



# Tracking Assault-injured, Drug-using Youth in Longitudinal Research: Follow-up Methods

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## ABSTRACT

**Objectives:** Violence is one of the leading causes of death among youth ages 14 to 24. Hospital- and emergency department (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, although 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, and 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:** A total of 599 patients (ages 14–24) were recruited from the ED (mean  $\pm$  SD age = 20.1  $\pm$  2.4 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 two to 53 times per follow-up time frame to complete a follow-up appointment, and more than 20% of appointments were completed off site at community locations (e.g., participants' homes, jail/prison). Participants who were younger ( $p < 0.05$ ) and female ( $p < 0.01$ ) were more likely to complete their 24-month follow-up interview. Participants who sought care in the ED for assault injury ( $p < 0.05$ ) and had a substance use disorder ( $p < 0.01$ ) at baseline required fewer contact attempts to complete their 24-month follow-up, while participants reporting a fight within the immediate 3 months before their 24-month follow-up ( $p < 0.01$ ) required more intensive contact efforts.

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

Violence is an important public health issue in the United States. Homicide is currently the third leading cause of death for youth between the ages of 14 to 24 years and results in over \$8.9 billion in medical and work lost costs a year in the United States (not accounting for nonfatal assault injuries).<sup>1</sup> In addition to fatal injuries, more than 400,000 youth (14–24 years old) seek emergency department (ED) care annually for nonfatal assault injuries.<sup>1</sup> Many of these youth are not regularly attending school<sup>2</sup> or accessing primary care clinicians,<sup>2,3</sup> which often serve as traditional sites for violence prevention programs. As a result, EDs have become the primary setting for many violence prevention programs, especially those that provide behavioral counseling and wrap-around care management interventions,<sup>4,5</sup> aimed at reducing the risk of future violence, especially for the hardest to reach, most at-risk youth.

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

The objective of this study is to describe effective approaches for tracking and retaining participants during a 2-year longitudinal study of violently injured and substance-using youth that achieved 85% follow-up. The techniques described here could aid future study design for interventions, especially in terms of retention of hard-

to-reach participants, and support public health efforts that address the high rates of violence among youth.

## METHODS

### Study Design

This study is part of a larger 2-year prospective longitudinal cohort study measuring the prevalence of substance use and violent injury among a sample of youth (14–24 years old) seeking ED care for assault injuries and reporting past-6-month drug use (assault-injury group [AIG]) and a comparison group of youth (proportionally sampled by age/sex) who were seeking ED treatment for nonassault reasons, but also reporting past 6-month drug-use (comparison group [CG]).<sup>2,24,25</sup> The study was approved by both the University of Michigan and Hurley Medical Center's Institutional Review Boards, and an NIH Certificate of Confidentiality was obtained.

### Study Setting and Population

Youth were recruited at a public urban Level I trauma center ED in Flint, MI. The ED provides care for ~75,000 adult and ~25,000 pediatric patients (<20 years old) annually. Flint has high rates of violent crime (14.8/1,000 population) that are comparable to other well-known deindustrialized urban centers, including Detroit, MI; Camden, NJ; and Oakland, CA.<sup>26</sup>

### Sample Recruitment

Patients 14 to 24 years old seeking care for an assault injury, as well as a consecutively enrolled comparison group based on sex and age range (i.e., 14–17, 18–20, and 21–24), who reported past-6-month drug use on a private, self-administered computerized screening survey were eligible for inclusion in the longitudinal study. Youth were excluded if they were not able to provide informed consent (e.g., altered mental status, psychosis, non-English speaking), presented for child abuse, acute sexual assault, or suicidal ideation/attempt. Patients were recruited 7 days per week, for 21 hours per day (5 AM–2 AM) on Tuesday and Wednesday and for 24 hours per day on Thursday through Monday between December 2009 and September 2011.

