

Editorial Board

Co-Editors-In-Chief

Ann Marie Finley, MS, CCC-SLP *Communication Sciences and Disorders*
Maura O’Fallon, MA, CCC-SLP *Communication Sciences and Disorders*

Faculty Editors

Jennifer K. Ibrahim, PhD, MPH *Associate Dean for Academic Affairs*
David B. Sarwer, PhD *Associate Dean for Research*

Managing Editor

Jacqueline C. Spitzer, MSED *Senior Project Director*

Production and Promotion Team Leader

Emma Lamoreaux *Undergraduate Student*

Editorial Board

Amy Confair, MPH *Community Engaged Research and Practice Office*
Paul D’Avanzo, MS *Social and Behavioral Sciences*
John C. Furey, BS *Health and Rehabilitation Sciences*
Ra’Shaun Gass *Community Engaged Research and Practice Office*
Sarah Kling, MD *Health Policy and Management; Department of Surgery, Temple University Hospital*
Rachael Loeb, MS, LAT, ATC *Health and Rehabilitation Sciences*
Edwin Maas, PhD *Communication Sciences and Disorders*
Ben Meister, MS *Kinesiology*
Megan Rath, MS *Kinesiology*
Daniel Rosney, PhD *Kinesiology*
Krista Schroeder, PhD, RN *Nursing*
Jeni Stolow, PhD *Social and Behavioral Sciences*
Sarah Jane Tomlinson, Esq., MBA *Health Services Administration and Policy*

About the Editorial Board

CommonHealth, a journal of the College of Public Health at Temple University, is a peer-reviewed, open access journal for rapid dissemination of high-quality research and scholarship related to all aspects of public health. The Editorial Board includes faculty and student representatives from across the College’s departments. Membership of the Board aligns with the CPH’s mission to promote transdisciplinary collaboration and develop the next generation of leaders in research, scholarship, service, and innovation. The journal serves as a training opportunity to prepare students for successful engagement with the broader academic community.

CommonHealth

A Journal of the College of Public Health at Temple University

<https://tuljournals.temple.edu/index.php/commonhealth>

Online ISSN: 2690-6910

TABLE OF CONTENTS

INTRODUCTION TO THE ISSUE

- iii-v** **Turning a Natural
Disaster into an
Opportunity at Temple
University's Ambler
Campus**
Vicki McGarvey

ORIGINAL RESEARCH ARTICLES

- 47-64** **Comparative Efficacy of
Exercise Training and
Conventional
Psychotherapies for
Adults Depression: A
Network Meta-Analysis**
*Nicholas Hooper, Tessa
Johnson, Michael Sachs, Alexis
Silverio, Lin Zhu, Aisha
Bhimla, Logan Teal, Stephanie
Roth, Caitlin LaGrotte, Joyce
Stravarakis, Frank Arcangelo*

- 65-74** **The Effects of a Single
Session of Online Yoga
for Anxiety and Mood
States: A Pilot Study**
*Emma Soliva, Sara Kovacs,
Kathryn Fritz*

VOLUME 3 | ISSUE 2 | JUNE 2022

*Common*Health

A Journal of the College of Public Health at Temple University

<https://tuljournals.temple.edu/index.php/commonhealth>

Online ISSN: 2690-6910

CASE REPORTS

75-86

**Dissemination and
Implementation
Science to Advance
Health Equity: An
Imperative for
Systemic Change**

*Gabriella M. McLoughlin,
Omar Martinez*

87-97

**Extreme Weather
Preparedness for
Institutions of Higher
Education: Impacts
and Lessons Learned
to Inform Campus
Health**

*Jeni Stolon, Marissa
Cloutier, Amy Freestone,
Kathleen Salisbury*

OPINION

97-98

**New Gerber Baby is
Welcome Statement
About Inclusion of
Persons with Visible
Differences**

*David B. Sarver, Elizabeth
C. Thomas*

Turning a Natural Disaster into an Opportunity at Temple University's Ambler Campus

VICKY MCGARVEY, EDD¹

¹Vice Provost for University College and Director at Temple University Ambler Campus

Correspondence: vicki.mcgarvey@temple.edu (Vicki McGarvey).

Temple University takes pride in its identity as an urban university with deep roots and commitment to its north Philadelphia neighborhood. Just 16 miles north of its main campus, the university also maintains a 187-acre campus in the heart of suburban Montgomery County. Many people wonder how the Ambler campus contributes to Temple University's mission. I believe that the campus is an integral part of Temple's mission. We are all connected; we are all one Temple.

As a top-tier research university, the core of Temple's mission and values are the creation and dissemination of knowledge. The Ambler campus is an arboretum, a field station, and a hub of experiential learning that allows students to participate in research studies, environmental restoration, and design-build projects. It also features gardens, walking trails, and other natural areas. The campus contributes to Temple's initiatives in health, wellness, research, and sustainability.

In 2010, Temple issued its first Climate Action Plan, focusing on goals to help combat climate change including reducing carbon emissions, improving energy efficiency, and building more resilient infrastructure. The updated 2019 plan included a goal of securing the designation of the Ambler campus as a research field station, providing the facilities to support both basic and applied research in sustainability disciplines. The plan included goals for increasing the number of

sustainability-related courses and departments offering sustainability courses as well as increasing co-curricular and non-credit learning experiences to accompany the academic curriculum. The Ambler campus is key to achieving these goals.

In 2020, the Ambler campus was designated as a field station, serving as a platform for experiential education, outreach, and training, especially for students interested in environmental fields. In response to the rapid growth of interest in these topics, the College of Science and Technology recently launched a new major, Ecology, Evolution and Biodiversity, joining existing offerings in environmental studies, environmental science, ecological restoration, environmental design, sustainability, among others. The proximity of the Field Station to an urban area is important to creating access and promoting diversity in environmental fields where students from underrepresented populations have lacked access to advanced field training.

On September 1, 2021, the Ambler campus was struck by a devastating EF2 tornado. What could have been seen only as a tragic event has elevated the Ambler campus' importance as a site for research and planning for our collective futures in a way that no one could have imagined. Prior to the tornado, the Field Station staff and students had made significant progress in documenting the contents and conditions of the Temple Forest

Observatory, which is a part of the Smithsonian Institution's Forest Global Earth Observatory (ForestGEO). It is uncommon for an old-growth forest in this region of the country to experience a tornado strike. It is even more rare for it to have occurred in an area that has been so well documented.

For these reasons, the decision was made to withhold human intervention in this area. As a result, the forest is now an invaluable space for studying natural recovery and regeneration. Our students have the opportunity to learn and practice research methods while contributing to knowledge with real-world implications.

Just across the street, the campus hosts the cultivated gardens and other maintained areas that make up the Ambler Arboretum of Temple University. More than 500 trees were lost from its collection when the tornado hit. Within these areas, we have the chance to plan and replant for a future climate that is already different than when the lost trees were planted 60 to 100 years ago. Students in the horticulture and landscape architecture programs have been able to take their knowledge out of the classroom and be a part of the campus restoration. Well over 100 new trees have been planted during these recovery efforts thanks to the dedication of our students, staff, and an army of volunteers.

While the Field Station and the Ambler Arboretum focus on applied research and planning for today and future generations, Temple Ambler is also reimagining the use of its building infrastructure. The campus is working closely with the Tyler School of Art and Architecture, the College of Science and Technology, College of Engineering, Criminal Justice Training Programs, and other university units to develop the Ambler Research + Collaboration Building, a shared space for design-build projects, research, and other cross-disciplinary projects. These facilities and environments are invaluable for training our students to be the next generation of scientists, engineers, horticulturalists, and designers of a sustainable built environment.

Temple Ambler, however, is not just important for its value as a site for experiential

learning and research. There is a growing body of evidence that spending time in nature leads to better health. Stress and anxiety can reduce the brain's ability to capture and process information by as much as 80 percent. Studies show that spending as little as 20 minutes in nature can reduce the levels of the stress hormone, cortisol.

Temple Ambler is a part of the growing number of universities joining the "Nature Rx" movement and offering programs and opportunities for students and the larger community to get outside and enjoy nature and improve their mental and physical health. The campus continues to add amenities, such as a low ropes challenge course, to make more options available for Temple students and the public to engage in physical activity and co-curricular activities.

In an analysis of more than 20 years of peer-reviewed studies, researchers at Stanford University concluded that environmental education has positive impacts including improved academic performance and enhanced critical thinking and inspires personal growth, life-building and leadership skills, civic engagement, and positive environmental behaviors. The campus, in collaboration with the Field Station, Arboretum, and Temple Ambler EarthFest, offers a number of citizen-science opportunities for the general public as well as environmental education programs for children and families.

Temple Ambler contributed to its community and served as an experiential learning laboratory since its founding as the Pennsylvania School of Horticulture for Women (PSHW) in 1911. Tracing back to its roots as the PSHW where women were trained in agricultural techniques to support food shortages during World War I, Temple Ambler continues to host courses in sustainable food systems. The food crops course offered through the Tyler School of Art and Architecture grows more than 600 pounds of fresh vegetables that are donated to a local food pantry each year. Community members turn to the campus for programs and advice regarding their own gardens and trees.

There is no question that the tornado brought loss to the Ambler Campus. At the same time, it has provided new opportunities to learn and grow from the experience. As we find ourselves saying around campus, we are making lemonade from the lemons that the tornado served us. The tornado has brought attention from the local and national media to this rare opportunity to train students and contribute to knowledge about ecology and climate change.

The tornado also provided an opportunity to contribute to the body of knowledge about disaster preparedness and response. As you can read about in this journal, the Ambler Campus community participated in a study of Temple's response to the tornado. Our community reported being unprepared for the tornado.; this work has helped us to learn about the gaps in our response. As climate change continues to generate more extreme

weather patterns and events, I hope that the knowledge gained from this study will help us to improve our own preparation for future natural disasters and that our experience can benefit others.

I believe that the value of the Ambler Campus lies in its diverse programs and environments and how they enhance and complement what is available on main campus. Chief Seattle said that "Humankind has not woven the web of life. We are but one thread within it. Whatever we do to the web, we do to ourselves. All things are bound together. All things connect." We are connected. And our proximity means that students don't have to choose — they can have the best of both worlds.

Comparative Efficacy of Exercise Training and Conventional Psychotherapies for Adult Depression: A Network Meta-Analysis

NICHOLAS HOOPER, MS¹; TESSA JOHNSON, MS²; MICHAEL SACHS, PHD³; ALEXIS SILVERIO, MPH³; LIN ZHU, PHD⁴; AISHA BHIMLA, MPH, PHD⁴; LOGAN TEAL, MSA⁵; STEPHANIE ROTH, MLIS⁶; CATILIN LAGROTTE, PSYD, MED⁷; JOYCE STRAVRAKIS, MS⁸; FRANK ARCANGELO, PHD⁹

¹Department of Medicine, Virginia Commonwealth University School of Medicine

²Department of Health and Rehabilitation Sciences, College of Public Health, Temple University

³Department of Kinesiology, College of Public Health, Temple University

⁴Center for Asian Health, Lewis Katz School of Medicine, Temple University

⁵Elevate Credit, Austin TX

⁶Ginsburgh Health Sciences Library, Temple University

⁷Behavioral Medicine, Cooper University

⁸Department of Education, Temple University

⁹Saratoga Psychological Associates, Saratoga Springs, New York

Correspondence: hoopernr@mymail.vcu.edu (Nicholas Hooper).

Objective An estimated 3.8% of the global population experiences depression, according to the [2019] WHO report. Evidence supports the efficacy of exercise training (EX) for depression; however, its comparative efficacy to conventional, evidence-supported psychotherapies remains understudied. Therefore, we conducted a network meta-analysis to compare the efficacy of exercise training (EX), behavioral activation therapy (BA), cognitive-behavioral therapy (CBT), and non-directive supportive therapy (NDST). **Methods** Our search was performed in seven relevant databases (inception to March 10, 2020) and targeted randomized trials comparing psychological interventions head-to-head and/or to a treatment as usual (TAU) or waitlist (WL) control for the treatment of adults (18 years or older) with depression. Included trials assessed depression using a validated psychometric tool. **Results** From 28,716 studies, 133 trials with 14,493 patients (mean age of 45.8 years; 71.9% female) were included. All treatment arms significantly outperformed TAU (standard mean difference [SMD] range, -0.49 to -0.95) and WL (SMD range, -0.80 to -1.26) controls. According to surface under the cumulative ranking (SUCRA) probabilities, BA was mostly likely to have the highest efficacy (1.6), followed by CBT (1.9), EX (2.8), and NDST (3.8). Effect size estimates between BA and CBT (SMD = -0.09, 95% CI [-0.50 to 0.31]), BA and EX (-0.22, [-0.68 to 0.24]), and CBT and EX (-0.12, [-0.42 to 0.17]) were very small, suggesting comparable treatment effects of BA, CBT, and EX. With individual comparisons of EX, BA, and CBT to NDST, we found small to moderate effect sizes (0.09 to 0.46), suggesting EX, BA, and CBT may equally outperform NDST. **Conclusions** Findings provide preliminary yet cautionary support for the clinical use of exercise training for adult depression. High study heterogeneity and lack of sound investigations of exercise must be considered. Continued research is needed to position exercise training as an evidence-based therapy.

Keywords: Exercise, Depression, Psychotherapy, Network Meta-Analysis, Physical Activity

Introduction

According to the World Health Organization, depression affects 3.8% of the global adult population and is a leading cause of global disability.¹⁻² Characterized by a depressed mood or a loss of interest or pleasure in daily activities, depression is often accompanied by problems with sleep, eating, energy, concentration, and self-worth.³ Considerable evidence demonstrates that exercise training (EX) reduces depressive symptoms,⁴⁻¹³ and some recent evidence-based guidelines support its use as a primary treatment for patients with mild to moderate depression.¹⁴ The National Institute for Health and Care Excellence (NICE), for example, recommends that patients with less severe presentations pursue a physical activity program as an initial treatment.⁸⁻⁹ For more severe presentations like major depressive disorder (MDD), studies demonstrate that adjunctive exercise training may improve clinical outcomes. EX combined with medication, for example, has produced higher remission rates than stand-alone medication treatment.¹⁵⁻¹⁶

Exercise training is an attractive therapy for depression for several reasons. First, exercise training (EX) is well-studied for its physical health benefits. Many patients with depression have health co-morbidities commonly associated with depression, including cardiovascular disease and diabetes mellitus.^{5-7,14} Exercise training programs may thus ease depressive symptoms directly and indirectly by resolving physical illnesses that might contribute to or worsen depression. Second, exercise is considered a “low-intensity therapy” because it can be pursued at a low cost, with less time investment from a specialized therapist, and with less client-therapist commitment¹⁷; therefore, it may be a more feasible treatment option for some patients compared to psychotherapy approaches.¹⁸ Indeed, many patients report practical barriers to psychotherapy, including concerns with the high cost of treatment,¹⁹ intense time commitment, and lack of access to qualified therapists. Patients may also encounter emotional and cultural barriers to psychotherapy.¹⁹⁻²⁰ Exercise training programs expect less disclosure of

personal and private information and are also imbued with less stigma. Thus, patients reluctant to pursue psychotherapy for such reasons may be more comfortable with an exercise-based approach. Finally, exercise training programs are well-tolerated by patients with a low risk of adverse side effects.²¹ Exercise may thus be an alternative approach for patients that respond poorly to medication. Indeed, up to 40% of patients report drug-related adverse effects.²²⁻²⁴ Due to drug-related side effects, patients increasingly prefer non-pharmacological approaches to treatment.²⁵

Though there is evidence for the antidepressant effects of stand-alone and adjunctive EX, some evidence suggests it remains underused as a treatment approach in clinical practice.²⁶ Indeed, EX is recommended less often for mental illnesses compared to physical illnesses despite growing evidence that EX eases the mental health burden.¹⁵ The lack of clinical implementation may reflect the lack of research on the comparative efficacy of exercise to other evidence-based psychotherapies for adult depression. Few randomized controlled trials have directly compared exercise to multiple established psychotherapeutic approaches. A network meta-analysis is a technique that can be used to gather evidence from both direct and indirect comparisons.²⁷ To date, no network meta-analysis has compared EX to multiple psychotherapies. The objective of this NMA was to compare the efficacy of EX and three evidence-supported behavioral therapies: cognitive-behavioral therapy (CBT), behavioral activation therapy (BA), and non-directive supportive therapy (NDST). CBT, a “gold standard” therapy, involves cognitive restructuring to correct maladaptive thinking, which is thought to contribute to behaviors that maintain or increase depression.²⁸ CBT often includes problem-solving strategies and skills training, behavioral activation, mindfulness and relaxation, exposure therapy, role-playing, and imagery²⁸ with evidence supporting its effective delivery in multiple formats (individual, group, in-person, book, computerized, and remote).²⁹ BA, widely used for depression, aims to reduce

depressive behaviors such as inactivity and avoidance through goal-setting, self-monitoring, problem-solving, and activity scheduling.^{30,31} Individuals receive positive reinforcement by engaging in activities that improve mood, thus mitigating depressive behaviors.³² Though these approaches share common features, they are

directed toward distinct goals: CBT resolves distorted cognitions³³, BA promotes behavioral activation³¹; and NDST increases social sharing and support³⁴. Evidence suggests that CBT, BA, and NDST elicit comparable treatment effects for individuals; therefore, we selected these therapies as comparators to EX.²⁵

Methods

Identification and Selection of Studies

The protocol for this network meta-analysis was registered at PROSPERO (CRD42018089067) and reported according to PRISMA guidelines (see Appendix 1).³⁵ A medical librarian conducted a detailed literature search (January 22, 2018, to March 10, 2020) in seven databases: PubMed (NLM); Embase (Elsevier); Scopus (Elsevier); Cochrane Central (Wiley); PsycInfo (EbscoHost); ClinicalTrials.gov; and PsychiatryOnline.org (see Appendix 2). Searches included a combination of controlled vocabulary and free text terms relevant to psychotherapy, exercise training, and depression with filters for human studies and randomized trials. Google Scholar was also searched to locate unpublished grey literature, ongoing studies, uncatalogued studies, and relevant dissertations. No language or publication date restrictions were imposed. After completing the search, two researchers independently screened studies for inclusion and exclusion using Rayyan QCRI software.³⁶ Full texts were retrieved if the title and abstract content were insufficient to determine inclusion. A third researcher resolved any disagreements.

Interventions were considered exercise training if they involved planned, structured, repetitive, and purposive exercise designed to improve or maintain physical fitness. Aerobic training, strength-focused training, and mixed training protocols (i.e., included both aerobic and strength-based training components) were included. Exercise protocols with contemplative components (e.g., yoga, tai chi, or qigong) were excluded. Contemplative techniques (e.g., mindfulness and/or meditation practices, breathwork, intention setting, loving-kindness,

and psychoeducation) often produce anti-depressant effects when practiced in isolation.⁷ Because this NMA sought to assess exercise-specific effects, we excluded mindful exercise programs. Prior work also indicates differential effects of non-mindful exercise compared to mindful exercise for depression³⁷; therefore, distinct mechanisms likely subserve the therapeutic action of non-mindful compared to mindful exercise programs. Randomized trials investigating mindful exercise programs also consistently suffer from significant methodological heterogeneity issues,³⁷ which are less common in randomized trials of non-mindful or pure exercise training protocols. In addition to exercise training, behavioral activation therapy, cognitive-behavioral therapy, and non-directive supportive therapy were included as treatment arms based on their distinct therapeutic approaches and widespread clinical use.³⁸⁻⁴⁰

Randomized trials comparing psychological interventions head-to-head and/or to a treatment as usual (TAU) or waitlist (WL) control were considered for inclusion. Trials included adult patients (18 years or older) with depression according to the Diagnostic and Statistical Manual of Mental Disorders (DSM) criteria or a validated psychometric assessment for depression such as the Beck Depression Inventory (BDI)⁴¹ or the Hamilton Depression Rating Scale (HAMD).⁴² Trials including patients with or without somatic and/or non-psychotic mental illnesses were considered. No restrictions were imposed on the format or structure of psychological interventions (i.e., treatment duration, frequency, dose, setting

(internet or in-person), individual or group therapy) as some prior work indicates that treatments produce an anti-depressant effect regardless of format.²⁵ We excluded studies assessing patients with seasonal depressive

disorder, bipolar disorder, and/or psychotic disorders, studies assessing relapse prevention and maintenance treatment, and studies lacking English translation.

