the participant’s medical record, which included confirming
204 information provided by the participant and adding new contact information, was conducted.
205 Then, public databases, such as Department of Public Health death records, internet people
206 finder databases (e.g., Alumnifinder, Yahoo people search), and offender and prison websites
207 were reviewed. If contact information was still not found, a visit to the participant’s home was
208 scheduled. A letter informing the participant of the home visit was sent out at least 1 week
209 before the scheduled visit. Home visits were conducted with two interviewers (for safety) and
210 took place during daylight hours. If the participant was not home, interviewers left friendly,
211 handwritten notes on index cards, similar to the ones given to the participant at baseline. During
212 visits to the participant’s residence, study personnel would attempt to contact neighbors (without
213 revealing that the study was related to substance use or violence) to confirm if the participant
214 resided at that address or if they knew a more current address. During winter months, letters were

215 left at local shelters or soup kitchens where homeless participants were known to have previously
216 stayed or visited.

217 For participants incarcerated at the time of follow-up, the study received permission from
218 both the MDOC (Michigan Department of Corrections), both (U-M and Hurley) IRBs, and from
219 participants themselves to contact them while in jail/state prison. If participants were known to
220 be in jail or state prison during their follow-up appointment (either through a search of publically
221 available offender websites, or family members or participants themselves notifying the study
222 team), a letter was sent to the warden of the jail or state prison introducing the study, as well as
223 providing a copy of the MDOC approval letter granting the study permission to conduct the
224 interview while the participant was incarcerated (which was obtained at the outset of the study).
225 After the warden provided written permission for the study to conduct the follow-up interview,
226 the written permission was submitted to the IRB and appointments were made with the jail/state
227 prison and the participant to set up a time to conduct the follow-up interview. Interviews were
228 conducted over the phone or in-person within interview rooms. Response cards were used to
229 preserve confidentiality; data from participants were not shared with the warden or prison staff.

230 For all contact attempts, participants were called during the times they indicated during
231 the initial study interview were most convenient for them. Typically, interviewers would call
232 throughout the day (9am-8pm), leaving only a single message per day. During subsequent
233 participant interactions, their contact information was verified and/or updated. In compliance
234 with IRB requirements, if at any time participant asked not to be contacted, they were thanked
235 for their participation in the study and no further contact efforts were attempted. Participants
236 were allowed a total of 3 months to complete a follow-up after their exact follow-up date (i.e.,
237 for the 6 month follow-up interview, participants had 90 days to complete their appointment
238 from their 6 month post ED date before they would time out for that follow-up appointment).
239 The findings and conclusions in this report are those of the authors and do not necessarily
240 represent the official position of the funding agencies, and the funding agencies had no role in
241 the conduct or reporting of the study.

242

243 Measures

244 Outcome Measures: Completion of study follow-up at 6, 12,18 and 24 months was examined.

245 Completion was not necessarily consecutive (i.e., the few who did not complete the 6 month

246 follow-up could complete the 12, 18 or 24 month follow up interviews). Subsequently, contact
247 difficulty at the 24 month time point was examined. Difficulty was measured by the number of
248 contacts required to complete follow-up or determine the patient would not complete the
249 interview (i.e. patient declined or the study was completed). Contact difficulty was defined as
250 needing more contact attempts. Contact attempts include both attempts made by staff and by
251 participants. Study team initiated and participant initiated contact attempts were combined into a
252 single metric in order to fully capture the resources and scope of work needed to successfully
253 complete follow ups among a high risk population

254
255 Tracking Measures: Every contact attempt made by a staff member to reach a participant or from
256 a participant to the study team was recorded in their unique follow-up file folder. Information
257 collected on contacts included date, time, type of contact (mail, email, call, home visit), who was
258 involved (e.g., participant, family member, unknown), and the main focus of the contact (e.g.,
259 change of address).

260
261 Socio-demographics: Demographics and socio-economic measures (i.e., age, gender, race,
262 public assistance) were collected using validated measures from the Drug Abuse Treatment
263 Outcome Studies (DATOS)²⁷ and the National Longitudinal Study of Adolescent Health.²⁸ For
264 analysis, race was dichotomized as African American vs. Other given that African-Americans
265 comprise 57% of the Flint community.²⁹

266
267 Baseline Substance Use Disorder: The RA-administered Mini International Neuropsychiatric
268 Interview (MINI, version 6.0, 1/1/10) was used to assess whether participants met diagnostic
269 criteria for an alcohol or drug use disorder (i.e. abuse or dependence) at the time of the baseline
270 assessment.³⁰

