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Statistical Analysis Plan

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1 SAP Signatures

The SAP for the trial entitled Emergency Department Healthcare Education Assessment and Response for Teen Relationships (ED-HEART): A Pilot Feasibility Study has been reviewed and approved by the principal investigator and approved by its authors upon locking of the data.

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Name: Janelle Noel-MacDonnell, PhD

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Date: 08/20/2024

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Date: 8/22/2024

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3 Abbreviations

Adolescent Relationship Abuse (ARA)
Emergency Contraception (EC)
Emergency Department (ED)
Emergency Department Healthcare Education Assessment And Response For Teen Relationships (ED-HEART)
Intimate Partner Violence (IPV)
Motivational Interviewing (MI)
Point Of Care (POC)
Reproductive And Sexual Health (RSH)
Sexually Transmitted Infection (STI)
Theory Of Planned Behavior (TPB)

4 Introduction

4.1 Preface

Despite school, community, and healthcare-based interventions, adolescent relationship abuse (ARA) remains a major public health concern with wide-reaching, lifelong negative outcomes. ARA includes physical, sexual, cyber, and psychological abuse, reproductive coercion, and sexual exploitation. Approximately 10% of high school students report past-year physical abuse by a dating partner; 14% of females and 6% of males report sexual abuse by a dating partner.[1] 26-41% report cyber abuse. [2,3] 13% of females report past 3-month reproductive coercion, behavior exerted by a male abuser to coerce pregnancy or control pregnancy outcomes.[2] Further, sexual exploitation, the exchange of sex for food, shelter or other returns, often begins within an adolescent dating relationship.[4-6] Negative outcomes associated with ARA include homicide, suicidality, depression, pregnancy, sexually transmitted infections (STIs), poor academic achievement, and adult intimate partner violence (IPV).[7-16] Thus, given the prevalence of ARA and lifelong associated negative outcomes, novel interventions to promote healthy relationships among at-risk adolescents are critically needed.

Emergency departments (EDs) offer unique opportunities to reach adolescents at risk, but current ED-based interventions are limited. The ED offers unique opportunities to address ARA among adolescents who are 1) at increased risk for ARA, [17-20] 2) unlikely to receive intervention in primary care settings, [21-23] and 3) may not receive school-based intervention due to truancy or drop out.

HEART is a universal education and brief counseling intervention for use in school health centers that uses a safety card (https://www.futureswithoutviolence.org/hanging-out-or-hooking-up-2/; available in English and Spanish) and clinician scripts to facilitate a brief conversation about 1) healthy relationship behaviors and ARA, 2) partner negotiation around sexual and technology boundaries, 3) harm reduction strategies, and 4) resources for ARA and related concerns. HEART does not incorporate routine point-of-care (POC) provision of harm reduction resources such as emergency (EC) and condoms. Therefore, this study proposes to adapt HEART for the ED (ED-HEART) setting using mixed methods by 1) incorporation of motivational interviewing (MI) techniques to facilitate internal motivation utilization of POC harm reduction resources, 2) delivery by a health educator to reduce intervention burden on ED staff, [22] 3) POC provision of harm reduction resources routinely available in the ED (i.e. condoms, emergency contraception [EC]), and 4) additional enhancements as identified via key stakeholder input.

4.2 Scope of the analyses

The analysis will assess feasibility of the ED-HEART intervention through the eight Bowen model feasibility constructs. Additionally, the analysis will examine theory of planned constructs (attitudes, beliefs, perceived behavioral control, intention)[38] to facilitate exploratory analysis of factors that may contribute to differential outcomes. Comparisons will be made between the standard of care study arm (control study arm) and the ED-HEART study arm with respect to demographics and survey questions.

5 Study Objectives and Aims

5.1 Study Objectives

The principal research question is: Is the ED-HEART intervention feasible?

5.2 Aims

Primary aim:
The primary outcome is to determine feasibility of ED-HEART. A randomized, controlled trial using mixed methodology to assess eight feasibility constructs (acceptability, demand, implementation, practicality, adaptation, integration, expansion, and limited-efficacy testing) will be conducted.

Secondary aims:
Secondary aims that will be explored include: 1) examine the Theory of Planned Behavior constructs that may impact the efficacy of ED-HEART, and 2) conduct exploratory analysis of factors that may additionally impact efficacy and/or implementation of ED-HEART.

5.3 Hypotheses

Hypothesis 5.3.1: ED-HEART will be feasible as measured by data from adolescents and ED stakeholders.