Data Analysis

Data Extraction Methods

An a priori data extraction form was adapted from the Cochrane Collaboration. From each study, the authors extracted: (1) general information (i.e., title, authorship, and publication date); (2) research design; (3) participant characteristics; (4) outcome measures; (5) statistical data; and (6) details

about the format and features of each intervention (i.e., type of intervention, frequency of sessions, intervention duration, session duration). Three researchers independently completed data extraction on included studies (see Appendix 3 for study characteristics).

Risk of Bias

Bias risk was judged using Cochrane's Risk of Bias Tool (RoB 2.0) for randomized trials and the CINeMA (Confidence in Network Meta-Analysis) web application.⁴³ Using the RoB 2.0 tool for randomized trials, two reviewers independently evaluated bias resulting from the randomization process; deviations from intended interventions missing outcome data; measurement of outcomes; and selection of the reported result.⁴⁴⁻⁴⁵ Bias risk for each criterion was judged as either low, some concerns, or high.⁴⁴⁻⁴⁵ The overall judgment for each domain of potential bias for each study was

then judged as low, high, or unclear. A third researcher resolved any disagreements. The certainty of the evidence for each outcome was then evaluated using the CINeMA approach—an approach based on the GRADE (Grades of Recommendation, Assessment, Development, and Evaluation) framework and used to evaluate within-study bias, reporting bias, indirectness, imprecision, heterogeneity, and incoherence (see Appendix 4).⁴³ Using CINeMA, judgments were summarized into four confidence levels for each treatment effect: very low, low, moderate, or high.⁴³⁻⁴⁵

Network Meta-Analysis

The NMA was run through the program Stata version 15⁴⁶ using Stata routines as previously described by Chamimani and colleagues (see analysis codes in Appendices 5 and 6).⁴⁷ All within-group effect sizes were computed to run the NMA through Stata. The outcome measure was the standardized mean difference (SMD) statistic. A network plot was produced to illustrate the interventions and their respective evidence base with node size and line thickness corresponding to the number of patients randomized to each intervention and the number of studies between comparators,

respectively.⁴⁷ A contribution plot was also produced to inspect the influence of each direct piece of information on neighboring comparisons.⁴⁷ To evaluate the basic assumptions of an NMA, inconsistency and prediction interval plots were produced.⁴⁷ Inconsistency—understood as any discrepancy between direct and indirect effect estimates for the same comparison—threatens the validity of the results and the basic assumptions of an NMA. The inconsistency plot produces inconsistency factors (Ifs) for each closed loop (e.g., the loop of CBT-WL-BA).⁴⁷ Prediction

intervals (PrL) give the range within which the results of a future study might lie. Within the NMA framework, tests to assess multivariate heterogeneity have yet to be applied to NMAs.⁴⁸ Presenting summary effects with PrL facilitates the interpretation of the results even with heterogeneity but does not correct for high heterogeneity.⁴⁷ Lastly, surface under the cumulative ranking (SUCRA) probabilities were

produced to rank the treatments based on the outcome measure.⁴⁷ SUCRA curves express, as a percentage, the efficacy of every intervention relative to an imaginary intervention that always ranks best.⁴⁷ Therefore, larger SUCRA scores indicate a more effective intervention. As such, a higher SURCA score will correspond to a larger effect size and, thus, a treatment ranking closer to a first-place ranking.

Meta-Regression to Assess Moderators of Exercise Training Efficacy

To assess the effect of potential moderators on the efficacy of exercise training, we performed a meta-regression. Moderators included exercise type (i.e., aerobic, anaerobic, mixed), frequency (i.e., number of training sessions per week), intensity (i.e., low, moderate, vigorous), dose (i.e., minutes of exercise per training session), length of intervention (i.e., number of weeks), and severity of depression at baseline. Exercise intensity level for each study was determined based on the description of the intervention (e.g., low, moderate, or vigorous). If exercise intensity was unspecified, the type of physical activity or target heart rate determined intensity level. Using the American College of

Sports Medicine's guidelines⁴⁹, we defined an exercise intervention as moderate or vigorous if target heart rates were between 40-60% or 60-85% of maximum heart rate, respectively. If heart rate targets were unspecified and the intervention was described as walking (not brisk walking), the intervention was coded as low intensity. All anaerobic exercise studies were defined by how much weight individuals lifted (i.e., percentage of one's one repetition maximum). Baseline severity of depression was determined by interpreting the minimum cut-off score for inclusion in each study and comparing it to the scoring system for the depression scale implemented.

Results

Search Results and Study Characteristics

Of the 28,716 studies identified from the search, 133 randomized trials (14,493 patients) satisfied the inclusion and exclusion criteria (Figure 1; Appendix 9 for references of included studies). Detailed results and statistical code are available in Appendices 5, 6, 7.

The network plot, as shown in Figure 2, indicates that CBT, TAU, and WL were the most frequent comparators within the network. Most of the head-to-head trials compared an active treatment to either TAU or WL with most studies comparing CBT to TAU (n = 41) or CBT to WL (n = 40). Of the remaining treatment arms, most of the head-to-head trials were between CBT to NDST (n = 11) followed by BA to CBT (n = 7); EX to CBT (n = 5); BA to EX (n = 2); and BA and NDST (n = 1).

Overall, three arms lacked direct evidence: TAU and WL, NDST and EX, and NDST and WL. Most patients received CBT (n = 5,436) followed by EX (n = 1,665), BA (n = 778), and NDST (n = 508). More patients were assigned to TAU (n = 3,956) compared to WL (n = 2,150).

Across studies, most patients presented with mild to moderate depression. A diagnosis of unspecified depressive disorder was most common. Most of the patients were recruited from community samples or outpatient settings. Most of the participants were female (71.9%). The youngest average age of participants was 19.2 years,⁵⁰ and the oldest, 87.9 years.⁵¹ The average age of study participants was 45.8 years. Based on each study's reported average age of

participants, 23.3% of studies included predominately older adults (56 years and older), 53.4% middle-aged adults (36-55 years), and 23.3% younger adults (18-35 years). Most treatment lengths ranged from 8 to 12 weeks.

Across included studies, the average length of study duration was 12.2 weeks. The shortest duration of treatment was ten days,⁵² and the longest duration, 12 months (see Appendix 3).⁵¹

Figure 1. Flow Chart for the Inclusion of Studies

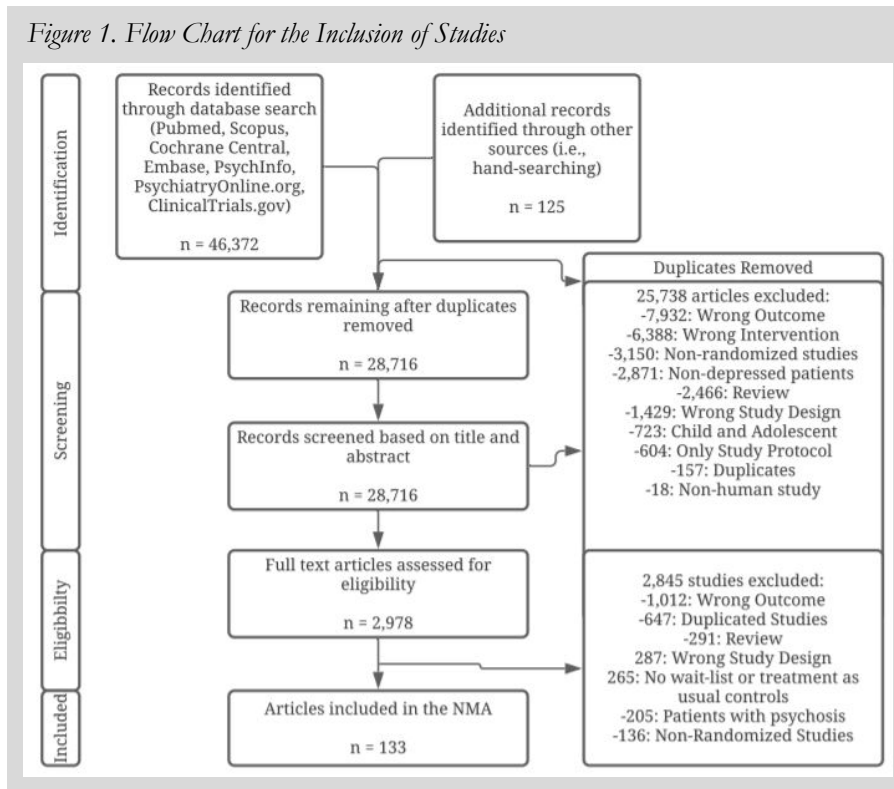
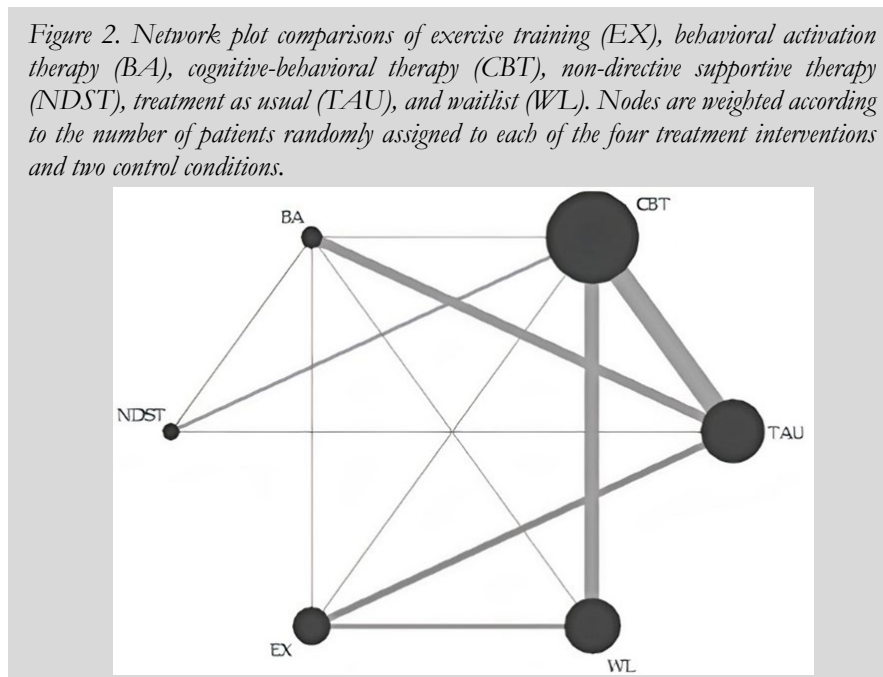


Figure 2. Network plot comparisons of exercise training (EX), behavioral activation therapy (BA), cognitive-behavioral therapy (CBT), non-directive supportive therapy (NDST), treatment as usual (TAU), and waitlist (WL). Nodes are weighted according to the number of patients randomly assigned to each of the four treatment interventions and two control conditions.



Exercise Training Study Characteristics

Of the 133 included studies, 36 studies (1,665 patients) implemented one or more exercise interventions. Based on the reported average age of participants, 41.7% of exercise studies included predominately older adults (56 years and older), 30.7% middle-aged adults (36-55 years), and 27.8% younger adults (18-35 years). Most studies (86.1%) included outpatient samples. Most studies (72.2%) included patients with a primary diagnosis of clinical depression or elevated symptoms of depression. The remaining studies included patients with clinical depression or elevated depression symptoms secondary to a brain-based disorder (e.g., stroke, multiple sclerosis, Parkinson's Disease, Alzheimer's Disease, or mild cognitive impairment), colorectal cancer, Sjogren's Syndrome, congestive heart failure, or polycystic ovarian syndrome. About half of the studies (55.6%) included patients with mild to moderate depression at baseline. Based on the 26 of 36 studies that provided sex characteristics, most participants ($n = 1093$) were female (73.6%). Most studies were conducted in North America (27.8%) and Europe (27.8%). Exercise interventions were most often supervised

(86.1%) by therapists, exercise specialists, or other trained professionals, delivered in a group format (55.6%), and conducted at a non-home-based location (66.7%). Exercise protocols were predominately aerobic; however, strength training (16.7%) and mixed protocols (19.4%) were also widely implemented. Aerobic interventions commonly featured walking, cycling, or running programs most often performed at a moderate intensity level (33.3%). The average duration of exercise training interventions was 11.6 weeks (ranging from 1.4 to 39.1 weeks). The average minimum dose (single bout) of exercise was 48.1 minutes (ranging from 20 to 60 minutes) with an average frequency of 3.2 exercise training sessions per week. All studies using anaerobic interventions implemented two or three training sessions per week. In contrast, only 65% of aerobic protocols implemented two to three training sessions per week; thus, aerobic training interventions had slightly higher variability in training frequency. In examining exercise intensity, most aerobic exercise interventions were of moderate intensity (45.5%), followed by low (31.8%) and vigorous intensity (22.7%).

Risk of Bias

Overall, most studies demonstrated a moderate to high risk of bias. Most of the direct evidence had a moderate risk of bias. Within-study bias most often resulted from a lack of blinding participants, researchers, and outcomes. Only one direct comparison—BA versus NDST—had an overall high risk of bias (see Figure 2).

According to CINeMA results, 3 of the 15 comparisons (20.0%) were rated with moderate confidence, 7 (46.7%) with low confidence, and 5 (33.3%) with very low confidence. Overall, each study showed a moderate risk for bias in each category.

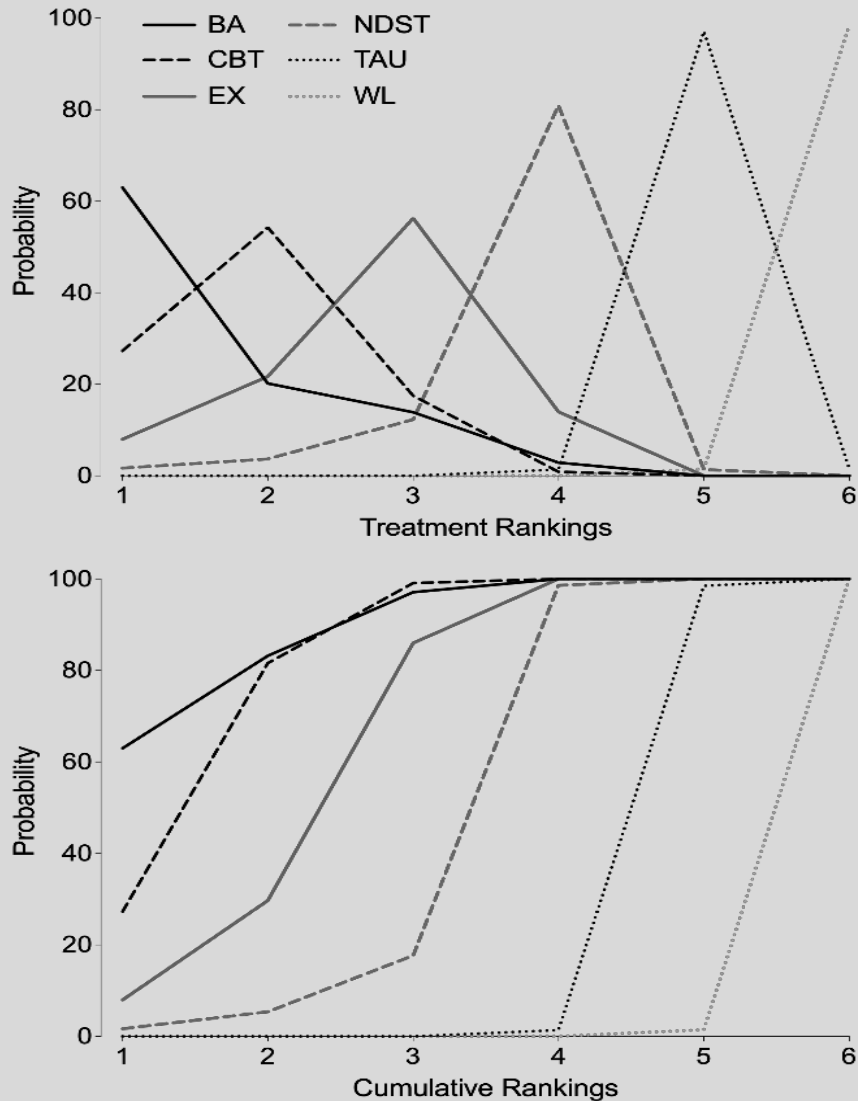
Network Meta-Analysis

SUCRA Treatment Rankings and Probabilities

Cumulative ranking plots for each of the treatment modalities, as shown in Figure 3, indicate the relative probability for each treatment arm to achieve a certain ranking. BA had a 97.1% chance of being ranked either first, second, or third. Of the treatments, BA had the

highest probability of being ranked first, at 63.0%. CBT had a 99.1% chance to rank in the top three treatments. Of the treatments, CBT had the highest probability of being ranked second, at 54.3%, and a 27.3% chance of being ranked first. EX, at 86.0%, had a slightly lower

Figure 3. Treatment and cumulative ranking plots for each intervention. This figure presents treatment (top) and cumulative (bottom) ranking plots formed using SUCRA. The treatment ranking plot shows the probability for each arm to receive a ranking of 1-6. The cumulative ranking plot show the cumulative probability of each arm.



BA = behavioral activation therapy; CBT = cognitive-behavioral therapy; EX = exercise training; NDST = non-directive support therapy; TAU = treatment as usual; and WL = waitlist.

chance of ranking in the top three treatments compared to BA and CBT and had the highest probability of being ranked third, at 56.3%, and a 21.7% likelihood of ranking second. Finally, NDST had the highest probability ranking fourth, at 80.9%, with only a 17.7% chance to rank in the top three. Finally, TAU had a 97.1%

chance of ranking second to last, and WL, a 98.5% chance of ranking last. Based on SUCRA values, BA (1.6) had the highest mean ranking, followed by CBT (1.9), EX (2.8), and NDST (3.8) (Table 1).

Table 1. SUCRA results, probability of each intervention being ranked 1st, and the average rank of each intervention when compared to each other.

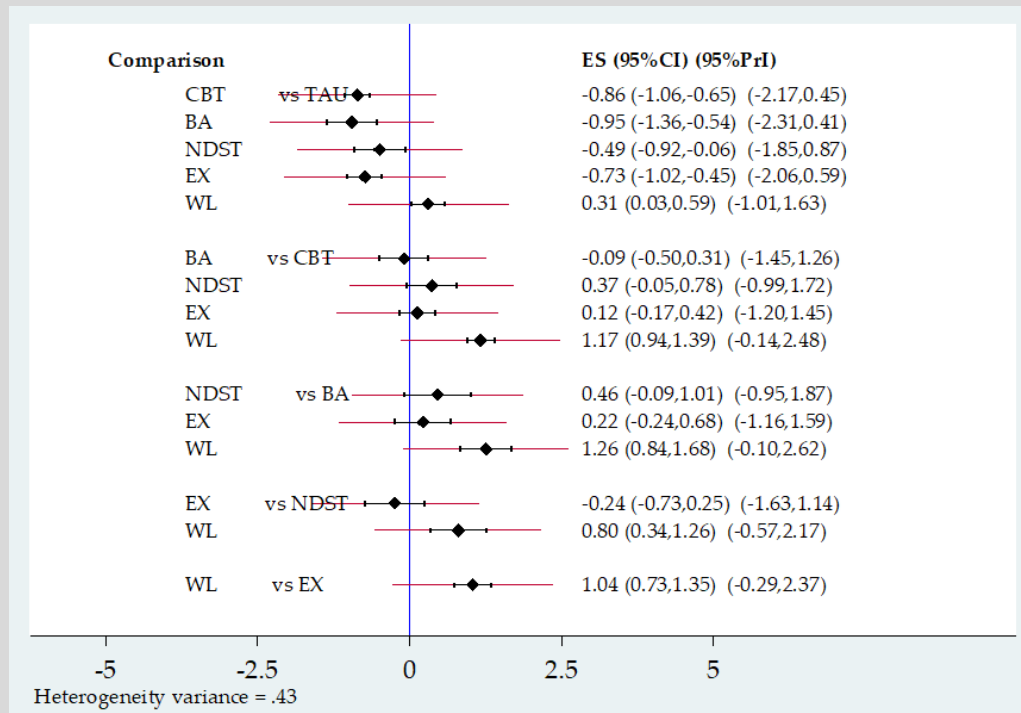
Treatment	SUCRA	Probability Ranked 1 st	Mean Rank
Behavioral Activation	88.7	63.0	1.6
Cognitive-behavioral Therapy	81.6	27.3	1.9
Exercise Training	64.7	8.0	2.8
Non-Directive Supportive Therapy	44.7	1.7	3.8
Treatment As Usual	20.0	00.0	5.0
Waitlist	00.3	00.0	6.0

Effect Size Estimates

All interventions were superior to TAU (SMD range, -0.49 to -0.95) and WL (SMD range, -0.80 to -1.26) control conditions (Figure 4). BA had the largest overall effect sizes compared to both WL (SMD = 1.26, 95% CI [0.84, 1.68]) and TAU (-0.95, [-1.36,-0.54]). EX also resulted in large effect sizes compared to both TAU (-0.73, [-1.02, -0.45]) and WL (1.04, [0.73, 1.35]) conditions. When comparing active treatment arms, EX resulted in a small effect

size compared to NDST (-0.24, [-0.73,0.25]). Finally, EX resulted in a small, less efficacious, effect size than both CBT (0.12, [-0.17,0.42]) and BA (0.22, [-0.24, 0.68]). Further analysis of effect measures can be found in the prediction interval plots (Figure 4). The contribution of direct and indirect statistics for each treatment arm can be found in the contribution plots (see Appendix 7).

