Pilot and Feasibility Studies

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Feasibility and acceptability of a pilot randomized trial of a single session of imagery rescripting targeting the primary consequences of negative experiences with eating and appearance

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Abstract

Background Negative experiences related to eating and appearance (NEREAs), such as critical commentary from parents about food, are common and associated with depression and disordered eating. Imagery rescripting (IR) is a therapeutic process during which individuals are guided through recalling and bringing support into distressing memories, like NEREAs. Single sessions of IR demonstrate promise in shifting the primary negative consequences of NEREAs in clinical samples of women. The primary objectives of this pilot trial were to evaluate the feasibility and acceptability of a remote-delivered, single session of IR and a nutrition education control group in a community sample of adults with NEREAs.

Methods In this parallel two-arm pilot trial, participants completed an in-person baseline visit, one remote-delivered, single-session intervention (IR or attention-matched nutrition education control), and in-person 1- and 3-month follow-up visits between February 2023 and April 2024 in Oregon, USA. Markers of feasibility included recruitment, visit and survey completion rates, and intervention fidelity; acceptability was evaluated using participant feedback and instances of adverse events.

Results One hundred one adults completed a phone screen; 96% reported at least one NEREA. Most of these adults were ineligible because they met psychiatric disorder criteria and/or were taking medication known to influence mood and/or appetite. Thirty-two participants completed a baseline study visit; 89% of these participants ($N = 27$; mean age [SD] = 32.52 [15.78], range = 18–73; 56% cisgender women; 74.1% non-Hispanic White, 14.8% Asian, 11.1% Hispanic/Latine, 7.4% Black, and 3.7% multiracial) were randomly assigned (using a random number generator) to and completed an intervention condition (13 IR, 14 control). Curriculum adherence, on average, was 94% for IR and 97% for control. One-month retention was 82%, and 3-month retention was 59%. Post-intervention ratings indicated good acceptability for both arms. No adverse events occurred.

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Conclusions The delivered interventions are feasible and acceptable to a community sample of men and women; as such, a future definitive trial is recommended. Additional strategies for increasing retention are needed. Single-session interventions, like IR, have the potential for high impact and reach. They are inherently flexible and cost-effective interventions that can be delivered across systems of care, while remote delivery mitigates concerns with stigma and access.

Trial registration ClinicalTrial.gov, NCT06610318. Registered on 23 September 2024—retrospectively registered.

Keywords Imagery rescripting, Single session, Eating, Food, Appearance, Weight, Non-clinical, Community

Key messages regarding feasibility

1) What uncertainties existed regarding the feasibility? It was unclear whether a clinical protocol, like imagery rescripting, could be applied to negative experiences related to eating and/or appearance, and whether such an intervention would be feasible with and acceptable to a non-clinical sample of men and women. It was also unknown whether these individuals would have a delivery modality preference and what their opinions were regarding the importance of gender and racial matching with interventionists.

2) What are the key feasibility findings? Data from this study suggest that the recruitment, enrollment, and intervention engagement of a non-clinical sample of men and women were feasible. Data collection was also feasible, as evidenced by minimal missing data. Fidelity ratings were very high, providing evidence for the feasibility of training interventionists to deliver intervention content as intended. Feasibility for participant retention declined over time, highlighting the need for additional strategies to improve engagement for lengthier follow-up evaluations, particularly for adults currently enrolled in school.

3) What are the implications of the feasibility findings for the design of the main study? Feasibility data from the current study support the implementation of a fully powered clinical trial to evaluate the efficacy of a remote-delivered imagery rescripting session on the depressive symptoms and disordered eating of a community sample of adult men and women with a history of negative experiences related to eating and/or appearance. Specific strategies for retaining participants for long-term follow-ups need to be identified and implemented, and recruitment efforts should focus on engaging more diverse samples in terms of race, ethnicity, and gender.

Background

Negative experiences related to eating and appearance (NEREAs), such as parents' critical commentary about eating habits and weight-related teasing, are common and closely related to health. Approximately 37–61% of children and 40% of adults [1–3] report experiencing various forms of NEREAs, and these experiences are related to increased risk for chronic diseases [4, 5], psychiatric morbidity [6], and premature mortality [7]. NEREAs are thought to increase the risk for disease and mortality, in part, through their close connections with depressive symptoms and disordered eating behaviors. Critical commentary related to weight and eating, for example, is related to higher depressive symptoms, including suicidal ideation [8–16], as well as more frequent engagement in disordered eating behaviors, including emotional and binge eating [12, 14, 17–22]. Nearly all of these studies adjusted for body mass index (BMI), indicating that links with health and health behaviors are independent of any potential biological contributions of adiposity [23, 24].