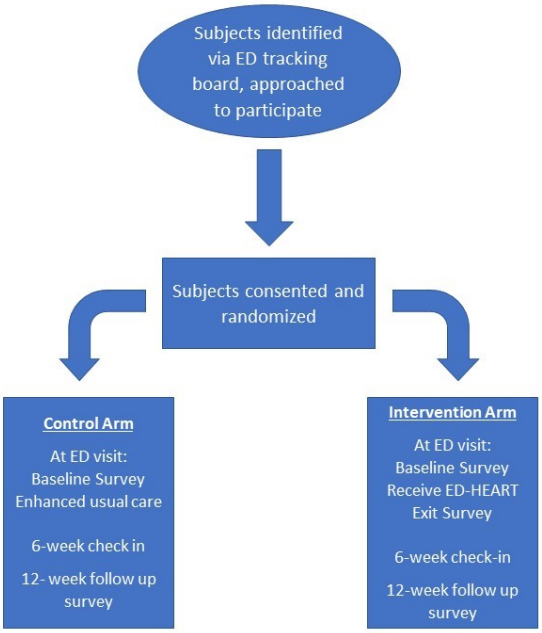
Hypothesis 5.3.2: Adolescents receiving ED-HEART will report less ARA at three-month follow-up, compared to controls.

6 Study Methods

6.1 General Study Design and Plan

The ED-HEART pilot has been designed as a randomized controlled trial comparing enhanced standard of care (control study arm) to the ED-HEART intervention. Individuals will be randomized in a 1:1 allocation.

Subjects will be identified from the ED tracking board and approached to see if they would like to participate in the study. Once pre-screening has occurred and consent/assent has been obtained, individuals will fill out a baseline survey. Those in the ED-HEART study arm will additionally be given the ED-HEART intervention and an exit survey. Each arm will receive a 6-week check in and a 12-week follow-up survey. All completed surveys will be completed confidentially and will not contain identifying information. We will use a unique, participant-created code to link study surveys over time.[39] Those individuals that refused to be part of the study will be given the option to complete a refusal survey.



6.2 Inclusion-Exclusion Criteria and General Study Population

Inclusion criteria

- Adolescent patients (14-19 years of age) seen in the ED at Children's Mercy Hospital (CMH).

Exclusion criteria

- Developmental delay, severe illness, or cognitive impairment precluding informed consent/assent or completion of study activities, as determined by ED team or study team
- Evaluation for acute sexual assault/abuse
- Current mental or behavioral health symptoms precluding completion of study activities, as determined by ED team or study team
- Caregiver declines to step out to allow assent/consent in private or adolescent declines for caregiver to step out to allow assent/consent or participation in private
- Previous participation in this study
- Adolescent is non-English speaking
- Parent is non-English or non-Spanish speaking

6.3 Randomization and Blinding

After signed informed permission, patients enrolled in the study will be randomized to groups (1:1 ratio) using a standard random number generator. No stratification will be made. Due to the nature of the intervention blinding will not be possible.

7 Sample Size

A sample size of 69 per arm provides 80.4% power to detect a between-arm difference, assuming control and intervention arm TVD rates of 0.55 and 0.30, respectively, at 3 months at follow-up (two-sided Fisher's Exact Test at alpha=0.05). We set a final sample as n=174 participants (n=87 each arm) to account for an estimated 20% loss to follow up, based on our previous work.

8 General Analysis Considerations

8.1 Planned Analyses

Descriptive summaries will be made for the Bowen model's eight constructs regarding feasibility (primary outcome). Specifically, the measures defined in the table below will be summarized.

Assessment of Bowen Feasibility Constructs		
Construct	**Definition**	**Assessment measures**
Acceptability	To what extent is ED-HEART suitable?	Adolescent surveys, Health Educator field notes
Demand	To what extent is ED-HEART likely to be used?	Proportion of screened adolescents eligible; proportion of eligible adolescents enrolled; Health Educator field notes
Implementation	To what extent can ED-HEART be delivered as planned?	Fidelity assessment per adolescent survey, Health Educator field notes, audio recordings of intervention delivery
Practicality	What factors make delivery challenging or facilitate delivery?	Health Educator field notes
Adaptation	To what extent does ED-HEART perform in a new system?	Comparison with published outcomes in original setting[33]
Integration	To what extent can ED-HEART be integrated within existing system?	Health Educator field notes
Expansion	To what extent can the existing system be expanded to provide ED-HEART?	Health Educator field notes
Limited efficacy	Are ED-HEART outcomes promising?	Primary outcome: any ARA at 3-month follow up[33], per adolescent survey

Acceptability ratings will be collapsed to dichotomous variables. ED-HEART will be deemed acceptable if the test of the proportion of very/fairly satisfactory ratings for adolescents, the health educator, and ED staff being at least 85%. We will compare ED length of stay between the two arms and calculate the mean/median number of interruptions per participant, with a list of reasons for interruption. For limited efficacy assessment, our primary outcome is any ARA as individual types of abuse rarely occur in isolation and HEART is designed to address ARA broadly. We will compare odds of reporting ARA at follow-up for the two arms by fitting a logistic regression model with any ARA victimization at follow-up (yes or no) as the dependent variable, baseline ARA (yes or no) as a covariate, and study arm as focal predictor. This approach should have higher statistical power than the Fisher's Exact Test used in the power analysis, making our sample size somewhat conservative.

