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Understanding polysubstance use at the daily and event levels: protocol for a mixed-methods qualitative and ecological momentary assessment study in a community-based sample of people who use illicit drugs in Oakland, California, USA

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ABSTRACT

Introduction Polysubstance use is extremely common among people who use illicit opioids in the USA. It is associated with poor substance use treatment outcomes, infectious disease risk and alarming rates of drug overdose. Nearly all extant literature examines polysubstance use over broad time frames, such as 30 days or 6 months. However, both substance use and overdose risk are episodic. To build a stronger understanding of polysubstance use and overdose risk, we need to expand the knowledge base to include daily-level and event-level data that examine how substances are used together, in which combinations and in which contexts. The study described in this protocol will use qualitative and ecological momentary assessment (EMA) methods to examine polysubstance use and overdose risk on a daily and event level.

Methods and analysis This is a mixed-methods observational study with three phases. The first phase is formative, consisting of qualitative interviews with people who use multiple substances (N=20), to inform the development of items for the EMA component. The second phase is EMA data collection with people who use multiple substances (N=120), three times daily for 28 days. The third phase consists of mixed-methods inquiries with a subset of participants (N=20), using participant-level EMA data and qualitative techniques to build a nuanced understanding of the motivations and contexts of polysubstance use in everyday life. Analytical induction methods will be used to interpret qualitative data. Hierarchical linear modelling methods will be used to analyse EMA data.

Ethics and dissemination This research has been reviewed and approved by the Institutional Review Board at RTI International (#MOD00001782 for EMA procedures and #MOD00001241 for qualitative procedures). Participants engage in an informed consent procedure for each component of the study. Data will be managed and shared per the National Institutes of Health extramural data sharing policy.

STRENGTHS AND LIMITATIONS OF THIS STUDY

⇒ The use of ecological momentary assessment (EMA) methods will produce fine-grained data on patterns and timing of polysubstance use.
⇒ In addition to substance use, a range of contextual factors will be measured, including mood, pain level and social and physical environment.
⇒ The development of EMA items will be guided by formative research using qualitative methods.
⇒ Community-based research strategies with a participant-centred approach will facilitate recruitment, retention and compliance during the 28-day EMA study period.
⇒ A potential limitation is the use of smartphones for data collection, which may be stolen, lost or difficult for unhoused participants to keep charged.

INTRODUCTION

Polysubstance use is extremely common among people who use opioids in the USA, with up to 90% reporting using more than one drug in the past 30 days.[1 2] Polysubstance use is associated with poor substance use treatment outcomes,[3 4] infectious disease risk[5 6] and alarming rates of fatal drug overdose.[7 8] In 2021, nearly three-fourths of fatal heroin overdoses involved additional opioids, most commonly fentanyl.[9] Polysubstance use has featured importantly in the third wave of the opioid overdose epidemic, characterised by the emergence of fentanyl as a contaminant in many substances[10] and the current fourth wave, characterised by combined consumption of opioids and stimulants.[11]

In recent years, polysubstance use has grown as a field of inquiry. However, nearly all extant literature examines use of multiple substances in broad time frames (eg, last 30 days or 6 months). There is a dearth of data that examine polysubstance use in 'real life' or as it occurs in the daily lives of people who use drugs. Timeline follow-back methods, while well validated,[12] typically measure daily use as recollected over a 30-day period, do not focus on individual episodes of use and can be cumbersome when trying to be inclusive of multiple substances. Drug use is episodic, and each episode of substance use is potentially informed by a variety of individual and situational influences.[13] For a stronger understanding of polysubstance use and overdose risk, we need to expand the knowledge base to include daily-level and event-level data that examine how substances are used together, in which combinations and in which contexts. This is particularly important if we want to intervene in overdose risk. Ecological momentary assessment (EMA) is the repeated sampling of people's behaviours and experiences in real time and in their natural environments.[14] EMA is a promising method to capture daily substance use patterns and factors which affect them. An international meta-analysis of over 120 EMA studies with people who use drugs found a pooled compliance rate of 75%[15]; while most studies focused on single substances, this suggests EMA methods can improve knowledge regarding polysubstance use as well.

The study described in this protocol will use qualitative and EMA methods to better understand the substances, timing, motivations and contexts involved in polysubstance use on a daily and event level. By gaining a more fine-grained understanding in the context of everyday substance use, we seek to better understand and address overdose risk.