According to cognitive theory [25], pathological behaviors and psychological symptoms, including depressive symptoms and disordered eating, are maintained by maladaptive cognitive schemas. Negative early life events, such as NEREAs, contribute to the development of dysfunctional core schemas or beliefs about the self and others. When these schemas are made salient, an individual experiences attention biases for threatening cues, which leads to maladaptive behaviors and psychological symptoms that ultimately serve to reinforce core schemas. For instance, early experiences with weight-related teasing contribute to the development of schemas related to feeling unattractive in a larger body [26]. When these schemas are activated, perhaps upon hearing a negative weight-related comment from a family member, various attention biases ensue in which a person, for example, becomes rigidly attentive to their self-defined "unattractive" body parts [27]. These beliefs and biases serve to reinforce negative affect, like depressed mood, and associated maladaptive behaviors, such as restrictive dieting to lose weight and binge eating in response to restriction [26, 28]. A similar pattern occurs in response to negative experiences with eating. For example, children who receive critical comments from their parents related to consuming too much food may develop core schemas related to insufficient self-control, which contributes to binge eating [29, 30]. Ultimately, maladaptive core schemas related to eating and appearance serve to reinforce

the primary pathological symptoms and behaviors associated with NEREAs. Indeed, there is now substantial evidence for the role of maladaptive cognitive schemas in the onset and maintenance of depressive symptoms [31] and disordered eating [30, 32–34].

Imagery rescripting (IR) is a brief intervention that aims to modify an individual's maladaptive core schemas through short visualization exercises [35]. Specifically, IR asks an individual to recall distressing memories in detail and then to modify the meaning of these recollections with a brief intervention, most commonly by inserting a compassionate adult's perspective and support [36]. Through modifying the meaning of episodic memories, recollections of difficult early events no longer function to reinforce existing maladaptive core schemas. In this way, IR is thought to more deeply shift the core schemas underlying pathological symptoms and behaviors than present-focused cognitive therapies [33]. For instance, if an individual's recollection of early experiences with weight-related teasing moves away from beliefs related to being inferior and more towards self-compassionate beliefs related to Western culture's unhealthy emphasis on the thin ideal, these shifts are thought to improve core schemas, modify corresponding attention biases, and reduce associated symptoms such as depressed affect and disordered eating.

Historically, IR has been used as an adjunct to cognitive therapy and has been found to shift core cognitive schemas and reduce psychological symptoms in patients with a variety of diagnoses, including depression and post-traumatic stress disorder, among others; however, recent data indicate that IR can be used as a brief, stand-alone treatment with comparable or better outcomes than multi-session cognitive therapy approaches [37–43]. In fact, preliminary data suggest that a single session of IR is effective in shifting the core schemas of adults with binge eating disorder [44], reducing binge eating among women with bulimia nervosa [45, 46], and decreasing rigid dietary restriction in women with high body image concerns [47]. Despite the clear promise of a single session of IR in targeting the primary mechanism linking NEREAs with depressive symptoms and disordered eating, such an approach has not been evaluated in a non-clinical sample of adults. Given the prevalence of NEREAs [1, 2], community samples of adults are likely to benefit from brief intervention, even in the absence of a psychiatric disorder. Men have also largely been absent from clinical research targeting disordered eating [48], so it remains unknown whether this population would engage with and benefit from IR [33]. Extant trials of IR have also not included a number of outcomes related to NEREAs, including overeating and emotional eating [49–54]. With additional research in community-based samples, IR may represent a high-impact, low-resource intervention for the substantial number of men and women who have been and continue to be negatively affected by NEREAs.

To that end, the aim of the current study was to evaluate the feasibility and acceptability of a single session of IR, an active comparison group, and associated recruitment and data collection methods in a community-based sample of adults with a history of at least one NEREA. Indicators of feasibility included recruitment and enrollment numbers, retention across 1- and 3-month study visits, intervention fidelity, and data collection completeness. Indicators of acceptability included participant feedback on the intervention arms and the occurrence of adverse events. Ultimately, these data will assist in determining whether a definitive randomized controlled efficacy trial to evaluate the effects of a single session of IR on the primary psychological and behavioral symptoms associated with NEREAs, including depressive symptoms and disordered eating, is supported.

Methods

Design and procedures

The current study used a randomized controlled trial design in which participants were randomly assigned to one of two conditions: (1) IR or (2) active control (nutrition education). Eligible participants were block-randomized by sex assigned at birth and BMI (< or ≥ 30 kg/m^2, or 27 kg/m^2 for Asians and Asian Americans) [55]. The study coordinator (author KJD) used an online random number generator to prepopulate a random list of 1 s (IR) and 2 s (control). Numbers were generated separately by sex and BMI to ensure equal random assignment by these factors. The study coordinator was responsible for storing this information in a password-protected file, thereby concealing the sequence from interventionists and research staff. The coordinator also assigned participants to an intervention arm after they provided consent and were determined to be eligible. Over the course of the study, participants completed four visits and were compensated by cash or electronic gift cards accordingly: an in-person baseline visit ($80), a remote-delivered intervention session ($40), an in-person 1-month follow-up visit ($40), and an in-person 3-month follow-up visit ($60). For participants who attended the baseline visit and were determined to be ineligible, they were compensated for their time at a rate of $20 per hour. All participants provided written informed consent and all procedures were approved by the University of Oregon's Institutional Review Board (STUDY00000592).