We will analyze secondary outcomes (ARA victimization, recognition of abusive behaviors, knowledge of ARA resources, self-efficacy to use harm reduction strategies, use of harm

reduction strategies and resources) similarly. Factors potentially affecting intervention efficacy (e.g., sex, gender, race/ethnicity, recognition of behaviors as abusive, intention to engage in healthy relationship behaviors, adolescent change talk, MI fidelity [MI-consistent/-inconsistent behaviors], intervention intensity [number of intervention topics discussed]) will be considered as additional model predictors. We will summarize demographics and report baseline prevalence of any ARA and individual types of ARA. We will check for differences in demographics and baseline variables between the two arms, as well as for demographic differences between participants and refusals.

Additional analysis will include looking into the mismatching of the special code, assessing data in aggregate at each timepoint (e.g., baseline and 12-week follow-up), examining findings in those that have both baseline and follow-up linked surveys completed for how responses may have changed, and investigate those that did not follow-up.

Analysis will begin after the final enrolled patient is 13 weeks out from enrollment.

8.2 Covariates and Subgroups

Factors potentially effecting efficacy will be investigated. These include but aren't limited to age, race/ethnicity, gender, sexual orientation, insurance status, chief complaint in the ED, POC resources, and relationship status. Depending on results from the proposed analysis and provided the available sample size, subgroups by ARA status may be explored.

8.3 Missing Data

Missing data will be excluded case-wise by analysis and noted for variables missing large portions. It is anticipated that not all follow-up surveys will be able to be linked to the baseline surveys due to data entry errors. No imputation will be used.

8.4 Interim Analysis and Data Monitoring (as applicable)

No interim analysis is planned. No data monitoring committee will be needed due to the minimal risk exemption. Data will be collected via REDCap and stored per CMH's record retention policy. The final dataset will be locked after the final enrolled patient was 13 weeks out from enrollment.

8.5 Adjusting for Bias

We will examine enrolment bias by comparing demographic (age and gender) in those that enrolled and those that refused. Allocation to study group will only be performed after consent/assent to participate has been. No personal identifiers are entered into the system due to coding system. We will utilize the 6-week check-in to remind participants of the 12-week survey. follow-up as outlined in study procedures section to optimize the final outcome data.

8.6 Adverse Events

This study has been designated as "minimum risk." No adverse events, serious adverse events, and/or death are anticipated. PI and study team will meet weekly during enrollment and the 3-month follow-up period to identify and discuss adverse events and unanticipated problems. Provided any adverse events occur, a safety table will be included in the supplement.

9 Summary of Changes to the Protocol and/or SAP

Protocol Revision #	Version Date	Summary of Changes	Consent Change?
1	3/9/2022	Additional text/email if needed to send survey link after phone call at 6-week check-in	No
2	04/27/2022	Update 6-week check in and 12-week follow up to allow for coordinator to check in at inpatient and outpatient visits during follow up window to complete surveys	Yes
3	05/16/2022	Increase the 12-week survey gift card from $20 to $25	Yes
4	07/20/2022	Add a reminder to contact participant at week 11 for the 12 week survey completion Add option to notify participants of 6-week check in and12-week f/u survey availability via social media.	Yes
5	6/19/2024	Increase sample size to 175	No

No changes have been made to the SAP.

10 Listing of Tables

Various tables will be used to summarize the data. The tables listed below are not comprehensive but are planned for the reporting of data. This basic tables can also be expanded to subgroup analysis mentioned above. Any table can be reduced in the variables that it contains.

Table 1: Enrollment Descriptive Statistics by Study Arm
Table 2: Bivariate comparison of ARA in Control Arm for All Variables
Table 3: Bivariate comparison of ARA in ED-HEART Arm for All Variables
Supplemental Table 1: Refusal Descriptive Statistics
Supplemental Table 2 (if applicable): Safety Table

11 Listings and Figures

The figures listed below are not comprehensive but are planned for the reporting of data.

Figure 1: CONSORT diagram
Figure 2: Forest Plot of ARA at Baseline and Follow-up for Each Study Arm (including odds ratios and 95% CI)

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