## Study Protocol

Assault-injured youth were identified through electronic medical records and approached by trained research assistants (RAs) in treatment spaces or waiting rooms. Assaults were defined as any injury intentionally caused by another person and included gunshot wounds, being struck by/against (punching), and stab wounds. RAs assessed whether the injury complaint fit the definition of assault when they approached potential participants. Youth agreeing to study participation completed written consent (written assent with parental consent if they were < 18 years old), and self-administered a private computerized screening survey to assess eligibility (i.e., past-6-month drug use).<sup>24</sup> Participants who completed the screen were compensated with a dollar store gift worth \$1.00. The CG was enrolled consecutively with the AIG to limit seasonal and temporal variation and was proportionally balanced by age range (as above) and sex. For example, after identifying a 20-year-old female with an acute assault-related injury and past-6-month drug use on the screening survey, the RA would recruit sequentially, by time of triage, the next 18- to 20-year-old female seeking ED care for a medical complaint or unintentional injury (e.g., motor vehicle crash); those screening positive for any past-6-month drug use would be consented for inclusion in the longitudinal study. After consenting for the longitudinal study, eligible participants completed a second written assent/consent (and parental consent < 18) and completed a ~90-minute baseline survey, including both an RA-administered structured interview and a computerized self-administered survey portion. This consent process included a consent for the study team to review the patient's medical record. Remuneration was \$20 cash. Additionally, any patient who was unstable while in the ED could be recruited on the hospital floors if they stabilized within 72 hours from triage.

Follow-up assessments were conducted at 6, 12, 18, and 24 months at a location convenient for the participant, including in the study ED, in community locations (e.g., library, restaurant, their homes), via telephone, or in jail/state prison (process described below) if the participant was incarcerated during the follow-up period. If needed, transportation to follow-up appointments was provided. Remuneration included \$30 for the 6-month interview, \$35 for the 12-month interview, \$35 for the 18-month interview, and \$45 for the 24-month interview. Cash payments were provided at each follow-up. Participants were also

provided with a toll-free phone number to contact study offices and were remunerated \$5 per interview if they telephoned the study office within 2 weeks of their scheduled interview date and confirmed or rescheduled their appointment. Incarcerated participants were not allowed compensation. Participants who turned 18 during the follow-up time frame were consented as adults at their next appointment. Family and friends accompanying the patient were not allowed to observe or participate during survey administration.<sup>25</sup>

## Participant Tracking Protocol

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

## Participant Follow-up and Contact Protocol

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

Participants were called 48 hours after their index ED visit to confirm their contact information and that their 6-month appointment had been scheduled. Between each longitudinal follow-up time point, RAs contacted participants a minimum of four times. First,

**Table 1**  
Tracking Techniques Used to Locate and Interview Participants and Timeline of Contact Efforts

Tracking Strategy	Examples	Time Frame Used
Participant information collected	<ul style="list-style-type: none"> <li>• Participant information               <ul style="list-style-type: none"> <li>○ Full name + other name/nicknames/alias</li> <li>○ Social security number</li> <li>○ Home address</li> <li>○ Best mailing address</li> <li>○ Best phone number + home phone + cell phone</li> <li>○ E-mail</li> <li>○ Myspace/Facebook account names</li> <li>○ Additional info (i.e., best time to call, which phones receive texts)</li> <li>○ Work address + work phone + permission to contact here</li> <li>○ Places most likely to hang out</li> <li>○ School</li> <li>○ Upcoming incarceration possibilities</li> </ul> </li> <li>• Other people's info               <ul style="list-style-type: none"> <li>○ Three significant others' names, relationship type</li> <li>○ Home address</li> <li>○ Best phone number</li> <li>○ Parents, siblings + other relatives' names, relationship type</li> <li>○ Home address</li> <li>○ Best phone number</li> </ul> </li> </ul>	At each successful contact or follow-up interview this information was updated
Standard tracking procedures/effort	<ul style="list-style-type: none"> <li>• Business cards and stationery with project logo, address, telephone number (collect calls accepted), date of next interview, and payment</li> <li>• Gifts with project logo and office phone number</li> </ul>	Given at time of initial contact, follow-up interview, and each letter and home visit effort
	<ul style="list-style-type: none"> <li>• 48-hour call made after initial contact in ED</li> </ul>	48 hours after ED visit
	<ul style="list-style-type: none"> <li>• Postcard sent</li> </ul>	3 months before interview
	<ul style="list-style-type: none"> <li>• Reminder letter sent</li> </ul>	4 weeks before interview
	<ul style="list-style-type: none"> <li>• Reminder postcard sent</li> </ul>	2 weeks before due date
	<ul style="list-style-type: none"> <li>• Thank you letter sent after each interview completed</li> </ul>	After each interview
	<ul style="list-style-type: none"> <li>• Holiday cards sent around mid to end of December</li> </ul>	Mid to end of December
	<ul style="list-style-type: none"> <li>• 24-hour call to confirm appointment</li> </ul>	24 hours before appointment
Tracking procedures/effort for hard-to-reach participants	<ul style="list-style-type: none"> <li>• Other letters—if noncompliant               <ul style="list-style-type: none"> <li>○ Drop-by home visit—to leave business cards and talk with neighbors</li> <li>○ Touch base</li> <li>○ Missed appointment</li> </ul> </li> <li>• Other calls—if noncompliant               <ul style="list-style-type: none"> <li>○ Missed appointment call</li> <li>○ 2-week no contact/mail returned call</li> </ul> </li> <li>• Other contacts—if noncompliant or in jail/state prison               <ul style="list-style-type: none"> <li>○ Contacts in ED</li> <li>○ Emails/texts/social media contact attempts</li> <li>○ Calls/e-mails/faxes to jail/warden</li> <li>○ Searches</li> </ul> </li> </ul>	As needed, repeated letters to all known addresses 2 weeks before due date—if participant is noncompliant.
		As needed, repeated calls to working numbers 2 weeks before due date—if participant is noncompliant.
		As needed—if participant is noncompliant or in jail
Participant incentives	<ul style="list-style-type: none"> <li>• Payment for interview (cash)               <ul style="list-style-type: none"> <li>○ \$30 for 6-month interview</li> <li>○ \$35 for 12-month interview</li> <li>○ \$35 for 18-month interview</li> <li>○ \$45 for 24-month interview</li> </ul> </li> <li>• At each interview, participants could receive extra \$5 for confirming appointment/notifying change of address/contact info</li> <li>• Interview conducted at a location/time/day of the participant's choice</li> <li>• Refreshments provided</li> <li>• Bus/cab fare provided, if needed</li> <li>• Confidentiality assured</li> </ul>	At each interview