Figure 4. Forest plots to present effect size estimates of comparisons. Prediction intervals (PrI) estimate where the outcomes of future RCTs may lie. Direct estimates are also presented. All outcomes are standardized mean difference with 95% confidence intervals (CI). The black line represents the current effect size 95% CI, while the red line represents the 95% prediction intervals. Heterogeneity variance = 0.43.



BA = behavioral activation therapy; CBT = cognitive-behavioral therapy; EX = exercise training; NDST = non-directive support therapy; TAU = treatment as usual; and WL = waitlist.

Heterogeneity

The inconsistency plot presents ten evidence loops within the network. When applying a common heterogeneity estimate to assess inconsistency, one of the ten loops showed statistically significant IF values suggesting some inconsistency between indirect

and direct estimates. However, when applying loop-specific heterogeneity estimates to assess inconsistency, none of the loops showed statistically significant IF values suggesting good agreement between indirect and direct estimates.

Exercise Training Meta-Regression

The moderator variables included in the meta-regression analysis yielded no significant effects

on the efficacy of exercise training (see Appendix 8).

Discussion

To our knowledge, this is the first network meta-analysis comparing the efficacy of exercise training to three conventional and common evidence-supported psychotherapies for adult depression. Based on comparative data from 133 randomized trials (14,493 patients), we present two findings: (1) as anticipated, exercise training, behavioral activation therapy, cognitive-behavioral therapy, and non-directive supportive therapy demonstrated greater efficacy for adult depression compared to two

inactive control conditions; and (2) exercise training demonstrated comparable efficacy to behavioral activation therapy, cognitive-behavioral therapy, and non-directive supportive therapy for adult depression. However, the methodological shortcomings of included trials hinder any conclusive statements of exercise training's evidence-based standing. Findings encourage more systematic investigation of exercise therapy for adult depression.

Differential Effects of Psychological Interventions

As anticipated, all treatment interventions were superior to control conditions. Of the four interventions, behavioral activation therapy was most likely to demonstrate the highest efficacy, followed by cognitive-behavioral therapy, exercise training, and non-directive supportive therapy. Though rankings suggest differential treatment effects, effect sizes between CBT and EX (0.12, [-0.17, 0.42]), EX and BA (0.22, [-0.24, 0.68]), and BA and CBT (-0.09, [-0.50, 0.31]) suggested no minimally important clinical differences (i.e., below the effect size cut-off of 0.24).⁵³ Thus, BA, CBT, and EX may produce comparable clinical treatment effects for adult depression. With individual comparisons of EX, BA, and CBT to NDST, effect sizes suggested minimally important clinical differences. Thus, EX, BA, and CBT may each produce a greater anti-

depressant effect compared to NDST. Overall, our effect size estimates converge with recent meta-analytic findings.⁵⁴⁻⁵⁷

Though our results indicate that EX, BA, and CBT have similar treatment effects, BA was most likely to have the highest efficacy compared to the other therapies. Though evidence for the efficacy of CBT for depression is most robust, multiple studies demonstrate superior efficacy of BA compared to CBT.⁵⁸⁻⁵⁹ In the 1990s, a component analysis of CBT found that the behavioral components worked as well as the entirety of the CBT intervention.⁵⁸ More recently, multiple RCTs have demonstrated that BA is comparable or superior to CBT.^{30,59} Such results indicate that there may be substantial value in using behavioral activation strategies (i.e., goal-setting, self-monitoring, activity scheduling, and reducing

avoidant behavior) for the treatment of depression.⁵⁹ These strategies are often incorporated into EX interventions.⁶⁰ Given the shared behavioral strategies used in BA and EX,

Exercise Training Features

Much to our surprise, our meta-regression analysis found no significant moderator effects. Strong evidence points to specific exercise training forms and formats that produce stronger anti-depressant effects.^{7,61} A recent cross-sectional study, for example, found that team sports produced the strongest anti-depressant effect followed by cycling, aerobic, and gym activities; therefore, social support may strengthen the anti-depressant effect of exercise training.⁷ Other evidence suggests that there may be important differences in response as a function of exercise type, frequency, and duration.⁷ For example, some evidence suggests an optimal effect with 45-minute bouts of exercise performed three to five times a week.⁷ The lack of moderator effects may stem from the considerable heterogeneity of included trials in this NMA. Some recent work, however, suggests that all exercise training formats reduce the burden of mental illness irrespective of training dose, type, and intensity.⁷ Because depression is commonly associated with reduced physical activity levels, sedentariness, and health issues consequent to inactivity,⁷ adults with depression may be particularly responsive to any structured exercise intervention. Current CDC guidelines recommend that adults perform at least 150 minutes per week of moderate-intensity activity.⁶² Most of the exercise interventions (61.1%) included in this NMA met the CDC's physical activity recommendations. Thus, when recommending exercise training as an alternative or adjunct treatment, clinicians might initially advise eligible patients to pursue any structured exercise program, provided the minimum physical activity requirements are met.

Given the inconsistent findings of moderator effects in the literature, additional systematic research is needed to parse the

BA and EX may share similar mechanisms of action and may be used in complementary ways, a speculation we discuss more below.

features of EX that may modulate its anti-depressant effect. This includes better characterizing high responders versus low non-responders. A patient's diagnosis, severity of depression, capacity for exercise, exercise history, motivational state, and other factors likely predict responsiveness to specific forms of exercise. For example, there is evidence that certain exercise training protocols may be more effective for certain types of patients, particularly those with chronic physical health problems.⁷ In addition, recent research suggests that comorbid anxiety may diminish the therapeutic effect of exercise for depression.⁶³ As such, it is important that further research examine the effect of exercise training formats, types of exercise, and co-morbidities on the therapeutic benefit of exercise training for depression. Assessing such factors will support the development of evidence-based guidelines for exercise training protocols for depression. As with other forms of therapy (e.g., BA), an individualized, patient-centered approach may optimize treatment.

Previous studies have examined the effectiveness of a combinational BA and EX approach.⁶⁰ In BA, the patient is guided to identify and practice activities perceived as pleasant.³¹ Exercise activities might be included to increase physical activity levels and improve health outcomes. It is well-established in the sport psychology literature that exercise adherence is stronger when the exerciser develops clear goals and is intrinsically motivated to partake in the exercise activity.⁶⁴ Thus, BA might provide a useful framework for promoting exercise in patients with depression whilst capitalizing on the benefits of both EX and BA. This combination approach might, in turn, produce a stronger anti-depressant effect for the patient. Future work might systematically explore the addition of exercise within a BA

framework. Similarly, CBT and EX may be stacked to augment the behavioral components of CBT. Exercise training interventions might

also borrow from behavioral activation principles to promote exercise adherence.

Limitations

Several limitations warrant mention. First, most studies suffered from methodological limitations, including small sample size, selective reporting of data and protocols, publication bias, and multiple outcome and time point measures. Second, this NMA excluded studies comparing pharmacology to exercise for depression. Many studies have compared exercise to pharmacology, but the objective of this study was to better assess the use of exercise compared to other behavioral, non-pharmacological approaches. Though anti-depressants are widely used in clinical practice, numerous studies report that patients increasingly prefer non-pharmacological treatments.^{25,65} Future research might conduct a more comprehensive NMA, comparing psychotherapy, psychopharmacology, and exercise training for depression.

Despite stringent inclusion and exclusion criteria, a large portion of the findings yielded heterogeneous outcomes. High heterogeneity may challenge the transitivity assumption. Given the heterogeneous outcomes and the questions regarding basic network meta-analytic assumptions, it is imperative to interpret the results of this analysis with caution.

As another confounding factor, this study did not control for depression severity, which may have affected the efficacy outcomes of each treatment modality. Most studies included patients with mild to moderate depression as scored with validated screening tools. The few studies that examined more severe forms of depression, such as major depression disorder (MDD), employed CBT. The use of CBT for MDD may be due to the overwhelming and long-standing support for CBT for depression.⁶⁶ At present, few studies have examined the efficacy of EX for MDD. Because amotivation is typically associated with MDD, individuals with MDD may lack the

necessary motivation to exercise.⁶¹ Future studies are needed to address this speculation. Future work will also benefit by controlling for the effect of depression severity.

Findings may also be limited by our use of a Frequentist in lieu of a Bayesian approach. Evidence suggests that differences in effect sizes can occur depending on which of these approaches is adopted.^{67,68} In a re-analysis of data from 14 NMAs, Sadeghirad and colleagues (2017) found differences in the magnitude of effect estimates.⁶⁷ However, similar to previous work,⁶⁸ the authors rarely found differences in the direction of treatment rankings. According to these findings, applying a Bayesian approach to this NMA may have produced slightly larger effect estimates, but the treatment rankings would have likely remained unchanged.

Use of treatment as usual and waitlist controls as comparators may have contributed to the study's moderate to high levels of bias and confounded treatment estimates. According to some findings, WL control conditions may produce a placebo effect.⁶⁹ Delayed treatment may implicitly discourage patients from seeking alternative treatments until the waitlist period has finished, which might cause disappointment and increased depression. As a result, this may drive spurious findings in favor of the active comparison. TAU also invites some concern as it is often an ill-defined and highly variable control condition across trials. TAU may depend, for example, on the clinical context of the research trial. It could consist of comprehensive clinical care or little to no care at all. It is possible, for example, that the structure of TAU is different when compared to CBT, a therapy more likely to be offered in clinical settings with good quality TAU than when it is compared to exercise, a therapy more likely to be offered in non-clinical settings without good quality TAU. To assess the differential effects of TAU and WL control conditions, we performed

two additional network analyses. The TAU network found that both BA and EX had an equal average ranking of 2.0, while CBT ranked 2.3. In contrast, the WL network found that BA ranked first (1.2), followed by CBT (2.0) and EX (3.3). Though TAU and WL may skew effect size estimates, previous NMAs heavily employ these control conditions.⁷⁰⁻⁷² Even so, the authors realize that claiming treatment interventions are effective because they outdo TAU and WL conditions is potentially flawed as TAU and WL conditions may be weak comparisons from which to arrive at such claims. Future investigations of psychological interventions for depression might consider using more clearly defined control conditions, active controls, and/or controlling for the quality of TAU.

Another important point to address is that the number of studies employing exercise training was comparatively less compared to CBT. The overwhelming evidence base of this NMA compared CBT to TAU or CBT to WL. In addition, most of the head-to-head trials included in the analysis compared an active treatment to either of these two control conditions. CBT for depression has been heavily researched for over 50 years; therefore, the

number of randomized trials examining CBT is expectedly greater than other interventions. Of the evidence base, however, 27% of our studies examined exercise as a treatment modality, which is the second highest for any treatment arm behind CBT. Although the evidence base included in this paper is less for exercise than for CBT, we are limited to the available evidence. In addition, there was a limited number of RCTs directly comparing EX to these established therapies. Due to the variability of depressive symptoms over time and the rate of spontaneous remission, it is important to have direct head-to-head RCTs comparing forms of therapy to draw stronger conclusions regarding therapeutic efficacy. Additional work evaluating the efficacy of exercise training for depression in larger samples is thus encouraged.

Finally, we limited our analysis to four psychological interventions, excluding both mindfulness-based exercise programs and psychopharmacology. Future work might consider including a more comprehensive set of treatments to make additional comparisons; however, such investigations must develop strict methodologies to ensure basic network meta-analysis assumptions are met.

Conclusions and Future Directions

According to findings from this network meta-analysis, exercise training may be a useful treatment option for adult depression with comparable effects to “gold standard” therapies.⁶⁶ However, there is insufficient evidence to recommend exercise training as a proven, evidence-based therapy to treat clinical depression in adults. There are very few methodologically sound RCTs that compare exercise to different non-pharmacologic treatments for adult depression. More research

is thus needed. Considering the limited evidence, clinicians might consider exercise training as an alternate or adjunct treatment for adults with mild to moderate depression. Most of the exercise interventions included in this NMA satisfied CDC physical activity guidelines for adult depression; thus, these guidelines might be recommended as part of treatment. Future research is needed to develop more well-defined exercise training guidelines.

Conflicts of Interest

None of the authors have any potential conflict of interests.

Funding Sources

L. Zhu's research is funded by Postdoctoral Fellowship, Award Number 18POST34030416 from American Heart Association (AHA), and TUFCCC/HC Regional Comprehensive Cancer Health

Disparity Partnership, Award Number U54 CA221704(5) from the National Cancer Institute of National Institutes of Health (NCI/NIH). The contents are solely the responsibility of the authors and do not necessarily represent the official views of the AHA or NCI/NIH.

Statement of Contributions

NH and MS had the idea for the paper. NH was the primary author. Other co-authors contributed specific sections: SR (literature search), AS (secondary reviewer and risk of bias assessment), TJ (manuscript preparation and data extraction), AB (data extraction), LT (data extraction), LZ (data analysis and coding), CL (tie breaker for inclusion), JS (tie breaker for inclusion), and FA (tie breaker for inclusion). All authors revised the draft report and approved the final version. TJ significantly contributed to the development of the manuscript.

References

1. CDC. National Center for Health Statistics: Depression. <https://www.cdc.gov/nchs/fastats/depression.htm>
2. World Health Organization. Depression: Fact sheet May 1 2021. <https://www.who.int/news-room/fact-sheets/detail/depression>.
3. American Psychiatric Association. (2013). Depressive Disorders. In Diagnostic and statistical manual of mental disorders (5th ed.). <https://doi.org/10.1176/appi.books.9780890425596.dsm05>
4. Correll CU, et al. Prevalence, incidence and mortality from cardiovascular disease in patients with pooled and specific severe mental illness: a large-scale meta-analysis of 3,211,768 patients and 113,383,368 controls. *World Psychiatry* 2017; 16:163-180.
5. Vancampfort D, et al Diabetes mellitus in people with schizophrenia, bipolar disorder and major depressive disorder: a systematic review and large scale meta-analysis. *World Psychiatry* 2016;15:166-74.
6. Firth, J. et al. The Lancet Psychiatry Commission: A blueprint for protecting physical health in people with mental illness. *The Lancet Psychiatry* 2019; 6: 675-712/
7. Chekroud SR, et al. Association between physical exercise and mental health in 1.2 million individuals in the USA between 2011 and 2015: A cross-sectional study. *The Lancet Psychiatry* 2018;9: 739-746.
8. National Institute for Health and Care Excellence. Depression in adults: Recognition and management. April 2018. <https://www.nice.org.uk/guidance/cg90> (Jun 11 2019).
9. World Health Organization. Mental health: Physical activity. Jun 2012. https://www.who.int/mental_health/mhgap/evidence/resource/depression_q6.pdf?ua=1 (Jun 11 2019).
10. Schuch FB, Vancampfort D, Richards JA, Rosenbaum S, Ward PB, Stubbs B. Exercise as a treatment for depression: A meta-analysis adjusting for publication bias. *J Psychiatr Res* 2016; 77: 42-51.
11. Cooney GM, Dwan K, Greig CA, Lawlor DA, Rimer J, Waugh FR, McMurdo M, Mead GE. Exercise for depression. *Cochrane Database Syst Rev*. 2013 Sep 12;(9):CD004366. doi: 10.1002/14651858.CD004366.pub6.
12. Helgadóttir B, Forsell Y, Hallgren M, Möller J, Ekblom Ö. Long-term effects of exercise at different intensity levels on depression: A randomized controlled trial. *Prev Med*. 2017 Dec;105:37-46. doi: 10.1016/j.ypmed.2017.08.008.
13. Rethorst, C. D. (2019). Effects of exercise on depression and other mental disorders. In M. H. Anshel, S. J. Petruzzello, & E. E. Labbé (Eds.), *APA handbook of sport and exercise psychology*, Vol. 2. Exercise psychology (pp. 109–121). American Psychological Association. <https://doi.org/10.1037/0000124-006>
14. Stubbs B., et al. EPA guidance on physical activity as a treatment for severe mental illness: A meta-review of evidence and position statement from the European Psychiatric Association (EPA),

- supported by the International Organization of Physical Therapists in Mental Health (IOPTMH). *Eur Psychiatry* 2018; 54: 124-144.
15. Chekroud AM, Trugerman A. The opportunity for exercise to improve population mental health. *JAMA Psych* 2019. Published online Sep 4, doi: 10.1001/jamapsychiatry.2019.2282.
 16. Trivedi MH, Greer TL, Church TS, et al. Exercise as an augmentation treatment for nonremitted major depressive disorder: A randomized, parallel dose comparison. *J Clin Psychiatry* 2011; 72(5): 677-684.
 17. Bennett-Levy, J., Richards, D., Farrand, P., Griffiths, D. K., Klein, B., Proudfoot, J., & Ritterband, L. (2014). *Oxford Guide to low intensity CBT interventions*. OUP Oxford.
 18. Cochrane Collaboration Depression, Anxiety, and Neurosis Group. CCDAN Topic list: Intervention-psychological therapies. 2013. http://ccdan.cochrane.org/sites/ccdan.cochrane.org/files/uploads/CCDAN%20topics%20list_psychological%20therapies%20for%20website.pdf (Jun 11 2019).
 19. Chekroud AM, Foster D, Zheutlin AB, Gerhard DM, Roy B, Koutsouleris N, et al. Predicting Barriers to Treatment for Depression in a U.S. National Sample: A Cross-Sectional, Proof-of-Concept Study. *Psychiatr Serv*. 2018 Aug 1;69(8):927-934. doi: 10.1176/appi.ps.201800094
 20. Mohr DC, Hart SL, Howard I, Julian L, Vella L, Catledge C, et al. Barriers to psychotherapy among depressed and nondepressed primary care patients. *Ann Behav Med*. 2006 Dec;32(3):254-8. doi: 10.1207/s15324796abm3203_12
 21. Belvederi Murri M., Ekkekakis P, Magagnoli M, et al. Physical exercise in major depression: Reducing the mortality gap while improving clinical outcomes. *Frontiers in psychiatry* 2019; 9: 762. <https://doi.org/10.3389/fpsy.2018.00762>
 22. Cascade, E., Kalali, A. H., & Kennedy, S. H.. Real-World Data on SSRI Anti-depressant Side Effects. *Psychiatry (Edmont (Pa. : Township))* 2009; 6(2), 16–18.
 23. Hirsch M, Birnbaum RJ. Selective serotonin reuptake inhibitors: Pharmacology, administration, and side effects. *UpToDate* 2019.
 24. Gartlehner G, Thieda P, Hansen RA, et al. Comparative risk for harms of second-generation anti-depressants: A systematic review and meta-analysis. *Drug Saf* 2008; 31: 851-865.
 25. Cuijpers P, Quero S, Dowrick C, Arroll B. Psychological treatment of depression in primary care: Recent developments. *Curr Psychiatry Rep* 2019.
 26. Morres ID, Hatzigeorgiadis A, Stathi A et al. Aerobic exercise for adult patients with major depressive disorder in mental health services: A systematic review and meta-analysis. *Depress. Anxiety* 2018; 36(1):39-53.
 27. Petticrew M, Rehfuss E, Noyes J, et al. Synthesizing evidence on complex interventions: how meta-analytical, qualitative, and mixed-method approaches can contribute. *J Clin Epidemiol* 2013; Published online Aug 14. DOI: 10.1016/j.jclinepi.2013.06.005.
 28. Beck, J. S. (2011). *Cognitive behavior therapy: Basics and beyond*. New York, NY: Guilford Press
 29. Cuijpers P, Noma H, Karyotaki E, Cipriani A, Furukawa TA. Effectiveness and Acceptability of Cognitive Behavior Therapy Delivery Formats in Adults With Depression: A Network Meta-analysis. *JAMA Psychiatry*. 2019;76(7):700-707. doi: 10.1001/jamapsychiatry.2019.0268
 30. Soleimani, M., Mohammadkhani, P., Dolatshahi, B., Alizadeh, H., Overmann, K. A., & Coolidge, F. L. A Comparative Study of Group Behavioral Activation and Cognitive Therapy in Reducing Subsyndromal Anxiety and Depressive Symptoms. *Iran. J. Psychiatry* 2015; 10(2), 71–78.
 31. Dimidjian S, Barrera M Jr, Martell C, Muñoz RF, Lewinsohn PM. The origins and current status of behavioral activation treatments for depression. *Annu Rev Clin Psychol*. 2011;7:1-38. doi: 10.1146/annurev-clinpsy-032210-104535
 32. Hopko DR, Lejuez CW, Ruggiero KJ, Eifert GH. Contemporary behavioral activation treatments for depression: procedures, principles, and progress. *Clin Psychol Rev*. 2003;23(5):699-717. doi: 10.1016/s0272-7358(03)00070-9.