271
272 Past 3-month Violence: The Time Line Follow Back (TLFB)-Aggression Module (TLFB-AM),
273 developed to be used with the TLFB, assessed detailed characteristics of incidents of physical
274 violence in the past 90 days and was administered at baseline and during each of the subsequent
275 follow-up appointments.³¹⁻³³ Using monthly calendars, beginning on the day of assessment, and

276 working backwards, participants were asked to identify specific dates in which they experienced
277 interpersonal conflict (whether victimization or aggression) with partners or others.³¹

278

279 Data Analysis

280 All analyses were conducted using SAS 9.4. To define different participants and the number of
281 contact attempts needed to reach them, those that were easy to reach were defined as those in the
282 lower three quartiles of contact attempts made or received at each time point; the hard-to-reach
283 was defined as the top quartile of number of contact attempts made or received. A phi coefficient
284 was calculated to determine the relationship between where a participant completed their follow-
285 up at 6-months and at 24-months. Chi-square analyses and t-tests were used to evaluate bivariate
286 associations with the outcome of interest (i.e., follow-up completion). We used a significance
287 level of $\alpha=.05$ for all hypothesis tests. A logistic regression was used to identify variables
288 associated with 24-month follow-up completion (completed 24-month follow-up versus not
289 completed). Predictors in the model were chosen to account for the sampling scheme (i.e., age,
290 sex), theoretical considerations (i.e., race, public assistance), and significance in bivariate
291 comparisons (i.e., substance use disorder, AIG). A separate analysis was conducted to determine
292 the variables associated with contact difficulty. Due to overdispersion in the outcome variable of
293 contact difficulty (total number of contact attempts), a negative binomial regression was used to
294 predict contact difficulty at 24-month among the entire sample. Again, background
295 characteristics were included in the model based on prior literature, or based on significance in
296 bivariate analyses.

297

298 **Results**

299

300 Sample Characteristics

301

302 The baseline and longitudinal FYI sample has been described in prior publications.^{2,24,25}
303 The longitudinal sample included 349 youth in the assault-injury group (AIG) and 250 youth in
304 the comparison group (CG). Differences in group sample size was due to oversampling the AIG
305 to meet the aims of the original grant.²⁵ At baseline, participants were mostly Black (58%), male

306 (59%), and in receipt of public assistance (73%). No baseline differences were observed between
307 the two groups (AIG vs. CG) with respect to age, sex, race, or receipt of public assistance.

308

309 Follow-up Rates and Characteristics

310 The longitudinal sample was followed for 24 months at 6-month intervals. Follow-up
311 completion rates were 85.3%, 83.7%, 84.2%, and 85.3% at 6, 12, 18, and 24 months,
312 respectively. There were no significant differences in completion rates by time point. The
313 majority of follow-up interviews (78.9%) were completed at the study site where the initial ED
314 encounter took place. The study site was easy for participants to find, with relatively good access
315 to transportation, and was considered a safe place in the community. The next most common
316 location for completion of follow-up interviews was the participant's home (9.5% of follow-up
317 interviews), although this was noted to decrease over time. At the 6-month follow-up, 14% of
318 follow-up appointments occurred at the participant's home, while at 24 months only 7% were
319 completed at a participant's home. In total, 2% of follow-up appointments were completed at
320 community locations (e.g., at a fast food restaurant, public library) other than the hospital or
321 participant's home. Participants completed their follow-up appointment in jail/state prison 3.4%
322 of the time (by time point: 2.9% at 6-months, 3.0% at 12-months, 4.4% at 18-months, and 3.5%
323 at 24-months). Participants were also given the option to complete their follow-up appointment
324 over the phone if it was not possible to meet in person. At 6 months, 4% of appointments were
325 completed over the phone, while at 24 months, 10% were completed over the phone. Participant
326 completing the 6-month follow-up at the study site more likely to complete their 24-month
327 follow-up interview at the study site (ϕ coefficient= .5508, $p < .001$). However, participants
328 completed more home visit interviews at 6 months than at 24 months, and more phone interviews
329 at 24 months than 6 months ($p < .001$).

330

331 Follow-Up Contact Attempts

332 Figure 1 shows the average number of contact attempts per participant by contact type
333 and appointment time point. Contact attempts include both attempts made by staff and by
334 participants, and included both a standard contact protocol and hard-to-reach contact protocol
335 (see table 1). Each time point shows the average number of contacts required to reach someone
336 who needed the "least effort" (among the lower 3 quartiles of contact attempts but completed the

337 appointment) as well as the average for those who were “hard-to-reach” (among the upper
338 quartile of contact attempts but completed the appointment), and the contact attempts for
339 participants who did not complete the appointment. Easy-to-reach participants (those requiring
340 the least effort) initiated/recieved an average of 6.2 (standard deviation (SD)=1.5) contact
341 attempts, 97-100% of which were phone calls and letters. Hard-to-reach
342 participants initiated/recieved 14.1 (SD=6.0) contact attempts, with only 92-94% of contact
343 attempts by phone and 6-8% contact attempts requiring more intensive contact methods beyond
344 the standard calls and letters, such as home visits, text messages, and public database searches.
345 Participants who did not complete appointments initiated/recieved 15.7 (SD=9.3) contact
346 attempts, and required 9-21% of these attempts to be more intensive (e.g., home visits, text
347 messages, public database searches).

