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Diabetes Rescue, Engagement, and Management (D-REM): Rationale and Design of a Pragmatic Clinical Trial of a Community Paramedicine Program to Improve Diabetes Care

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ABSTRACT

Introduction. Diabetes is one of the most common serious chronic health conditions in the U.S. People living with diabetes face multiple barriers to optimal diabetes care, including gaps in access to medical care and self-management education, diabetes distress, and high burden of treatment. Community paramedics (CPs) are uniquely positioned to support multi-disciplinary care for patients with diabetes by delivering focused diabetes self-management education and support and bridging the gaps between patients and the clinical and community resources they need to live well with their disease.

Methods and Analysis. We will conduct a pragmatic single-arm prospective trial of a CP-led Diabetes Rescue, Engagement, and Management (D-REM) program that seeks to reduce diabetes distress. We will enroll 70 adults (≥18 years) with diabetes who have hemoglobin A1c (HbA1c) ≥9.0%, experienced an emergency department (ED) visit or hospitalization for any cause within the prior 6 months, and reside in areas with available CP support in Southeast Minnesota (Olmsted, Freeborn, and Mower counties) and Northwest Wisconsin (Barron, Rusk, and Dunn counties). Participants will be identified using Mayo Clinic electronic health records (EHR), contacted for consent, and enrolled into the D-REM program. Visit frequency will be individualized for each patient, but will be an average of four CP visits over the course of approximately one month. Outcomes will be change in diabetes distress (primary outcome), confidence in diabetes self-management, health-related quality of life, self-reported hypoglycemia and hyperglycemia, HbA1c, ED visits, and hospitalizations. Outcomes will be assessed upon enrollment, program completion, and 3 months after program completion.

Ethics and Dissemination. The study was approved by Mayo Clinic Institutional Review Board. Findings will be disseminated through peer-reviewed publications and presentations. If

demonstrated to be successful, this model of care can be implemented across diverse settings and populations to support patients living with diabetes.

Registration. ClinicalTrials.gov NCT04385758

STRENGTHS AND LIMITATIONS

- This prospective pragmatic clinical trial is the first, to our knowledge, to evaluate the effectiveness of a Community Paramedic intervention in patients with uncontrolled diabetes.
- Strengths of this study include its pragmatic design and evaluation of a scalable, generalizable intervention.
- By including patients living in urban, rural, and highly rural areas this study will examine the feasibility and effectiveness of a community-based intervention across settings with a wide range of access to healthcare resources.
- Limitations include a relatively small sample size, location in the upper Midwest, and limited prevalence of racial/ethnic minorities in the included geography.

INTRODUCTION

More than one in eight American adults, or 34.1 million people, are living with diabetes,[1] making it a leading cause of morbidity, disability, impaired quality of life, mortality, and high healthcare costs in the U.S.[2-7] The goals of glucose-lowering therapy are to prevent acute and chronic complications of diabetes by controlling hyperglycemia, avoiding hypoglycemia, and minimizing burdens of treatment and disease.[8-13] Despite advances in the science of diabetes management, rates of acute and chronic diabetes complications remain unacceptably high, particularly in racial/ethnic minorities, low income individuals, and rural residents[14-18] who often have limited access to comprehensive diabetes care. Recent data suggests that control of hyperglycemia and key cardiovascular disease risk factors, particularly hypertension and hyperlipidemia, has worsened since 2010.[19] Thus, there is great need for innovative care delivery models that can support patient-centered, accessible, and affordable diabetes care.

Community Paramedicine has emerged across the U.S. and in other countries around the world as an effective and efficient care delivery model to improve health care access for underserved communities and populations.[20-27] Community Paramedics (CPs) are uniquely positioned to provide multi-disciplinary, inter-professional care for patients with both medical and socioeconomic complexities with the goals of improving access to care, health outcomes, and reducing costs.[28-30] CPs are experienced paramedics with advanced training in the management of low acuity and chronic health conditions, primary/preventive care, and social determinant of health. They practice under the supervision of a physician medical director to provide a wide range of services tailored to each patient's medical, educational, and social needs. In contrast to traditional emergency medical services (EMS), which focuses on high acuity medical care, CPs deliver longitudinal low and intermediate acuity care with emphasis on

primary care, education, social support, and wellness.[22 25-29 31-43] Thus far, most CP programs have primarily focused on specific high risk patient populations, most often those with history of frequent hospital, ED, and/or EMS utilization, multi-morbidity, and frailty.[22 27 37 39 44-47] While to our knowledge there has been no diabetes-specific CP program, community paramedicine is uniquely suited to meet the multi-faceted needs of patients with diabetes living in rural and underserved communities.[48-50] work to specifically target high-risk adults with diabetes

Our objective in this prospective single-arm pragmatic trial is to evaluate the effectiveness of a CP-led intervention – Diabetes Rescue, Engagement, and Management (D-REM) – on reducing diabetes distress and improving diabetes self-efficacy, glycemic control, and quality of life. Our ultimate goal is to bring care to the communities and homes where people live, and ultimately improve health outcomes and quality of life for people living with this serious, progressive, chronic disease.

METHODS AND ANALYSIS

Study Design

Prospective pragmatic single-arm clinical trial.

Setting

Patients residing in six counties of southeast Minnesota (Olmsted, Freeborn, and Mower counties) and northwest Wisconsin (Barron, Rusk, and Dunn counties) were eligible for enrollment if they were paneled to a Mayo Clinic Rochester or Mayo Clinic Health System (MCHS) primary care provider (PCP). These specific locations were chosen because they have CP available CP services and to ensure a diverse patient population in terms race/ethnicity, socioeconomic status, rurality, and access to primary and diabetes-specific care.

Mayo Clinic is an integrated healthcare delivery system serving local, regional, national, and international patients with a central hub in Rochester, Minnesota (Olmsted County). Mayo Clinic Rochester primary care practices (internal medicine, geriatrics, family medicine, and pediatrics specialties) care for Mayo Clinic employees, their dependents, and local area residents. MCHS is a network of community-based clinics, hospitals, and health care facilities serving communities in southeast and southwest Minnesota and in northwest and southwest Wisconsin, delivering primary and specialty care to empaneled patient populations.

Mayo Clinic Ambulance carries multiple accreditations including the Commission on Accreditation of Ambulance Services (ground ambulance), Commission on Accreditation of Medical Transport Systems (ground and air ambulance), and Accredited Center of Excellence (emergency communications center). It serves as the primary advanced life support (ALS) provider for 14 locations throughout eastern and central Minnesota and western Wisconsin, covering 6,894 square miles of urban, suburban, and rural areas. Mayo Clinic Ambulance is staffed by emergency medical technicians, paramedics, and registered nurses, and responds to approximately 100,000 requests for service, including 75,000 911 calls, each year. The Mayo Clinic Ambulance Community Paramedic Program has two hubs: a small hub in Barron county, WI (with 1.0 CP full-time equivalent [FTE] CP staffing) and a larger hub in Olmsted county, MN (3.0 FTE).

Participants

Eligible participants will be patients with an established diagnosis of type 1 or type 2 diabetes, ≥18 years old, and a most recent hemoglobin A1c ≥9.0% obtained within the last two years. Patients will be required to be paneled to a PCP in Mayo Clinic Rochester or MCHS, be able to provide informed consent, have conversational English, live independently in a private residence

(i.e. not in a skilled nursing facility or another congregate living setting where they receive medication management), and live in Mower, Freeborn, or Olmsted counties of Minnesota or Barron, Rusk, and Dunn counties of Wisconsin.

Potential participants will be identified by using Mayo Clinic electronic health records (EHR) to identify all patients meeting eligibility criteria. A report will be run monthly to identify potential participants. Their charts will be reviewed by the study coordinator to confirm that inclusion criteria are met and to further exclude individuals if they have 1) cognitive impairment precluding informed consent, 2) lack of conversational English skills, 3) are a resident of a long-term care facility, 4) are enrolled in hospice, 5) are enrolled in a care coordination or disease management program, or 6) have advanced or terminal illness. Once eligibility is confirmed, the study coordinator will call potential participants to introduce them to the D-REM program and offer participation in the study. Upon receipt of oral consent, the study coordinator will mail patients (via postal mail or e-mail, per participant preference) a HIPAA release form and (via postal mail only) the baseline study survey.

Trial enrollment will be by invitation only and contingent on CP program availability. If a clinician were to contact the study team to request enrollment of their patient, that patient will be reviewed for eligibility criteria and offered study enrollment only if all eligibility criteria are met and the CP program has capacity to accept new patients.

Intervention

After the signed HIPAA release form is received by the study coordinator, she will notify three CPs (two from Olmsted county and one from Barron county) that the participant is ready to be scheduled for their first visit. Scheduling will be done by the CPs for their respective region. The CP will call the participant and schedule an intake visit for a mutually agreeable time and place

(if not at the participant's home). For southeast Minnesota, the participant will be assigned to be seen by the CP scheduled to work the day the participant selects as most convenient for their first visit. Subsequent visits, whether in person or phone, will be scheduled by the CP caring for them in consultation with the participant. Only one CP is available in northwest Wisconsin and will complete all scheduling and visits herself.

The intervention is detailed in **Figure 1**. During the first (intake) visit, CPs will clarify the roles and responsibilities of the CP as compared to other members of the participant's health care team and answer any questions the participant may have about the intervention. CPs will obtain a full history, review and reconcile medications, obtain vital signs, perform a physical exam, and review and validate the information found in the EHR as pertinent to the patient's diabetes management and overall health. Review of systems and physical exam will pay specific attention to diabetes-related complications, including skin problems (e.g. lower extremity ulcers, rashes, and/or injection site reactions), nervous system problems (e.g. central, autonomic, and/or peripheral neuropathy), cardiovascular problems (e.g. dyspnea, angina, claudication), vision and/or hearing impairment, cognitive/memory concerns, and mood concerns (e.g. depression, anxiety, diabetes distress, burnout). As part of medication review, CPs will assess medication adherence and how participants store, administer, and dispose of their medications. To identify potential barriers to optimal diabetes management and elicit clinical and non-clinical needs, CPs will assess the participant's psychosocial status, including food insecurity, housing insecurity, and cost-related nonadherence to medications and/or care plan.