33. Hofmann, S. G., Asaani, A., Vonk, I. J. J., Sawyer, A. T. & Fang, A. The efficacy of cognitive-behavioral therapy: A review of meta-analyses. *Cognit Ther Res* 2012; 36(5), 427-440. doi: 10.1007/s10608-012-9476-1
34. Barth J, Munder T, Gerger H, et al. Comparative efficacy of seven psychotherapeutic interventions for patients with depression: A network meta-analysis. *PLoS Med* 2013; Published online May 28. DOI: 10.1371/journal.pmed.1001454.
35. Moher D, Liberati A, Tetzlaff J, Altman DG. Preferred reporting items for systematic reviews and meta-analyses: The PRISMA statement. *PLoS Med*. 2009;6(7):e1000097.
36. Ouzzani M, Hammady H, Fedorowicz Z, Elmagarmid A. Rayyan- A web and mobile app for systematic reviewers. *Syst Rev* 2016; 5: 210.
37. Tsang HW, Chan EP, Cheung WM. Effects of mindful and non-mindful exercises on people with depression: a systematic review. *Br J Clin Psychol*. 2008 Sep;47(Pt 3):303-22. doi: 10.1348/014466508X279260
38. Jobst A, Brakemeier EL, Buchheim A, et al. European Psychiatric Association Guidance on psychotherapy in chronic depression across Europe. *Eur Psychiatry* 2016; 33: 18-36.
39. Qaseem A, Berry MJ, Kansagara D. Clinical Guidelines Committee of the American College of Physicians. Nonpharmacologic versus pharmacologic treatment of adult patients with major depressive disorder: a clinical practice guideline from the American College of Physicians. *Ann Intern Med* 2016; 164: 350-359.
40. NICE. Depression in adults: Recognition and management clinical guidance. 2009. <https://www.nice.org.uk/guidance/cg90/chapter/Recommendations>
41. Beck AT, Ward CH, Mendelson M, Mock J, Erbaugh J. An inventory for measuring depression. *Arch Gen Psychiatry* 1961; 4: 561-571.
42. Hamilton M. Development of a rating scale for primary depressive illness. *Br J Soc Clin Psychol* 1967; 6: 278-296.
43. Nikolakopoulou, A., Higgins, J., Papakonstantinou, T., Chaimani, A., Del Giovane, C., Egger, M., & Salanti, G. CINeMA: An approach for assessing confidence in the results of a network meta-analysis. *PLoS med* 2020, 17(4), e1003082. <https://doi.org/10.1371/journal.pmed.1003082>
44. National Collaborating Centre for Methods and Tools. Appraising the risk of bias in randomized trials using the Cochrane Risk of Bias Tool. 2016. <https://www.nccmt.ca/knowledge-repositories/search/280> (Jun 21 2019).
45. Page MJ, Shamsler L, Altman DG, et al. Epidemiology and reporting characteristics of systematic reviews of biomedical research: A cross-sectional study. *PLoS Med* 2016; Published online May 24. DOI: 10.1371/journal.pmed.1002028.
46. StataCorp. Stata Software. 2018. <https://www.stata.com/> (Jun 21 2019).
47. Chaimani A, Higgins JP, Mayrdis D, Spyridonos P, Salanti G. Graphical tools for network meta-analysis in STATA. *PLoS One* 2013; Published online Oct 3. DOI: 10.1371/journal.pone.0076654.
48. Lin L. Use of Prediction Intervals in Network Meta-analysis. *JAMA Netw Open* 2019 Aug 2;2(8):e199735. doi: 10.1001/jamanetworkopen.2019.9735. PMID: 31433478; PMCID: PMC6707007.
49. Reibe D , Jonathan K , Liguori G , et al . ACSM's Guidelines for Exercise Testing and Prescription. 10th edn. Wolters Kluter, 2018.
50. McIndoo CC, File AA, Preddy T, Clark CG, Hopko DR. Mindfulness-based therapy and behavioral activation: A randomized controlled trial with depressed college students. *Behav Res Ther* 2016; 77; 118-128.
51. Williams CL, Tappen RM. Exercise training for depressed older adults with Alzheimer's disease. *Aging Ment Health* 2008; 12: 72-80.
52. Martin PR, Aiello R, Gilson K, Meadows G, Milgrom J, Reece J. Cognitive behavior therapy for comorbid migraine and/or tension-type headache and major depressive disorder: An exploratory randomized controlled trial. *Behav Res Ther* 2015; 73: 8-18.

53. Cuijpers P, Turner, EK, Koole SL, Dijke AV, Smit F. What is the threshold for a clinically relevant effect? The case of major depressive disorders. *Depress Anxiety* 2014; 00: 1-5.
54. Van Straten A, Geraedts A, Verdonck-de LI, Andersson G, Cuijpers P. Psychological treatment of depressive symptoms in patients with medical disorders: A meta-analysis. *J Psychosom Res* 2010; 69: 23-32.
55. Beltman MW, Voshaar RC, Speckens AE. Cognitive-behavioral therapy for depression in people with somatic disease: Meta-analysis of randomized controlled trials. *Br J Psychiatry* 2010; 197: 11-19.
56. Cuijpers P, Driessen E, Hollon SD, van Oppen P, Barth J, Andersson G. The efficacy of non-directive supportive therapy for adult depression: a meta-analysis. *Clin Psychol Rev* 2012;32(4):280-91. doi: 10.1016/j.cpr.2012.01.003.
57. Ekers D, Webster L, Van Straten A, Cuijpers P, Richards D, Gilbody S. Behavioural activation for depression; an update of meta-analysis of effectiveness and sub group analysis. *PLoS One* 2014;9(6):e100100. doi: 10.1371/journal.pone.0100100.
58. Jacobson, N. S., Dobson, K. S., Truax, P. A., Addis, M. E., Koerner, K., Gollan, J. K., et al. A component analysis of cognitive-behavioral treatment for depression. *J Consult Clin Psychol* 1996; 64, 295–304. <https://doi.org/10.1037/0022-006X.64.2.295>.
59. Dimidjian S, Hollon SD, Dobson KS, Schmaling KB, Kohlenberg RJ, Addis ME, et al. Randomized trial of behavioral activation, cognitive therapy, and anti-depressant medication in the acute treatment of adults with major depression. *J Consult Clin Psychol.* 2006;74(4):658-70. doi: 10.1037/0022-006X.74.4.658.
60. Lambert, JD., Greaves, CJ., Farrand, P., Price, L., Haase, AM., & Taylor, AH. (2018). Web-Based Intervention Using Behavioral Activation and Physical Activity for Adults With Depression (The eMotion Study): Pilot Randomized Controlled Trial. *J. Med. Internet Res.* 2018; 20(7), e10112. <https://doi.org/10.2196/10112>
61. Schuch FB, Vancampfort D, Richards J, Rosenbaum S, Ward PB, Stubbs B. Exercise as a treatment for depression: A meta-analysis adjusting for publication bias. *J Psychiatr Res.* 2016;77:42-51. doi: 10.1016/j.jpsychires.2016.02.023
62. How much physical activity do adults need? (2020, October 07). Retrieved February 05, 2021, from <https://www.cdc.gov/physicalactivity/basics/adults/index.htm>
63. Blumenthal JA, Babyak MA, Craighead WE, Davidson J, Hinderliter A, Hoffman B, et al. The role of comorbid anxiety in exercise and depression trials: Secondary analysis of the SMILE-II randomized clinical trial. *Depress Anxiety.* 2021;38(2):124-133. doi: 10.1002/da.23088.
64. Weinberg, Robert S, and Daniel Gould. *Foundations of Sport and Exercise Psychology.* Champaign, IL: Human Kinetics, 1995.
65. Hickie IB, Luscombe GM, Davenport TA, Burns JM, Highet NJ. Perspectives of young people on depression: awareness, experiences, attitudes and treatment preferences. *Early Interv Psychiatry.* 2007;1(4):333-9. doi: 10.1111/j.1751-7893.2007.00042.x.
66. David D, Cristea I, Hofmann SG. Why cognitive-behavioral therapy is the current gold standard for psychotherapy. *Front Psychiatry* 2018. Published online Jan 29, 2018. Doi: 10.3389/fpsy.2018.00004
67. Sadeghirad B, Brignardello-Petersen R, Johnston BC, Guyatt GH, Beyene J. Comparing bayesian and frequentist approaches for network meta-analysis: An empirical study. *Global Evidence Summit, Cape Town, South Africa.* 15 Sept 2017.
68. Hong H, Carlin, BP, Shamliyan TA, et al. Comparing Bayesian and frequentist approaches for multiple outcome mixed treatment comparisons. *Med Decis Making* 2013; 33: 702-714.
69. Furkawa TA, Noma H, Caldwell DM, et al. Waiting list may be a nocebo condition in psychotherapy trails: A contribution from network meta-analysis. *Acta Psychiatr Scand* 2014; 130: 181-192.

70. Cuijpers P, Noma H, Karyotakki E, Cipriani A, Furukawa TA. Effectiveness and acceptability of cognitive behavior therapy delivery formats in adults with depression: A network meta-analysis. *JAMA Psychiatry* 2019; 76: 700-707.
71. Lopez- Lopez JA, Davies SR, Caldwell DM, et al. The process and delivery of CBT for depression in adults: A systematic review and network meta-analysis. *Psychol Med* 2019; 49: 1937-1947.
72. Corbett MA, Rice SJ, Madurasinghe V, et al. Acupuncture and other physical treatments for the relief of pain due to osteoarthritis of the knee: Network meta-analysis. *Osteoarthritis Cartilage* 2013; 21: 1290-1298.

The Effects of a Single Session of Online Yoga for Anxiety and Mood States: A Pilot Study

EMMA SOLIVA, BS¹; SARA KOVACS, PHD¹; KATHRYN FRITZ, PHD¹

¹Department of Kinesiology, College of Public Health, Temple University

Correspondence: ewasolvia@gmail.com (Emma Solvia)

PURPOSE: The purpose of this study was to examine the effects that a single session of online yoga has on anxiety. The secondary purpose was to compare the anxiolytic effects of this study to the effect size reported for the effects of single session in-person yoga. **METHODS:** Eligible participants were randomly assigned to a 30-minute, prerecorded Zoom session of either yoga practice or yoga information. Prior to and following completion of the recording, participants completed an online survey assessing anxiety and mood. An effect size (SMD) was calculated and compared to the effect size reported in a meta-analysis. **RESULTS:** Statistically significant group X time interactions were found for anxiety outcomes (intensity, frequency, total) ($p < .026$) and for POMS tension, fatigue, depression, esteem-related, vigor, and total mood disturbance scores, $p < .041$. Yoga participants reported a greater reduction in total anxiety and total mood disturbance scores compared to information participants. The SMD anxiety scores in this study was .54 (95% CI, .051-1.03), which is comparable to the effect size previously reported which was .55 (95% CI, .29-.79). **CONCLUSION:** A single session of online yoga was found to reduce anxiety. When compared to in person yoga, online yoga appears to have similar anxiolytic effects.

Keywords: Online exercise, anxiety, yoga, mood

Introduction

The novel coronavirus 2019 (COVID – 19) pandemic brought immense alterations on daily life, causing drastic limitations and restrictions on daily tasks, inhibiting normal social activities and interactions. Individuals' mental health has also been impacted by the pandemic. A nationwide psychological survey on the general Chinese population, found that 53.8% of the participants reported the COVID-19 outbreak as moderate or severely psychologically impactful.¹ Additionally 28.8% of respondents reported moderate to severe anxiety symptoms.¹ When compared to pre-pandemic anxiety levels, there has been an

increase in individuals reporting symptoms of anxiety during the pandemic, 17.3% to 20.1%.² Data from a nationally representative sample in the US revealed that the percentage of individuals screening positive for anxiety increased from 8.2% in 2019 to as high as 30.0% in 2020.³ Anxiety symptoms have been shown to impact social activities, work, and home life.⁴

The impact of COVID-19 has potentially left many individuals without proper psychological treatment. Possible anxiety-related circumstances, such as fear of crowds or fear of infection, and limited psychological services may also contribute towards individuals

being unable to receive treatment. Common treatments for anxiety include pharmaceutical medication and cognitive behavioral therapy.⁵ Pharmaceutical medication such as selective serotonin reuptake inhibitors (SSRIs) and serotonin/ norepinephrine reuptake inhibitors (SNRIs) have been shown to significantly improve anxiety and anxiety-related disorders.⁵ Face-to-face cognitive behavioral therapy has also been found as an effective treatment for anxiety.⁵ Although significantly effective in treating anxiety, such treatment options can be expensive and/or require a physician's prescription that individuals may have been unable to obtain due to COVID-19 restrictions or unable to afford due to loss of job and benefits resulting from the pandemic. Alternative treatments for anxiety that are safe, effective, and accessible are needed.

Participation in a single session of physical activity has been shown to decrease anxiety⁶ and increase overall mood⁷ whilst being cost effective for many individuals.⁷ One study found that during COVID, self-reported physical activity was associated with improving mood states, with anxiety relief being a top motivator for physical activity.⁸ However, Marashi et al. reported barriers to physical activity during COVID were lack of equipment and access to gym facilities.⁸ Pre-COVID common barriers to physical activity among young adults were found to be: Facilities do not have inconvenient schedules for me, Costs too much money, Place too far away, and Too few places.⁹ These studies highlight the need to address barriers concerning access to physical activity. One type of physical activity that has been shown to result in improvement in anxiety symptoms is yoga.¹⁰ Unlike aerobic or resistance

training exercises that can require gym equipment or adequate space, yoga participation can occur within the home with little equipment. One meta-analysis summarizing the effects of a single session of yoga on anxiety found that a single session of yoga resulted in a small to moderate but significant reduction in anxiety.¹⁰ Larger reductions in anxiety were found for yoga sessions rated over 10 (light intensity) on Borg's 6-20 RPE scale, for participants that had previous yoga experience, and when anxiety was assessed 0-10 minutes after the yoga session.¹⁰ Due to pandemic constraints, opportunities to participate in yoga through Internet based platforms, has created a space where individuals are able to continue to participate in physical activity classes from their own home. A meta-analysis found that online Hatha yoga interventions were a feasible, "lower cost, and non-invasive intervention" option for management of an array of disorders and symptoms that yielded promising attendance and practice rates.¹¹ This suggests that providing online yoga interventions could reduce barriers to seeking alternative treatment options for conditions such as anxiety. One form of yoga, hatha yoga, may be particularly beneficial for reducing anxiety as hatha yoga focuses on slow and deliberate movement as well as the constructs of relaxation and mindfulness. The aims of the present study were 1) to examine the effects of a single session of online hatha yoga session on anxiety and mood state in college-aged individuals, and 2) to compare the results found in the current study to results reported in a recent meta-analysis¹⁰ that summarized the effects of a single session of in-person yoga on anxiety.

Methods

Participants

The participants (n = 29) were recruited via email, campus flyers around the Temple University and Philadelphia area, and word of mouth. Recruitment of participants lasted from October 2021 to March 2022. Inclusion criteria

included participants being between the ages of 18 to 30 years old, having no contraindications to exercise, and having a score of at least a total score of 60 on the Anxiety Symptoms Questionnaire (ASQ). All participants provided

informed consent before participating in this study. The Temple University Institutional

Review Board approved the study (record number: 28743).

Participant Screening

Potential participants were screened through a Qualtrics screening survey that assessed physical health status, participation in physical activity, and anxiety symptoms. Physical health status was evaluated utilizing the Physical Activity Readiness Questionnaire (PAR-Q+)¹². Participation in physical activity

was assessed using the Paffenbarger Physical Activity Questionnaire.¹³ Anxiety symptoms were assessed using the Anxiety Symptom Questionnaire (ASQ).¹⁴ Participants were not required to be diagnosed with an anxiety disorder in order to be included in this study.

Measures

Anxiety

Anxiety was assessed utilizing the Anxiety Symptoms Questionnaire (ASQ).¹⁴ This is a 17-item questionnaire that measures the frequency and intensity of anxiety symptoms on a 0 (None) – 10 (Extreme) scale. An example of a statement included “Please select number below that best describes your experiences regarding the Intensity (A) and Frequency (B) of this symptom: Nervousness.” The ASQ assesses a range of symptoms central to anxiety that includes nervousness, worrying, irritability, trouble relaxing, insomnia, lack of energy, difficulty concentrating, somatic symptoms and impairment in functioning due to anxiety. The ASQ total score is calculated by summing the 17

frequency and 17 intensity scores together. The subtotal ranges for both frequency and intensity are 0 to 170 and total ASQ scores ranges from 0 to 340. A minimum score of 60 was required to be included in this study based on findings from a previous study using the ASQ in college-aged individuals.¹⁴ The ASQ takes approximately 2 - 3 minutes to complete. The ASQ was found to have a test-retest reliability of 0.77 in a sample of college students.¹⁴ Additionally, the ASQ in a sample of college students was found to have an overall Cronbach’s α of 0.96 for total scores and Cronbach’s α of 0.93 for both the intensity and frequency subscales.¹⁴

Mood States

Mood states were assessed using the short-form version of the Profile for Mood States (POMS).¹⁵ This version is a 37-item inventory of six subscales: tension-anxiety, depression-dejection, anger-hostility, vigor-activity, fatigue-inertia, and confusion-bewilderment. Eligible participants rated the overarching question “How are you feeling right now?” for each stated mood descriptor (e.g., Tense). Responses were provided on a 5-point scale with a range of 0 (not at all) and 4

(extremely). Scores are calculated through the summing of 5 subscales (tension-anxiety, depression-dejection, anger-hostility, fatigue-inertia, and confusion-bewilderment) and subtracting the subscale scores of vigor-activity and esteem-related affect. The POMS-SF takes approximately 5 -7 minutes to complete. The Profile of Mood States Short Form has been found to have a test-retest reliability ranging from .76 to .95.¹⁶

Rate of Perceived Exertion

Rate of Perceived Exertion was assessed utilizing Borg's 6-20 Rating of Perceived Exertion scale.¹⁷ This was a 1-item inventory with a category scale that ranged from 6 (no exertion at all) to 20 (maximal exertion). Rating of perceived exertion was assessed during the post-condition questionnaire.

Yoga Intervention

Hatha yoga was chosen as the form of yoga as it focuses on slow and deliberate movement as well as the constructs of relaxation and mindfulness. The yoga practice recording included a Hatha yoga sequence of tabletop, cat/cow, hip circles on knees, mountain pose, standing stretches, sun salutation, tree, and star

Yoga Information

The yoga information recording included background information about Hatha yoga, the relationship between yoga and psychological health, and information about mindfulness. There was no physical activity involved with the yoga information group.