approximately 3 months prior to each scheduled 6-, 12-, 18-, and 24-month follow-up appointment, a postcard was sent to the participant, which included information on their scheduled date, time, and location of the appointment. The postcard also contained information on the remuneration for participation in the follow-up and provided study contact information for the participant to reschedule their appointment if necessary. Next, a “reminder” letter was sent to each participant 4 weeks before their intended appointment. This letter included the same information as the postcard that was sent prior, if information had not been updated. Third, two weeks prior to each follow-up appointment, a reminder postcard was sent to the participant. Finally, RAs contacted participants by phone the day prior to their appointment to confirm the date/time.

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

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

For participants who missed their scheduled follow-up, multiple additional attempts at contact were made. In addition to the contact attempts detailed, participants that did not show up for appointments were sent texts, e-mails, and Facebook messages. These methods of contact were noted as part of the consent signed at time of study enrollment. If participants were unable to be reached via the contact information provided at the time of the ED visit, a search of their medical record and public databases was conducted, and more intensive contact attempts were made. First, a review of the participant’s medical record, which included confirming information provided by the participant and adding new contact information, was conducted. Then, public

databases, such as Department of Public Health death records, Internet people finder databases (e.g., Alumnifinder, Yahoo people search), and offender and prison websites were reviewed. If contact information was still not found, a visit to the participant’s home was scheduled. A letter informing the participant of the home visit was sent out at least 1 week before the scheduled visit. Home visits were conducted with two interviewers (for safety) and took place during daylight hours. If the participant was not home, interviewers left friendly, handwritten notes on index cards, similar to the ones given to the participant at baseline. During visits to the participant’s residence, study personnel would attempt to contact neighbors (without revealing that the study was related to substance use or violence) to confirm if the participant resided at that address or if they knew a more current address. During winter months, letters were left at local shelters or soup kitchens where homeless participants were known to have previously stayed or visited.

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

For all contact attempts, participants were called during the times they indicated during the initial study interview were most convenient for them. Typically, interviewers would call throughout the day (9 AM–8 PM), leaving only a single message per day. During subsequent participant interactions, their contact



information was verified and/or updated. In compliance with IRB requirements, if at any time participant asked not to be contacted, they were thanked for their participation in the study and no further contact efforts were attempted. Participants were allowed a total of 3 months to complete a follow-up after their exact follow-up date (i.e., for the 6-month follow-up interview, participants had 90 days to complete their appointment from their 6 month post ED date before they would time out for that follow-up appointment). The findings and conclusions in this report are those of the authors and do not necessarily represent the official position of the funding agencies, and the funding agencies had no role in the conduct or reporting of the study.