Participants and procedures

To be eligible for the current study, participants had to be ≥18 years old and endorse a history of at least one NEREA. Individuals were ineligible if they (1) endorsed a current major medical condition; (2) met criteria for a full threshold psychiatric disorder (of moderate intensity when severity ratings are necessary, such as for substance use disorders and binge eating disorder); (3) were at high risk for suicide; (4) endorsed current or recent pregnancy or anticipated becoming pregnant within the next year; (5) were taking medication known to affect eating, weight, and/or chronic disease risk; (6) were participating in eating, weight, or diabetes programming; (7) experienced weight loss >10% in the past six months; and/or (8) could not complete study procedures in English. Exclusions related to medication and programming were implemented to avoid introducing confounds related to the outcomes of interest. These active interventions may interfere with potential changes in mood or eating that might otherwise be observed following the intervention conditions being piloted in the current study.

Participants were recruited primarily through mass mailings to adults in Eugene and Springfield, Oregon, USA. Advertisements were also posted on online platforms and at community organizations. A phone screen was used to provide interested individuals with details about the study and to determine preliminary eligibility. If individuals met initial eligibility criteria, they were scheduled for their baseline visit. A medical history and psychiatric interview [56] during the baseline visit were used to confirm study eligibility. Height and weight were also collected using a digital scale and a stadiometer, respectively, to calculate BMI. Waist circumference was also measured and various surveys were completed at all study visits. Baseline, 1-month, and 3-month study visits started between 9 A.M. and 9:30 A.M. Participants were instructed to consume their normal breakfast, as well as any vitamins or prescription medications, before arriving at their visits to standardize satiety. Participants were offered a snack (i.e., snack bars including nut-free options) during all study visits that were over 2-h long.

Intervention and control conditions

Intervention (IR) and control (nutrition education) conditions occurred within 2 weeks of the participants' baseline visit and were delivered remotely via HIPAA-compliant Zoom. Both conditions were facilitated by doctoral students in counseling psychology (including author BS) under the supervision of a licensed psychologist (author NK). All intervention sessions were recorded to assist with training/supervision and to facilitate evaluations of fidelity. Interventionist training included reviewing detailed manuals with scripts and practicing protocol administration with one another and the supervising psychologist. The supervising psychologist also reviewed recordings of the first several sessions and provided interventionists with detailed feedback. Intervention protocols are available from the corresponding author upon request.

IR condition

Procedures for this condition closely mirror prior studies in which a single session of IR was used as a standalone treatment [44, 47, 57, 58]. Interventionists led participants through three stages. In the first stage, participants were asked to select their most distressing memory related to their appearance. Examples were provided to help participants select their most salient memory. They were instructed, explicitly, not to select examples of physical or sexual trauma. They were then asked to imagine or visualize the selected memory, in detail, as if it were happening to them again, in the present moment. Questions were asked to engage all senses during this memory recall, including emotional experiences and physical sensations. After a memory was recalled and reimagined, interventionists used a downward arrow technique to identify two to three maladaptive core schemas. This entails the repeated use of questions such as "and what does that say about you/the world/others?" In the second stage, participants were asked to identify a real or imagined trusted adult. Then, they were asked to imagine what their younger self might need to cope with or feel calmer in the situation of their selected memory. Interventionists provided examples to help them brainstorm (e.g., a hug, reassurance, standing up for them, removing them from the situation). In the third and final stage, the participant was instructed to imagine asking the trusted adult for what they needed. Then, they were prompted to imagine the trusted adult providing their selected interventions and describe how they felt afterward. These procedures were then repeated with participants' most distressing memory related to eating.

Control condition

The active control condition consisted of a time- and attention-matched general nutrition education session. The curriculum for this intervention included information from the United States Department of Agriculture's Dietary Guidelines (e.g., food labels, describing the benefits of macronutrients) [59]. This control group approach was selected for several reasons. First, controlling for the therapeutic benefits of time and attention maximizes internal validity [60]. Second, providing dietary counseling is a common, albeit unsolicited, approach

to engaging with adults who are at high risk for NEREAs because of their larger body size [61, 62], making this a realistic comparator. Third, this approach allowed us to frame the current study as a "health intervention study" with two conditions to maintain interventionists' and participants' expectations and engagement [63, 64].

Measures

Feasibility

Feasibility outcomes included recruitment and enrollment numbers, retention across study 1- and 3-month visits, intervention fidelity, and data collection completeness. At baseline, 1-month, and 3-month follow-up visits, surveys were administered online using Qualtrics and assessed constructs of interest for a larger clinical trial. Depressive symptoms were assessed with the Center for Epidemiologic Studies Depression [65]. Emotional eating was examined with the Dutch Eating Behavior Questionnaire [66]. Rigid dietary restraint and binge eating were measured with the Eating Disorder Examination Questionnaire [67]. State affect was collected before and after the intervention conditions using the positive and negative affect schedule [68]. As outlined above, two to three maladaptive core schemas were identified among participants in the IR condition. These participants were also asked to rate to what extent they agreed with each schema, rationally and emotionally, on a scale from 0 (not at all) to 100 (extremely). These data were not gathered from participants in the control condition because to do so would introduce a significant therapeutic confound.