348

349 Factors Associated with 24 months Appointment Completion

350

351 Younger ($p<.05$) and female ($p<.01$) participants were more likely to complete their 24-
352 month follow-up interview. Race, receiving public assistance, a baseline diagnosis of a substance
353 use disorder and belonging to the AIG did not affect 24-month follow-up completion (Table 2).
354 There was no evidence for severe lack of model fit based on the Hosmer and Lemeshow test
355 ($p=0.39$).

356

357 Factors Associated with Contact Difficulty at 24 Months Post-ED Visit

358

359 At 24 months, AIG participants ($p<.05$) and those who met diagnostic criteria for a
360 substance use disorder at baseline ($p<.01$) required fewer contact attempts, while participants
361 reporting a violent fight within the 3 months prior to their 24-month follow-up ($p<.01$) required a
362 greater number of contact attempts to complete their 24-month follow-up. Contact difficulty was
363 defined as needing more contact attempts. Age, sex, race, and receiving public assistance did not
364 affect contact difficulty (Table 3). The deviance to degrees of freedom ratio was 1.01, indicating
365 good model fit. The largest variance inflation factor was 1.06 indicating that collinearity was not
366 a concern in either model.

367

368 **Discussion**

369

370 Following violently-injured research study participants requires extensive effort and
371 dedication. This is particularly challenging in emergency department-based studies where
372 patients have an episodic connection to care rather than a longitudinal relationship. To our
373 knowledge this is the first study to describe methodological best practices for successful
374 retention of high-risk youth populations recruited from emergency department (ED) settings.
375 Previous research on substance-using populations has demonstrated effective strategies for
376 minimizing attrition which informed the strategies employed with our violently-injured youth
377 population to achieve a greater than 85% follow-up rate.^{12-16,20-23}

378

379 We also describe the characteristics of the hardest-to-reach sample. Importantly, this
380 paper demonstrates both the feasibility of following this hard-to-reach sample, and the
381 significant effort and resources required to do so successfully. Understanding this population
382 and the contact efforts necessary are crucial to successfully completing valid studies in injury
383 research. Although some degree of attrition is inevitable, without the inclusion of the hard-to-
384 reach sample, biased results are more likely.¹⁵ Quantifying the effort required to achieve the
385 follow-up necessary for validity allows for better targeting of limited resources in future studies.
386 This effort was uniquely designed to create the greatest accessibility to the study population. To
387 that end we have provided detail regarding methods and resources used for the successful follow-
388 up protocols.

389

390 Completion of the 24-month follow-up interview was associated with being younger and
391 of female gender, without any significant differences for self-reported race, receipt of public
392 assistance, substance use disorder, or having sustained an assault injury. The association of
393 younger participants may reflect a difference in housing stability, as early adulthood is
394 characterized by major transitions in housing.³⁴ Younger participants would be more likely to
395 continue to live with their parents or guardians for the duration of the study versus living
396 independently. The latter would be expected to result in greater mobility, less stability, and thus
397 a greater difficulty reaching or locating such participants. Additionally, although transportation
398 was aided with taxi/bus vouchers, participants who were younger and lived with other family

399 members likely had access to family modes of transportation that our older participants did not.
400 Lastly, the association of female gender could be due to the known trend for females to seek care
401 more often than males,³⁵ and thus be more likely to be connected to the medical system and more
402 likely to complete their follow-up appointment.

403
404 Participants in the assault-injured group required less contact effort than the comparison
405 group to complete the 24-month follow-up appointment. The finding that the acutely violently
406 injured patient that seek care in the ED is easier to track, likely reflects that people in the AIG
407 who sustained a violent injury may have more frequent contacts with the medical system in the
408 months after an injury (e.g., follow-up visits to orthopedics/trauma surgery, etc.). These contacts
409 may promote a stronger connection with the medical system, making such patients more likely to
410 complete follow-up visits. For a visit for a more minor medical issue such as strep throat, young,
411 otherwise healthy participants may not have the same degree of linkage with the medical system.

412
413 Conversely, participants with recent violence (fighting within 3 months preceding 24-month
414 follow-up visit), required greater effort to complete the follow-up interview. It may be the
415 contemporaneous violence occurring at their time in their life made scheduling more difficult, or
416 that an ongoing conflict may cause participants to “lay low” or avoid encounters with unfamiliar
417 individuals or locations out of fear of recurrence of fighting, retribution, or exposure to the
418 police/authorities, thereby making them much more difficult to contact through regular channels.