Zoom recordings were used for both conditions, with each recording lasting approximately 30 minutes, and taught by the same licensed yoga instructor. Participants in both conditions were asked to complete a pre-

Statistical Analysis

Data was analyzed using version 28.0 of the IBM Statistical Package for the Social Sciences (SPSS) software (IBM Armonk, NY). The primary hypothesis that anxiety would be reduced significantly for the yoga participants and unchanged for the yoga information participants was tested using a two-way ANOVA (two groups X two time points) using $p < .05$ as the criterion for statistical significance. Data were checked for normality and outliers. One participant from the yoga information group was identified as an outlier on most POMS outcomes (depression, fatigue, total

Eligible participants were then randomized into two groups: yoga practice or yoga information. This study was completed entirely online, with no required in-person meeting. All data were gathered using Qualtrics.

pose. Variations for certain poses were also offered to provide participants with alternative options to ensure they were able to complete the sequence safely. The yoga practice session was conducted at low intensity to minimize risk of injury.

condition questionnaire via Qualtrics that assessed amount of sleep during the prior night, caffeine consumption prior to completion of session, expectations of session, anxiety symptoms, and mood states. Participants then watched their respective Zoom recording. Once the recording was completed, participants then completed the post-condition questionnaire via Qualtrics which assessed rate of perceived exertion, anxiety symptoms, and mood states.

mood disturbance) and was removed from all POMS analyses. Previous yoga experience and baseline anxiety scores (intensity, frequency, and total) were tested individually as covariates. These covariates did not significantly influence the results. The results below are from the analyses with no covariates included.

The secondary hypothesis that a single session of online yoga would reduce anxiety to the same degree as a single session of in person yoga was tested by calculating the effect size for anxiety total scores (SMD) with 95% CI. The

SMD in this study was then compared with the effect size reported in Yin et al.¹⁰

Results

A total of 29 participants completed all study procedures (n=14 yoga practice; n= 15 yoga information). Participant characteristics are presented in Table 1. Descriptive statistics for

the Anxiety Symptom Questionnaire (ASQ) outcomes (intensity, frequency, and total) are presented in Table 2. Descriptive statistics for the POMS are presented in Table 3.

Table 1.
Participant Characteristics

Measure		Yoga Practice N = 14 (%)	Yoga Information N = 15 (%)
Gender	Female	13 (93%)	10 (67%)
	Male	1 (7%)	5 (33%)
Age-years	Mean (SD)	21.28 (1.94)	20.33 (1.63)
Race/ Ethnicity	White or Caucasian	9 (64%)	10 (67%)
	Black or African American	2 (14%)	2 (13%)
	Asian	2 (14%)	2 (13%)
	Latin	0	1 (7%)
	Jamaican	1 (8%)	0
Yoga Participation	Regularly participate	4 (29%)	6 (40%)
	Had participated	7 (50%)	6 (40%)
	Never participated	3 (21%)	3 (20%)

Data presented are number and rounded %; Gender, Race/Ethnicity, and Age were write in options.

Table 2.
Anxiety Symptom Questionnaire Descriptives

Group	Measure		Mean	95%CI
Yoga Practice (N = 14)	Intensity	Pre	59.29 (14.69)	50.80, 67.77
		Post	46.43 (15.64)	37.40, 55.46
	Frequency	Pre	54.64 (20.32)	42.91, 66.37
		Post	45.79 (17.49)	35.69, 55.88
	Total	Pre	113.93 (30.32)	96.42, 131.43
		Post	92.21 (29.74)	75.04, 109.39
Yoga Information (N = 15)	Intensity	Pre	46.13 (17.65)	36.36, 55.91
		Post	49.80 (18.29)	39.67, 59.93
	Frequency	Pre	48.00 (18.22)	37.91, 58.09
		Post	48.40(18.36)	38.23, 58.57
	Total	Pre	94.13 (34.39)	75.09, 113.18
		Post	98.20 (34.83)	78.91, 117.49

Table 3.
Profile of Mood States Descriptives

Group	Measure		Mean (SD)	95%CI
Yoga Practice (N = 14)	Tension	Pre	7.43 (3.32)	5.51, 9.35
		Post	2.00 (1.66)	1.04, 2.96
	Anger	Pre	1.21 (1.25)	0.49, 1.94
		Post	0.21 (0.58)	-0.12, 0.55
	Fatigue	Pre	7.29 (2.92)	5.60, 8.97
		Post	2.57 (1.56)	1.67, 3.47
	Depression	Pre	3.21 (2.29)	1.89, 4.54
		Post	1.00 (2.08)	-0.20, 2.20
	Esteem-related Affect	Pre	6.29 (2.84)	4.65, 7.93
		Post	8.57 (2.21)	7.30, 9.85
	Vigor	Pre	4.21 (1.89)	3.12, 5.30
		Post	7.21 (2.39)	5.83, 8.60
	Confusion	Pre	3.57 (1.87)	2.49, 4.65
		Post	1.29 (1.07)	0.67, 1.90
Total	Pre	12.21 (9.30)	6.84, 17.58	
	Post	-8.71 (7.05)	-12.79, -4.64	
Yoga Information (N= 15)	Tension	Pre	7.33 (3.16)	5.59, 9.08
		Post	5.73 (4.04)	3.49, 7.97
	Anger	Pre	1.53 (1.46)	0.73, 2.34
		Post	0.93 (1.49)	0.11, 2.76
	Fatigue	Pre	7.40 (3.36)	5.54, 9.26
		Post	6.00 (3.42)	4.10, 7.90
	Depression	Pre	3.47 (2.26)	2.21, 4.72
		Post	2.87 (2.83)	1.30, 4.43
	Esteem-related Affect	Pre	5.80 (2.57)	4.38, 7.22
		Post	5.40 (3.29)	3.58, 7.22
	Vigor	Pre	4.07 (3.52)	2.12, 6.01
		Post	4.80 (3.41)	2.91, 6.69
	Confusion	Pre	3.60 (3.02)	1.93, 5.27
		Post	2.20 (2.46)	0.84, 3.56
Total	Pre	13.47 (12.27)	6.67, 20.26	
	Post	7.53 (15.84)	-1.24, 16.30	

Anxiety Symptom Questionnaire

As shown in Figure 1, the condition by time interaction for ASQ intensity scores was significant, $F(1, 27)=15.362$, $p<.001$. The condition by time interaction for ASQ

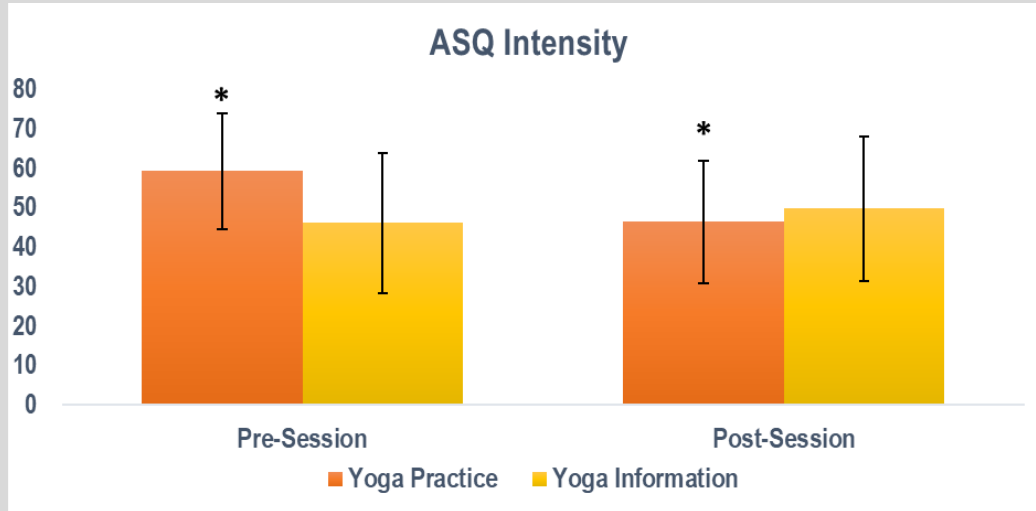
frequency scores was significant, $F(1, 27)=6.736$, $p=.015$. As shown in Figure 2, the condition by time interaction for ASQ total scores was significant, $F(1, 27)=12.225$, $p=.002$.

Profile of Mood States

The condition by time interactions for POMS tension, fatigue, depression, esteem-related, vigor, and total mood disturbance

scores were significant, $p<.041$. The condition by time interactions for POMS anger and confusion scores were not significant, $p>.242$.

Figure 1.
Anxiety Symptom Questionnaire Intensity Scores Before and After either the Yoga Practice Session or Yoga Information Session



* Indicates a significant ($p < .05$) reduction pre to post for Intensity ASQ scores for the yoga practice group.

Figure 2.
Anxiety Symptom Questionnaire Total Scores Before and After either the Yoga Practice Session or Yoga Information Session



* Indicates a significant ($p < .05$) reduction pre to post for Total ASQ scores for the yoga practice group

Secondary Analysis

For the secondary purpose, effect sizes (SMD) with 95% CI were calculated and compared with the effect size reported in Yin et al.¹⁰ The SMD for Total Anxiety scores in this

study was .54 (95% CI, .051-1.03). This is comparable to the effect size previously reported by Yin et al. which was .55 (95% CI, .29-.79).¹⁰

Discussion

The primary purpose of this study was to examine the effects that a single session of online yoga has on anxiety and mood states. The results revealed that a 30-minute session of light-intensity, online yoga reduced the anxiety intensity scores as well as improved overall mood. There was no significant reduction in anxiety frequency scores after the yoga practice. The POMS score for tension, fatigue, depression, esteem-related, vigor, and total mood disturbance were significantly improved after the yoga practice; however, did not improve after the yoga information session. It appears the single session of online, low-intensity yoga may be an effective form of physical activity to improve anxiety and mood in adults.

The utilization of online yoga for mental health has produced favorable results in improving mental well-being. Online Isha Upa yoga, a form of yoga that focuses on joints, muscles, and energy system, has been shown to significantly reduce stress and positively improve well-being in college students.¹⁸ Additionally, online yoga has been shown to improve symptoms of mood disturbance for individuals with mood disorders.¹⁹ The accessibility and acceptability of online yoga has also seen positive results from both participants and yoga practitioners, with individuals reporting that online yoga provided safety from risks of COVID-19, was cost effective, and provided wider access for yoga participants.^{11, 20} The utilization of online yoga can potentially aid towards improving daily mood disturbance thus reducing the severity of several anxiety-related symptoms. Furthermore, online yoga may be a beneficial form of physical activity and mood disturbance control for individuals who are uncomfortable with in-person options. It would

be beneficial to extend the findings of this study to future research studies in populations with limited mobility or limited transportation to determine if online yoga is feasible, safe, and effective at improving mood.

The secondary purpose was to compare the effect size reported in the current study to the effect size reported in a recent meta-analysis that investigated single session in-person yoga on anxiety.¹⁰ The effect size found in this study (SMD= 0.54) was of similar magnitude for in-person single session yoga (SMD= .32-.55).¹⁰ This suggests that the anxiolytic effects of a single session of yoga are not mode dependent. Additionally, the effect size found in this study is also comparable to the effect size reported for a single session of exercise for anxiety of 0.16.⁶ There may be concerns over the safety of participants through online delivery of yoga²⁰; however, participating in low or light intensity a single session of yoga has not been associated with increased risk of injury further suggesting that online, single session yoga may be an effective and accessible way to reduce anxiety. Online treatment forms for anxiety, such as videoconference-based cognitive behavioral therapy, have been shown to improve anxiety to a similar degree when compared to in-person cognitive behavioral therapy.²¹ The potential of reducing anxiety from home may offer a more readily accessible form of treatment to a significant portion of the population. However, this does produce a potential barrier of access as some individuals may not access to a device with internet connection or do not have consistent internet availability. The results from the current study and other studies²¹ suggest researchers should continue to investigate online treatment options for those with anxiety.

There were limitations to this study. One limitation was that the majority of the participants were white college-aged females thus the results found from this study cannot be generalized towards other populations. Another potential limitation was the use of recordings instead of a live class; a live class would confirm if participants completed their session, however, participants did report their level of perceived exertion for their session and scores were indicative of participants having completed their session.

In summary, the results from this study suggest that a single session of online yoga may be an accessible and effective alternative for individuals to reduce their anxiety. Anxiety continues to affect many individuals with access to treatment continually being a barrier. It would be beneficial for researchers to implement a training study to determine the longer-term effects of online yoga for anxiety symptom reduction. Future studies should also aim to further explore how online yoga may be used to reduce anxiety symptoms in more diverse samples.

Acknowledgments

The authors would like to thank Madlyn Strouse for volunteering her time to create the yoga sequence and the yoga information session and for recording both sessions. The authors would also like to thank the participants for their participation.

Conflicts of Interest

The authors have no relationships to disclose.

Statement of Contributions

Ms. Soliva contributed to the conception and design of the study, collected the data, was involved in the interpretation of the data analyses, and drafted the manuscript. Dr. Sara Kovacs contributed to the study design and manuscript preparation. Dr. Fritz contributed to the conception and design of the study, supervised data collection and data analyses, and reviewed and revised the manuscript.

References

1. Qiu, J.Y., et al., A nationwide survey of psychological distress among Chinese people in the COVID-19 epidemic: implications and policy recommendations. *General Psychiatry*, 2020. 33(2).
2. Ramiz, L., et al., A longitudinal study of mental health before and during COVID-19 lockdown in the French population. *Globalization and Health*, 2021. 17(1): p. 1-16.
3. Twenge, J.M. and T.E. Joiner, US Census Bureau-assessed prevalence of anxiety and depressive symptoms in 2019 and during the 2020 COVID-19 pandemic. *Depression and anxiety*, 2020. 37(10): p. 954-956.
4. Association, A.P., *Diagnostic and statistical manual of mental disorders (DSM-5®)*. 2013: American Psychiatric Pub.
5. Bandelow, B., S. Michaelis, and D. Wedekind, Treatment of anxiety disorders. *Dialogues in Clinical Neuroscience*, 2017. 19(2): p. 93-106.
6. Ensari, I., et al., Meta-analysis of acute exercise effects on state anxiety: an update of randomized controlled trials over the past 25 years. *Depression and Anxiety*, 2015. 32(8): p. 624-634.
7. Crush, E.A., E. Frith, and P.D. Loprinzi, Experimental effects of acute exercise duration and exercise recovery on mood state. *Journal of Affective Disorders*, 2018. 229: p. 282-287.

8. Marashi, M.Y., et al., A mental health paradox: Mental health was both a motivator and barrier to physical activity during the COVID-19 pandemic. *Plos One*, 2021. 16(4).
9. Shin, C.-N., Y.-S. Lee, and M. Belyea, Physical activity, benefits, and barriers across the aging continuum. *Applied Nursing Research*, 2018. 44: p. 107-112.
10. Yin, J., L. Tang, and R.K. Dishman, The effects of a single session of mindful exercise on anxiety: A systematic review and meta-analysis. 2021, *Mental Health and Physical Activity*.
11. Brosnan, P., M. Nauphal, and M.C. Tompson, Acceptability and feasibility of the online delivery of hatha yoga: A systematic review of the literature. 2021, *Complementary Therapies in Medicine*.
12. Adams, R., Revised physical activity readiness questionnaire. *Canadian Family Physician*, 1999. 45: p. 992-+.
13. Paffenbarger, R., A. Wing, and R. Hyde, Paffenbarger physical activity questionnaire. *Am J Epidemiol*, 1978. 108(3): p. 161-175.
14. Baker, A., et al., Anxiety Symptoms Questionnaire (ASQ): development and validation. *General Psychiatry*, 2019. 32(6).
15. Shacham, S., A shortened version of the Profile of Mood States. 1983.
16. Curran, S.L., M.A. Andrykowski, and J.L. Studts, Short Form of the Profile of Mood States (POMS-SF): Psychometric Information. 1995, American Psychological Association, Inc.
17. Borg, G., Borg's range model and scales. *International Journal of Sport Psychology*, 2001. 32(2): p. 110-126.
18. Chang, T.F.H., et al., Online Isha Upa Yoga for student mental health and well-being during COVID-19: A randomized control trial. *Applied Psychology-Health and Well Being*.
19. Uebelacker, L., et al., Examining the Feasibility and Acceptability of an Online Yoga Class for Mood Disorders: A MoodNetwork Study. *Journal of Psychiatric Practice*, 2018. 24(1): p. 60-67.
20. Sharma, S.K., et al., Yoga instructors' reported benefits and disadvantages associated with functioning online: A convenience sampling survey. *Complementary Therapies in Clinical Practice*, 2022. 46.
21. Stubbings, D.R., et al., Comparing In-Person to Videoconference-Based Cognitive Behavioral Therapy for Mood and Anxiety Disorders: Randomized Controlled Trial. *Journal of Medical Internet Research*, 2013. 15(11).

Dissemination and Implementation Science to Advance Health Equity: An Imperative for Systemic Change

GABRIELLA M. MCLOUGHLIN, PHD, MS^{1, 2}; OMAR MARTINEZ, JD, MPH, MS³

¹Department of Kinesiology, College of Public Health, Temple University

²Implementation Science Center for Cancer Control and Prevention Research Center, Brown School, Washington University in St. Louis

³School of Social Work, College of Public Health, Temple University

Correspondence: gabriella.mcloughlin@temple.edu (Gabriella M. McLoughlin)

Innovations in public health research and evidence-based interventions targeting chronic and infectious diseases are only effective if they reach their target populations. Individuals from low socioeconomic background, racial and ethnic minorities, and sexual/gender minority communities are most susceptible to chronic diseases such as obesity and cancer, and infectious diseases such as HIV and COVID-19. These disparities are driven by social and structural conditions including stigma and discrimination, housing instability and food insecurity, among others. Accordingly, interventions that aim to improve population health must be targeted toward marginalized communities who are often systematically excluded from decision making processes. This article introduces dissemination and implementation science as a key opportunity to advance health equity through integrating measures and metrics that evaluate if an intervention is successful at improving health outcomes in marginalized populations. Implementation science also provides frameworks to help evaluate the key determinants to implementation success which can inform subsequent health outcomes. Examples of how researchers have engaged with community stakeholders are provided, along with strategies in which dissemination has gone beyond traditional practices. Finally, ways in which universities can build capacity for implementation science as a means to address health disparities are provided with the goal of improving the translation of research to practice.

Keywords: *implementation science, health equity, community engagement, dissemination*

Introduction

Key social and structural drivers of health disparities in infectious and chronic diseases warrant significant attention.¹⁻³ Such social and structural drivers of diseases include structural racism and discrimination, structural stigma, segregation, incarceration, anti-immigration policies, housing instability, and historical trauma.⁴ Systematically excluded racial

and ethnic and sexual and gender minorities and those from low socio-economic status are at a greater risk for such diseases and are often excluded from decision-making processes which take place concerning prevention and treatment.⁵ Many interventions have been conducted to mitigate increases in rates of diseases, but more research is needed to

understand how and why these interventions succeed or fail in real-world settings. To fully address these issues, researchers and practitioners must address the factors that contribute to enhance equity, effectiveness, scale-up and sustainability of preventive measures, programs, policies, and interventions.

Dissemination and implementation science provides a key set of theories, models, and frameworks to address these issues through a pragmatic approach.⁶ This field is driven by the pervasive issues in translating evidence-based interventions and practices into real-world systems and policies. This paper provides an overview of the field of implementation science and its necessary use to advance health

equity through community partnerships. Few pragmatic examples exist in the literature to illustrate how implementation science and community engagement align, so case examples are included on work with communities that serve systematically excluded and marginalized populations with an eye toward stakeholder engagement as a form of ongoing dissemination. Finally, the article concludes by recommending ways to build capacity for rigorous and meaningful implementation science grounded in addressing health disparities and inequities and practicing equitable dissemination and information sharing from the beginning of the research process.

Key Concepts of Implementation Science

Dissemination and implementation science facilitates the process by which evidence-based interventions are implemented and sustained in practice.⁶ Table 1 provides a concise overview of key definitions in implementation science. Through this lens, the desired outcome is implementation effectiveness as a means to reach clinical effectiveness (i.e., HIV, COVID-19, obesity prevention). This is achieved by developing implementation strategies which are designed to enhance implementation of evidence-based interventions (EBI).⁷ Such strategies can be chosen through a variety of ways, but implementation mapping is a key method to ensure a stakeholder-driven process.⁸ Although

implementation science provides systematic approaches for increasing real-world impact of obesity prevention, health equity is not explicitly considered.⁹

Numerous key theories, models, and frameworks provide structural underpinning for implementation science research.¹⁰⁻¹² These can be conceptualized as fitting in to three primary “categories” of 1) implementation determinants; 2) implementation process; and 3) implementation outcomes. A review by Tabak and colleagues provides a strong and comprehensive overview of these various frameworks,¹⁰ those most commonly used are below.