Acceptability

Acceptability across multiple domains [60] was evaluated using a brief survey administered to participants in both conditions at the 1-month follow-up visit (see Fig. 1 for items). This survey included items asking about preferences for gender and racial matching with the interventionist, as well as preferences for remote versus in-person delivery. The occurrence of adverse events was also tracked as a second indicator of acceptability.

Sample size justification

Given the current pilot study's emphasis on investigating feasibility and acceptability, a formal sample size calculation was not performed. An enrollment goal of 24 (12 per arm) was selected based on published recommendations that suggest 12 participants per group is sufficient for evaluating feasibility [69, 70]. This sample size was also necessitated by unanticipated resource limitations, delays, and staff retraining needs caused by the COVID-19 pandemic.

Statistical analyses

Indicators of feasibility and acceptability were operationalized with frequency counts, percentage calculations, and other descriptive statistics. Acceptability survey scores are presented as condition means and mean condition differences. Precision of acceptability scores and sample retention is reported as 95% confidence intervals. Narrative descriptions of results are also provided. The statistical significance of mean group differences in survey results was not analyzed because the study's sample size was selected to investigate feasibility and, as a result, did not permit well-powered significance testing [71].

Results

Feasibility

Figure 2 CONSORT Diagram outlines recruitment and enrollment numbers. Between February 2023 and April 2024, 101 individuals were screened for the current

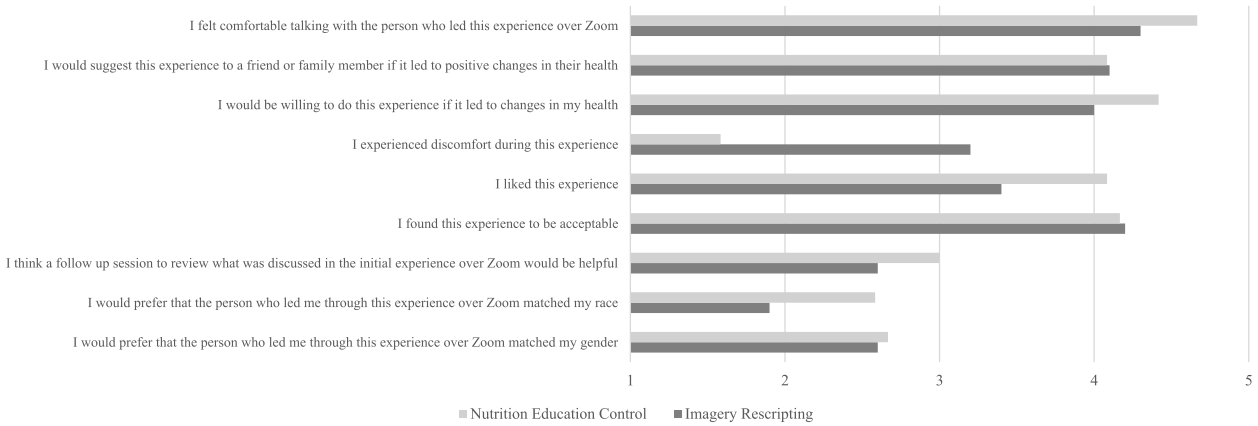

Fig. 1 Acceptability ratings by condition. Legend. For all acceptability survey items, participants were given the following instructions: "During your last visit, you spent one or two hours either talking about memories related to food/your body or reviewed nutrition information. The following questions ask about those 1-2 hours only, NOT the rest of the time you have been in the study." Responses were on a five-point Likert-type scale from 1 (strongly disagree) to 5 (strongly agree)