419
420 Participants with a substance use disorder at baseline also required fewer contact attempts
421 to complete the 24-month follow-up interview. Although this may reflect a greater motivation to
422 obtain compensation, measures of low socioeconomic status such as receiving public assistance
423 were not significantly associated with contact difficulty. Alternatively, those with a substance
424 use disorder may also be more highly connected to nearby substance abuse treatment clinics and
425 community resources that improved their access to the interview sites and reliable points of
426 contact. Similar findings have been observed in previous studies.¹³

427
428 We did note a trend requiring greater flexibility in location of follow-up appointment and
429 types of contact attempts to complete the follow-up interview over time. Initially, more

430 interviews were completed at the participant's home, but at 24 months a greater number of
431 interviews required phone completion. This may reflect the transient nature of our sample, which
432 made home visits impossible in later follow-up appointments due to movement outside of the
433 study city and state. Future studies will need to ensure a robust process for conducting phone or
434 web-based interviews and delivering the participation stipend in order to adequately capture such
435 samples accurately.

436
437 The resources required to complete follow-up assessments with the hard-to-reach
438 population were significantly greater than those required for the general study sample. In order
439 to plan for adequate follow-up rates to support acceptable internal and external study validity,
440 future studies should plan to invest follow-up resources accordingly in order to reach their hard-
441 to-reach sample. Staffing on the follow-up portion of this study included a masters-level
442 coordinator, two full-time bachelors level research assistants, and one part-time research
443 assistant.

444
445 In this study, use of technology such as text messaging, email, and social media did not
446 play a major role in contact attempts, for many reasons. First, many of our participants did not
447 have active email accounts (based on self-report). Next, at the time of the study 2009-2013,
448 many participants did not have access to unlimited text/SMS message services and many used
449 phone plans purchased by minutes of use (minute phones), and asked the study team not to text
450 them. Third, access to Wi-Fi and 3G/4G/LTE service within this community is limited, making it
451 difficult to connect with participants through the internet. Lastly, per our IRB protocol, we were
452 only allowed to private message participants on Facebook. We did not "friend" participants or
453 "write on their walls". These private non-friend messages would automatically arrive in an
454 alternative message inbox (due to not being friends), which most participants were not aware of
455 or checked often. Current studies in this population have been able to utilize SMS messaging
456 more frequently and successfully, and the use of apps to aid in research has promising contact
457 potential.

458
459 This study analyzes data from a 24-month ED-based prospective cohort study of assault-
460 injured, drug-using youth to describe methodological best practices for successful retention of

461 high-risk youth populations recruited from emergency department (ED) settings. It should be
462 noted that other analyses from this study have examined trajectories of the study population over
463 the 24-month time period. These analyses include joint trajectories of alcohol use and
464 anxiety/depression symptoms over time,³⁶ prediction of future firearm violence,³⁷ trajectories of
465 marijuana use,³⁸ and predictors of assault re-injury.²⁵

467 **Limitations**

469 Study limitations should be recognized. First, this study was conducted at a single ED in
470 a deindustrialized Midwestern city, potentially limiting generalizability. However, the profile of
471 this ED is similar to those of other urban level-1 trauma centers. Further, our sample reflects the
472 racial composition of Flint. Future studies may want to explore samples with broader ranges of
473 ethnicities and races, particularly Hispanic youth. This study still adds to the literature, however,
474 given that few prior investigations have provided this granular level of information on follow-up
475 with hard-to-reach populations. These data relied on staff to record every contact attempt made
476 with a participant; for most incidences, we did not have a way to independently verify that every
477 attempt was recorded. However, staff were trained to log all contact attempts and the study
478 coordinator conducted monthly supervision and quality assurance on contact notes.

480 **Conclusions**

482 The FYI study demonstrated that achieving high follow-up rates for a difficult-to-track
483 violently-injured ED population is feasible. This was achieved by employing established contact
484 strategies and flexible interview locations which were important for interview completion in this
485 hard-to-reach group. Future studies focusing on hard-to-reach populations should take into
486 account the time needed to achieve successful follow-up retention, and the number and types of
487 contacts needed to ensure the continued involvement of as many participants as possible.
488 Further, newer developing methods of contacting participants through advancements in
489 technology should be explored. Using these methods to reduce attrition should improve the
490 quality of hospital- and ED-based violence prevention programs, and help promote evidence-
491 based best practices.