Table 1.
Key Definitions for Dissemination and Implementation Science

Term	Definition
Implementation Research	The study of how best to help clinics/schools/communities implement evidence-based interventions (EBI)
Implementation Determinants	Factors which have been identified as influential to implementation of an EBI
Implementation Outcomes	Measures that inform how well the EBI was executed
Implementation Strategies	Interventions that are developed and tested to improve uptake of the EBI
Implementation Mapping	Stakeholder-driven approach to selecting and tailoring implementation strategies for an EBI

Implementation Processes and Outcomes

The Reach, Effectiveness, Adoption, Implementation, and Maintenance (RE-AIM) framework is frequently used to guide researchers' development and evaluation of EBIs when implemented in a variety of settings, such as healthcare, communities, schools, and others.^{13,14} The word *Reach* pertains to the proposed/actual population that is impacted by a certain EBI as a marker of implementation success, with the notion that the better an intervention is penetrated within a system, the more likely it may be to succeed. *Effectiveness* relates to the perceived or actual efficacy of an intervention to elicit specific outcomes, such as a change in health behavior or an organizational construct (e.g., capacity, retention, climate). *Adoption* is operationalized as the willingness and intentions of key stakeholders within an organization to implement the EBI. *Implementation* relates to a series of specific outcomes that indicate an EBI has successfully been implemented within its target setting. These outcomes can be singular or multifaceted constructs (discussed below) which help to elucidate if an intervention is working and how.

Implementation Determinants

In addition to knowing whether a specific EBI was implemented successfully, researchers also need to know how/why this occurred. This is especially helpful when an effort has had varying levels of success among multiple settings (e.g., several different healthcare facilities) and investigators need to understand what factors influenced implementation.¹⁶ To help us understand these factors, implementation determinant frameworks are needed which encompass empirically derived factors known to drive these outcomes. One commonly used framework is the Consolidated Framework for Implementation Research (CFIR),^{17,18} which provides a comprehensive set of domains to categorize constructs/factors which are commonly understood as influential in implementation of EBIs. These five domains

Finally, *Maintenance* places emphasis on the degree to which an EBI has been sustained in practice and the processes needed to ensure such sustainment. The RE-AIM provides an ideal overarching implementation process framework and is perhaps the most commonly used model in implementation science due to its simplicity and pragmatism.

To operationalize key implementation outcomes, Proctor and colleagues led the development of a framework to operationalize eight key indicators of successful implementation.¹⁵ These are: 1) acceptability (satisfaction with EBI), 2) adoption (intentions to implement), 3) appropriateness (degree of fit within institution), 4) cost (financial costs of implementation), 5) feasibility (relative ease of implementation), 6) fidelity (implementation as intended), 7) penetration (relative reach), and 8) sustainment (maintenance over time). This framework is often applied to study how well an EBI has been implemented within a specific setting; numerous measurement tools have been produced to help assess the degree of implementation success.

are: 1) Innovation Characteristics (factors about the intervention itself), 2) Outer Setting (factors outside the immediate implementation setting such as networks and policies), 3) Inner Setting (within-context facets of organizational culture, climate, leadership, and readiness), 4) Individual Characteristics (implementation leadership, self-efficacy, training), and 5) Implementation Process (planning, engaging stakeholders, implementing, reflecting, and evaluating). In its entirety, this framework helps researchers to fully address contextual variables which can impact implementation and provide meaningful, rich data for development of implementation strategies to bolster positive determinants or mitigate negative determinants. Despite existence of multiple frameworks and models, the meaningful integration of health equity is essential to achieve systemic change, and to

understand how systematically and structurally excluded populations may fully benefit from evidence-based interventions.⁹

Need for Health Equity as Key Focus of Implementation Science

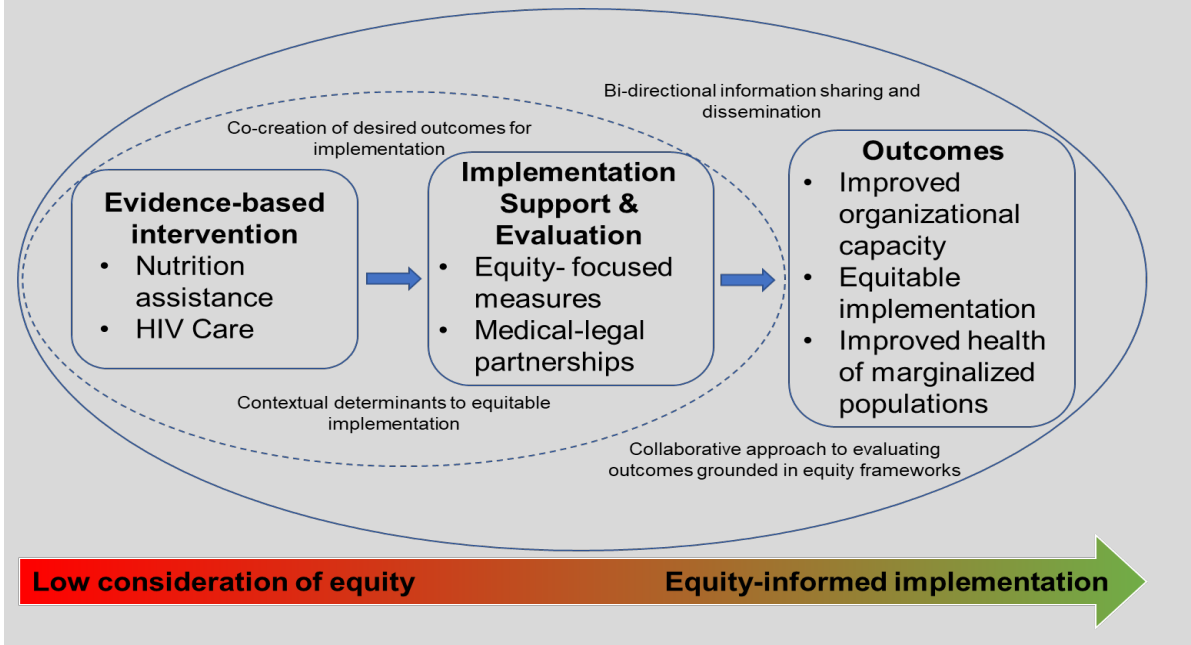
The field of implementation science has embraced health equity as a key focus for advancing the field, with numerous key commentaries published to advance conceptualization of this integration.¹⁹⁻²² One particular commentary by Bauman & Cabassa²² highlights key steps needed to advance this integration using the Proctor implementation evaluation framework as an illustrative example. Specific guidance included a focus on reach from the very beginning whereby interventions and implementation strategies should be tailored to reach the needs of a specific population, conducting a needs assessment to tailor these interventions to the target population, and develop adaptations to adjust nuanced needs over time. In addition, they suggest using an equity lens to evaluate implementation outcomes and build on existing frameworks for such evaluation. Complementary work from other scholars in the field has provided ways to expand frameworks, such as RE-AIM,^{13,23,24} to advance health equity through careful integration of each component of the model.²⁵ Such incremental conceptualization can facilitate dialogue between researchers and stimulate the development of new measures to examine outcomes.

Further, to improve understanding of implementation determinants, frameworks such as the Health Equity Implementation Framework (HEIF) have been developed.^{20,26} The HEIF builds on the CFIR and similar frameworks through providing a series of constructs which will help address some of the structural, interpersonal, and policy-related factors heavily linked to equity and equitable implementation. For example, in addition to understanding individual characteristics and inner setting factors, the HEIF emphasizes the need to study provider and recipient

characteristics (i.e., race/ethnicity, experience, beliefs) which could impact how interventions are implemented with equity. Woodward et al. expanded on this framework with a pragmatic resource to embed equity constructs into other determinant frameworks and measures, helping researchers and practitioners looking to improve their efforts to address health disparities.²⁰

Despite the growth of literature and resources in the last several years, there is a lack of guidance for researchers and practitioners on equitable dissemination to the populations who are the recipients of our EBIs, warranting a deeper dive into these issues. Few illustrative/pragmatic examples are in the published literature on how implementation scientists can meaningfully integrate equitable communication and engagement with the populations they seek to serve through research. Perhaps due to other norms and policies governing academic work, dissemination seems to stop at a peer-reviewed publication and/or conference presentation.²⁷ While this is a necessary action to succeed in academic fields, researchers may unintentionally be circumventing information without disseminating it to the people who need it most. Further, researchers are more likely to miss important details and insights gleaned through engagement of our most important stakeholders. Accordingly, the next section includes two specific examples of how the authors are working to address this issue and argue that dissemination should be a key focus from the outset of a research partnership. **Figure 1** illustrates a conceptual overview of how the authors envision implementation science support as a means to improve the equity and effectiveness of evidence-based interventions.

Figure 1.
Conceptual Overview of Implementation Science as a Means to Advance Health Equity in Disease Prevention



Pragmatic Examples of Implementation Science and Health Equity Integration

Below are two pragmatic examples of how researchers have built partnerships with organizations to facilitate equity in disease prevention. Through this lens, it is posited that

dissemination should be integrated into this collaborative work from the outset and should be a shared process whereby power is equally distributed between researchers, practitioners.

Collaboration with school districts and school policy practitioners to mitigate child food insecurity and obesity

Much work has been conducted to examine the relationships between school health policies and subsequent outcomes at the student level.^{28,29} Considerable research points to the various factors that drive implementation of school policies, such as organizational capacity/readiness, leadership, school culture, and outer setting influences such as district policy and external collaborators.³⁰⁻³² However, to date there are few working examples of how to build capacity within existing school systems for policy implementation, and how key implementing stakeholders are engaged throughout the research process.

the research process; involving them from the very beginning is essential to equitable dissemination and allows for dissemination as an ongoing process as opposed to an outcome. One example of this work transpired in 2020 from the onset of the COVID-19 pandemic, whereby a group of school-based health policy researchers and practitioners began to meet regularly about the state of the evidence regarding food security and school meal distribution during the acute onset of school closures. This work necessitated a balance of urgency to meet local and national stakeholder needs with the rigor of scientific inquiry. Two examples of this were a multi-site case study of four of the nation’s largest school districts and

Collaboration with schools and school districts brings a much-needed pragmatism to

their implementation of universal school meals, and a nationwide assessment of policy implementation of USDA waivers and communication practices related to emergency school meals.^{33,34} These were conducted as rapid-cycle studies, whereby ongoing dissemination of findings occurred at weekly meetings with the researcher-practitioner group,³⁵ and findings were presented at the School Nutrition Association (SNA)³⁶ webinar series to facilitate feedback on the study. Other products included a BBC World Service podcast³⁷ and numerous press releases.

Presently, the lead author and others are working with the School District of Philadelphia Office of Research and Evaluation (ORE) which is uniquely positioned as the research arm of the district and also the evaluation hub of the Supplemental Nutrition Assistance Program- Education (SNAP-Ed). Over the last year, collaboration has emerged through a) providing evaluation support to the ongoing evaluation for SNAP-Ed, school meal programming, and other policy initiatives, and b) working directly with ORE and local partners such as the equity audit tool working group to develop meaningful metrics and indicators that can be used across the district to advance equitable implementation of various policies and programs. These activities have been in response to ORE staff and district needs for

evaluation support and have provided a meaningful opportunity for our work to be fully embedded within community needs.

Through a grant funded by the Urban School Food Alliance (USFA),³⁸ researchers are actively working with the equity audit working group which comprises school and district staff, teachers, and administration to develop these measures and metrics to assess equitable implementation and determinants of policies such as universal school meals. Further, we will engage students as key decision makers through organizing a series of listening sessions and collaborative discussion to ensure their voices are included in designing and development. Through such work, researchers are responsive to the needs of practitioners who serve predominantly low-income and marginalized populations, sharing decision-making power regarding research objectives and procedures. Ongoing local and national *dissemination practices* include attending and presenting at regular USFA and ORE meetings and webinars, participating in the school district equity audit working group, and presenting to the Healthy Eating Research/Nutrition and Obesity Policy Research and Evaluation Network COVID-19 working group which comprises researchers and practitioners to share updates about this work and receive feedback from implementation stakeholders.

Medical Legal Partnerships to Enhance Equity in Healthcare

Medical Legal Partnerships (MLPs) offer a structural integrated intervention that could facilitate improvements in psychosocial, medical and social outcomes among systematically and structurally excluded populations.³⁹⁻⁴² Through legal aid, MLPs can ensure that clients are able to access comprehensive services and receive appropriate legal assistance in a culturally sensitive environment (see Table 2). Our preliminary research on MLPs documents the importance of: 1) identifying the level of severity of health-harming legal needs (both general and specific to diseases); 2) initiating action to resolve legal issues early on in the clinical process, highlighting the significance of preventive legal

aid and advocacy; and 3) coordinating with medical, health-social services, and community partners to support patients throughout the resolution process, including clear protocols of communication between health and legal teams. This process facilitates a patient-centered approach to improving healthcare through legal support, enhancing the equity of care delivery.

Four core components of MLPs have been identified, particularly for those which serve people living with HIV which are: (1) support of leadership; (2) provider-patient trust; (3) physical presence of the attorney at health centers; (4) reliable funding streams; and (5) active community engagement and dissemination.⁴³ An attorney from one of our

studies highlighted the importance of community engagement, they stated “having that ability to help people in a place that they trust and there's consistency and these are the people who live in their community with them, and they are working with us, that is what, it really makes a huge difference to us.” This example illustrates how patients’ voices are integrated heavily into decision making and care delivery, and the ways in which this drives research inquiry as a response to patient needs. Accordingly, our research with MLPs provides a concrete example of how researchers, legal

professionals, clinicians, and patients collaborate in shared decision-making to enhance equity in healthcare. Dissemination must be an ongoing process which is embedded into all aspects of research. Current *dissemination to patient populations* includes serving on two primary committees for the City of Philadelphia which serve sexual and gender minority populations, participating in city-wide webinars and outreach efforts to address health-harming legal needs and advance HIV prevention and care, and actively advocating for enhanced care through community and board engagement.

Table 2.

Added Value of Attorney in Health Care Team

Theme	Evidence-Based Benefits of MLP
Advocacy	Legal partners can address health-harming legal needs Prevent issues from becoming legal needs
Education	Provide guidance to clinical staff during the course of patient care Present educational “Know Your Rights” workshops for patients and community members
Evaluation	Assist in advancing health equity at the community level

Discussion

The purpose of this article was to introduce implementation science as a lens through which to address structural inequities related to public health. There is a critical need to think about health equity domains when developing, testing and evaluating structural interventions.²² As previously mentioned, the authors posit that in order to enhance the impact of implementation strategies, it is necessary to engage community members in all stages of research process, including dissemination and designing for dissemination as part of initial conversations. It is essential for researchers and policymakers to focus on the intersectional structures – including anti-immigration rhetoric, discriminatory policies, structural stigma, and racism and discrimination – that continue to drive epidemics/pandemics among structurally and systematically excluded populations.⁴⁴ Such incorporation will ultimately enhance the dissemination and sustainability of interventions through meeting the needs of

marginalized communities who are most impacted by chronic disease.

The field of implementation science is embracing health equity as a key facet, with numerous recommendations regarding adaptation of existing theories and development of new ones,^{21,25} or emphasizing how researchers can better target marginalized populations through adaptation and community engagement.²² In this article, the authors provide examples of how they have engaged practitioners and community members in research and practice, with a view toward equitable implementation. Further, the authors posit that dissemination, whereby results and information are shared with end users and practitioners, should be *embedded throughout the research process*, and go far beyond a peer reviewed article or conference presentation. By treating dissemination as a *collaborative and bi-directional process*, end users and implementing actors can, in turn, disseminate information back to the researchers and enhance equitable partnership

development. Further, such collaborative practice will enhance researchers' abilities to respond to local needs and initiatives through scientific inquiry.

In order to expand capacity for implementation science and health equity, research institutions need to expand the scope and work of existing implementation science hubs/training centers and establish new ones in socioeconomically deprived jurisdictions. One example is at Temple University which is situated within North Philadelphia, an economically deprived section of the city housing a predominantly racial/ethnic minority population. As Temple is uniquely situated within such a community, building capacity for collaborative work will facilitate greater community impact. The National Institutes of Health has several center-based grants which they fund focused on cancer prevention and control,⁴⁵ mental health,⁴⁶ and heart, lung, and blood disorders.⁴⁷ These grants are housed at various institutions across the nation with the common goal to advance the translation of evidence-based interventions into routine care and practice. Despite this concerted effort to enhance translation and implementation, there is a lack of funding dedicated specifically to address social determinants of health within such centers, which presents an opportunity for innovation in implementation science. Accordingly, steps should be taken to advance capacity within institutions who are embedded within communities to facilitate community partnership building.

Through experiences working within and collaborating across established implementation science centers, the authors have learned that starting slowly with a core group of interdisciplinary scientists is key.

Acknowledgments

The authors would like to acknowledge the collaborative partnerships formed with the School District of Philadelphia, Urban School Food Alliance, Galaei QTBIPOC Radical Social Justice Organization, and the Philadelphia Center Against Sexual Violence. Their collective expertise and knowledge are invaluable to our research and practice in addressing health equity.

Conflicts of Interest

The authors have no conflicts to declare.

Activities such as trainings for faculty and researchers within the university, hosting journal clubs and webinars, and developing a social media presence are simple but effective ways to build capacity for implementation science presence on campus. Based on success of these initiatives, and similar to other methods/research centers housed within schools of public health and medicine, a research core may be a suitable next logical step which would facilitate interdisciplinary collaboration across the institution through consultation services, grant proposals, and other scientific and community engagement initiatives. Further, one area of improvement identified as a priority is to increase the presence of community partners within implementation science centers who are able to participate in key decision making and research initiatives. This may ultimately enhance relationships with the local community and advance public health research through an equitable and community-driven approach.

In conclusion, the field of dissemination and implementation science provides many tools and frameworks for improving the translation of evidence to practice, but more work is needed to advance its use to address and mitigate disparities in public health. This article provides pragmatic examples of our work in school-based policy and healthcare to illustrate how building partnerships with local organizations and providers can enhance the impact of research on public health. Finally, potential next steps are outlined for universities and those in public health and medicine to build capacity for meaningful and rigorous implementation science research and practice.

Funding Sources

Partial support was provided through a National Institute of Mental Health (NIMH) funded grant (1R34MH125718).

Statement of Contributions

Both authors contributed to the conceptualization of this manuscript and its contents. GMM led the writing of this manuscript, and OM provided significant editorial support.