Following the general assessment portion, diabetes- specific evaluations will include concerns or questions that the participant has related to their diabetes; self-reported hypoglycemia, hyperglycemia, and impaired hypoglycemia awareness; and factors potentially

contributing to hypoglycemia and hyperglycemia. CPs may conduct a variety of assessments and educational interventions including: observe a blood glucose check to make sure it is done correctly and confirm that the participant's glucometer is functioning properly; review glucose log with the participant or, if the participant does not keep a log, teach them how to maintain and interpret one; discuss the signs and symptoms of hypoglycemia and how to manage them; review the negative health consequences associated with hypoglycemia and hyperglycemia; discuss the risk factors for and causes of hypoglycemia and hyperglycemia; review the participant's daily routine as it related to diabetes management; ensure an optimal supply of and access to insulin/other medications and testing/administration supplies through local or regional supply chains; and review needle/syringe safe disposal. What items will be covered, and the order in which they are covered, will be guided by the clinical context and participant's needs.

The CPs will use this information to identify areas in need of intervention and education. They will work with the participant to set ≥3 SMART (Specific, Measurable, Achievable, Relevant, and Time-Bound) goals for the 1-month intervention. Depending on the needs identified by the CP and the participant, the CP will recommend referrals to primary care, social services, and/or community resources. If the participant agrees, the CP will execute these referrals after each visit is completed. CPs will also introduce the participant to the patient online services portal, a free online resource, as a means of efficient and secure asynchronous communication with the health care team, if not already set up.

This information will be charted in the Mayo Clinic EHR. Following completion of the intake visit, the CP will forward a copy of the patient's care summary, via the EHR, to the CP Medical Director (RGM), who is also the study Principal Investigator (PI), and the participant's PCP within 24 hours. If the participant already has established care with an endocrinologist,

certified diabetes care and education specialist (CDCES), and/or clinical pharmacist, they will be included in the communication as well. This correspondence will include the participant's care report; the participant's set goals, concerns, and questions; any needs for the patient identified by the CP; and any referrals to clinical providers or external agencies that the CP deems to be potentially necessary. The PCP will be responsible for ordering any clinical referrals as dictated by their judgement and within the scope of usual practice. Discussion with the primary care provider related to care planning can occur prior to subsequent visits. Medical issues requiring immediate or urgent attention will be forwarded to the PCP and/or CP Medical Director via the message feature imbedded in the EHR or by telephone, as the acuity of the issue dictates.

Frequency, timing, and modality (i.e. in person or telephone) of follow-up visits will be determined by the participant and the CP during the intake visit and will be reassessed at each subsequent encounter. An average of two in-person visits and two phone visits over the 1-month period is anticipated; however, an alternate schedule will be accommodated depending on clinical need. At each visit, CPs will obtain an interval history and deliver education and other services as dictated by participant's needs and circumstances.

Primary Outcome

The primary outcome will be change in diabetes distress, measured by the validated Diabetes Distress Scale (DDS)[51 52] and ascertained using mailed survey, from baseline to end of the intervention (1-month survey). Timeframe of outcome collection is shown in **Figure 2**. Each participant will receive up to three mailings of each survey with reminder phone calls to complete the survey if not received within a three week period.

Secondary Outcomes

Multiple secondary outcomes will be examined, measuring the change from baseline to one month (approximately at D-REM completion) to assess program effectiveness and four months (approximately three months after D-REM completion) to assess program durability. Outcomes collected via mailed survey will include (1) confidence in diabetes-self management (measured by the Diabetes Self-Management Questionnaire [DSMQ])[53]; (2) health-related quality of life (measured by the EQ-5D) [54 55]; (3) frequency of self-reported hypoglycemia (blood glucose <70 mg/dL and <54 mg/dL) and hyperglycemia (blood glucose ≥250 mg/dL); (4) open-ended questions regarding concerns/challenges with diabetes management and perceptions of the CP program. The EHR will be used to assess for (1) HbA1c before and within 3-6 months after enrollment; (2) attainment of the D5 composite measure[56] of diabetes care quality (includes indicators of HbA1c, blood pressure, and low density lipoprotein cholesterol control, tobacco use, and aspirin use) before and 4 months after enrollment; and (3) number of ED visits and hospitalizations during the 6 and 12 months before, and 6 and 12 months after, enrollment. EHR-derived outcomes will be collected for all study participants, including those who do not respond to the surveys.

During the final phase of the research we will conduct interviews with CPs engaged in the program to examine barriers to implementation, opportunities for improvement, and potential gaps in knowledge/training/resources. All CPs delivering the intervention will be invited to participate and share their experiences related to the program via teleconference technology at a time that is convenient for them. Participation will be voluntary. Interviews will last 45-60 minutes and be conducted by a qualitative researcher unaffiliated with the CP program. All interviews will be audio recorded and transcribed for analysis.

Independent Variables

The EHR will be used to ascertain patient age, gender, race/ethnicity, rurality, glucose-lowering medications, comorbidities, and prior ED/hospital utilization for hypo- and hyperglycemia. Comorbidities of interest will be ascertained using validated code sets and include retinopathy, neuropathy, coronary artery disease, cerebrovascular disease, peripheral arterial disease, heart failure, chronic kidney disease, chronic obstructive pulmonary disease, asthma, depression, other mental health disorders, hypertension, and substance use. Survey will ascertain diabetes type and duration. Survey will also assess baseline diabetes distress (Diabetes Distress Scale[51 52]), diabetes-self management (DSMQ[53]), self-reported hypoglycemia (glucose <54 mg/dL or need for 3rd party assistance), hyperglycemia (glucose ≥250 mg/dL), and quality of life (EQ-5D[54 55]).

Power Analysis

There has been no prior study examining impact of CP on diabetes management. However, we anticipate that our program will be as or more effective than other limited DSMES interventions. Based on a previous study[52], patients with diabetes who were administered an educational intervention showed a decrease in DDS score of 0.24±0.89 over a 4 month period, corresponding to a decline of approximately 0.27 standard deviations. If the change from baseline to end of study has a similar effect size, a sample size of N = 64 (one-tailed, alpha=0.1) will provide statistical power of 80%. To accommodate sample attrition of up to 10%, a total sample size of 70 is proposed. Participants will be recruited sequentially until target accrual is reached.

Analysis Plan

The primary outcome of the study will be the change in DDS score from baseline to 1 month. DDS scores from baseline to 4, and 1 month to 4 months will be analyzed to see the lasting impact of the intervention. Secondary outcomes of HbA1c, D5, and ED visits/hospitalizations are exploratory due to the short duration of the intervention. Descriptive statistics will be

summarized using mean and standard deviation for continuous variables and frequency percentages for categorical variables. Data will be analyzed using a one-tailed paired t-test with 90% confidence intervals.

Qualitative data gathered through free-text responses to the participant surveys and CP interview transcripts will be analyzed separately using a content analysis approach.[57] Data will be uploaded into NVivo qualitative management software for coding and analysis. A code structure will be developed for each using an integrated deductive and inductive approach informed by survey/interview questions and content that emerges from the data. An iterative process involving multiple members of the research team will be used to develop and refine the analysis and interpretation. An analysis audit trail will document decisions made during the analyses. Cross-cutting themes will be identified among the participant groups and compared within and across key subgroups, and presented through aggregate description.

Patient and Public Involvement: This work was motivated by the need for accessible patient-centered care delivery models for patients with diabetes, though not explicitly informed by individual patients' experience and preference. Patients were not directly involved in the design or conduct of this study.

ETHICS AND DISSEMINATION

The study protocol, consent form, survey instruments, and all communication materials have been reviewed and approved by the Mayo Clinic Institutional Review Board (IRB). Any protocol modifications that will occur during the course of the study will be reported to the IRB. Participants will be consented using verbal consent but will need to sign a HIPAA release form (either mailed or electronic) prior to enrollment in the study. At the time potential participants

provide verbal consent, they will be asked, for follow-up purposes, to provide their name, address, phone number, and e-mail address. They will be informed that study records will be kept as confidential as possible. No individual identities will be used on any reports or publications resulting from the study. Study information will be coded and stored in secured files. Only authorized study personnel will have access to the files. Individuals with cognitive impairment, which precludes them from providing informed consent, will not be included in the study per inclusion/exclusion criteria.

The potential risks associated with participation in this study are low, and the involved activities are considered minimal risk to subjects. Participants may be uncomfortable being identified as having uncontrolled diabetes, revealing personal information to the community paramedics, revealing their home living situation, or providing responses to certain questions included in the questionnaires. They will have the option to refuse to provide any information they are not comfortable providing and to schedule appointments outside of their home in a convenient, mutually agreed upon location. Safety and COVID-19 infection control precautions will be implemented and followed according to contemporaneous Mayo Clinic and Mayo Clinic Ambulance standard protocols.

CP participation in the interviews will be voluntary. Members of the CP leadership team, including the Medical Director, will not know if a CP declined participation and will not have access to identifiable interview transcripts. CPs will be advised that their decision whether to participate, and any information they provide during the interview, will have no impact on their employment or standing in Mayo Clinic Ambulance.

Dissemination of research findings will be a collaborative, multi-modal effort by the study investigators and Mayo Clinic Ambulance as a critical partner. Dissemination will occur at

academic conferences, peer-reviewed publications, and institutional meetings. We further anticipate that results of this study will inform clinical practice and allow for D-REM to be a standard offering to patients with uncontrolled diabetes.