492
493
494
495
496
497
498

Table 1. Tracking Techniques used to Locate and Interview Participants and Timeline of Contact Efforts

Tracking Strategy	Examples	Timeframe Used
Participant Information Collected	<ul style="list-style-type: none"> • Participant information <ul style="list-style-type: none"> ○ full name + other name/nicknames/alias ○ Social security number ○ home address ○ best mailing address ○ best phone number + home phone + cell phone ○ email ○ Myspace/Facebook account names ○ additional info (i.e., best time to call, which phones receive texts) ○ work address + work phone + permission to contact here ○ Places most likely to hang out ○ School ○ Upcoming incarceration possibilities • Other people’s info <ul style="list-style-type: none"> ○ Three significant others' names, relationship type <ul style="list-style-type: none"> ▪ Home address 	At each successful contact or follow-up interview this information was updated

Tracking Assault-Injured, Drug-Using Youth

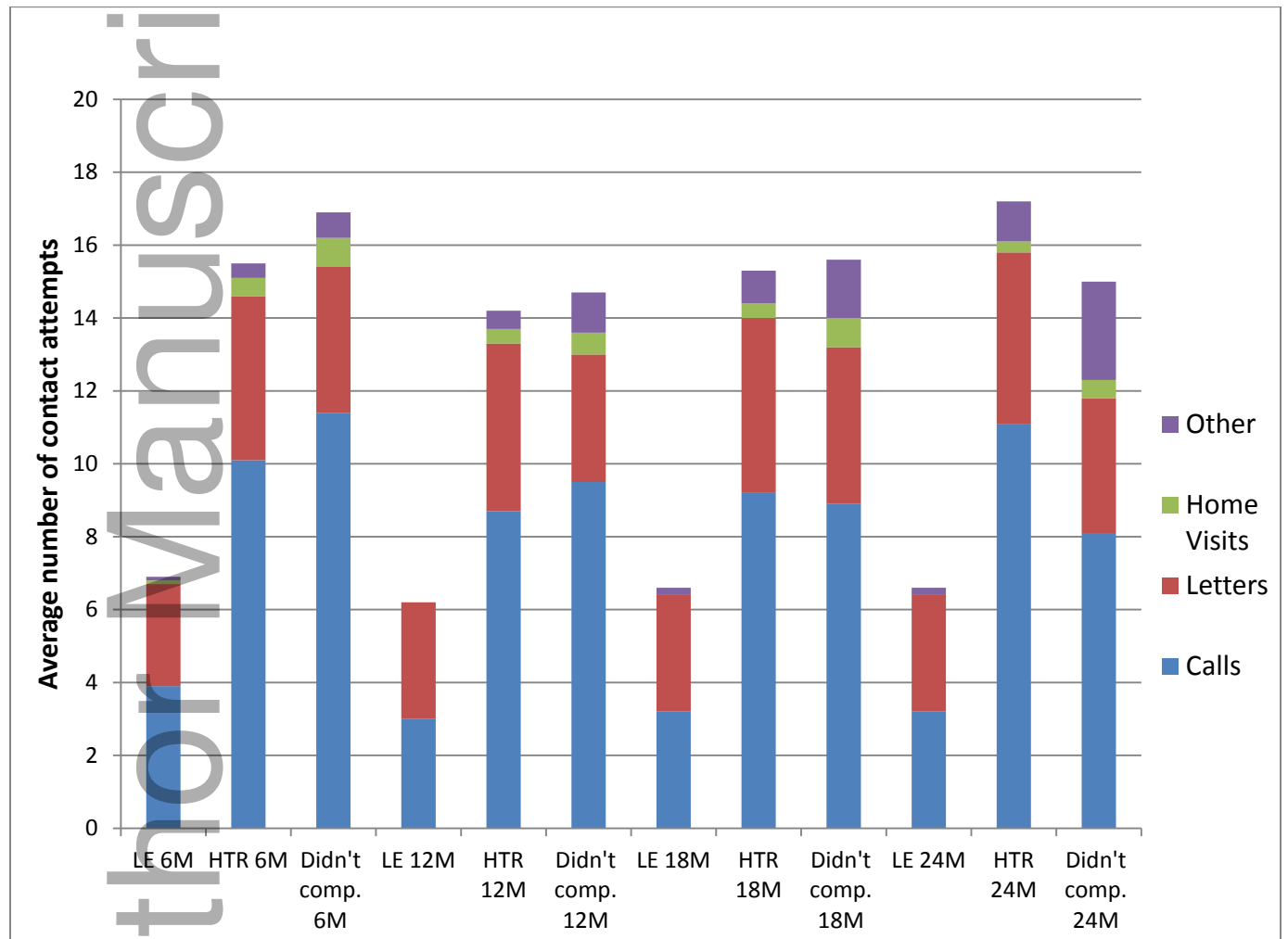
	<ul style="list-style-type: none"> ▪ Best phone number ○ Parents, siblings + other relatives' names, relationship type ▪ Home address ▪ Best phone number 	
<p>Standard Tracking Procedures/Effort</p>	<ul style="list-style-type: none"> • Business cards and stationery with project logo, address, telephone number (collect calls accepted), date of next interview, and payment • Gifts with project logo and office phone number 	<p>Given at time of initial contact, follow-up interview, and each letter and home visit effort.</p>
	<ul style="list-style-type: none"> • 48 hour call made after initial contact in ED 	<p>48 hours after ED visit</p>
	<ul style="list-style-type: none"> • Post card sent 	<p>3 months before interview</p>
	<ul style="list-style-type: none"> • Reminder letter sent 	<p>4 weeks before interview</p>
	<ul style="list-style-type: none"> • Reminder post-card sent 	<p>2 weeks before due date</p>
	<ul style="list-style-type: none"> • Thank you letter sent after each interview completed 	<p>After each interview</p>
	<ul style="list-style-type: none"> • Holiday cards sent around mid-end of December 	<p>Mid-end of December</p>
	<ul style="list-style-type: none"> • 24 call to confirm appointment 	<p>24 hours before appointment</p>
<p>Tracking Procedures/Effort for Hard-to-Reach participants</p>	<ul style="list-style-type: none"> • Other letters-if non-compliant <ul style="list-style-type: none"> ○ Drop-by home visit- to leave business cards and talk with neighbors ○ Touch base ○ Missed Appointment 	<p>As needed, repeated letters to all known addresses 2 weeks before due date-if participant is non-compliant.</p>
	<ul style="list-style-type: none"> • Other calls—if non-compliant <ul style="list-style-type: none"> ○ Missed appointment call ○ 2 week no contact/mail returned 	<p>As needed, repeated calls to working numbers 2 weeks before due date-if participant is</p>