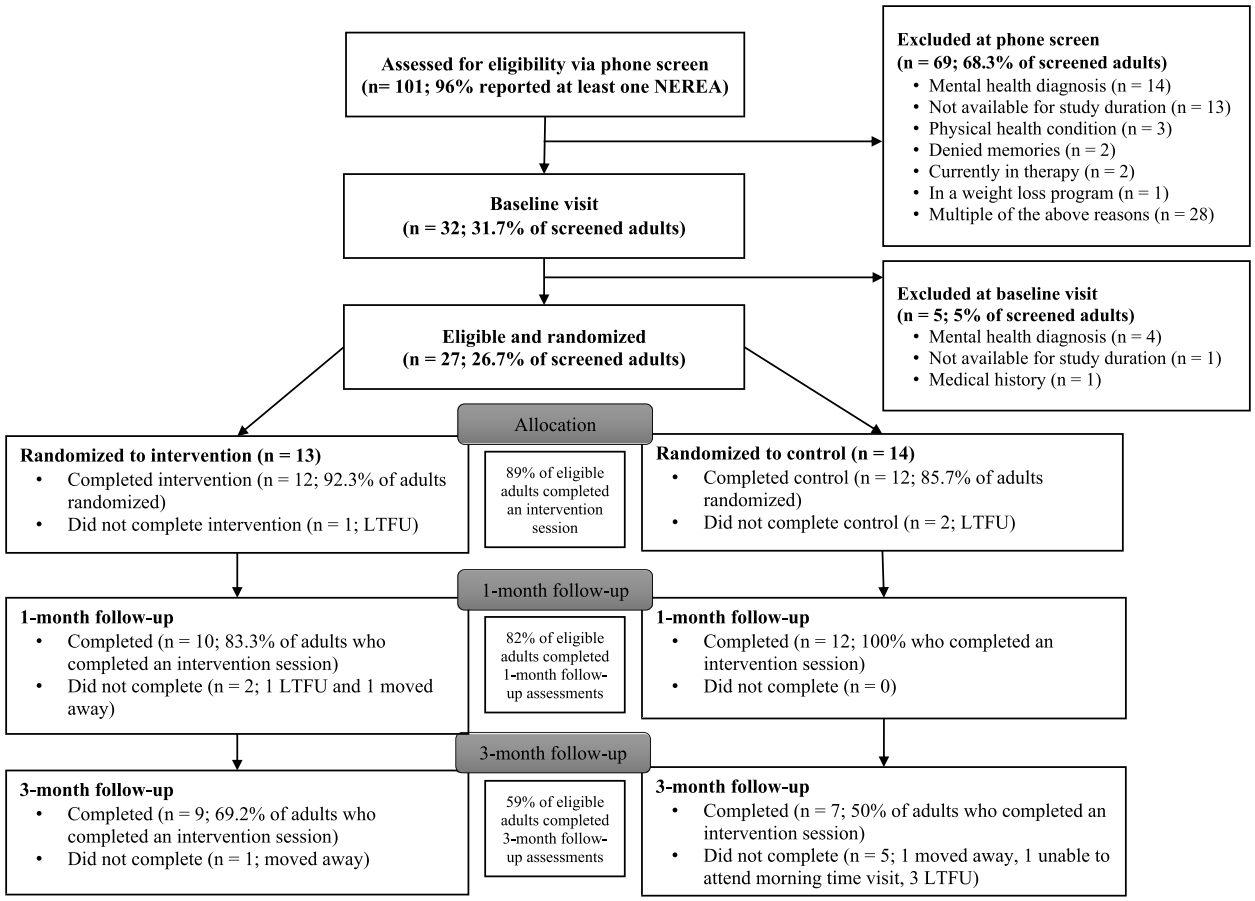

Fig. 2 CONSORT diagram

study. About 96% of adults (97/101) who completed a phone screen for the pilot trial also reported a history of at least one NEREA. Most of these individuals (68.3%, 69/101) were ultimately determined to be ineligible due to a combination of reasons, particularly having a current psychiatric diagnosis, medication use known to influence the primary outcomes of interest, and being unavailable for the duration of the study. An additional five participants (5%, 5/101) were determined to be ineligible during the baseline study visit. A total of 27 adults were eligible and randomized to an intervention condition (see Table 1 for detailed demographic and descriptive information on the full sample and by condition). Enrollment was slightly above the targeted sample size to accommodate adults who had already contacted the study team expressing their interest in participating. The pilot trial was stopped after enrollment goals were met.

Regarding retention, approximately 89% (24/27; 95% CI [71%, 98%]) of participants who provided baseline data attended an intervention session (IR: 92%, 12/13, control: 86%, 12/14 control; see Table 1 for demographic details by condition). IR sessions lasted, on average, 88.5 minutes (range 59 to 127 min). Nutrition education sessions were completed, on average, in 51 minutes (range 39 to 78 min). About 82% (22/27; 95% CI [62%, 94%]) of enrolled participants were retained at 1 month and 59% (16/27; 95% CI [39%, 78%]) were retained at 3 months.

Regarding fidelity, recordings from a random 50% of sessions across both conditions were reviewed by research staff with content checklists. Four different interventionists demonstrated strong adherence to the IR manual with 94% of content covered (range 89–100%). Adherence to the control condition protocol was also strong (97%, on average, range 94–99%).

Missing data across all study measures were minimal. At the item level, one item was missing one value (4%) and one item was missing three values (11%).