AUTHORS' CONTRIBUTIONS

RGM secured funding, designed the study, prepared the protocol, and drafted the manuscript. All other authors contributed to preparing the protocol and reviewed/revised the manuscript. All authors approved the final version of the manuscript. All authors will have access to study data.

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Competing Interests. The Authors have no conflicts of interest to declare. In the last 36 months, Dr. McCoy also received support from NIDDK (R03DK127010; P30DK111024), PCORI, and AARP® (Quality Measure Innovation Grant).

Role of the Sponsor. The study sponsors have had no role, and will not have a role, in the study design; collection, management, analysis, or interpretation of data; writing of the report; or the decision to submit the report for publication. Study contents are the sole responsibility of the authors and do not necessarily represent the official views of NIH.

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Figure 1. Schematic of the Intervention. SDOH, social determinants of health. PCP, primary care provider.

Figure 2. Study Timeline. D-REM, diabetes rescue engagement and management (the study intervention). EHR, electronic health record. D5, composite indicator of diabetes care quality.

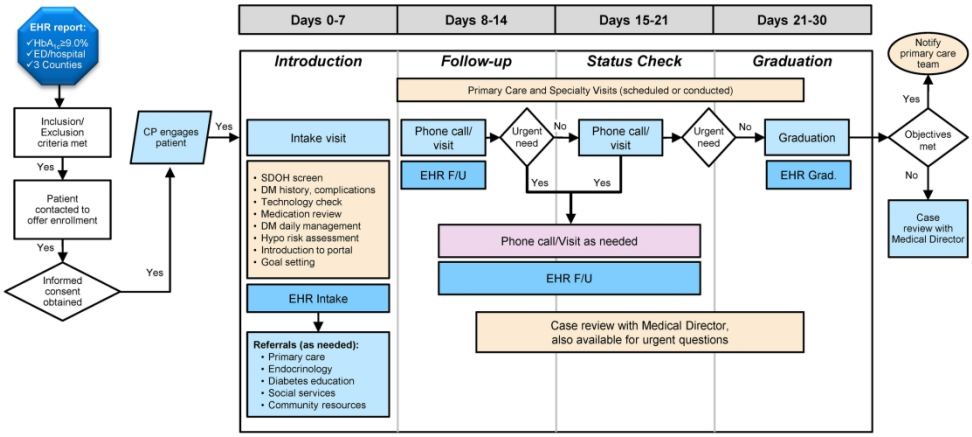

Figure 1. Schematic of the Intervention. SDOH, social determinants of health. PCP, primary care provider.

211x101mm (300 x 300 DPI)

Figure 2. Study Timeline. D-REM, diabetes rescue engagement and management (the study intervention). EHR, electronic health record. D5, composite indicator of diabetes care quality.

253x42mm (300 x 300 DPI)

Reporting checklist for protocol of a clinical trial.

Based on the SPIRIT guidelines.

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Complete this checklist by entering the page numbers from your manuscript where readers will find each of the items listed below.

Your article may not currently address all the items on the checklist. Please modify your text to include the missing information. If you are certain that an item does not apply, please write "n/a" and provide a short explanation.

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		Reporting Item	Page Number
Administrative information			
Title	#1	Descriptive title identifying the study design, population, interventions, and, if applicable, trial acronym	1
Trial registration	#2a	Trial identifier and registry name. If not yet registered, name of intended registry	3
Trial registration: data set	#2b	All items from the World Health Organization Trial Registration Data Set	n/a
Protocol version	#3	Date and version identifier	n/a
Funding	#4	Sources and types of financial, material, and other support	15
Roles and responsibilities: contributorship	#5a	Names, affiliations, and roles of protocol contributors	1, 15
Roles and responsibilities: sponsor contact information	#5b	Name and contact information for the trial sponsor	15

Roles and responsibilities: sponsor and funder	#5c	Role of study sponsor and funders, if any, in study design; collection, management, analysis, and interpretation of data; writing of the report; and the decision to submit the report for publication, including whether they will have ultimate authority over any of these activities	15
Roles and responsibilities: committees	#5d	Composition, roles, and responsibilities of the coordinating centre, steering committee, endpoint adjudication committee, data management team, and other individuals or groups overseeing the trial, if applicable (see Item 21a for data monitoring committee)	n/a
Introduction			
Background and rationale	#6a	Description of research question and justification for undertaking the trial, including summary of relevant studies (published and unpublished) examining benefits and harms for each intervention	4
Background and rationale: choice of comparators	#6b	Explanation for choice of comparators	4-5
Objectives	#7	Specific objectives or hypotheses	5
Trial design	#8	Description of trial design including type of trial (eg, parallel group, crossover, factorial, single group), allocation ratio, and framework (eg, superiority, equivalence, non-inferiority, exploratory)	5
Methods: Participants, interventions, and outcomes			
Study setting	#9	Description of study settings (eg, community clinic, academic hospital) and list of countries where data will be collected. Reference to where list of study sites can be obtained	5-6
Eligibility criteria	#10	Inclusion and exclusion criteria for participants. If applicable, eligibility criteria for study centres and individuals who will perform the interventions (eg, surgeons, psychotherapists)	6-7
Interventions: description	#11a	Interventions for each group with sufficient detail to allow replication, including how and when they will be administered	7-10; figure 1
Interventions: modifications	#11b	Criteria for discontinuing or modifying allocated interventions for a given trial participant (eg, drug dose change in response to harms, participant request, or improving / worsening disease)	n/a
Interventions: adherance	#11c	Strategies to improve adherence to intervention protocols, and any procedures for monitoring adherence (eg, drug tablet return; laboratory tests)	n/a

Interventions: concomitant care	#11d	Relevant concomitant care and interventions that are permitted or prohibited during the trial	n/a
Outcomes	#12	Primary, secondary, and other outcomes, including the specific measurement variable (eg, systolic blood pressure), analysis metric (eg, change from baseline, final value, time to event), method of aggregation (eg, median, proportion), and time point for each outcome. Explanation of the clinical relevance of chosen efficacy and harm outcomes is strongly recommended	10-11
Participant timeline	#13	Time schedule of enrolment, interventions (including any run-ins and washouts), assessments, and visits for participants. A schematic diagram is highly recommended (see Figure)	10-11; figure 2
Sample size	#14	Estimated number of participants needed to achieve study objectives and how it was determined, including clinical and statistical assumptions supporting any sample size calculations	12
Recruitment	#15	Strategies for achieving adequate participant enrolment to reach target sample size	12
Methods: Assignment of interventions (for controlled trials)			
Allocation: sequence generation	#16a	Method of generating the allocation sequence (eg, computer-generated random numbers), and list of any factors for stratification. To reduce predictability of a random sequence, details of any planned restriction (eg, blocking) should be provided in a separate document that is unavailable to those who enrol participants or assign interventions	n/a
Allocation concealment mechanism	#16b	Mechanism of implementing the allocation sequence (eg, central telephone; sequentially numbered, opaque, sealed envelopes), describing any steps to conceal the sequence until interventions are assigned	n/a
Allocation: implementation	#16c	Who will generate the allocation sequence, who will enrol participants, and who will assign participants to interventions	n/a
Blinding (masking)	#17a	Who will be blinded after assignment to interventions (eg, trial participants, care providers, outcome assessors, data analysts), and how	n/a
Blinding (masking): emergency unblinding	#17b	If blinded, circumstances under which unblinding is permissible, and procedure for revealing a participant's allocated intervention during the trial	n/a
Methods: Data collection, management, and analysis			

Data collection plan	#18a	Plans for assessment and collection of outcome, baseline, and other trial data, including any related processes to promote data quality (eg, duplicate measurements, training of assessors) and a description of study instruments (eg, questionnaires, laboratory tests) along with their reliability and validity, if known. Reference to where data collection forms can be found, if not in the protocol	10-11
Data collection plan: retention	#18b	Plans to promote participant retention and complete follow-up, including list of any outcome data to be collected for participants who discontinue or deviate from intervention protocols	10-11
Data management	#19	Plans for data entry, coding, security, and storage, including any related processes to promote data quality (eg, double data entry; range checks for data values). Reference to where details of data management procedures can be found, if not in the protocol	13
Statistics: outcomes	#20a	Statistical methods for analysing primary and secondary outcomes. Reference to where other details of the statistical analysis plan can be found, if not in the protocol	12-13
Statistics: additional analyses	#20b	Methods for any additional analyses (eg, subgroup and adjusted analyses)	n/a
Statistics: analysis population and missing data	#20c	Definition of analysis population relating to protocol non-adherence (eg, as randomised analysis), and any statistical methods to handle missing data (eg, multiple imputation)	n/a
Methods: Monitoring			
Data monitoring: formal committee	#21a	Composition of data monitoring committee (DMC); summary of its role and reporting structure; statement of whether it is independent from the sponsor and competing interests; and reference to where further details about its charter can be found, if not in the protocol. Alternatively, an explanation of why a DMC is not needed	n/a
Data monitoring: interim analysis	#21b	Description of any interim analyses and stopping guidelines, including who will have access to these interim results and make the final decision to terminate the trial	n/a
Harms	#22	Plans for collecting, assessing, reporting, and managing solicited and spontaneously reported adverse events and other unintended effects of trial interventions or trial conduct	n/a
Auditing	#23	Frequency and procedures for auditing trial conduct, if any, and whether the process will be independent from investigators and the sponsor	n/a
Ethics and dissemination			