## Measures

**Outcome Measures.** Completion of study follow-up at 6, 12, 18 and 24 months was examined. Completion was not necessarily consecutive (i.e., the few who did not complete the 6-month follow-up could complete the 12-, 18-, or 24-month follow-up interviews). Subsequently, contact difficulty at the 24-month time point was examined. Difficulty was measured by the number of contacts required to complete follow-up or determine the patient would not complete the interview (i.e., patient declined or the study was completed). Contact difficulty was defined as needing more contact attempts. Contact attempts include both attempts made by staff and by participants. Study team initiated and participant initiated contact attempts were combined into a single metric to fully capture the resources and scope of work needed to successfully complete follow ups among a high-risk population

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

**Sociodemographics.** Demographics and socioeconomic measures (i.e., age, sex, race, public assistance) were collected using validated measures from the Drug Abuse Treatment Outcome Studies (DATOS)<sup>27</sup> and the National Longitudinal Study of Adolescent Health.<sup>28</sup> For analysis, race was dichotomized as

African American versus other given that African Americans comprise 57% of the Flint community.<sup>29</sup>

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

**Past-3-month Violence.** The Time Line Follow Back (TLFB)-Aggression Module (TLFB-AM), developed to be used with the TLFB, assessed detailed characteristics of incidents of physical violence in the past 90 days and was administered at baseline and during each of the subsequent follow-up appointments.<sup>31–33</sup> Using monthly calendars, beginning on the day of assessment, and working backward, participants were asked to identify specific dates in which they experienced interpersonal conflict (whether victimization or aggression) with partners or others.<sup>31</sup>

## Data Analysis

All analyses were conducted using SAS 9.4. To define different participants and the number of contact attempts needed to reach them, those that were easy to reach were defined as those in the lower three quartiles of contact attempts made or received at each time point; the hard-to-reach was defined as the top quartile of number of contact attempts made or received. A phi coefficient was calculated to determine the relationship between where a participant completed their follow-up at 6 and 24 months. Chi-square analyses and t-tests were used to evaluate bivariate associations with the outcome of interest (i.e., follow-up completion). We used a significance level of  $\alpha = 0.05$  for all hypothesis tests. A logistic regression was used to identify variables associated with 24-month follow-up completion (completed 24-month follow-up versus not completed). Predictors in the model were chosen to account for the sampling scheme (i.e., age, sex), theoretical considerations (i.e., race, public assistance), and significance in bivariate comparisons (i.e., substance use disorder, AIG). A separate analysis was conducted to determine the variables associated with contact difficulty. Due to overdispersion in the outcome variable of contact difficulty (total number of contact attempts), a negative binomial regression was used to predict contact difficulty at 24 months among the entire sample. Again, background characteristics were included

in the model based on prior literature or based on significance in bivariate analyses.

## RESULTS

### Sample Characteristics

The baseline and longitudinal Flint Youth Injury (FYI) sample has been described in prior publications.<sup>2,24,25</sup> The longitudinal sample included 349 youth in the AIG and 250 youth in the CG. Differences in group sample size was due to oversampling the AIG to meet the aims of the original grant.<sup>25</sup> At baseline, participants were mostly black (58%), male (59%), and in receipt of public assistance (73%). No baseline differences were observed between the two groups (AIG vs. CG) with respect to age, sex, race, or receipt of public assistance.

### Follow-up Rates and Characteristics

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

coefficient = 0.5508,  $p < 0.001$ ). However, participants completed more home visit interviews at 6 months than at 24 months and more phone interviews at 24 months than at 6 months ( $p < 0.001$ ).