Acceptability

Acceptability was generally high. As detailed in Fig. 1, ratings of acceptability, liking, comfort with their interventionist, willingness to recommend the intervention to others, and willingness to engage were, on average, above 4 (on a scale of 1 to 5) for both conditions. Table 2

Table 1 Participant demographics and descriptive statistics for the full sample and by condition

		Full Sample	Imagery Rescripting	Nutrition Education Control
n		**27**	**13**	**14**
Age				
	M age	32.52	33.54	31.57
	SD age	16.08	19.39	12.97
	Range	18–73	18–73	20–57
Gender n (%)				
	Cisgender men	12 (44.4%)	5 (38.5%)	7 (50.0%)
	Cisgender women	15 (55.6%)	8 (61.5%)	7 (50.0%)
Race n (%)				
	Black	2 (7.4%)	1 (7.7%)	1 (7.1%)
	White	20 (74.1%)	9 (69.2%)	11 (78.6%)
	Asian	4 (14.8%)	2 (15.4%)	2 (14.3%)
	Other	1 (3.7%)	1 (7.7%)	0 (0%)
Ethnicity n (%)				
	Hispanic	3 (11.1%)	2 (15.4%)	1 (7.1%)
	Non-Hispanic	24 (88.9%)	11 (84.6%)	13 (92.89%)
BMI* n (%)				
	High	10 (37.4%)	5 (38.5%)	5 (35.7%)
	Low	17 (63.0%)	8 (61.5%)	9 (64.3%)
Depressive Symptoms				
	Baseline M(SD), range	9.54(6.70), 0–31	8.62(4.84), 2–18	10.46(8.26), 0–31
	Post M(SD), range	14.32(11.55), 1–41	16.50(13.52), 3–41	12.50(9.86), 1–35
Emotional Eating				
	Baseline M(SD), range	25.91(10.10), 13–45	27.42(10.84), 13–45	24.27(9.47), 13–44
	Post M(SD), range	28.05(11.35), 12–51	30.90(13.70), 15–51	25.67(8.89), 12–42
Rigid Dietary Restraint				
	Baseline M(SD), range	1.28(1.41), 0–5.20	1.51(1.60), 0–5.20	1.05(1.20), 0–4.20
	Post M(SD), range	1.53(1.55), 0–6.00	2.14(1.92), 0–6.00	1.02(0.98), 0–3.00

BMI Body mass index

*BMI cut offs: "High" = BMI ≥ 30 kg/m^2 or ≥ 27.5 kg/m^2 for Asian/Asian American participants

presents mean group difference values and their corresponding 95% confidence intervals.

On average, participants felt *neutral* about or *disagreed* with the need for matching based on race or gender with their interventionist. Approximately 27.2% (6/22) of participants reported that they *agreed* or *strongly agreed* with a preference for gender matching; two-thirds of these participants were in the IR condition. Only one person *agreed* or *strongly* agreed that racial matching was their preference; this person was in the control condition. Approximately 77.3% (17/22) indicated that they had no preference when it came to remote versus in-person intervention delivery, 13.6% (3/22) preferred in-person delivery, and 9.1% (2/22) preferred delivery over Zoom. These numbers were similar across conditions. When asked whether a follow-up session would be helpful, 22.7% (5/22) agreed, 45.5% (10/22) were neutral, and the remaining 31.8% (7/22) either *disagreed* or *strongly disagreed*. These numbers were also similar across conditions. Finally, there were no adverse events experienced by any participants in either of the interventions.

Discussion

Data from the current pilot study generally support the feasibility and acceptability of a randomized clinical trial including a remote-delivered, single session of IR and an active, time- and attention-matched control condition in a community or non-clinical sample of cisgender men and women with a history of NEREAs. In light of these findings, as well as the transdiagnostic benefits of IR [37–43] and the growing support for single sessions of this therapeutic approach [44–47], a well-powered efficacy trial with this population is warranted. Several findings from the current study offer important insights into designing and implementing such a trial.

Table 2 Mean differences and corresponding confidence intervals for the acceptability survey items by condition

		95% Confidence Interval of the Difference	
Acceptability Survey Items	Mean Difference	Lower	Upper
I found this experience to be acceptable.	0.03	− 0.57	0.64
I would be willing to do this experience if it led to changes in my health.	− 0.42	− 1.08	0.24
I liked this experience.	− 0.68	− 1.51	0.15
I believe this experience could lead to positive changes in my health.	− 0.50	− 1.26	0.26
I experienced discomfort during this experience.	1.62	0.63	2.61
I would suggest this experience to a friend or family member if it led to positive changes in their health.	0.02	− 0.73	0.76
I felt comfortable talking with the person who lead this experience over Zoom.	− 0.37	− 0.89	0.15
I would prefer that the person who lead me through this experience over Zoom matched my gender.	− 0.07	− 1.25	1.12
I would prefer that the person who lead me through this experience over Zoom matched my race.	− 0.68	− 1.66	0.29
I think a follow up session to review what was discussed in the initial experience over Zoom would have been helpful.	− 0.40	− 1.21	0.41

First, recruitment efforts were largely successful in reaching the audience of interest. The two primary recruitment strategies were mass mailings of postcards and paper flyers hung on and near a large university campus. Recruitment materials attempted to engage adults who were "concerned about" their health and willing to participate in a clinical trial focused on testing "brief interventions" targeting "predictors of chronic disease," like "eating". The overwhelming majority of these individuals endorsed at least one NEREA, providing evidence for the prevalence of these experiences, as well as the feasibility of screening for these experiences using two brief items. Our phone screening process was also effective in identifying a non-clinical sample, and only a few participants were determined to be ineligible after an in-person psychiatric interview. This is an important component of the enrollment process as phone screens are a much lower resource approach than an in-person visit that requires more time, staff, and incentives. It would not be feasible to use a phone screen to identify all adults with a psychiatric disorder given the prevalence of undiagnosed adults in the USA (e.g., [72]).