Research ethics approval	#24	Plans for seeking research ethics committee / institutional review board (REC / IRB) approval	13
Protocol amendments	#25	Plans for communicating important protocol modifications (eg, changes to eligibility criteria, outcomes, analyses) to relevant parties (eg, investigators, REC / IRBs, trial participants, trial registries, journals, regulators)	13
Consent or assent	#26a	Who will obtain informed consent or assent from potential trial participants or authorised surrogates, and how (see Item 32)	13-14
Consent or assent: ancillary studies	#26b	Additional consent provisions for collection and use of participant data and biological specimens in ancillary studies, if applicable	n/a
Confidentiality	#27	How personal information about potential and enrolled participants will be collected, shared, and maintained in order to protect confidentiality before, during, and after the trial	13-14
Declaration of interests	#28	Financial and other competing interests for principal investigators for the overall trial and each study site	15
Data access	#29	Statement of who will have access to the final trial dataset, and disclosure of contractual agreements that limit such access for investigators	15
Ancillary and post trial care	#30	Provisions, if any, for ancillary and post-trial care, and for compensation to those who suffer harm from trial participation	n/a
Dissemination policy: trial results	#31a	Plans for investigators and sponsor to communicate trial results to participants, healthcare professionals, the public, and other relevant groups (eg, via publication, reporting in results databases, or other data sharing arrangements), including any publication restrictions	14
Dissemination policy: authorship	#31b	Authorship eligibility guidelines and any intended use of professional writers	n/a
Dissemination policy: reproducible research	#31c	Plans, if any, for granting public access to the full protocol, participant-level dataset, and statistical code	n/a
Appendices			
Informed consent materials	#32	Model consent form and other related documentation given to participants and authorised surrogates	n/a
Biological specimens	#33	Plans for collection, laboratory evaluation, and storage of biological specimens for genetic or molecular analysis in the current trial and for future use in ancillary studies, if applicable	n/a

BMJ Open

Diabetes Rescue, Engagement, and Management (D-REM): Rationale and Design of a Pragmatic Clinical Trial of a Community Paramedicine Program to Improve Diabetes Care

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Diabetes Rescue, Engagement, and Management (D-REM): Rationale and Design of a Pragmatic Clinical Trial of a Community Paramedicine Program to Improve Diabetes Care

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ABSTRACT

Introduction. Diabetes is one of the most common serious chronic health conditions in the U.S. People living with diabetes face multiple barriers to optimal diabetes care, including gaps in access to medical care and self-management education, diabetes distress, and high burden of treatment. Community paramedics (CPs) are uniquely positioned to support multi-disciplinary care for patients with diabetes by delivering focused diabetes self-management education and support and bridging the gaps between patients and the clinical and community resources they need to live well with their disease.

Methods and Analysis. We will conduct a pragmatic single-arm prospective trial of a CP-led Diabetes Rescue, Engagement, and Management (D-REM) program that seeks to reduce diabetes distress. We will enroll 70 adults (≥18 years) with diabetes who have hemoglobin A1c (HbA1c) ≥9.0%, experienced an emergency department (ED) visit or hospitalization for any cause within the prior 6 months, and reside in areas with available CP support in Southeast Minnesota (Olmsted, Freeborn, and Mower counties) and Northwest Wisconsin (Barron, Rusk, and Dunn counties). Participants will be identified using Mayo Clinic electronic health records (EHR), contacted for consent, and enrolled into the D-REM program. Visit frequency will be individualized for each patient, but will be an average of four CP visits over the course of approximately one month. Outcomes will be change in diabetes distress (primary outcome), confidence in diabetes self-management, health-related quality of life, self-reported hypoglycemia and hyperglycemia, HbA1c, ED visits, and hospitalizations. Outcomes will be assessed upon enrollment, program completion, and 3 months after program completion.

Ethics and Dissemination. The study was approved by Mayo Clinic Institutional Review Board. Findings will be disseminated through peer-reviewed publications and presentations. If

demonstrated to be successful, this model of care can be implemented across diverse settings and populations to support patients living with diabetes.

Registration. ClinicalTrials.gov NCT04385758

STRENGTHS AND LIMITATIONS

- This prospective pragmatic clinical trial is the first, to our knowledge, to evaluate the effectiveness of a Community Paramedic intervention in patients with uncontrolled diabetes.
- Strengths of this study include its pragmatic design and evaluation of a scalable, generalizable intervention.
- By including patients living in urban, rural, and highly rural areas this study will examine the feasibility and effectiveness of a community-based intervention across settings with a wide range of access to healthcare resources.
- Limitations include a relatively small sample size, location in the upper Midwest, and limited prevalence of racial/ethnic minorities in the included geography.

INTRODUCTION

More than one in eight American adults, or 34.1 million people, are living with diabetes,[1] making it a leading cause of morbidity, disability, impaired quality of life, mortality, and high healthcare costs in the U.S.[2-7] The goals of glucose-lowering therapy are to prevent acute and chronic complications of diabetes by controlling hyperglycemia, avoiding hypoglycemia, and minimizing burdens of treatment and disease.[8-13] Despite advances in the science of diabetes management, rates of acute and chronic diabetes complications remain unacceptably high, particularly in racial/ethnic minorities, low income individuals, and rural residents[14-18] who often have limited access to comprehensive diabetes care. Recent data suggests that control of hyperglycemia and key cardiovascular disease risk factors, particularly hypertension and hyperlipidemia, has worsened since 2010.[19] Thus, there is great need for innovative care delivery models that can support patient-centered, accessible, and affordable diabetes care.

Community Paramedicine has emerged across the U.S. and in other countries around the world as an effective and efficient care delivery model to improve health care access for underserved communities and populations.[20-27] Community Paramedics (CPs) are uniquely positioned to provide multi-disciplinary, inter-professional care for patients with both medical and socioeconomic complexities with the goals of improving access to care, health outcomes, and reducing costs.[28-30] CPs are experienced paramedics with advanced training in the management of low acuity and chronic health conditions, primary/preventive care, and social determinant of health. They practice under the supervision of a physician medical director to provide a wide range of services tailored to each patient's medical, educational, and social needs. In contrast to traditional emergency medical services (EMS), which focuses on high acuity medical care, CPs deliver longitudinal low and intermediate acuity care with emphasis on

primary care, education, social support, and wellness.[22 25-29 31-43] In the U.S. fee-for-service healthcare system, financial sustainability is one of the biggest challenges facing CP programs as a novel care delivery model. Minnesota is currently the only state to legislatively require Medicaid to reimburse for CP services as professional services. Additionally, and not limited to Minnesota, CP services can be billed to Medicare as "incident-to" to other physician services. Finally, CP services can be funded under the umbrella of Accountable Care Organizations, Medicaid Integrated Health Partnerships, and other value-based care models.[44] For this study, CP services will be supported by institutional grant funding seeking to improve diabetes care in rural and underserved communities, with plans for broader implementation and dissemination using established funding streams once program effectiveness is established.

Thus far, most CP programs have primarily focused on specific high risk patient populations, most often those with history of frequent hospital, ED, and/or EMS utilization, multi-morbidity, and frailty.[22 27 37 39 45-48] While to our knowledge there has been no diabetes-specific CP program, community paramedicine is uniquely suited to meet the multi-faceted needs of patients with diabetes living in rural and underserved communities.[49-51] work to specifically target high-risk adults with diabetes.

Our objective in this prospective single-arm pragmatic trial is to evaluate the effectiveness of a CP-led intervention – Diabetes Rescue, Engagement, and Management (D-REM) – on reducing diabetes distress and improving diabetes self-efficacy, glycemic control, and quality of life. Our ultimate goal is to bring care to the communities and homes where people live, and ultimately improve health outcomes and quality of life for people living with this serious, progressive, chronic disease.

METHODS AND ANALYSIS

Study Design

Prospective pragmatic single-arm clinical trial that began July 13, 2020, has an estimated primary completion date June 30, 2022, and a final completion date of June 30, 2023.

Setting

Patients residing in six counties of southeast Minnesota (Olmsted, Freeborn, and Mower counties) and northwest Wisconsin (Barron, Rusk, and Dunn counties) were eligible for enrollment if they were paneled to a Mayo Clinic Rochester or Mayo Clinic Health System (MCHS) primary care provider (PCP). These specific locations were chosen because they have CP available CP services and to ensure a diverse patient population in terms race/ethnicity, socioeconomic status, rurality, and access to primary and diabetes-specific care.

Mayo Clinic is an integrated healthcare delivery system serving local, regional, national, and international patients with a central hub in Rochester, Minnesota (Olmsted County). Mayo Clinic Rochester primary care practices (internal medicine, geriatrics, family medicine, and pediatrics specialties) care for Mayo Clinic employees, their dependents, and local area residents. MCHS is a network of community-based clinics, hospitals, and health care facilities serving communities in southeast and southwest Minnesota and in northwest and southwest Wisconsin, delivering primary and specialty care to empaneled patient populations.

Mayo Clinic Ambulance carries multiple accreditations including the Commission on Accreditation of Ambulance Services (ground ambulance), Commission on Accreditation of Medical Transport Systems (ground and air ambulance), and Accredited Center of Excellence (emergency communications center). It serves as the primary advanced life support (ALS) provider for 14 locations throughout eastern and central Minnesota and western Wisconsin,

covering 6,894 square miles of urban, suburban, and rural areas. Mayo Clinic Ambulance is staffed by emergency medical technicians, paramedics, and registered nurses, and responds to approximately 100,000 requests for service, including 75,000 911 calls, each year. The Mayo Clinic Ambulance Community Paramedic Service has two hubs: a small hub in Barron county, WI (with 1.0 CP full-time equivalent [FTE] CP staffing, working Monday through Friday, 8:00-17:00) and a larger hub in Olmsted county, MN (3.0 FTE, working seven days per week, 7:00-19:00). All CPs will be involved in this work.

Participants

Eligible participants will be patients with an established diagnosis of type 1 or type 2 diabetes, ≥18 years old, and a most recent hemoglobin A1c ≥9.0% obtained within the last two years. Patients will be required to be paneled to a PCP in Mayo Clinic Rochester or MCHS, be able to provide informed consent, have conversational English, live independently in a private residence (i.e. not in a skilled nursing facility or another congregate living setting where they receive medication management), and live in Mower, Freeborn, or Olmsted counties of Minnesota or Barron, Rusk, and Dunn counties of Wisconsin.