Theoretical framework

The study is informed by the theoretical framework of Drug, Set and Setting,[16] which has been instrumental in exploratory studies of substance use patterns.[17 18] In our conceptualisation, 'drug' refers to the substances used and the timing of use; 'set' refers to person-level factors that influence use, such as mood or pain; and 'setting' refers to social and structural factors that influence use, such as friendships and living situations. We will work within this framework to examine person-level and event-level drug use patterns, as well as set and setting characteristics, that influence polysubstance use.

Study objectives

The study objectives are (1) to use formative, qualitative methods to explore and identify 'set' and 'setting' influences on polysubstance use among people who use illicit opioids. Findings will inform the development of EMA items; (2) to use EMA methods to investigate polysubstance use timing, sequencing and drug combinations at the person and event levels; (3) to use EMA and qualitative methods to conduct in-depth examinations of how 'drug', 'set' and 'setting' factors are associated with polysubstance use at the person and event levels, with special emphasis on risk behaviour for overdose.

METHODS

Patient and public involvement

Participants were not directly involved in the development of the research protocol.

Study community

The study will be conducted in Oakland, a mid-size city in Alameda County, California, with substantial health inequities driven by structural racism and income inequality.[19] Polysubstance use is on the rise in the county and rates of fatal opioid overdose have more than doubled in recent years, from 5.75/100 000 in 2019 to 12.09/100 000 in 2021. We will establish a community field site for data collection, equipped with internet access and private interview rooms. The field site will be centrally located in the downtown area and easily accessible by public transit. Field staff will be trained in a participant-centred approach, rooted in the principles of harm reduction. Training will be provided by the principal investigator (JL), who has over 30 years of experience in harm reduction work, and by participation in training activities provided by the National Harm Reduction Coalition and the State of California. The study will strive to provide a safe, positive and judgement-free environment for data collection. There is no expectation on participants to trust the staff; however, the study team will strive to prove themselves trustworthy through kindness, authenticity, and most importantly, predictability within the boundaries of the study relationship. By continually removing barriers (eg, providing cash for transportation, being flexible about appointment times), the research team will engender a setting that facilitates participation with ease. Given the expected needs of the study population, harm reduction supplies such as naloxone and fentanyl test strips will be available to participants, as well as hygiene supplies, snacks and referrals to providers for other needs as they arise.

Phase 1: formative component

The first phase of the study will involve formative qualitative interviews with people who use multiple substances, including at least one opioid. They will focus on the 'set' and 'setting' aspects of polysubstance use, such as mood, social relationships and physical safety. Formative data will be used to help select and develop items for the EMA component.

Sample

Formative interviews will be conducted with 20 individuals who use illicit opioids. We will include at least five of each of these groups: (1) multiple opioids; (2) opioids plus alcohol; (3) opioids plus stimulants; (4) opioids plus benzodiazepines.

Eligibility criteria

Criteria are: (1) 18 years or older; (2) have used an illicit opioid in the past 24–72 hours; (3) have used either a second type of opioid, alcohol, benzodiazepines, cocaine or methamphetamine in the past 24–72 hours; (4) able to speak and understand English; and (5) able to provide informed consent.

Recruitment

Participants will be recruited by study staff from local syringe service programme sites, harm reduction providers and other community-based organisations that work with people who use drugs.

Consent

Participants will provide informed consent in a process approved by the Institutional Review Board (IRB) at RTI International.

Data collection

Formative interviews will focus on elucidating information about set and setting factors that influence polysubstance use. An interview guide with open-ended questions will be used (online supplemental file 1). The guide was developed by the principal investigator and qualitative co-investigator (MLC), gleaning insights from previous work on polysubstance use[20] and the literature, as well as direct experience working with people who use multiple substances. After the first three interviews are conducted, we will review the guide and interview transcripts and make revisions as needed. Staff conducting interviews will encourage participants to describe at length when and why they use multiple substances, the physical and psychological effects they are seeking and the physical and social circumstances of polysubstance use. We will also probe for perceptions of polysubstance use as a risk factor for overdose. In this process of discovery, we will explore other relevant ideas, topics and concerns raised by participants. Interviews will be recorded and transcribed for analysis.

Data analysis

Formative data will be analysed using analytical induction,[21] which uses inductive reasoning and emphasises concurrent data collection and analysis. Two members of the investigative team will read each transcript and write analytical memos on key themes. At weekly analysis meetings, the investigative team will discuss the transcripts and further develop and refine the memos. The primary purpose will be to identify topic areas for EMA items that help give meaning and context to polysubstance use events.