### Follow-up Contact Attempts

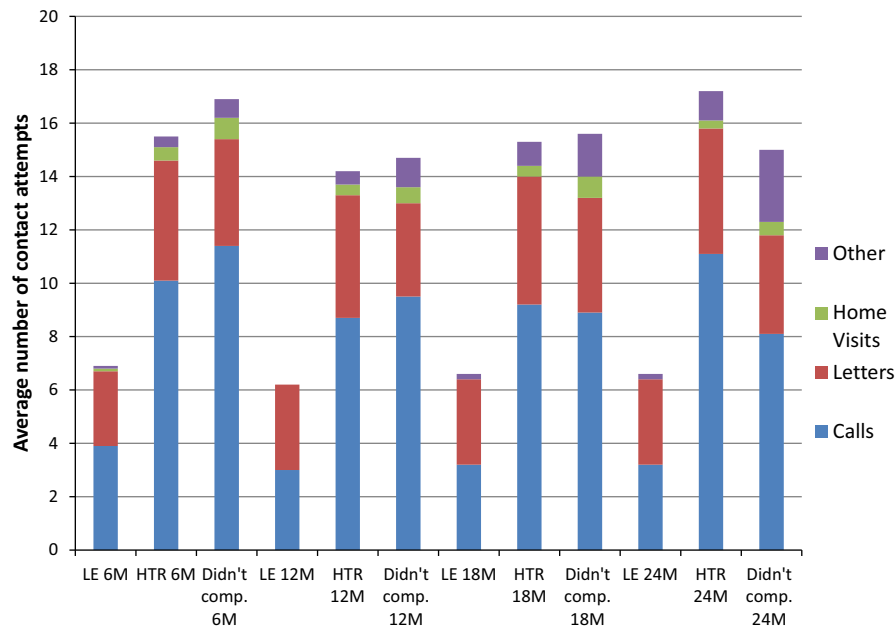
Figure 1 shows the average number of contact attempts per participant by contact type and appointment time point. Contact attempts include both attempts made by staff and by participants and included both a standard contact protocol and a hard-to-reach contact protocol (see Table 1). Each time point shows the average number of contacts required to reach someone who needed the "least effort" (among the lower three quartiles of contact attempts but completed the appointment) as well as the average for those who were "hard-to-reach" (among the upper quartile of contact attempts but completed the appointment) and the contact attempts for participants who did not complete the appointment. Easy-to-reach participants (those requiring the least effort) initiated/received an average of 6.2 (standard deviation [SD] = 1.5) contact attempts, 97% to 100% of which were phone calls and letters. Hard-to-reach participants initiated/received 14.1 (SD = 6.0) contact attempts, with only 92% to 94% of contact attempts by phone and 6% to 8% of contact attempts requiring more intensive contact methods beyond the standard calls and letters, such as home visits, text messages, and public database searches. Participants who did not complete appointments initiated/received 15.7 (SD = 9.3) contact attempts, and required 9% to 21% of these attempts to be more intensive (e.g., home visits, text messages, public database searches).

### Factors Associated With 24-month Appointment Completion

Younger ( $p < 0.05$ ) and female ( $p < 0.01$ ) participants were more likely to complete their 24-month follow-up interview. Race, receiving public assistance, a baseline diagnosis of a substance use disorder, and belonging to the AIG did not affect 24-month follow-up completion (Table 2). There was no evidence for severe lack of model fit based on the Hosmer and Lemeshow test ( $p = 0.39$ ).

### Factors Associated With Contact Difficulty at 24-months Post-ED Visit

At 24 months, AIG participants ( $p < 0.05$ ) and those who met diagnostic criteria for a substance use



**Figure 1.** Average number of contact attempts per participant by contact type and follow-up interview. LE = least effort, lower three 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, e-mails, letters, and/or e-mails to the warden of a jail/state prison)

disorder at baseline ( $p < 0.01$ ) required fewer contact attempts, while participants reporting a violent fight within the 3 months prior to their 24-month follow-up ( $p < 0.01$ ) required a greater number of contact attempts to complete their 24-month follow-up. Contact difficulty was defined as needing more contact attempts. Age, sex, race, and receiving public assistance did not affect contact difficulty (Table 3). The deviance to degrees of freedom ratio was 1.01, indicating good model fit. The largest variance inflation factor was 1.06 indicating that collinearity was not a concern in either model.

## DISCUSSION

Following violently injured research study participants requires extensive effort and dedication. This is particularly challenging in ED-based studies where patients have an episodic connection to care rather than a longitudinal relationship. To our knowledge this is the first study to describe methodologic best practices for successful retention of high-risk youth populations recruited from ED settings. Previous research on substance-using populations has demonstrated effective strategies for minimizing attrition which informed the strategies employed with our violently injured youth population to achieve a greater than 85% follow-up rate.<sup>12–16,20–23</sup>

We also describe the characteristics of the hardest-to-reach sample. Importantly, this paper demonstrates

**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)
Public assistance	1.17 (0.66–2.07)
Substance use disorder	0.79 (0.45–1.37)
AIG	0.94 (0.55–1.60)

AIG = assault-injury group; AOR = adjusted odds ratio.