Potential participants will be identified by using Mayo Clinic electronic health records (EHR) to identify all patients meeting eligibility criteria. An initial data pull identified 233 potential participants. A report will be run monthly by an analyst within Mayo Clinic Ambulance (M.C.R) to identify potential participants, with new eligible patients to be identified during each data pull. Their charts will be reviewed by the study coordinator (there will be one study coordinator [A.K.M.] supporting this study at 0.2 FTE) to confirm that inclusion criteria are met and to further exclude individuals if they have 1) cognitive impairment precluding informed consent, 2) lack of conversational English skills, 3) are a resident of a long-term care facility, 4)

are enrolled in hospice, 5) are enrolled in a care coordination or disease management program, or 6) have advanced or terminal illness. Once eligibility is confirmed, the study coordinator will call potential participants to introduce them to the D-REM program and offer participation in the study. Upon receipt of oral consent (see Supplement), the study coordinator will mail patients (via postal mail or e-mail, per participant preference) a HIPAA release form and (via postal mail only) the baseline study survey.

Trial enrollment will be by invitation only and contingent on CP program availability. If a clinician were to contact the study team to request enrollment of their patient, that patient will be reviewed for eligibility criteria and offered study enrollment only if all eligibility criteria are met and the CP program has capacity to accept new patients.

Intervention

After the signed HIPAA release form is received by the study coordinator, she will notify three CPs (two from Olmsted county and one from Barron county) that the participant is ready to be scheduled for their first visit. Scheduling will be done by the CPs for their respective region. The CP will call the participant and schedule an intake visit for a mutually agreeable time and place (if not at the participant's home). For southeast Minnesota, the participant will be assigned to be seen by the CP scheduled to work the day the participant selects as most convenient for their first visit. Subsequent visits, whether in person or phone, will be scheduled by the CP caring for them in consultation with the participant. Only one CP is available in northwest Wisconsin and will complete all scheduling and visits herself.

Trial procedures are detailed in **Figure 1**, while the care processes and guidelines for CPs are detailed in **Figure 2** and the Appendix During the first (intake) visit, CPs will clarify the roles and responsibilities of the CP as compared to other members of the participant's health care

team and answer any questions the participant may have about the intervention. CPs will obtain a full history, review and reconcile medications, obtain vital signs, perform a physical exam, and review and validate the information found in the EHR as pertinent to the patient's diabetes management and overall health. Review of systems and physical exam will pay specific attention to diabetes-related complications, including skin problems (e.g. lower extremity ulcers, rashes, and/or injection site reactions), nervous system problems (e.g. central, autonomic, and/or peripheral neuropathy), cardiovascular problems (e.g. dyspnea, angina, claudication), vision and/or hearing impairment, cognitive/memory concerns, and mood concerns (e.g. depression, anxiety, diabetes distress, burnout). As part of medication review, CPs will assess medication adherence and how participants store, administer, and dispose of their medications. To identify potential barriers to optimal diabetes management and elicit clinical and non-clinical needs, CPs will assess the participant's psychosocial status, including food insecurity, housing insecurity, and cost-related nonadherence to medications and/or care plan.

Following the general assessment portion, diabetes- specific evaluations will include concerns or questions that the participant has related to their diabetes; self-reported hypoglycemia, hyperglycemia, and impaired hypoglycemia awareness; and factors potentially contributing to hypoglycemia and hyperglycemia. CPs may conduct a variety of assessments and educational interventions including: observe a blood glucose check to make sure it is done correctly and confirm that the participant's glucometer is functioning properly; review glucose log with the participant or, if the participant does not keep a log, teach them how to maintain and interpret one; discuss the signs and symptoms of hypoglycemia and how to manage them; review the negative health consequences associated with hypoglycemia and hyperglycemia; discuss the risk factors for and causes of hypoglycemia and hyperglycemia; review the participant's daily

routine as it related to diabetes management; ensure an optimal supply of and access to insulin/other medications and testing/administration supplies through local or regional supply chains; and review needle/syringe safe disposal. What items will be covered, and the order in which they are covered, will be guided by the clinical context and participant's needs.

The CPs will use this information to identify areas in need of intervention and education. They will work with the participant to set ≥3 SMART (Specific, Measurable, Achievable, Relevant, and Time-Bound) goals for the 1-month intervention. Depending on the needs identified by the CP and the participant, the CP will recommend referrals to primary care, social services, and/or community resources. If the participant agrees, the CP will execute these referrals after each visit is completed. CPs will also introduce the participant to the patient online services portal, a free online resource, as a means of efficient and secure asynchronous communication with the health care team, if not already set up.

This information will be charted in the Mayo Clinic EHR. Following completion of the intake visit, the CP will forward a copy of the patient's care summary, via the EHR, to the CP Medical Director (RGM), who is also the study Principal Investigator (PI), and the participant's PCP within 24 hours. If the participant already has established care with an endocrinologist, certified diabetes care and education specialist (CDCES), and/or clinical pharmacist, they will be included in the communication as well. This correspondence will include the participant's care report; the participant's set goals, concerns, and questions; any needs for the patient identified by the CP; and any referrals to clinical providers or external agencies that the CP deems to be potentially necessary. The PCP will be responsible for ordering any clinical referrals as dictated by their judgement and within the scope of usual practice. Discussion with the primary care provider related to care planning can occur prior to subsequent visits. Medical issues requiring

immediate or urgent attention will be forwarded to the PCP and/or CP Medical Director via the message feature imbedded in the EHR or by telephone, as the acuity of the issue dictates.

Frequency, timing, and modality (i.e. in person or telephone) of follow-up visits will be determined by the participant and the CP during the intake visit and will be reassessed at each subsequent encounter. An average of two in-person visits and two phone visits over the 1-month period is anticipated; however, an alternate schedule will be accommodated depending on clinical need. At each visit, CPs will obtain an interval history and deliver education and other services as dictated by participant's needs and circumstances.

Primary Outcome

The primary outcome will be change in diabetes distress, measured by the validated Diabetes Distress Scale (DDS)[52 53] and ascertained using mailed survey, from baseline to end of the intervention (1-month survey). Timeframe of outcome collection is shown in **Figure 3**. Each participant will receive up to three mailings of each survey with reminder phone calls to complete the survey if not received within a three-week period.

Secondary Outcomes

Multiple secondary outcomes will be examined, measuring the change from baseline to one month (approximately at D-REM completion) to assess program effectiveness and four months (approximately three months after D-REM completion) to assess program durability. Outcomes collected via mailed survey will include (1) confidence in diabetes-self management (measured by the Diabetes Self-Management Questionnaire [DSMQ])[54]; (2) health-related quality of life (measured by the EQ-5D) [55 56]; (3) frequency of self-reported hypoglycemia (blood glucose <70 mg/dL and <54 mg/dL) and hyperglycemia (blood glucose ≥250 mg/dL); (4) open-ended questions regarding concerns/challenges with diabetes management and perceptions of the CP

program. The EHR will be used to assess for (1) HbA1c before and within 3-6 months after enrollment; (2) attainment of the D5 composite measure[57] of diabetes care quality (includes indicators of HbA1c, blood pressure, and low density lipoprotein cholesterol control, tobacco use, and aspirin use) before and 4 months after enrollment; and (3) number of ED visits and hospitalizations during the 6 and 12 months before, and 6 and 12 months after, enrollment. EHR-derived outcomes will be collected for all study participants, including those who do not respond to the surveys.

During the final phase of the research we will conduct interviews with CPs engaged in the program to examine barriers to implementation, opportunities for improvement, and potential gaps in knowledge/training/resources. All CPs delivering the intervention will be invited to participate and share their experiences related to the program via teleconference technology at a time that is convenient for them. Participation will be voluntary. Interviews will last 45-60 minutes and be conducted by a qualitative researcher unaffiliated with the CP Service. All interviews will be audio recorded and transcribed for analysis.

Independent Variables

The EHR will be used to ascertain patient age, gender, race/ethnicity, rurality, glucose-lowering medications, comorbidities, and prior ED/hospital utilization for hypo- and hyperglycemia. Comorbidities of interest will be ascertained using validated code sets and include retinopathy, neuropathy, coronary artery disease, cerebrovascular disease, peripheral arterial disease, heart failure, chronic kidney disease, chronic obstructive pulmonary disease, asthma, depression, other mental health disorders, hypertension, and substance use. Survey will ascertain diabetes type and duration. Survey will also assess baseline diabetes distress (Diabetes Distress Scale[52 53]),

diabetes-self management (DSMQ[54]), self-reported hypoglycemia (glucose <54 mg/dL or need for 3rd party assistance), hyperglycemia (glucose ≥250 mg/dL), and quality of life (EQ-5D[55 56]).

Power Analysis

There has been no prior study examining impact of CP on diabetes management. However, we anticipate that our program will be as or more effective than other limited diabetes self-management education/support interventions. Based on a previous study[53], patients with diabetes who were administered an educational intervention showed a decrease in DDS score of 0.24±0.89 over a 4 month period, corresponding to a decline of approximately 0.27 standard deviations. If the change from baseline to end of study has a similar effect size, a sample size of N = 64 (one-tailed, alpha=0.1) will provide statistical power of 80%. To accommodate sample attrition of up to 10%, a total sample size of 70 is proposed. Participants will be recruited sequentially until target accrual is reached.

Analysis Plan

The primary outcome of the study will be the change in DDS score from baseline to 1 month. DDS scores from baseline to 4, and 1 month to 4 months will be analyzed to see the lasting impact of the intervention. Secondary outcomes of HbA1c, D5, and ED visits/hospitalizations are exploratory due to the short duration of the intervention. Descriptive statistics will be summarized using mean and standard deviation for continuous variables and frequency percentages for categorical variables. Data will be analyzed using a one-tailed paired t-test with 90% confidence intervals.