Tailored recruitment efforts were not necessary to engage a relatively equal number of cisgender men and women spanning a wide age range, highlighting the potential for a future efficacy trial to enroll older adults and men, populations rarely included in trials focused on eating- and appearance-related concerns. At the same time, no eligible individuals identified as transgender or non-binary, populations at high risk for NEREAs [73], depression [74], and disordered eating [75], and there was certainly underrepresentation of several racial and ethnic groups in our sample, underscoring the importance of building relationships with and soliciting input from members of these communities to increase study engagement prior to the development of a larger clinical trial. One additional point that became evident during the recruitment process was that most individuals who were interested in participating in this study were determined to be ineligible, largely because of a current psychiatric diagnosis and/or medication use known to influence the primary outcomes of interest. These findings speak to the potential importance of evaluating whether a single session of IR might also be helpful with a clinical sample of adults with a history of NEREAs. Given IR's long history of reducing symptoms associated with a number of psychiatric symptoms, including disordered eating, there is certainly evidence to suggest that this therapeutic approach could be beneficial [37–47]. Nonetheless, an efficacy trial with individuals who hold diverse gender identities, a well-powered sample size, and an active comparator would be necessary to confirm this hypothesis. The current study's selected recruitment and screening process may be useful in engaging a clinical sample, given the number of people determined ineligible because of a psychiatric condition. Importantly, including a clinical sample would require greater attention to safety, as this population is likely to be at higher risk for adverse events.

Retention rates for the intervention sessions were good, providing evidence of acceptability based on the description of both brief conditions presented during the screening and consent processes. Offering these sessions remotely at any time between 9 AM and 7 PM, 7 days

a week may have played a role in retaining participants after their baseline visit. Importantly, retention at in-person follow-up visits declined over time, with only 59% of participants returning for their final 3-month follow-up (it should be noted, however, that the study's small sample size does not allow for a precise estimate of long-term retention in a future trial). A substantial portion of participants lost to follow-up were students who either graduated and moved away or were visiting family during their follow-up window. It is important to engage both student and non-student adults with NEREAs; as such, future trials will need to identify strategies for improving retention for all participants at lengthier follow-up points. Using fully remote assessment methods would allow study participants to complete surveys from any location, and using Qualtrics, an online survey platform that prompts individuals to attend to incomplete items, successfully minimized missing data in the current study. Although our study team provided visit reminders 1 week and 24–48 h before each visit and participant compensation increased from the 1- to 3-month follow-up, additional retention strategies are needed, particularly for more transient populations, like college students. Allocating more financial resources towards hiring recruitment specialists, delivering intermittent and personalized remote check-ins via text, allowing participants to select their preferred vendors for gift cards, minimizing survey burden, using multiple methods for survey completion (particularly web-based and mail), and considering a multi-arm trial that allows some participants to choose their preferred condition may all be helpful [76–79]. Artificial intelligence could be used to assist with some aspects of these suggestions, while reducing staff burden, such as automating text messages and rescheduling study visits [80].

A small percentage of participants also felt that it was important that their interventionist match their gender, particularly in the IR condition. This is not entirely surprising as the content of this intervention arm focuses on eating- and appearance-related concerns, experiences that are highly gendered [81]. Participants may appreciate the shared social experiences and feel safer showing vulnerability with a same-gender interventionist, which may contribute to increased study engagement. A community-based participatory approach may also improve retention, as well as the engagement of a more diverse sample in terms of gender, race, and ethnicity (e.g.,[82]). With more diverse study samples, it will be important for future trials to reassess preferences for social identity matching with interventionists across several dimensions.

There was evidence for the acceptability of the pilot study's intervention and control conditions, an important consideration in designing an efficacy trial and, ultimately, in disseminating single sessions of IR on a broader scale if found to be efficacious. Specifically, participants *agreed* or *strongly agreed*, on average, that they liked the remote-delivered single sessions of IR and nutrition education and would be willing to engage in and recommend these interventions to friends or family members if they were found to be beneficial to their health. The only notable finding within the acceptability ratings by condition was that individuals in the IR arm reported experiencing more discomfort, on average, than participants in the nutrition education arm. Although a larger sample would be needed to evaluate the statistical significance of an effect size that corresponds with this potential difference, the pattern of the finding is not surprising as feeling discomfort is an expected emotional experience during psychological interventions, particularly those in which clients are asked to recall difficult memories in detail. Having said that, average discomfort ratings in the IR condition were *neutral*, suggesting that participants in this condition may not have experienced a noticeable degree of discomfort. There were no adverse events, supporting the safety of the described interventions with a community-based sample. Nonetheless, future efficacy trials should consider including additional indicators of psychological safety, such as monitoring whether a remote-delivered single session of IR exacerbates mental health symptoms. Greater attention to psychological safety feels particularly important in the context of remote delivery of single-session interventions, in which there is very little provider contact. Artificial intelligence could be used to contact therapists working with research participants who describe concerning degrees of psychological functioning on their study surveys [80]. Changes in mental health symptoms were not described in the current study because of concerns about misrepresenting the presence or absence of significant change; we were not adequately powered to detect these changes.