	<p>call</p> <ul style="list-style-type: none"> • Other contacts-if non-compliant or in jail/state prison <ul style="list-style-type: none"> ○ Contacts in ED ○ Emails/texts/social media contact attempts ○ Calls/emails/faxes to jail/warden ○ Searches 	<p>non-compliant.</p> <p>As needed-if participant is non-compliant or in jail</p>
<p>Participant Incentives</p>	<ul style="list-style-type: none"> • Payment for interview (cash) <ul style="list-style-type: none"> ○ \$30 for 6-month interview ○ \$35 for 12-month interview ○ \$35 for 18-month interview ○ \$45 for 24-month interview ○ At each interview, participants could receive extra \$5 for confirming appointment/notifying change of address/contact info • Interview conducted at a location/time/day of the participant's choice • Refreshments provided • Bas/cab fare provided, if needed • Confidentiality assured 	<p>At each interview</p>

499
500
501
502
503
504
505
506
507

508
509
510
511
512
513

Figure 1. Average Number of Contact Attempts per participant by Contact Type and Follow-Up Interview.



514
515
516
517
518
519
520

521
522
523
524
525
526
527
528
529
530
531
532
533
534
535
536
537
538
539
540
541
542
543
544
545
546
547
548
549
550
551

Figure legends:

LE= least effort, lower 3 quartiles

HTR = Hard to reach, upper quartile

M=Month

Other= any methods used other than calls, letters or home visits (i.e., texts, Facebook messages, emails, letters and/or emails to the warden of a jail/state prison, etc.)

Author Manuscript

552
553
554
555
556
557
558
559
560
561
562
563
564
565
566
567
568
569
570
571
572
573
574
575
576
577

Table 2: Multivariable Logistic Regression of Participant Completion of the 24 Month Follow-Up Appointment (n=599)

Baseline Characteristics	AOR (95% CI)
Age	0.86 (0.77- 0.97)*
Female	2.28 (1.24- 4.18)**
African-American	1.44 (0.85- 2.43)

Tracking Assault-Injured, Drug-Using Youth

Public Assistance	1.17 (0.66- 2.07)
Substance Use Disorder	0.79 (0.45- 1.37)
Assault-injury Group (AIG)	0.94 (0.55- 1.60)

578

579 Note: CI= Confidence Interval, AOR: adjusted odds ratio.

580 *p< 0.05; ** p< 0.01; ***p< 0.001

581

582

583

584

585

586

587

588

589

590

591

592

593

594

595

596

597

598

599

600

601

602

603

604

605

Author Manuscript

606

607

608

609 **Table 3:** Negative Binomial Regression of Contact Difficulty at 24-Month Follow-Up