Qualitative data gathered through free-text responses to the participant surveys and CP interview transcripts will be analyzed separately using a content analysis approach.[58] Data will be uploaded into NVivo qualitative management software for coding and analysis. A code

structure will be developed for each using an integrated deductive and inductive approach informed by survey/interview questions and content that emerges from the data. An iterative process involving multiple members of the research team will be used to develop and refine the analysis and interpretation. An analysis audit trail will document decisions made during the analyses. Cross-cutting themes will be identified among the participant groups and compared within and across key subgroups, and presented through aggregate description.

Patient and Public Involvement: This work was motivated by the need for accessible patient-centered care delivery models for patients with diabetes, though not explicitly informed by individual patients' experience and preference. Patients were not directly involved in the design or conduct of this study.

ETHICS AND DISSEMINATION

The study protocol, consent form, survey instruments, and all communication materials have been reviewed and approved by the Mayo Clinic Institutional Review Board (IRB). Any protocol modifications that will occur during the course of the study will be reported to the IRB. Participants will be consented using verbal consent but will need to sign a HIPAA release form (either mailed or electronic) prior to enrollment in the study. At the time potential participants provide verbal consent, they will be asked, for follow-up purposes, to provide their name, address, phone number, and e-mail address. They will be informed that study records will be kept as confidential as possible. No individual identities will be used on any reports or publications resulting from the study. Study information will be coded and stored in secured files. Only authorized study personnel will have access to the files. Individuals with cognitive

impairment, which precludes them from providing informed consent, will not be included in the study per inclusion/exclusion criteria.

The potential risks associated with participation in this study are low, and the involved activities are considered minimal risk to subjects. Participants may be uncomfortable being identified as having uncontrolled diabetes, revealing personal information to the community paramedics, revealing their home living situation, or providing responses to certain questions included in the questionnaires. They will have the option to refuse to provide any information they are not comfortable providing and to schedule appointments outside of their home in a convenient, mutually agreed upon location. Safety and COVID-19 infection control precautions will be implemented and followed according to contemporaneous Mayo Clinic and Mayo Clinic Ambulance standard protocols.

CP participation in the interviews will be voluntary. Members of the CP leadership team, including the Medical Director, will not know if a CP declined participation and will not have access to identifiable interview transcripts. CPs will be advised that their decision whether to participate, and any information they provide during the interview, will have no impact on their employment or standing in Mayo Clinic Ambulance.

Dissemination of research findings will be a collaborative, multi-modal effort by the study investigators and Mayo Clinic Ambulance as a critical partner. Dissemination will occur at academic conferences, peer-reviewed publications, and institutional meetings. We further anticipate that results of this study will inform clinical practice and allow for D-REM to be a standard offering to patients with uncontrolled diabetes.

AUTHORS' CONTRIBUTIONS

MBJ oversees the community paramedic intervention and reviewed/revised the manuscript. CPL co-created the diabetes clinical practice guidelines and reviewed/revised the manuscript. PNC co-designed the community paramedic intervention and reviewed/revised the manuscript. LAM participated in study design and reviewed/revised the manuscript. ZRS supported the study coordinator and reviewed/revised the manuscript. RJS supported the study coordinator and reviewed/revised the manuscript. AKM is the lead study coordinator on the study and reviewed/revised the manuscript. EKB supported the study coordinator, participated in study design, and reviewed/revised the manuscript. MAL participated in study design, will oversee qualitative analyses, and reviewed/revised the manuscript. MCR conducted analyses and reviewed/revised the manuscript. KMF participated in study design, will be conducting analyses, and reviewed/revised the manuscript. RGM secured funding, designed the study, prepared the protocol, and drafted the manuscript. All authors approved the final version of the manuscript. All authors will have access to study data.

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Competing Interests. In the last 36 months, Dr. McCoy received support from NIDDK, PCORI, and AARP®. She also serves as a consultant to Emmi® (Wolters Kluwer) on developing patient education materials related to diabetes.

Role of the Sponsor. The study sponsors have had no role, and will not have a role, in the study design; collection, management, analysis, or interpretation of data; writing of the report; or the

decision to submit the report for publication. Study contents are the sole responsibility of the authors and do not necessarily represent the official views of NIH.

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Figure 1. Schematic of the Intervention. PCP, primary care provider. SDOH, social determinants of health.

Figure 2. Care Processes for Community Paramedic Diabetes Visits. F2F, face-to-face. PCP, primary care provider. SDOH, social determinants of health.

Figure 3. Study Timeline. D5, composite indicator of diabetes care quality. D-REM, diabetes rescue engagement and management (the study intervention). EHR, electronic health record.

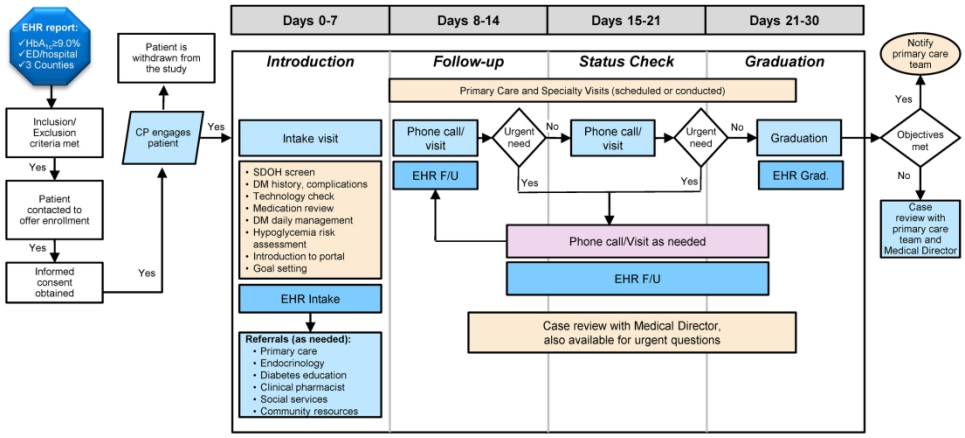

Figure 1. Schematic of the Intervention. PCP, primary care provider. SDOH, social determinants of health.

211x101mm (300 x 300 DPI)

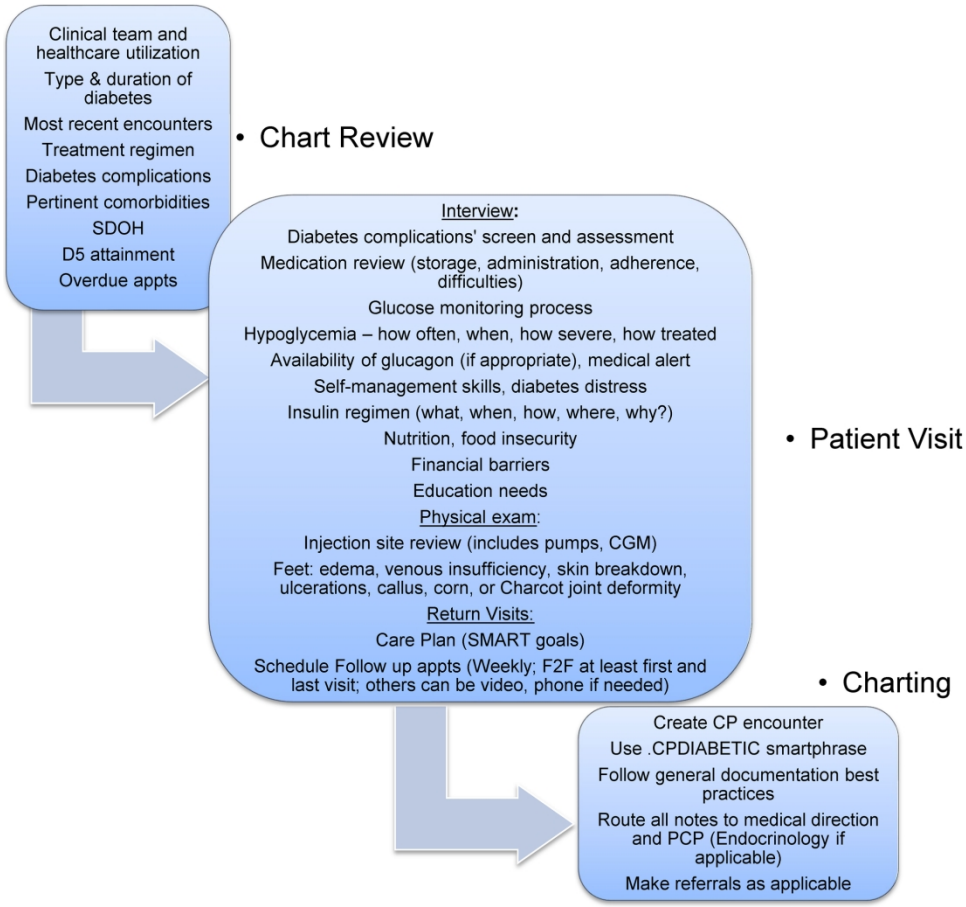

Figure 2. Care Processes for Community Paramedic Diabetes Visits. F2F, face-to-face. PCP, primary care provider. SDOH, social determinants of health.

194x186mm (300 x 300 DPI)

Figure 3. Study Timeline. D5, composite indicator of diabetes care quality. D-REM, diabetes rescue engagement and management (the study intervention). EHR, electronic health record.