References

1. Jennsen BP, Kelly MK, Powell M, Bouchelle Z, Mayne SL, Fiks AG. COVID-19 and Changes in Child Obesity. *Pediatrics*. 2021;147(5):e2021050123. doi:10.1542/peds.2021-050123
2. Lackland DT, Sims-Robinson C, Jones Buie JN, Voeks JH. Impact of COVID-19 on Clinical Research and Inclusion of Diverse Populations. *Ethnicity & Disease*. 2020;30(3):429-432. doi:10.18865/ed.30.3.429
3. Abrams EM, Szeffler SJ. COVID-19 and the impact of social determinants of health. *The Lancet Respiratory Medicine*. 2020;doi:10.1016/S2213-2600(20)30234-4
4. Marmot M, Friel S, Bell R, Houweling TAJ, Taylor S. Closing the gap in a generation: health equity through action on the social determinants of health. *The Lancet*. 2008/11/08/2008;372(9650):1661-1669. doi:https://doi.org/10.1016/S0140-6736(08)61690-6
5. Alcántara C, Diaz SV, Cosenzo LG, Loucks EB, Penedo FJ, Williams NJ. Social determinants as moderators of the effectiveness of health behavior change interventions: scientific gaps and opportunities. *Health Psychol Rev*. Mar 2020;14(1):132-144. doi:10.1080/17437199.2020.1718527
6. Brownson RC, Colditz GA, Proctor EK, eds. *Dissemination and Implementation Research in Health: Translating Science to Practice, Second Edition*. Oxford University Press; 2018.
7. Powell BJ, McMillen JC, Proctor EK, et al. A compilation of strategies for implementing clinical innovations in health and mental health. *Med Care Res Rev*. Apr 2012;69(2):123-57. doi:10.1177/1077558711430690
8. Fernandez ME, Ten Hoor GA, van Lieshout S, et al. Implementation Mapping: Using Intervention Mapping to Develop Implementation Strategies. *Frontiers in public health*. 2019;7:158-158. doi:10.3389/fpubh.2019.00158
9. Brownson RC, Kumanyika SK, Kreuter MW, Haire-Joshu D. Implementation science should give higher priority to health equity. *Implementation Science*. 2021/03/19 2021;16(1):28. doi:10.1186/s13012-021-01097-0
10. Tabak RG, Khoong EC, Chambers DA, Brownson RC. Bridging research and practice: models for dissemination and implementation research. *American journal of preventive medicine*. 2012;43(3):337-350. doi:10.1016/j.amepre.2012.05.024
11. Vamos CA, Green SM, Griner S, et al. Identifying Implementation Science Characteristics for a Prenatal Oral Health eHealth Application. *Health Promotion Practice*. 2020/03/01 2018;21(2):246-258. doi:10.1177/1524839918793628
12. Purtle JD, EA; Brownson, RC. Policy Dissemination Research. In: Brownson R, ; Colditz, GA; Proctor, EK, ed. *Dissemination and Implementation Research in Health: Translating Science to Practice, Second Edition*. Oxford University Press; 2018.
13. Glasgow RE, Dziewaltowski DA, Estabrooks PA, Gaglio BA, King D, Klesges L. RE-AIM. 2010.
14. Glasgow RE, Klesges LM, Dziewaltowski DA, Estabrooks PA, Vogt TM. Evaluating the impact of health promotion programs: using the RE-AIM framework to form summary measures for decision making involving complex issues. *Health Education Research*. 2006;21(5):688-694. doi:10.1093/her/cyl081

15. Proctor E, Silmere H, Raghavan R, et al. Outcomes for Implementation Research: Conceptual Distinctions, Measurement Challenges, and Research Agenda. *Administration and Policy in Mental Health and Mental Health Services Research*. 2011;38(2):65-76. doi:10.1007/s10488-010-0319-7
16. Mazzucca S, Tabak RG, Pilar M, et al. Variation in Research Designs Used to Test the Effectiveness of Dissemination and Implementation Strategies: A Review. *Front Public Health*. 2018;6:32. doi:10.3389/fpubh.2018.00032
17. Damschroder L, Safaenili N, Rojas-Smith L, Woodward EN. Introduction and application of the consolidated framework for implementation research (CFIR): Version 2 (CFIR V2). . presented at: 14th Annual Conference on the Science of Dissemination and Implementation; 2021; Washington, DC.
18. Damschroder LJ, Aron DC, Keith RE, Kirsh SR, Alexander JA, Lowery JC. Fostering implementation of health services research findings into practice: a consolidated framework for advancing implementation science. *Implementation Science*. 2009;4(1):50-50. doi:10.1186/1748-5908-4-50
19. Emmons KM, Chambers DA. Policy Implementation Science - An Unexplored Strategy to Address Social Determinants of Health. *Ethn Dis*. Winter 2021;31(1):133-138. doi:10.18865/ed.31.1.133
20. Woodward EN, Singh RS, Ndebele-Ngwenya P, Melgar Castillo A, Dickson KS, Kirchner JE. A more practical guide to incorporating health equity domains in implementation determinant frameworks. *Implementation Science Communications*. 2021/06/05 2021;2(1):61. doi:10.1186/s43058-021-00146-5
21. Shelton RC, Adsul P, Oh A, Moise N, Griffith DM. Application of an antiracism lens in the field of implementation science (IS): Recommendations for reframing implementation research with a focus on justice and racial equity. *Implementation Research and Practice*. 2021/01/01 2021;2:26334895211049482. doi:10.1177/26334895211049482
22. Baumann AA, Cabassa LJ. Reframing implementation science to address inequities in healthcare delivery. *BMC Health Services Research*. 2020/03/12 2020;20(1):190. doi:10.1186/s12913-020-4975-3
23. Glasgow RE, Nelson CC, Strycker LA, King DK. Using RE-AIM Metrics to Evaluate Diabetes Self-Management Support Interventions. *American Journal of Preventive Medicine*. 2006;30(1):67-73. doi:10.1016/j.amepre.2005.08.037
24. Glasgow RE, McKay HG, Piette JD, Reynolds KD. The RE-AIM framework for evaluating interventions: what can it tell us about approaches to chronic illness management? *Patient Education and Counseling*. 2001;44(2):119-127. doi:https://doi.org/10.1016/S0738-3991(00)00186-5
25. Shelton RC, Chambers DA, Glasgow RE. An Extension of RE-AIM to Enhance Sustainability: Addressing Dynamic Context and Promoting Health Equity Over Time. *Perspective*. *Frontiers in Public Health*. 2020-May-12 2020;8(134)doi:10.3389/fpubh.2020.00134
26. Woodward EN, Matthieu MM, Uchendu US, Rogal S, Kirchner JE. The health equity implementation framework: proposal and preliminary study of hepatitis C virus treatment. *Implementation Science*. 2019;14(1):26-26. doi:10.1186/s13012-019-0861-y
27. Knoepke CE, Ingle MP, Matlock DD, Brownson RC, Glasgow RE. Dissemination and stakeholder engagement practices among dissemination & implementation scientists: Results from an online survey. *PLOS ONE*. 2019;14(11):e0216971-e0216971.
28. Matsuzaki M, Sánchez BN, Acosta ME, Sanchez-Vaznaugh EV. Competitive Food and Beverage Policies and Obesity among Middle School Students: Variability by Urbanicity in California. *Childhood Obesity*. 2021;doi:10.1089/chi.2021.0025
29. Au LE, Ritchie LD, Gurzo K, et al. Post-Healthy, Hunger-Free Kids Act Adherence to Select School Nutrition Standards by Region and Poverty Level: The Healthy Communities Study. *J Nutr Educ Behav*. Mar 2020;52(3):249-258. doi:10.1016/j.jneb.2019.10.016
30. McLoughlin GM, Candal P, Vazou S, et al. Evaluating the implementation of the SWITCH® school wellness intervention and capacity-building process through multiple methods. *International Journal of Behavioral Nutrition and Physical Activity*. 2020/12/11 2020;17(1):162. doi:10.1186/s12966-020-01070-y

31. Wilhelm AK, Schwedhelm M, Bigelow M, et al. Evaluation of a school-based participatory intervention to improve school environments using the Consolidated Framework for Implementation Research. *BMC Public Health*. Sep 3 2021;21(1):1615. doi:10.1186/s12889-021-11644-5
32. Kien C, Grillich L, Nussbaumer-Streit B, Schoberberger R. Pathways leading to success and non-success: a process evaluation of a cluster randomized physical activity health promotion program applying fuzzy-set qualitative comparative analysis. *BMC Public Health*. 2018;18(1):1386-1386. doi:10.1186/s12889-018-6284-x
33. McLoughlin GM, McCarthy JA, McGuirt JT, Singleton CR, Dunn CG, Gadhoke P. Addressing Food Insecurity through a Health Equity Lens: a Case Study of Large Urban School Districts during the COVID-19 Pandemic. *J Urban Health*. 2020;1-17. doi:10.1007/s11524-020-00476-0
34. McLoughlin GM, Fleischhacker S, Hecht AA, et al. Feeding Students During COVID-19 - Related School Closures: A Nationwide Assessment of Initial Responses. *Journal of Nutrition Education and Behavior*. 2020;52(12):1120-1130. doi:10.1016/j.jneb.2020.09.018
35. Nutrition and Obesity Policy, Research, and Evaluation Network. NOPREN COVID-19 Response. 2020. Accessed January 30, 2021. <https://nopren.org/covid19/>
36. School Nutrition Association. Impact of COVID-19 on School Nutrition Programs: Back to School 2020. 2020. Accessed February 1, 2021. https://schoolnutrition.org/uploadedFiles/6_News_Publications_and_Research/8_SNA_Research/Impact-of-Covid-19-on-School-Nutrition-Programs-Back-to-School-2020.pdf
37. BBC World Service. 2020. Has Coronavirus changed school meals forever? Accessed January 30, 2021. <https://www.bbc.co.uk/programmes/w3cszjr7>
38. Urban School Food Alliance. The Urban School Food Alliance. Accessed December 6, 2021. <https://urbanschoolfoodalliance.org/>
39. Muñoz-Laboy M, Martínez O, Davison R, Fernandez I. Examining the impact of medical legal partnerships in improving outcomes on the HIV care continuum: rationale, design and methods. *BMC Health Services Research*. 2019/11/20 2019;19(1):849. doi:10.1186/s12913-019-4632-x
40. Martínez O, Boles J, Muñoz-Laboy M, et al. Bridging Health Disparity Gaps through the Use of Medical Legal Partnerships in Patient Care: A Systematic Review. *The Journal of Law, Medicine & Ethics*. 2017/06/01 2017;45(2):260-273. doi:10.1177/1073110517720654
41. Penner T. Lawyers in Schools: Navigating the Risks and Rewards of School-Based Medical-Legal Partnerships. *Houston Law Review*. 2021;59(2):479.
42. National Center for Medical Legal Partnerships. Health Center Based Medical Legal Partnerships. Accessed March 28, 2022. <chrome-extension://efaidnbnmnibpcjpcglclefindmkaj/viewer.html?pdfurl=https%3A%2F%2Fmedical-legalpartnership.org%2Fwp-content%2Fuploads%2F2017%2F12%2FHealth-Center-based-Medical-Legal-Partnerships.pdf&clen=485841&chunk=true>
43. Martínez O. A review of current strategies to improve HIV prevention and treatment in sexual and gender minority Latinx (SGML) communities. *Expert Review of Anti-infective Therapy*. 2021/03/04 2021;19(3):323-329. doi:10.1080/14787210.2020.1819790
44. Bauer GR, Churchill SM, Mahendran M, Walwyn C, Lizotte D, Villa-Rueda AA. Intersectionality in quantitative research: A systematic review of its emergence and applications of theory and methods. *SSM - Population Health*. 2021/06/01/ 2021;14:100798. doi:<https://doi.org/10.1016/j.ssmph.2021.100798>
45. National Cancer Institute. Implementation Science Centers for Cancer Control. Accessed February 1, 2021. <https://cancercontrol.cancer.gov/is/initiatives/isc3>
46. National Institutes of Mental Health. Advanced Laboratories for Accelerating the Reach and Impact of Treatments for Youth and Adults with Mental Illness (ALACRITY). Accessed February 5, 2022. <https://www.nimh.nih.gov/research/research-funded-by-nimh/research-initiatives/advanced-laboratories-for-accelerating-the-reach-and-impact-of-treatments-for-youth-and-adults-with-mental-illness-alacrity>

47. National Heart, Lung, and Blood Institute. Building the workforce to translate discoveries into health. Accessed February 1, 2019. <https://www.nhlbi.nih.gov/news/2017/building-workforce-translate-discoveries-health>

Extreme Weather Preparedness for Institutions of Higher Education: Impacts and Lessons Learned to Inform Campus Health

JENI STOLOW, PHD¹; MARISSA CLOUTIER, PHD¹; AMY FREESTONE, PHD^{2,3}; KATHLEEN SALISBURY, MS³

¹Department of Social and Behavioral Sciences, College of Public Health, Temple University

²Department of Biology, College of Science and Technology, Temple University

³Temple Ambler Field Station

Correspondence: jeni.stolow@temple.edu (Jeni Stolow)

BACKGROUND: On September 1, 2021, a tornado touched down at Temple University's Ambler, PA campus. The tornado, a byproduct of Hurricane Ida, damaged most of the buildings on the campus, destroyed thousands of academic resources, and killed hundreds of irreplaceable trees, plants, and natural resources. The purpose of this study was to identify needs among the Ambler campus community, document the impact of the tornado, and capture student, faculty, and staff perceptions toward disaster preparedness, climate change, and lessons learned for future disaster preparedness. **METHODS:** Data were collected in partnership with the Ambler campus community. A Rapid Needs Assessment, influenced by the Centers for Disease Control (CDC) Community Assessment for Public Health Emergency Response (CASPER) was utilized. The needs assessment was comprised of a mixed method approach via a site visit, an online survey, and in-depth interviews. **RESULTS:** A total of 74 survey responses and 20 interviews were collected. Survey and interview respondents included students, faculty, and staff. Findings indicated that participants: felt unprepared for the tornado; experienced a variety of social, professional, mental, and physical impacts; and require additional training, education, and communication for future emergencies and natural disasters. **CONCLUSION:** As climate change continues to impact weather patterns, institutions of higher education must prepare for more frequent, more severe, and unprecedented natural disasters. It is time to ensure that (1) campuses have transparent protocols in place for the full spectrum of possible weather events, and (2) that students, faculty, and staff receive comprehensive education, training, and communication about such weather-related events and potential negative outcomes.

Keywords: Needs assessment, disaster response, campus health.

Introduction

Campus preparedness for natural disasters is crucial as it can save lives and keep institutions running. Institutions of higher education must establish readiness and

preparedness plans across natural disaster scenarios as they are responsible for the safety of students, faculty, and staff on campus.

Additionally, campus administrators must consider the secondary impacts natural disasters can have on campus finances as well as campus operations. Colleges and universities often experience substantial financial loss in the wake of a natural disaster. Reasons for this include increased student dropout rates and substantial cost of repairs (recent storms have yielded costs ranging from 6 million to 132 million dollars)¹. Furthermore, campus closures and the discontinuation of campus services can impact the campus community as many students rely on campus resources for housing, food

The Setting

Temple University is a large institution of higher education with a student body of over 40,000 students. It consists of six campuses across Pennsylvania, with its main campus located in North Philadelphia. The university also has two international sites in Rome, Italy and Tokyo, Japan.

Temple University's Ambler campus is a 187-acre campus located in Montgomery County, Pennsylvania. The campus houses approximately 40 undergraduate programs, numerous minors and certifications, continuing education credits, and graduate programs such as the Master of Landscape Architecture. Ambler additionally hosts a Law Enforcement Training Center, as well as a Science and Mathematics Scholars Program for high school students.⁴ Community members frequently use the campus space for physical activity, event space, as well as mental health and wellness. Unique features of the campus include the arboretum, the field station, numerous gardens, and a greenhouse which houses over 1,600 species of rare and tropical plants. Ambler Field Station's Temple Forest Observatory, which was established in collaboration with the Smithsonian Institution's Forest Global Earth Observatory (ForestGEO), is an active platform for research and training at the forefront of environmental, ecosystem, and climate sciences⁵. The Ambler campus is a major asset to

security, physical health and mental health services, internet access, and safe spaces.^{1,2} Those institutions that can show that they are able to handle these challenges will be in a better place to vie for future student applicants as colleges and universities are becoming more scrutinized based on their 'disaster management plan' rankings.² We call upon decisionmakers across institutions of higher education to take steps in preparedness and readiness for climate change's increasingly common and severe weather events.³

Temple University as evidenced by its high level of community engagement, unique learning opportunities, and membership in several national and an international science networks.⁶

The Ambler campus was struck by a tornado, triggered by Hurricane Ida, on September 1, 2021.⁷ The tornado measured at an EF-2, touching down at about 5:30pm with up to 135mph winds. While no lives were lost or injured on campus, the damage to the campus infrastructure was significant. 16 out of 18 buildings were impacted and over 17,000 items within the library were lost. In addition, there was irreversible damage to their arboretum that included the loss of over 175 historic trees and hundreds of plants. The Temple Forest Observatory site was heavily impacted, with most large trees either blown down or heavily damaged. Students, faculty, and staff (many of whom sheltered-in-place overnight during the storm) lost entire departments. Surrounding roads were washed out, local areas were flooded, cars were destroyed, neighboring homes were damaged, and there were numerous downed power lines, falling trees, and broken glass scattered throughout the area. Campus recovery began early on September 2nd, 2021. Faculty and staff returned to campus over the next two weeks, and in-person learning was reinstated on September 15th, 2021.

The Study

The purpose of this study was to inform decision makers of the impacts and continued needs resulting from the September 1st, 2021 tornado at the Temple University's Ambler Campus. Results are aimed toward raising awareness of the possible risk and impacts other campuses may face in this unpredictable age of unabated climate change. This study utilized an Emergency or Rapid Needs Assessment predicated on the US Centers for Disease Control and Prevention (CDC)'s Community Assessment for Public

Health Emergency Response (CASPER) model, which we modified for this campus-specific mixed-method study.⁹ A CASPER assessment traditionally uses an epidemiologic technique to provide quick, post-disaster data about community's needs for decision makers. The overall aims of this study were to (1) Determine and document any critical health needs; (2) Provide insights into how students, faculty and staff perceived the impacts of the tornado; and (3) Evaluate aspects of Temple University's response to the tornado.

Methods

Qualitative and quantitative data collection took place from October – December, 2021 and included: (1) a site visit to Ambler campus, (2) an online survey, and (3) a series of qualitative interviews. The site visit took place on October 22nd, 2021 to inform the study design, gather observational data, connect with partners, and collect informational interviews. Results from the site visit led to the development of the survey questions and interview guide format. The survey and interview instruments were reviewed by campus partners prior to data collection.

Once data collection instruments were approved by the campus partners, an anonymous online survey was sent to students, faculty, and staff to collect perceptions toward, experiences of, and needs produced by the

tornado. Students, faculty, and staff each had a unique version of the survey to best capture the impact of the tornado on their unique roles at Ambler campus. Survey data were analyzed for basic descriptive statistics. The last survey question asked respondents to provide an email address if they were interested in participating in a follow-up interview to share their experiences with the tornado and recovery efforts. Those who listed contact information were contacted via email to schedule a Zoom interview. Zoom automatically recorded the interviews and produced transcripts. Transcripts were reviewed for accuracy, line-by-line coded, sorted into categories, then thematically analyzed via Grounded Theory. Exemplar quotes were selected to demonstrate key themes.¹⁰

Results

In total, 74 survey responses and 20 interviews were collected. The characteristics of survey respondents are presented in Table 1. Interview representation spanned across students, faculty, and staff (some of which were Temple University administration members). Overall, the results indicate that

participants felt unprepared for the tornado, were largely negatively impacted by the tornado, require more resources during this recovery period, require additional training and education for future natural disasters, and request an increase in transparent communication. All participants will remain anonymous.

Table 1.
Participant Characteristics

	Number of Respondents	Number of Years at Ambler Campus			On Ambler Campus During the Tornado	
		< 2 years	2 - 5 years	5+ years	Yes	No
Students	38	45%	50%	5%	29%	71%
Faculty	6	17%	33%	50%	0%	100%
Staff	30	6%	27%	67%	20%	80%

Preparedness

The tornado that hit Temple University’s campus was highly uncharacteristic and unexpected. Hence, results are unsurprising as almost all respondents (89% of students, 100% of faculty, and 73% of staff) did not feel at all prepared for such an event. Post-tornado, a large proportion of respondents felt at least somewhat prepared for a future tornado (57% of students, 33% of faculty, and 83% of staff). Although numbers suggest survey respondents feel more prepared for a future tornado, interview insights demonstrated that there is still a substantial way to go for the people to feel confident or very prepared for

such a future disaster. This notion is illustrated in the following quote:

“Of course, I wasn’t prepared for a tornado! I live in Pennsylvania and have never thought about tornadoes a day in my life. Why would I believe a tornado threat? That sounds ridiculous. Now I feel somewhat more prepared because I can believe it could happen to me. Do I know what to do if a tornado touched down again? Absolutely not.” (Interviewee 2, Student)

Communication

Communication before, during, and after natural disasters is essential to ensure students, faculty, and staff are best prepared, protected, and able to recover as quickly as possible. On September 1st, 2021, Temple University Alerts (TUALerts), the campus’s emergency communication system, sent information pertaining to the tornado watch and warning to cell phone numbers and email addresses registered for this service.¹¹ However, this communication was widely reported by participants as nonexistent or insufficient. Conversely, participants reported that communication during the recovery period has been sufficient in making them feel safe and informed. As was stated,

“I had no idea what was going on after the tornado, there was seriously no communication, none at all, from anyone. I was panicking

not knowing how my staff, students, peers, whoever were doing...but now I feel like they’re trying to communicate more frequently at least”. (Interviewee 11, Staff)

Survey respondent perceptions toward the communication provided by TUALerts on the day of the tornado, during the tornado, and after the tornado can be found below in Table 2.

Table 2.
Temple University Communication Before, During and After the Tornado (%)

	Information Provided by TU Before the Tornado			Information Provided by TU During the Tornado			Information Provided by TU After the Tornado		
	I did not receive information from TU before the tornado	I did receive information, but not enough	Yes, the information provided made me feel safe and prepared	I did not receive information from TU during the tornado	I did receive information, but not enough	Yes, the information provided made me feel safe and prepared	I did not receive information from TU after the tornado	I did receive information, but not enough	Yes, the information provided made me feel safe and prepared
Students	74	24	3	37	47	16	4	41	56
Faculty	100	0	0	33	33	33	33	33	33
Staff	87	10	3	70	20	10	43	43	13

Deeper conversations via interviews found that the TUAAlerts lacked specificity, which made it difficult for individuals to know what to do or how to prepare. For example, there was no explanation of the difference between a “tornado watch” versus a “tornado warning”. Furthermore, many interviewees noted that due to the high influx of TUAAlerts, they rarely pay attention to these text messages or emails. It’s also important to note that the related TUAAlert messaging came after 5:00pm when most people had already left campus or were preparing to do so.