610 Appointment (n=599)

611

Participant Characteristic	IRR	95% CI
Age	1.004	(0.983- 1.025)
Female	0.992	(0.897- 1.097)
African American	1.038	(0.964- 1.117)
Receive Public Assistance	0.953	(0.852- 1.067)
Assault Injury at Baseline*	0.906	(0.821- 1.000)
Substance Use Disorder at Baseline**	0.861	(0.779- 0.952)
Have Fights in 3 months leading up to 24 month follow-up **	1.060	(1.023- 1.098)

612 Note: CI= Confidence Interval, IRR : incident rate ratio

613 *p< 0.05; ** p< 0.01; ***p< 0.001

614

615

616

617

618

619

620

621

622

623

624
625
626
627
628
629
630
631
632
633
634
635
636
637
638
639
640
641
642
643
644
645
646
647
648
649
650
651
652
653

References

1. Web-based Injury Statistics Query and Reporting System (WISQARS). 2017. at [www.cdc.gov/ncipc/wisqars.](http://www.cdc.gov/ncipc/wisqars))
2. Bohnert KM, Walton MA, Ranney M, et al. Understanding the service needs of assault-injured, drug-using youth presenting for care in an urban Emergency Department. *Addictive behaviors* 2015;41:97-105.
3. Grove DD, Lazebnik R, Petrack EM. Urban emergency department utilization by adolescents. *Clinical pediatrics* 2000;39:479-83.
4. Shibru D, Zahnd E, Becker M, Bekaert N, Calhoun D, Victorino GP. Benefits of a hospital-based peer intervention program for violently injured youth. *Journal of the American College of Surgeons* 2007;205:684-9.
5. Carter P, Roche J, Walton M, Cunningham R. 29 Open-pilot of an ed-based multi-session remote therapy intervention (rti) for violence. *Injury Prevention* 2017;23:A11-A.

Tracking Assault-Injured, Drug-Using Youth

- 654 6. Becker MG, Hall JS, Ursic CM, Jain S, Calhoun D. Caught in the crossfire: the effects of a
655 peer-based intervention program for violently injured youth. *Journal of Adolescent Health*
656 2004;34:177-83.
- 657 7. Cooper C, Eslinger DM, Stolley PD. Hospital-based violence intervention programs work.
658 *Journal of Trauma and Acute Care Surgery* 2006;61:534-40.
- 659 8. Cheng TL, Wright JL, Markakis D, Copeland-Linder N, Menvielle E. Randomized trial of a
660 case management program for assault-injured youth: impact on service utilization and risk for
661 reinjury. *Pediatric emergency care* 2008;24:130-6.
- 662 9. Karraker N, Cunningham RM, Becker MG, Fein JA, Knox LM. Violence is preventable: a
663 best practices guide for launching & sustaining a hospital-based program to break the cycle of
664 violence. Office of Victims of Crime, Office of Justice Programs, US Department of Justice,
665 Washington, DC 2011.
- 666 10. Zun LS, Downey L, Rosen J. The effectiveness of an ED-based violence prevention
667 program. *The American journal of emergency medicine* 2006;24:8-13.
- 668 11. De Vos E, Stone DA, Goetz MA, Dahlberg LL. Evaluation of a hospital-based youth
669 violence intervention. *American journal of preventive medicine* 1995;12:101-8.
- 670 12. Scott CK. A replicable model for achieving over 90% follow-up rates in longitudinal
671 studies of substance abusers. *Drug and alcohol dependence* 2004;74:21-36.
- 672 13. Cunningham R, Walton MA, Tripathi SP, Outman R, Murray R, Booth BM. Tracking inner
673 city substance users from the emergency department: how many contacts does it take?
674 *Academic emergency medicine* 2008;15:136-43.
- 675 14. Bootsmiller BJ, Ribisl KM, Mowbray CT, Davidson WS, Walton MA, Herman SE. Methods
676 of ensuring high follow-up rates: lessons from a longitudinal study of dual diagnosed
677 participants. *Substance Use & Misuse* 1998;33:2665-85.
- 678 15. Ribisl KM, Walton MA, Mowbray CT, Luke DA, Davidson WS, Bootsmiller BJ. Minimizing
679 participant attrition in panel studies through the use of effective retention and tracking
680 strategies: Review and recommendations. *Evaluation and Program Planning* 1996;19:1-25.