253x42mm (300 x 300 DPI)

Background

Screening and Monitoring Parameters

1. Hemoglobin A1c (HbA1c) should be checked every 3 months if not at goal, every 6 months if at goal
2. Lipid panel should be checked annually
3. Kidney function (creatinine, urine albumin/creatinine ratio, potassium if treated with an ACE inhibitor or an angiotensin receptor blocker, sodium if treated with a diuretic) should be checked at least annually. More frequent monitoring required if patients have kidney disease.
4. Annual eye exam
5. Annual foot exam
6. Hypoglycemia: every patient treated with medications that place them at risk for hypoglycemia (insulin, sulfonylurea) should be screened for hypoglycemia at each visit

Optimal Diabetes Care (D5)

This is what the primary care team will consider to be "goal" for most patients with diabetes (both type 1 and type 2), as this measure is calculated and reported for all adults ages 18 through 75 years (exceptions: pregnancy, skilled nursing facility resident, enrolled in hospice). Importantly, these hemoglobin A1c (HbA1c) and blood pressure targets are the upper limits of what is acceptable and is not necessarily the evidence-based goal of therapy. Diabetes management is about a lot more than just blood sugars. It is also about blood pressure, taking a cholesterol medication, not smoking, and taking aspirin if they have heart disease. *We need to be asking patients about all these things doing our visit.*

1. HbA1c <8%
    - Evidence-based goals: <7% for most adults; <8% for adults with multiple or advanced comorbidities; goals lower than 7% may be appropriate for select patients if achieved without hypoglycemia or treatment burden.
2. BP <140/90 mmHg
    - BP <130/80 may be appropriate for patients at high risk for cardiovascular disease, if achieved without hypotension or treatment burden
3. Statin therapy for patients ≥40 years old, unless LDL-C <70 mg/dL (without history of cardiovascular disease) or LDL-C <40 mg/dL (with history of cardiovascular disease) or patient has an allergy or contraindication to a statin.
4. Nonsmoker (no tobacco use of any kind, including no chewed or vaped tobacco)
5. Aspirin use required only for patients who have existing vascular disease (cardiovascular, cerebrovascular, or peripheral vascular), unless they have an allergy or contraindication to aspirin (such as history of significant bleed).

Initial Chart Review

☐ Review most recent notes from primary care, endocrinology, pharmacy, certified diabetes care and education specialist (CDCES), dietician, and social worker as available.

- ☐ Get a sense of their healthcare utilization: emergency department visits, hospitalizations, no show rates to appointments, engagement with primary care, specialists seen.
- ☐ Diabetes history
  - Diabetes type: type 1, type 2, post-pancreatectomy or post-pancreatitis, steroid-induced, other
  - Year first diagnosed with diabetes
  - Diabetes control (most recent and trends in HbA1c over time)
- ☐ Current treatment regimen:
  - Glucose-lowering medications
  - Glucagon: yes/no, what type (injection, nasal)
    - Glucagon should be prescribed to all patients with type 1 diabetes, most patients with type 2 diabetes treated with intensive insulin therapy (multiple daily insulin injections or insulin pump).
  - Diabetes testing supplies: see what is listed in the medication list, if anything
  - Cholesterol-lowering medications
  - Blood pressure medications
  - Aspirin
- ☐ Diabetes complications (review problem list, prior hospital notes, most recent primary care H&P, most recent endocrine note if present)
  - Retinopathy or visual impairment
  - Neuropathy
  - Kidney disease
  - History of amputation, lower extremity ulcers, other lower extremity complications; note if there is an alert for an overdue foot exam
  - Heart disease (history of MI, stenting, CABG)
  - Cerebrovascular disease (history of stroke or TIA)
  - Peripheral vascular disease (mention of claudication, prior lower extremity stenting procedures, carotid artery stenting)
  - History of severe hypoglycemia (ED visit or hospitalization)
  - History of severe hyperglycemia (ED visit or hospitalization for DKA or hyperglycemic hyperosmolar state)
- ☐ Pertinent comorbidities
  - Depression
  - Anxiety
  - Substance use
  - Smoking
  - Serious mental illness (schizophrenia, bipolar disorder, etc)
  - Sleep apnea (note CPAP or BiPAP use)
  - Obesity (note BMI)
  - Dementia or other cognitive impairment
- ☐ Review the social determinants of health section for any concerns
- ☐ What are they overdue for? (review BPAs and HM module) – if overdue, would be helpful to tell them that their PCP may be contacting them to schedule these and they should do it
  - A1c should be checked every 3 months if 8% or higher, otherwise every 6 months
  - Creatinine, Cholesterol, and urine microalbumin should be checked every 12 months
  - Eye exam every year (either dilated eye exam or retinopathy photo screen)

First Visit

- ☐ Verify diabetes type and duration
- ☐ Ask about diabetes complications and their symptoms – heart disease (chest pain, shortness of breath), eye disease (blurry vision), kidney disease (verify awareness of kidney disease if present), amputation (screen for ambulation concerns and fall risk), lower extremity pain/numbness/tingling/ulcers/corn/callus (symptom screen, foot exam)
- ☐ Medication review, including screen for adherence, side effects, cost concerns, storage
- ☐ Glucose monitoring: how, how often, and when; what are the values
    - I typically ask the patient to walk me through their day to understand how diabetes fits into their life and what challenges they face
- ☐ Hypoglycemia – how often, when, how severe (level 1: glucose <70, level 2: glucose <54, level 3/severe: any glucose when another person had to help the patient be treated). Ask about the circumstances these happened in, how the patient treated them, what they learned for the future to avoid having future hypoglycemia
- ☐ If they endorse severe hypoglycemia (hypo that required another person to help treat), have type 1 diabetes, or are treated with an insulin pump or 4 injections of insulin per day, they should have glucagon. Glucagon expires after 1-2 years, depending on the specific type, so check the expiration date.
- ☐ If treated with insulin, ask if they take the same doses of insulin every time or if they vary it based on either their blood sugar or their meal or some other factor. If they have a correction scale or sliding scale, ask to see it and make sure they are doing what it says. If they vary the insulin dose without specific instructions to do so, note that it may be dangerous and they should talk to their PCP/endocrinologist about it. Document what they are actually doing to discuss with PCP/endocrinologist after the visit.
- ☐ Ask about meals – who cooks them, what kinds of food, how often, food insecurity
- ☐ Make sure they have a fridge to store their insulin (if insulin treated) and food
- ☐ Ask about financial barriers to medications, testing supplies, insulin administration supplies; rationing of insulin or medications or food.
- ☐ Physical activity and exercise

On physical exam, key areas to look at are:

1. Sites of insulin/GLP-1 receptor agonist (the non-insulin injectable diabetes medication) administration to see if there are many bruises or hardened areas where they keep injecting the insulin; counsel to inject in a different site every time (M or W method)
2. If they have a device (pump or CGM), look at the site where it is inserted and assess for irritation or other problems at the insertion site
3. Feet: edema, venous insufficiency, skin breakdown, ulcerations, callus formation, or Charcot joint deformity. Microfilament exam (if not done within the last year per).
4. Comorbidity-specific: lung exam with heart failure and lung disease; heart exam with any cardiovascular disease.
5. Screen for depression with PHQ-2:

Return Visits

- Create care plan during the first visit together with the patient (SMART goals)
- Cadence and type (in person, video, or phone) to be determined based on patient's need

- At each visit, set at least one goal to be achieved prior to the next visit
- Expectation of at least 4 visits with the patient over the course of the month

Charting

1. Create a community paramedic external outreach encounter
2. Use the CPDIABETIC smart phrase and follow general documentation best practices
3. Route each note to medical director, primary care physician, and any other diabetes provider (endocrinology, CDCES, pharmacist, dietician) as appropriate. Note should include details on glucose levels, barriers to care, recommendations to patient, requests/recommendations to the clinical team.

Patient Resources

- Use relevant patient education materials from Mayo Clinic Patient Education
- Medication cost assistance resources (savings cards, patient assistance programs)
- Community resources: Aunt Bertha, county social services

Mayo Clinic: Office for Human Research Protection

Oral Consent Script

Protocol Title: Community Paramedicine Program to Improve Diabetes Care Quality, Equity, and Outcomes
IRB #: 20-001011
Principal Investigator: Rozalina McCoy, MD, MS

You are being asked to participate in a research study about a home-based diabetes management and support program offered to patients with diabetes. You are being invited to participate in this study because you have diabetes with elevated hemoglobin A1c, and have had an emergency department visit or hospitalization within the last six months.

The goal of this research study is to learn about how our patients manage their diabetes, what challenges they face as they live with diabetes, and how community paramedics can help patients like you manage their diabetes.

If you agree to participate, you will be connected with a community paramedic to enroll in a program designed to support patients with diabetes. As part of this program, a community paramedic will follow-up with you in person and/or by phone over the course of the next month. We estimate an average of two one-hour in-person visits and two 30-minute phone visits; however, you may receive more or less depending on your individual desire and need. The community paramedic will work with you to help manage your diabetes, improve your health, and connect you with any additional resources that may be needed. The community paramedics will document these clinical encounters in your medical record.

Additionally, you will be asked to complete three questionnaires over the course of four months: (1) right now, (2) at the time that you complete the program, and (3) in about four months. We anticipate these will take about 15 minutes of your time to complete. Your medical record will be accessed to collect information regarding your history with diabetes and basic demographic information (age, sex, etc.). All information that is collected during this study will be stored in a locked file cabinet and on a secure, password-protected computer. You and/or your insurance will be responsible for covering the cost of any tests or procedures that are ordered as part of your clinical care through your participation in this program. You will not receive remuneration for your participation, but the in-person and phone visit portions of this program will be offered at no cost to you.

If you decide to participate, you will need to read and sign the Authorization to Use and Disclose Protected Health Information (HIPAA) form and return it with the first questionnaire. You may choose to have the HIPAA sent to you electronically or by mail for review and signature. We are not allowed to use the answers without your signature on the HIPAA form. An extra copy will be included for your records. Once your signed authorization (HIPAA) form has been signed and returned, a member of our study team will forward your information to a community paramedic to start your enrollment into the program.

The risks associated with the research study are minimal, which means that we do not believe that they will be any different than what you would experience at a routine clinical visit or during your daily life. You may choose not to answer any questions that make you feel uncomfortable.