\* $p < 0.05$ .

† $p < 0.01$ .

both the feasibility of following this hard-to-reach sample and the significant effort and resources required to do so successfully. Understanding this population and the contact efforts necessary are crucial to successfully completing valid studies in injury research. Although some degree of attrition is inevitable, without the inclusion of the hard-to-reach sample, biased results are more likely.<sup>15</sup> Quantifying the effort required to achieve the follow-up necessary for validity allows for better targeting of limited resources in future studies. This effort was uniquely designed to create the greatest accessibility to the study population. To that end we have provided detail regarding methods and resources used for the successful follow-up protocols.



**Table 3**  
Negative Binomial Regression of Contact Difficulty at 24-Month Follow-up Appointment (*n* = 599)

Participant Characteristics	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)

IRR = incident rate ratio.

\**p* < 0.05.

†*p* < 0.01.

Completion of the 24-month follow-up interview was associated with being younger and of female sex, without any significant differences for self-reported race, receipt of public assistance, substance use disorder, or having sustained an assault injury. The association of younger participants may reflect a difference in housing stability, as early adulthood is characterized by major transitions in housing.<sup>34</sup> Younger participants would be more likely to continue to live with their parents or guardians for the duration of the study versus living independently. The latter would be expected to result in greater mobility, less stability, and thus a greater difficulty reaching or locating such participants. Additionally, although transportation was aided with taxi/bus vouchers, participants who were younger and lived with other family members likely had access to family modes of transportation that our older participants did not. Finally, the association of female sex could be due to the known trend for females to seek care more often than males<sup>35</sup> and thus be more likely to be connected to the medical system and more likely to complete their follow-up appointment.

Participants in the AIG required less contact effort than the CG to complete the 24-month follow-up appointment. The finding that the acutely violently injured patient that seek care in the ED is easier to track likely reflects that people in the AIG who sustained a violent injury may have more frequent contacts with the medical system in the months after an injury (e.g., follow-up visits to orthopedics/trauma surgery). These contacts may promote a stronger connection with the medical system, making such patients more likely to complete follow-up visits. For a visit for a more minor medical issue such as strep

throat, young, otherwise healthy participants may not have the same degree of linkage with the medical system.

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

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

We did note a trend requiring greater flexibility in location of follow-up appointment and types of contact attempts to complete the follow-up interview over time. Initially, more interviews were completed at the participant’s home, but at 24 months a greater number of interviews required phone completion. This may reflect the transient nature of our sample, which made home visits impossible in later follow-up appointments due to movement outside of the study city and state. Future studies will need to ensure a robust process for conducting phone or Web-based interviews and delivering the participation stipend to adequately capture such samples accurately.

The resources required to complete follow-up assessments with the hard-to-reach population were significantly greater than those required for the general study sample. To plan for adequate follow-up rates to support acceptable internal and external study validity, future studies should plan to invest follow-up resources accordingly to reach their hard-to-reach sample. Staffing on the follow-up portion of this study included a masters-level coordinator, two full-time bachelor’s-level RAs, and one part-time RA.

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

This study analyzes data from a 24-month ED-based prospective cohort study of assault-injured, drug-using youth to describe methodologic best practices for successful retention of high-risk youth populations recruited from ED settings. It should be noted that other analyses from this study have examined trajectories of the study population over the 24-month time period. These analyses include joint trajectories of alcohol use and anxiety/depression symptoms over time,<sup>36</sup> prediction of future firearm violence,<sup>37</sup> trajectories of marijuana use,<sup>38</sup> and predictors of assault reinjury.<sup>25</sup>

## LIMITATIONS

Study limitations should be recognized. First, this study was conducted at a single ED in a deindustrialized Midwestern city, potentially limiting generalizability. However, the profile of this ED is similar to those of other urban Level I trauma centers. Further, our sample reflects the racial composition of Flint. Future studies may want to explore samples with broader ranges of ethnicities and races, particularly Hispanic youth. This study still adds to the literature, however, given that few prior investigations have provided this granular level of information on follow-up with hard-to-reach populations. These data relied on staff to record every contact attempt made with a participant; for most incidences, we did not have a way to

independently verify that every attempt was recorded. However, staff were trained to log all contact attempts and the study coordinator conducted monthly supervision and quality assurance on contact notes.

## CONCLUSIONS

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

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