Intervention fidelity was excellent, providing support for the feasibility of the training protocols used and the ability to administer the two study conditions as intended. However, and importantly, anecdotal evidence suggests that optimal delivery of the IR condition (e.g., obtaining quality core schema versus any core schema, a distinction that would not be captured with adherence assessments) required some knowledge of cognitive theory and experience with counseling. Interventionists with less coursework and clinical experience required more time, attention, and feedback during the training period. This speaks to the importance of engaging an attentive supervisor, considering a more in-depth training protocol, and/or using licensed mental health providers in future clinical trials. To maximize the dissemination

of interventions like IR, future effectiveness trials need to determine what degree of education and training is needed to administer the IR curriculum with fidelity. One final important note related to intervention delivery is that the IR session was, on average, 30 min longer than the nutrition education session. While these data support the delivery of both interventions in a single session, future researchers should evaluate whether intervention duration relates to outcomes. Alternatively, using only one NEREA during an IR protocol may serve to reduce participant burden and make the two intervention conditions more comparable in length. With the appropriate sample size considerations, a larger clinical trial would also facilitate subgroup analyses to evaluate potential variations in acceptability by various social identities, important data for informing the development of culturally responsive iterations.

All future pilot/feasibility trials investigating the potential of a single session, remote delivered IR should prospectively register its aims and identify specific a priori progression criteria used to determine feasibility success (e.g., degree of missing data considered acceptable, minimum acceptability survey scores) [71]. Reporting the aims and corresponding progression criteria in a public forum prior to participant enrollment is an important ethical practice because it supports taxpayer scrutiny of federally funded research and helps reduce the odds of biases and conflicts of interest influencing the conduct and reporting of such research (e.g., prevents researchers from failing to disclose results that may not support their hypotheses) [83]. Well-defined progression criteria are used to determine whether to proceed to a definitive trial and to inform important changes to the study protocol (e.g., if the amount of missing data was below acceptable criteria, reconsidering data collection strategies; see [84] for specific suggestions). The current trial and progression criteria were not pre-registered, in part, because the aims changed multiple times as resources (financial and staff) and the ability to conduct in-person human subjects research changed throughout the COVID-19 pandemic. As a consequence, reporting for the current trial is more susceptible to bias. There are several additional sources of potential bias that should be acknowledged. Research staff in this pilot trial were not blind to outcome measures and the study coordinator was responsible for all randomization procedures. A better-funded efficacy trial should include independent staff to manage these aspects of the study to reduce bias that can emerge when the individuals invested in the study's outcomes are the same individuals managing important aspects of the study.

Conclusions

In conclusion, data from the current study provide evidence for the feasibility and acceptability of a randomized controlled trial involving a remote-delivered single session of IR and a nutrition education control group with a community sample of men and women with a history of at least one NEREA. These data set the stage for an efficacy trial to evaluate if IR offers benefits on the depressive symptoms and disordered eating behaviors of adults with NEREAs. IR represents a brief, individually tailored strategy for improving the pathological symptoms and behaviors that accompany NEREAs. Remote delivery of a single-session intervention maximizes impact, as such an approach reduces provider and participant burden, and addresses ongoing barriers to engagement in medical and mental health care [85, 86]. Single-session interventions are also inherently nimble and could be prescribed or delivered across the diverse clinical contexts in which adults with behavioral and psychological concerns present.

Abbreviations

NEREA	Negative experiences with eating and appearance
IR	Imagery rescripting
BMI	Body mass index

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Authors' contributions

NRK conceived and designed the research, analyzed most of the data for reporting, and drafted the manuscript. KJD coordinated the implementation of the study, assisted with the data collection, cleaned and organized the data, and drafted part of the manuscript. BS, SB, and SP assisted with the data collection. NJP assisted with the data analysis. ELB assisted with the study conceptualization. All authors (NRK, KJD, BS, SB, SP, NJP, and ELB) reviewed, edited, and approved the manuscript.

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Data availability

The datasets used and/or analyzed during the current study are available from the corresponding author on reasonable request.

Declarations

Ethics approval and consent to participate

The current study was reviewed and approved by the Institutional Review Board at the University of Oregon (STUDY00000592).

Consent for publication

Not applicable.

Competing interests

The authors declare that they have no competing interests.

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