This study will not make your health better. It is for the benefit of research. Information we will learn from this study will help us further develop the community paramedicine program and make it available to more patients across Minnesota.

Your information collected as a part of this research could be used for future research or distributed to another investigator for future research without additional informed consent from you, only after information that identifies you is removed.

Please understand your participation is voluntary and you have the right to withdraw your consent or discontinue participation at any time without penalty. Specifically, your current or future medical care at the Mayo Clinic or Mayo Clinic Health System will not be jeopardized if you choose not to participate.

If you have any questions about this research study you can contact Danielle Bostrom at 507-538-6911. If you have any concerns, complaints, or general questions about research or your rights as a participant, please contact the Mayo Institutional Review Board (IRB) to speak to someone independent of the research team at 507-266-4000 or toll free at 866-273-4681.

Reporting checklist for protocol of a clinical trial.

Based on the SPIRIT guidelines.

Instructions to authors

Complete this checklist by entering the page numbers from your manuscript where readers will find each of the items listed below.

Your article may not currently address all the items on the checklist. Please modify your text to include the missing information. If you are certain that an item does not apply, please write "n/a" and provide a short explanation.

Upload your completed checklist as an extra file when you submit to a journal.

In your methods section, say that you used the SPIRITreporting guidelines, and cite them as:

Chan A-W, Tetzlaff JM, Gøtzsche PC, Altman DG, Mann H, Berlin J, Dickersin K, Hróbjartsson A, Schulz KF, Parulekar WR, Krleža-Jerić K, Laupacis A, Moher D. SPIRIT 2013 Explanation and Elaboration: Guidance for protocols of clinical trials. BMJ. 2013;346:e7586

		Reporting Item	Page Number
Administrative information			
Title	#1	Descriptive title identifying the study design, population, interventions, and, if applicable, trial acronym	1
Trial registration	#2a	Trial identifier and registry name. If not yet registered, name of intended registry	3
Trial registration: data set	#2b	All items from the World Health Organization Trial Registration Data Set	n/a
Protocol version	#3	Date and version identifier	n/a
Funding	#4	Sources and types of financial, material, and other support	15
Roles and responsibilities: contributorship	#5a	Names, affiliations, and roles of protocol contributors	1, 15
Roles and responsibilities: sponsor contact information	#5b	Name and contact information for the trial sponsor	15

Roles and responsibilities: sponsor and funder	#5c	Role of study sponsor and funders, if any, in study design; collection, management, analysis, and interpretation of data; writing of the report; and the decision to submit the report for publication, including whether they will have ultimate authority over any of these activities	15
Roles and responsibilities: committees	#5d	Composition, roles, and responsibilities of the coordinating centre, steering committee, endpoint adjudication committee, data management team, and other individuals or groups overseeing the trial, if applicable (see Item 21a for data monitoring committee)	n/a
Introduction			
Background and rationale	#6a	Description of research question and justification for undertaking the trial, including summary of relevant studies (published and unpublished) examining benefits and harms for each intervention	4
Background and rationale: choice of comparators	#6b	Explanation for choice of comparators	4-5
Objectives	#7	Specific objectives or hypotheses	5
Trial design	#8	Description of trial design including type of trial (eg, parallel group, crossover, factorial, single group), allocation ratio, and framework (eg, superiority, equivalence, non-inferiority, exploratory)	5
Methods: Participants, interventions, and outcomes			
Study setting	#9	Description of study settings (eg, community clinic, academic hospital) and list of countries where data will be collected. Reference to where list of study sites can be obtained	5-6
Eligibility criteria	#10	Inclusion and exclusion criteria for participants. If applicable, eligibility criteria for study centres and individuals who will perform the interventions (eg, surgeons, psychotherapists)	6-7
Interventions: description	#11a	Interventions for each group with sufficient detail to allow replication, including how and when they will be administered	7-10; figure 1
Interventions: modifications	#11b	Criteria for discontinuing or modifying allocated interventions for a given trial participant (eg, drug dose change in response to harms, participant request, or improving / worsening disease)	n/a
Interventions: adherance	#11c	Strategies to improve adherence to intervention protocols, and any procedures for monitoring adherence (eg, drug tablet return; laboratory tests)	n/a

Interventions: concomitant care	#11d	Relevant concomitant care and interventions that are permitted or prohibited during the trial	n/a
Outcomes	#12	Primary, secondary, and other outcomes, including the specific measurement variable (eg, systolic blood pressure), analysis metric (eg, change from baseline, final value, time to event), method of aggregation (eg, median, proportion), and time point for each outcome. Explanation of the clinical relevance of chosen efficacy and harm outcomes is strongly recommended	10-11
Participant timeline	#13	Time schedule of enrolment, interventions (including any run-ins and washouts), assessments, and visits for participants. A schematic diagram is highly recommended (see Figure)	10-11; figure 2
Sample size	#14	Estimated number of participants needed to achieve study objectives and how it was determined, including clinical and statistical assumptions supporting any sample size calculations	12
Recruitment	#15	Strategies for achieving adequate participant enrolment to reach target sample size	12
Methods: Assignment of interventions (for controlled trials)			
Allocation: sequence generation	#16a	Method of generating the allocation sequence (eg, computer-generated random numbers), and list of any factors for stratification. To reduce predictability of a random sequence, details of any planned restriction (eg, blocking) should be provided in a separate document that is unavailable to those who enrol participants or assign interventions	n/a
Allocation concealment mechanism	#16b	Mechanism of implementing the allocation sequence (eg, central telephone; sequentially numbered, opaque, sealed envelopes), describing any steps to conceal the sequence until interventions are assigned	n/a
Allocation: implementation	#16c	Who will generate the allocation sequence, who will enrol participants, and who will assign participants to interventions	n/a
Blinding (masking)	#17a	Who will be blinded after assignment to interventions (eg, trial participants, care providers, outcome assessors, data analysts), and how	n/a
Blinding (masking): emergency unblinding	#17b	If blinded, circumstances under which unblinding is permissible, and procedure for revealing a participant's allocated intervention during the trial	n/a
Methods: Data collection, management, and analysis			

Data collection plan	#18a	Plans for assessment and collection of outcome, baseline, and other trial data, including any related processes to promote data quality (eg, duplicate measurements, training of assessors) and a description of study instruments (eg, questionnaires, laboratory tests) along with their reliability and validity, if known. Reference to where data collection forms can be found, if not in the protocol	10-11
Data collection plan: retention	#18b	Plans to promote participant retention and complete follow-up, including list of any outcome data to be collected for participants who discontinue or deviate from intervention protocols	10-11
Data management	#19	Plans for data entry, coding, security, and storage, including any related processes to promote data quality (eg, double data entry; range checks for data values). Reference to where details of data management procedures can be found, if not in the protocol	13
Statistics: outcomes	#20a	Statistical methods for analysing primary and secondary outcomes. Reference to where other details of the statistical analysis plan can be found, if not in the protocol	12-13
Statistics: additional analyses	#20b	Methods for any additional analyses (eg, subgroup and adjusted analyses)	n/a
Statistics: analysis population and missing data	#20c	Definition of analysis population relating to protocol non-adherence (eg, as randomised analysis), and any statistical methods to handle missing data (eg, multiple imputation)	n/a
Methods: Monitoring			
Data monitoring: formal committee	#21a	Composition of data monitoring committee (DMC); summary of its role and reporting structure; statement of whether it is independent from the sponsor and competing interests; and reference to where further details about its charter can be found, if not in the protocol. Alternatively, an explanation of why a DMC is not needed	n/a
Data monitoring: interim analysis	#21b	Description of any interim analyses and stopping guidelines, including who will have access to these interim results and make the final decision to terminate the trial	n/a
Harms	#22	Plans for collecting, assessing, reporting, and managing solicited and spontaneously reported adverse events and other unintended effects of trial interventions or trial conduct	n/a
Auditing	#23	Frequency and procedures for auditing trial conduct, if any, and whether the process will be independent from investigators and the sponsor	n/a
Ethics and dissemination			

Research ethics approval	#24	Plans for seeking research ethics committee / institutional review board (REC / IRB) approval	13
Protocol amendments	#25	Plans for communicating important protocol modifications (eg, changes to eligibility criteria, outcomes, analyses) to relevant parties (eg, investigators, REC / IRBs, trial participants, trial registries, journals, regulators)	13
Consent or assent	#26a	Who will obtain informed consent or assent from potential trial participants or authorised surrogates, and how (see Item 32)	13-14
Consent or assent: ancillary studies	#26b	Additional consent provisions for collection and use of participant data and biological specimens in ancillary studies, if applicable	n/a
Confidentiality	#27	How personal information about potential and enrolled participants will be collected, shared, and maintained in order to protect confidentiality before, during, and after the trial	13-14
Declaration of interests	#28	Financial and other competing interests for principal investigators for the overall trial and each study site	15
Data access	#29	Statement of who will have access to the final trial dataset, and disclosure of contractual agreements that limit such access for investigators	15
Ancillary and post trial care	#30	Provisions, if any, for ancillary and post-trial care, and for compensation to those who suffer harm from trial participation	n/a
Dissemination policy: trial results	#31a	Plans for investigators and sponsor to communicate trial results to participants, healthcare professionals, the public, and other relevant groups (eg, via publication, reporting in results databases, or other data sharing arrangements), including any publication restrictions	14
Dissemination policy: authorship	#31b	Authorship eligibility guidelines and any intended use of professional writers	n/a
Dissemination policy: reproducible research	#31c	Plans, if any, for granting public access to the full protocol, participant-level dataset, and statistical code	n/a
Appendices			
Informed consent materials	#32	Model consent form and other related documentation given to participants and authorised surrogates	n/a
Biological specimens	#33	Plans for collection, laboratory evaluation, and storage of biological specimens for genetic or molecular analysis in the current trial and for future use in ancillary studies, if applicable	n/a