Phase 2: EMA component

This part of the study is aimed at obtaining detailed, daily information from people about their drug and alcohol use, motivations, mood, pain level and the social and physical contexts of their daily lives. The goal is to understand polysubstance use at the person and event levels, with special emphasis on risk behaviour for overdose.

Participants will be given a 'smartphone' device with an application that sends them three brief surveys (morning, afternoon and evening) daily for 4 weeks. A network connection will not be necessary to receive, complete or save the surveys.

Sample size

One hundred eligible participants will be enrolled.

Eligibility criteria

Criteria are: (1) 18 years or older; (2) have used an illicit opioid in the past 24–72 hours; (3) have used either a second type of opioid, alcohol, benzodiazepines, cocaine or methamphetamine in the past 24–72 hours; (4) be willing to participate in urinalysis; (5) be able to speak and understand English; and (6) be able to provide informed consent.

Recruitment

Participants will be recruited by study staff from local syringe service programme sites. In addition, flyers advertising the study will be placed at community agencies that include people who use drugs in their service populations. Finally, we will accept, but not incentivise, referrals from other study participants.

Screening

People interested in the study will be screened for eligibility. Those who meet criteria in verbal screening will be given an appointment to complete screening with a point-of-care urinalysis test at the study field site.

Consent

All procedures will be approved by the IRB at RTI International. Consent will be read aloud to participants by an interviewer. To ascertain procedures are clearly communicated and understood, we will use 'teach-back' methods, in which participants will be asked to answer three questions regarding the content of the consent. Misunderstandings will be corrected before consent is obtained.

Baseline survey

A baseline survey will be conducted with each participant regarding demographic characteristics, living situation, service utilisation and overdose experiences (online supplemental file 2). In addition, we will collect dichotomous (y/n) data regarding use of a comprehensive list of illicit substances over the 30 days prior to interview.

Device

Older-model iPhones will be provided to participants for data collection. They will not include network service or a data plan. By providing the phone, we will avoid issues related to programming across multiple operating systems, unreliable devices and loss of service due to non-payment. In addition, this will enable people who do not own a phone to participate. In addition to the traditional device charger, participants will be provided with an auxiliary power bank.

EMA platform

We will use MetricWire software, which is compliant with Health Insurance Portability and Accountability Act (HIPAA) standards and used by several institutes at the National Institutes of Health (NIH). The interface is simple and easily readable. Importantly, the platform is capable of sending timed surveys in the absence of a network connection. Until the device is connected to a network to upload data, completed surveys are stored as encrypted data separating survey responses from identifiers. Once connected to a network, all stored data upload to the Cloud and are deleted from the device.

Training

The project director will provide training on the device and the EMA application, showing participants how to use the MetricWire program and what to expect from upcoming surveys. Participants will be encouraged to call the study cell number or stop by the community field site if they encounter difficulties.

EMA data collection

Participants will receive three alerts daily to enter data (morning, afternoon and evening). The morning survey will be set for the time each participant typically rises, as determined during the enrolment visit. The next two surveys will be triggered at 6 and 12 hours after the morning survey. Included will be questions regarding substance use (including alcohol), mood, pain level, physical environment and social interactions. Final items will be informed by the formative phase of the study. Responding to each survey will take participants 3–5 min. Each survey will remain open until completed or until the subsequent survey loads, whichever comes first.

Weekly check-ins

Participants will be asked to visit the field site once weekly for a data upload. They will receive an incentive for the upload visit plus a dollar bonus for each new survey completed between check-in visits (see the Incentive structure section).

Post-study survey

A brief post-study survey will be conducted with each participant to record any significant life events during the 28-day study period (eg, entering drug treatment, becoming unhoused). We will include a series of questions about their experiences using the EMA platform.

Incentive structure

Incentives will be provided for participation in each activity involved in a study visit. Baseline visit: $10 for urinalysis, $20 for baseline interview and $20 for EMA training. Weekly check-ins (4): $20 for data upload and $1 for each time they enter data (per-prompt incentive). Study completion visit: $10 for post-study interview and $30 for returning phone.