Tracking Assault-Injured, Drug-Using Youth

- 681 16. Cotter RB, Burke JD, Loeber R, Navratil JL. Innovative retention methods in longitudinal
682 research: A case study of the developmental trends study. *Journal of Child and Family Studies*
683 2002;11:485-98.
- 684 17. Claus RE, Kindleberger LR, Dugan MC. Predictors of attrition in a longitudinal study of
685 substance abusers. *Journal of psychoactive drugs* 2002;34:69-74.
- 686 18. Prinz RJ, Smith EP, Dumas JE, Laughlin JE, White DW, Barrón R. Recruitment and
687 retention of participants in prevention trials involving family-based interventions. *American*
688 *journal of preventive medicine* 2001;20:31-7.
- 689 19. Hansen WB, Collins LM, Malotte CK, Johnson CA, Fielding JE. Attrition in prevention
690 research. *Journal of behavioral medicine* 1985;8:261-75.
- 691 20. Hobden K, Curtis Forney J, Wyszacki Durham K, Toro P. Limiting attrition in longitudinal
692 research on homeless adolescents: What works best? *Journal of Community Psychology*
693 2011;39:443-51.
- 694 21. Desmond DP, Maddux JF, Johnson TH, Confer BA. Obtaining follow-up interviews for
695 treatment evaluation. *Journal of substance abuse treatment* 1995;12:95-102.
- 696 22. Twitchell GR, Hertzog CA, Klein JL, Schuckit MA. The anatomy of a follow-up. *British*
697 *Journal of Addiction* 1992;87:1327-33.
- 698 23. Marmor JK, Oliveria SA, Donahue RP, et al. Factors encouraging cohort maintenance in a
699 longitudinal study. *Journal of clinical epidemiology* 1991;44:531-5.
- 700 24. Cunningham RM, Ranney M, Newton M, Woodhull W, Zimmerman M, Walton MA.
701 Characteristics of youth seeking emergency care for assault injuries. *Pediatrics* 2014;133:e96-
702 e105.
- 703 25. Cunningham RM, Carter PM, Ranney M, et al. Violent reinjury and mortality among
704 youth seeking emergency department care for assault-related injury: a 2-year prospective
705 cohort study. *JAMA pediatrics* 2015;169:63-70.
- 706 26. Federal Bureau of Investigation. Uniform Crime Reports: Table 8 - Offenses Known to
707 Law Enforcement by State by City. 2017.

- 708 27. Handelsman L, Stein JA, Grella CE. Contrasting predictors of readiness for substance
709 abuse treatment in adults and adolescents: A latent variable analysis of DATOS and DATOS-A
710 participants. *Drug and alcohol dependence* 2005;80:63-81.
- 711 28. Sieving RE, Beuhring T, Resnick MD, et al. Development of adolescent self-report
712 measures from the National Longitudinal Study of Adolescent Health. *Journal of adolescent*
713 *health* 2001;28:73-81.
- 714 29. US Census Bureau. Profile of general population and housing characteristics: 2010
715 demographic profile data. *American Factfinder* 2010.
- 716 30. Sheehan DV, Sheehan KH, Shytle RD, et al. Reliability and validity of the mini
717 international neuropsychiatric interview for children and adolescents (MINI-KID). *The Journal of*
718 *clinical psychiatry* 2010;71:313-26.
- 719 31. Chermack ST, Grogan-Kaylor A, Perron BE, Murray RL, De Chavez P, Walton MA.
720 Violence among men and women in substance use disorder treatment: A multi-level event-
721 based analysis. *Drug and alcohol dependence* 2010;112:194-200.
- 722 32. Chermack ST, Blow FC. Violence among individuals in substance abuse treatment: The
723 role of alcohol and cocaine consumption. *Drug and alcohol dependence* 2002;66:29-37.
- 724 33. Chermack ST, Wryobeck JM, Walton MA, Blow FC. Distal and proximal factors related to
725 aggression severity among patients in substance abuse treatment: family history, alcohol use
726 and expectancies. *Addictive behaviors* 2006;31:845-58.
- 727 34. Beer A, Faulkner D. Housing transitions through the life course: aspirations, needs and
728 policy: Policy Press; 2011.
- 729 35. Bertakis KD, Azari R, Helms LJ, Callahan EJ, Robbins JA. Gender differences in the
730 utilization of health care services. *Journal of family practice* 2000;49:147-.
- 731 36. Goldstick JE, Bohnert KM, Davis AK, et al. Dual trajectories of depression/anxiety
732 symptoms and alcohol use, and their implications for violence outcomes among drug-using
733 urban youth. *Alcohol and Alcoholism* 2018.
- 734 37. Goldstick JE, Carter PM, Walton MA, et al. Development of the SaFETy score: a clinical
735 screening tool for predicting future firearm violence risk. *Annals of internal medicine*
736 2017;166:707-14.

737 38. Walton MA, Epstein-Ngo Q, Carter PM, et al. Marijuana use trajectories among drug-
738 using youth presenting to an urban emergency department: Violence and social influences.
739 Drug & Alcohol Dependence 2017;173:117-25.

740

Author Manuscript

Figure 1. Average Number of Contact Attempts per participant by Contact Type and Follow-Up Interview.