A common misconception was that Temple University decision makers put little thought into the tornado watch and tornado

warning decisions. Several interviews with campus administration explained that such a decision-making process is quite extensive as it entails the university-wide emergency team to connect with one another across campuses to process information they’ve received from SEPTA transit operations, local organizations, and Temple University’s AccuWeather partners. In this case, as a tornado was unprecedented, and severe rainstorms common, the emergency team proceeded as a typical weather event dictates. This decision-making process is fastmoving and dependent upon numerous variables to which most students, faculty, and staff are not made privy to.

Impact Assessment

This study demonstrated that the tornado impacted participants’ sense of security, work, schoolwork, finances, housing, physical health, and mental health. Results show that 66% of students, 100% of faculty, and 60% of staff felt their sense of security was at least somewhat negatively impacted by the tornado. Similarly, 97% of students, 100% of faculty, and 100% of staff felt their work or schoolwork was at least somewhat negatively impacted by the tornado. Only 31% of students, 34% of faculty, and 43% of staff felt their physical health had been at least somewhat impacted. However, 95% of students, 83% of faculty, and 93% of staff believed their mental health had been at least somewhat negatively impacted by the

tornado. Table 3 depicts a more nuanced view of how students, faculty, and staff felt their physical and mental health , as well as their fall semester , were impacted by the tornado.

The tornado impacted most students’ sense of security on campus, work or schoolwork, and mental health. The most common outcome of the tornado amongst students (34%) and staff (43%) was that the tornado caused or triggered anxiety or stress. Most faculty and staff felt the tornado impacted their sense of security on campus, work, and mental health. Almost all faculty (83%) and staff (60%) had their research and/or administrative work negatively impacted by the tornado. Data from interviews further detailed how substantial

the destruction was to Ambler campus' arboretum, field station, greenhouse, gardens, and green spaces. These issues were not only physically harmful, but also greatly disrupted the campus community's mental health. As one interviewee stated:

"The worst part of the storm is that now we have to just like exist in the wreckage. I mean what was damaged was our classrooms, our research, or

peace and quiet. It's hard to feel better or whatever when you're constantly reminded of what happened every time you walk around campus." (Interviewee 5, Faculty)

These campus spaces brought not only joy, tranquility, and collective pride to the Ambler campus, but they also served as research sites, workstations, classrooms, community learning areas, and safe spaces.

Table 3.
How the Tornado Impacted Participants (%)

	Physical Health			Mental Health			Fall Semester				
	Access to food	Lack of areas to walk or exercise	Not feeling safe on campus	Anxiety	Stress	Depression	Route to campus	Quality of work	Ability to focus	Teaching/ learning	Research/ staff work
Students	5	13	11	34	32	26	18	21	26	26	—
Faculty	0	33	33	1	33	33	17	50	33	83	83
Staff	10	40	17	43	37	37	10	27	30	7	60

Resources Provided and Needed

At each institution, resources necessary to help minimize damages and recover from environmental events should be determined for all possible events. Plans should be made to determine how gaps in resources can be filled, either through institutions obtaining resources, or methods for sharing resources promptly within regions, and if necessary, at the national level should be developed.

Results from Table 4 indicate that only a small portion of students, faculty, and staff received some form of post-tornado academic support, mental health services, food, financial support, social support, or training for future natural disasters. Most students (37%), faculty (33%), and staff (43%) reported receiving no additional

resources during the tornado recovery stage. All aforementioned resources were widely requested across students, faculty, and staff.

A key finding of this study is that the Ambler community requires more opportunities to voice concerns, needs, and opportunities for response improvement. Anonymous, frequent, feedback mechanisms are highly encouraged. Needs will change throughout this period of recovery and administrative support must be agile to meet those needs. While many needs are still apparent, there also exists a duality of optimism, as many interviewees see this tragedy as an opportunity to rebuild stronger, smarter, and ready for Ambler's future as a Temple University asset.

Table 4.
Resources Provided and Resources Needed (%)

	Resources Reported as Provided						Resources Reported as Needed				
	Academic support	Mental health services	Food/financial support	Social support	Training for future natural disasters	None of these	Academic support	Mental health services	Food/financial support	Social support	Training for future natural disasters
Students	11	18	3	29	24	37	16	16	13	13	58
Faculty	17	33	0	33	0	33	67	67	0	33	67
Staff	3	17	0	10	17	43	17	30	3	23	87

Barriers to Recovery

This study found three major barriers to Ambler campus’ recovery: (1) an unknown chain of command, (2) unclear communication, and (3) hesitancy to request assistance. Interviewees characterized the first few weeks after the tornado as being filled with confusion about the amount and severity of campus damage; who was allowed to be on campus; who was in command of which task; and who to contact for assistance in recovery efforts. For example, immediately after the tornado many faculty and staff were unsure if they should be reaching out to students and staff teams to check on their health, wellness, and safety, or if Temple University would be systematically checking that all Ambler campus members were safe and accounted. Interviews and survey responses show that this task fell on Ambler faculty and staff, yet they felt unprepared and underqualified to be working with students in such ways.

Interviewees explained that students, faculty, and staff were unaware of what communication to expect; from where communication would come from; a timeline of what to expect moving forward; and what was happening on campus. As access to the campus was limited in the first few weeks after the tornado, issues with unclear communication and unknown chain of command led to tension, rumors, and confusion throughout campus as people were unaware of what decisions were being made, by whom, and what decision-making processes were taking place. Examples

of such issues frequently related to the how the clearing of storm debris occurred. Reports of contracted workers sexually harassing students, leaving biohazard waste in faculty offices, and destroying research areas were common examples throughout interviews. One interviewee stated:

“...seriously, the contracted people hired to clear the debris were haphazardly discarding rare, endangered, and valuable materials; harming healthy plants; leaving trash around campus; and treating the campus community like an afterthought. It was rude, disrespectful, and was like salt in the wound. We were all mad, stressed, and just trying to get back to normal...and you had these guys just making things worse by disrespecting the healing process we all needed.”
(Interviewee 19, Staff)

Interviewees expressed concern as to if, and how, to ask for help after the storm. This is not uncommon in disaster scenarios. Oftentimes there is pressure for communities to appear resilient so that they be rebuilt, as opposed to being discarded as a “lost cause”. This notion was found throughout interviews as participants explained that the Ambler’s “Ready to Rebuild” post-tornado campaign felt insincere or neglectfully and condescendingly optimistic in contrast to the many negative physical, mental, and academic impacts of the tornado. While several barriers to recovery are present, the biggest facilitator to recovery is

community. We must note that we observed a great attachment to the Ambler campus from the students, faculty, and staff. This appreciation and great desire to rally behind the recovery efforts will move this campus past “normal” and

to a place of “even better.” Ambler Campus is a beloved Temple University asset, frequently viewed as a place for education, inspiration, and recreation.

Discussion

This case study aims to demonstrate the impact that an unprecedented weather event could have on a university campus. This report serves as a national call to action for institutions of higher education to ensure that they are best preparing their campuses for any form of natural disaster. All campuses should have specialty taskforces assembled to ensure their campus, students, faculty, staff, and administration are prepared for any number of natural disasters, no matter how unprecedented it may seem. Table 5, highlights key considerations campuses should prioritize to ensure their campus and personnel are thoroughly prepared before, during, and after an emergency event.

While a tornado may seem to be an unlikely and unprecedented event, campus administrators are urged to consider the inevitable influx and range of severe weather that is expected to become normalized as climate change continues. Tornadoes are no exception, as evident from the December 2021 tornado storms that crossed six states in one day, leaving thousands impacted.¹² More recently, a batch of tornadoes swept through Louisiana and Mississippi, damaging several campuses across states.¹³ It is highly recommended that other campuses take note as it is imperative to prepare for a wider variety of

natural disasters and crises that are highly likely to occur with unabated climate change.³

Beyond our recommendations for campus preparedness in Table 5, we call to the academic branches of higher education institutions to incorporate climate change readiness into the curriculum across disciplines as we recognize every member of our campus must be engaged in the collective effort to maximize solutions to these increasing events. Furthermore, we believe that all members of the campus community can contribute new insights for innovative approaches to climate change and preparedness.

It is critical to start developing university and campus-specific readiness and preparedness protocols and supportive mechanisms for a wide-range of natural disasters. It is time to think outside of our weather comfort zones and start making concrete plans for previously unlikely scenarios such as tornadoes, fires, and hurricanes. While this is a large undertaking, there are numerous resources available across institutions, organizations, and contexts.¹⁴⁻¹⁹ Now is the time to expect the unexpected. Campuses must start preparing for the unknown as weather gets more severe and widespread. We must start engaging with their campus communities to jointly create, strengthen, and support emergency preparedness.

Table 5.
Recommendations for Campus Preparedness

Recommendation	Operationalization
<p>PREPAREDNESS: Prepare early and thoroughly</p>	<ul style="list-style-type: none"> • Educate the campus community about how to prepare for all types of natural disasters • Train faculty and staff about how to support students in these conditions • Develop and require a standardized online training via Canvas • Start drills for events beyond a fire or active shooter event • Train campus police to be aware of how to help individuals within each campus setting • Frequently and widely distribute and restock safety boxes around campus that include first aid kits, phone chargers, flashlights, food, water, and other emergency materials.
<p>RESPONSE: Respond inclusively and with support in mind</p>	<ul style="list-style-type: none"> • Don't assume every person has equal ability to execute response measures • Don't assume every person has equal ability to understand the response communication • Create a crisis hierarchy to streamline future crisis response and recovery • Widely disseminate this crisis hierarchy via a document that explains who is considered essential, and how communication/delegation should flow during a crisis • Require debriefing of responders on: campus-specific information, expectations for how to treat the campus community, rules for interacting with the campus community, and best practices in disaster response and recovery
<p>COMMUNICATION: Communicate in a variety of ways with your audience in mind</p>	<ul style="list-style-type: none"> • Differentiate weather threat communications within campus alert systems • Clarify information between a weather warning vs. weather threat • Tailor messages for each campus and each campus population • Don't just rely on cellphones and internet for communication • Don't assume every student or faculty member registered for the TU Alert system. • Use an opt-out system to ensure at least campus email accounts are notified automatically • Install signs around campus that indicate where emergency resources are in each building • Put a hardcopy manual of information in each building on campus that includes information about the decision-making tree, list of key phone numbers, and basic information about what to do in each type of crisis or emergency • Communicate widely and repetitively when each of these initiatives are put into place so the campus community knows about the changes, improvements, and resources
<p>DECISION-MAKING: Decisions should be transparent with a two-way communication mechanisms established</p>	<ul style="list-style-type: none"> • Standardize a communication timeline so individuals know when to expect a decision • When disseminating a decision, deliver a rationale for that decision • Provide a contact person so individuals know who to contact for each possible need • Provide a separate contact person to address safety questions
<p>NEEDS ASSESSMENTS: Must be immediate and continuous throughout the recovery period</p>	<ul style="list-style-type: none"> • Use multiple forms of data collection methods (survey, interview, etc.) to immediately connect with the impacted community after a crisis • Continuously connect with the community for new or unresolved needs • Ensure all mechanisms for collecting information is neutral, anonymous, and multiple

Acknowledgments

This research would not be possible without the support, insights, time, and collaboration with Temple University's Ambler, PA, campus students, faculty, and staff. Thank you for your honest, rich, and meaningful insights.

Conflicts of Interest

The authors have no conflicts to disclose

Statement of Contributions

Dr.'s Stolow and Cloutier designed the study, conducted data, analyzed results, and wrote the report. Dr. Freedman (Director, Temple Ambler Field Station) and Kathleen Salisbury (Director of the Temple Arboretum) were key informants, community partners, and helped write dissemination materials.

References

1. Mello, F. & West, C. What has happened when campuses shut down for other disasters? The Hechinger Report. May 4, 2020. Accessed June 24, 2020. <https://hechingerreport.org/what-has-happened-when-campuses-shut-down-for-other-disasters-a-coronavirus-case-study/>
2. 30 US Colleges that are prepared for natural disasters: These colleges are well equipped to overcome a range of environmental emergencies. Great Value Colleges. Accessed June 24, 2022. <https://www.greatvaluecolleges.net/disaster-preparedness-plans/>
3. IPCC, 2021: Summary for Policymakers. In: Climate Change 2021: The Physical Science Basis. Contribution of Working Group I to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change [Masson-Delmotte, V., P. Zhai, A. Pirani, S.L. Connors, C. Péan, S. Berger, N. Caud, Y. Chen, L. Goldfarb, M.I. Gomis, M. Huang, K. Leitzell, E. Lonnoy, J.B.R. Matthews, T.K. Maycock, T. Waterfield, O. Yelekçi, R. Yu, and B. Zhou (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA, pp. 3–32, doi:10.1017/9781009157896.001.
4. Temple University. Ambler Campus Academics. Accessed June 24, 2022. <https://ambler.temple.edu/academics>.
5. Temple University. Ambler Campus; Ambler Arboretum. Accessed June 24, 2022. <https://ambler.temple.edu/arboretum>
6. Freestone, A. L., Bonfim, M., and Cortese, M. R.. 2021. A New Field Station, Footsteps from Philadelphia. *Bull Ecol Soc Am* 102(2):e01855. <https://doi.org/10.1002/bes2.1855>
7. Temple's Ambler Campus Damaged by Tornado. Temple News. Published September 1, 2021. Accessed June 24, 2022. <https://temple-news.com/temple-ambler-campus-damaged-by-tornado/>
8. Temple Ambler Campus to Reopen After Damage from Tornado. Temple News Published September 28, 2021. Accessed June 24, 2022. <https://temple-news.com/temple-ambler-campus-to-reopen-after-damage-from-tornado/>
9. Prevention. Community Assessment for Public Health Emergency Response (CASPER). Accessed June 24, 2022. <https://www.cdc.gov/nceh/casper/default.htm>.
10. Creswell, J. Research design: qualitative, quantitative and mixed methods approaches. *Nurse Res.* 2004;12(1):82-83. doi:10.7748/nr.12.1.82.s2
11. Temple University. TU Alert. Accessed June 24, 2022. <https://deanofstudents.temple.edu/tu-alert>.
12. Tornadoes Leave Trail of Devastation Across Six States, With Scores Dead. *New York Times*. Published December 11, 2021. Accessed March 29, 2022. <https://www.nytimes.com/live/2021/12/11/us/tornadoes-midwest-south> .

13. Tornado Cuts Destructive Path Through New Orleans as Storms Threaten South. New York Times. Published March 22, 2022. Accessed March 29, 2022.<https://www.nytimes.com/2022/03/22/us/louisiana-mississippi-severe-weather-forecast.html>.
14. U.S. Department of Education. Natural Disaster Resources. Accessed June 24, 2022. <https://www.ed.gov/hurricane-help>
15. Recovering from a Natural Disaster in College. March 2 , 2021. Accessed June 24, 2022 <https://www.affordablecollegesonline.org/college-resource-center/natural-disasters/>
16. National Hazards Center. Hazards and Disaster Research Centers in the Americas. Accessed June 24, 2022. <https://hazards.colorado.edu/resources/research-centers/americas>
17. National Association of School Psychologists. Natural Disaster Resources Accessed June 24, 2022. <https://www.nasponline.org/resources-and-publications/resources-and-podcasts/school-safety-and-crisis/natural-disaster-resources>
18. Ready.gov. U.S. Department of Homeland Security. Accessed June 24, 2022. <https://www.ready.gov/campus>
19. National Center on Safe Supportive Learning Environments. Community-Campus Readiness: Approaches to Disaster Preparedness. Accessed June 24, 2022. <https://safesupportivelearning.ed.gov/resources/community-campus-readiness-approaches-disaster-preparedness>

New Gerber Baby is Welcome Statement About Inclusion of Persons with Visible Differences

DAVID B. SARWER, PHD¹; ELIZABETH C. THOMAS, PHD¹

¹Department of Social and Behavioral Sciences, College of Public Health, Temple University

Correspondence: dsarwer@temple.edu (David B. Sarwer)

Earlier this spring, Gerber, the iconic baby food producer, named Isa Slish of Edmond, Oklahoma as their 2022 Gerber Spokesbaby. In addition to receiving cash prizes and Gerber food for a year, Isa also will serve as Chief Growing Officer on the company's executive committee during this time. The role often involves a good deal of public exposure.

It is impossible not to be drawn to Isa's beautiful, expressive face. She completely looks the part of the face of Gerber. What's more remarkable, is that Isa has a visible difference. Her parents learned when they were 18 weeks pregnant that Isa would be born without major bones in her right leg. As Isa's mother stated shortly after the announcement: "We hope Isa's story can bring more awareness for limb differences and create greater inclusion for children like her. Because, just like Isa, they too can be or do anything they want!"

Children are born with visible differences across the United States every day. Some are born with more commonly known conditions like cleft lip and palate, which can be improved with surgical treatment throughout childhood and, in some cases, into adolescence. Other conditions, like Isa's, are less common and leave the child—and eventually adolescent and adult—with a physical difference that is readily visible to others.

Such conditions can come with significant psychosocial challenges. Many children experience low self-esteem and poor

body image. Others struggle with depression and anxiety. Some are teased and bullied for looking different. In adolescence and early adulthood, some struggle in the classroom, are challenged to secure and maintain suitable employment (or have jobs where they do not interact with the public), and find romantic relationships difficult.

Persons who do not have a physical difference that is visible to others, for example those who have scars that can be covered with clothing or those who have psychiatric disabilities (that may not be noticeable to others) enjoy a degree of anonymity in public setting. Strangers don't often stare or look away; they don't stop and ask "What happened to you?" These experiences are quite common for those with visible difference. Years from now, unfortunately, Isa is more likely to have those things happen to her than to have someone ask, "Weren't you once the Gerber Spokesbaby?"

For years, persons with visible differences were not routinely represented in mass media. That has fortunately changed and we see a wider representation of humanity on our television screens and devices than ever before. Unfortunately, those who are disfigured are often portrayed in a negative light, reinforcing the inaccurate believe that an atypical appearance is associated with a negative character.

Isa's mother is optimistic that her selection as Spokesbaby makes a great statement

about the importance of inclusion. True inclusion would mean that people like Isa are not only physically and socially present in mainstream settings, like schools and workplaces, but that others welcome and embrace them for their uniqueness. Inclusion offers an opportunity for society to be made better and stronger, to grow as a result of our collective strengths and differences. Yet, it requires a concerted effort on the part of policymakers, researchers, healthcare providers, community members, families, and others, to make inclusion a reality. For example, in partnership with policymakers, providers, and people with lived experience, researchers at the [Temple University Collaborative on Community Inclusion](#) conduct groundbreaking

research and knowledge translation activities to promote inclusion of individuals with psychiatric disabilities. Reports and toolkits describing [fundamental principles of community inclusion](#), [practical strategies to promote participation in community life](#), and [creation of welcoming places in the community](#) are among the many evidence-based resources available on the Collaborative's website.

As clinical psychologists who work in the areas of visible differences and inclusion, we also applaud Isa's selection as Spokesbaby. May she be able to make changes to how we view and interact with others who look different. We will all be better for it.

About the Authors

David Sarwer, Ph.D., is the associate dean for research and professor of social and behavioral sciences at the College of Public Health at Temple University. For the last 25 years, he has studied the psychological aspects of physical appearance and body image. His current work in this area is supported by grants from the Department of Defense and is focused on the experiences of military veterans who have suffered catastrophic injuries that may leave them candidates for face or hand transplants.

Elizabeth Thomas, Ph.D. is an assistant professor of social and behavioral sciences in the College of Public Health at Temple University. Her work is dedicated to promoting community inclusion and participation among people with psychiatric disabilities, particularly young adults. Currently, she is co-investigator on a grant from the National Institute on Disability, Independent Living, and Rehabilitation Research (NIDILRR) that aims to identify and enhance community participation-promoting practices within early intervention in psychosis programs.

Conflicts of Interest

Dr. Sarwer has consulting relationships with Ethicon and NovoNordisk, companies that offer products to treat obesity.

Statement of Contributions

Dr. Sarwer wrote the initial draft of this paper. Drs. Sarwer and Thomas both contributed to the revision of the manuscript as well as have read and approved the final version of the document.