EMA data analysis

Analysis will begin by examining individual effects of identified predictors (eg, regressing substance use outcomes onto each set and setting characteristic identified in the formative research), followed by event-level interactions between set and setting predictors (eg, does the impact of motives on polysubstance use vary based on aspects of the physical context?). Finally, we will add person-level characteristics, either assessed at baseline or averaged across the 30 days of momentary assessments. As momentary assessments (ie, morning, afternoon, evening) will be nested within days and days will be nested within participants, we will use hierarchical linear modelling (HLM).[22] HLM accounts for this nesting of the data and allows us to separate variance across the event, day and person levels. All event-level variables will be group-mean centred, and person-level variables will be grand-mean centred, allowing for an easier separation of within-person and between-person effects. For all hypothesised models, we will begin by establishing the most parsimonious and stable model (ie, identifying appropriate random and fixed effects) by sequentially adding level 1 (momentary), level 2 (daily) and level 3 (person level) predictors to the model as appropriate. Level 1 predictors (and level 2 predictors within the three-level models) will address questions of within-day and within-person covariation. The addition of person-level predictors (level 2 or 3, depending on the model) will allow for the isolation of individual differences within and across substance use occasions. A binomial or overdispersed Poisson distribution will be used when the intended outcome is dichotomous (eg, whether they engaged in polysubstance use) or a zero-inflated count variable (eg, number of substances used).

Phase 3: EMA-informed qualitative interviews

An innovative mixed-methods approach will be undertaken for this component of the study. Individuals who have completed the 28-day EMA component will be asked to participate in an open-ended interview in which they review a visual summary of their EMA data and are asked open-ended questions. The objective is to facilitate reflections that contextualise the set and setting of their general patterns of use, as well as use that deviates notably from their norm (eg, use of a new substance or new combination of substances).

Sampling

A subsample of EMA participants (N=20) will be identified using baseline and EMA data to identify participants according to key variables of interest. We will select a diverse group of participants in terms of substance use, age, race and gender. Additional selection criteria will be developed as we examine findings from earlier phases of the study and determine which phenomena merit additional in-depth analysis.

Eligibility criteria

Completion of the EMA component of the study.

Recruitment

ID numbers of participants whom we want to interview will be flagged. At the final EMA appointment, the project director will offer them the opportunity to participate. They will be interviewed immediately or on the next day, whichever is most convenient for the participant, and will receive a $40 incentive for their time participating in the interview.

Consent

We will obtain consent according to procedures approved by the IRB at RTI International.

Interviews

A trained qualitative research interviewer will conduct the EMA-informed qualitative interviews. The interviewer will use a printed graphic of the EMA data reported by the individual participant to structure the conversation. First, they will explain what the various components of the graphic indicate. Then they will point out patterns and anomalies in the data, using them as a basis for further exploration. For example, if a participant reports certain patterns of polysubstance use on weekends and weekdays, the interviewer might ask, 'It looks like you tend to use alcohol and cocaine along with heroin on the weekends, but on weekdays you usually just use heroin. What makes weekends and weekdays different for you?' Event-specific questions will be posed as well such as, 'I see there was just 1 day last week that you report high levels of pain and stress. What was happening that morning? How did it relate to your substance use?' Follow-up prompts could include questions about differences in people the participant spends time with, income sources, hang-out spots or places to sleep, and obligations such as showing up for work, school or programmes. Interviews will be digitally recorded and transcribed verbatim by a professional service. The overarching goal will be to use each individual's data as a tool to help them reflect on patterns, motivations and contexts of polysubstance use.

Analysis of EMA-informed qualitative interviews

We will use the same analytical induction methods described for the formative data analysis. In addition, based on a methodological approach used extensively by the investigative team,[23] memos will be developed relating qualitative findings to quantitative results. The investigative team will conduct biweekly analysis meetings, in which we will move iteratively between both sets of findings, seek initiation (discovery of new perspectives and recasting of questions), complementarity (elaboration and enhancement of results) and expansion (extension of breadth and range of inquiry).[24]

ETHICS AND DISSEMINATION

This research has been reviewed and approved by the IRB at RTI International (#MOD00001782 for EMA procedures and #MOD00001241 for qualitative procedures). Participants engage in an informed consent procedure for each component of the study. Data will be managed and shared per the NIH extramural data sharing policy.

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Contributors JL wrote the initial draft of the paper and incorporated revised sections into the final draft. JH wrote sections of component 2 of the study description and provided feedback on all others. MJG wrote sections of component 2 and provided feedback on all others. JP contributed to the introduction and discussion sections of the paper. MLC wrote sections describing components 1 and 3 of the study and provided feedback on all others.

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Competing interests None declared.

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