

A pilot study on our non-traditional, varied writing accountability group for historically excluded and underrepresented persons in STEMM

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ABSTRACT

Underrepresented faculty have higher burnout rates and lower grant attainment rates when compared with their non-minority counterparts. Many in science, technology, engineering, mathematics, and medicine (STEMM) disciplines, including underrepresented individuals, often have difficulty dedicating time to the writing process, with trainees often being relegated to laboratory tasks in their training years, resulting in a lack of practice in academic writing. Notably, past studies have shown that grant attainment rates of underrepresented individuals are lower than their majority counterparts. Here, we sought to consider a mechanism targeted to underrepresented individuals, although applicable to everyone, to help overcome traditional

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barriers to writing in STEMM. The authors have hosted a writing accountability group (WAG) that uniquely provides a format focused on physical activity and different forms of writing to strengthen both career development and award/funding attainment. Our objectives were to evaluate this unique format, thus creating a resource for individuals and institutions to learn about WAGs and expand upon the framework to formulate their own WAG. To do this, we performed a small pilot study ($n = 21$) to investigate attitudes towards the WAG. We present the results of a survey conducted among underrepresented WAG participants, which spanned different career stages and was highly diverse demographically. Our results show that following attendance of our WAG, individuals did not note a significant change in scales pertaining to John Henryism (high-effort coping), resilience, sense of belonging, or grit. However, significant increases were noted in the self-perceived ability to handle stress, confidence in applying for awards, appreciation for mentoring, and satisfaction of WAGs. Taken together, the results of this study suggest that our unique WAG format can have some positive results as a career and writing development opportunity and may be able to support underrepresented individuals in attaining funding at higher education institutions.

1. Introduction

Writing can be a challenging process, with many often given inadequate writing instruction from the primary school level with the potential for long-term deficits in writing [1]. While Pew Research shows that generally young individuals enjoy writing for personal enjoyment, this value is disparate with the relatively lower number of individuals who enjoy it in a professional or scholastic context [2]. The importance of writing for science, technology, engineering, mathematics, and medicine (STEMM) professionals seeking to advance their careers cannot be overstated, given its relevance for both publications and grants [3]. Even though writing is a necessity, especially for grants, lack of technical expertise and time are the two largest difficulties faculty report in writing grants [4]. Notably, the average principal investigator spends over 100 h on each grant they submit, with a sub-20 % success rate suggesting considerable time commitment in writing [3]. While grant writing is undoubtedly important, many faculty often see it as requisite with intrinsic and extrinsic motivational factors causing them to prioritize it as a principal responsibility [5]. Notably, this can have negative implications, as administrative pressure to write grants, while increasing time allocated toward granting writing, decreases job satisfaction of faculty members [5]. Thus, we believe new mechanisms need to be devised to help faculty members overcome current limitations in writing grants, and other forms of writing, including finding technical support, dedicated time, and recontextualizing their relationship with writing.

Writing accountability groups (WAG) have been formed and are being utilized by many to spend more time writing or to improve their writing abilities [6–9]. In this pilot study, we will share the writing experiences of historically excluded and underrepresented members of the WAG and describe how the WAG helped them develop professionally. Individuals who are historically excluded and underrepresented are defined as those who are underrepresented because of their racial, ethnic, sexual, or disability status, or because they are first-generation students [10]. Critically, improving support for underrepresented faculty is important as diversity increases innovation and thought capacity [11]. However, barriers for underrepresented faculty, such as low grant attainment and publishing inequity, remain dependent on cultural climate, and overwhelmingly homogenous review boards [12,13]. In example, individuals from Historically Black Colleges and Universities face unique challenges [14] and often report that they have a lack of time for writing [64]. In the transition to faculty from the post-doctoral stage, the primary grant available in the United States is the K99/R00, which is a National Institutes of Health (NIH) grant. For White principal investigators (PI) there is a typical funding rate of 29.3 %, which is 1.7-fold higher than the funding rate for Black PIs [15,16], a disparity that continues to exist even when adjusting for education and publication records. Nationally, it has been noted that NIH funding rates are decreasing to about 20 % of total applications [17]. Furthermore, this number is 50 % lower for African-American investigators [6]. This suggests that early on in their careers, underrepresented trainees have inhibited success which may arise from lower confidence in writing or grantsmanship. Furthermore, even at an undergraduate level, self-imposed beliefs on writing conferred measures of self-efficacy, which can in turn result in maladaptive habits [18]. Together, this shows that underrepresented individuals have limited success in grant writing, which may be ameliorated by overcoming traditional limitations in writing grants and other pieces of writing. In the past, WAGs have been shown to be effective at a variety of institutions and contexts in helping individuals improve their writing abilities, gain motivation, professionally develop, and find mentors [6–9,19,20]. While we believe WAGs can be highly beneficial for individuals regardless of their identity, there is a lack of studies that have evaluated the impact of WAGs on diverse populations. In this pilot study, we sought to examine the impact of our unique WAG format which includes many historically excluded and underrepresented individuals.

We created a WAG to assist our faculty and students with writing techniques, and as a space dedicated to honing skills in capturing thoughts and organizing them in a clear and methodical process. Specifically, by providing dedicated peer and reverse mentoring, blocking off time for writing, and trying to reframe writing as a positive activity, we hoped to overcome traditional barriers associated with grant writing [4]. To facilitate reverse mentoring, our WAG included individuals from a variety of career stages, as we believed these same meetings could increase the confidence of early career-stage students. Our WAG met three days per week on Mondays, Wednesdays, and Fridays, with the former two sessions being optional and generally smaller. Thus, this paper will focus on participants who regularly attended the Friday morning sessions, since these sessions were open to a wider range of participants and included a less substantial time commitment. Additionally, these Friday sessions included more varied activities (See WAG Framework Section),

which was fitting as our participants had diverse backgrounds and brought a wide variety of academic-related writing projects to the WAG. Our WAG had a unique format that emphasizes peer mentoring and reversed mentoring [7], varied activities beyond writing, and instances of career development that focused on work-life balance and holistic mentoring. In delivering our WAG on a weekly basis, over time, Friday morning WAG participants reported feeling more accomplished and content due to the diversity that occurred on Fridays. Based on this, we sought to determine if our WAG format significantly altered the attitudes of the individuals, whether WAG participation directly affected writing productivity, and how participants assessed the mentoring provided by a WAG. Additionally, we were interested in discovering how our WAG helped underrepresented individuals develop their professional skills in STEMM. This study further seeks to provide a framework of our WAG as a foundation for future WAGs to consider in their development, as well as consider its strengths and weaknesses based on our study of a small, diverse cohort who regularly attended.

1.1. WAGs for writing, professional development, and mentoring

Writing accountability groups have myriad combinations of participants and formats [8]. The group size of WAGs may range from a few people in a department to hundreds of people across many departments in a university [19]. These groups can be formatted to occur in person, virtually, or in hybrid [8,9,20]. Writing accountability groups may task participants to state writing goals and report on the status of their respective goals-achievement to promote self-accountability [8]. Adding more complexity, some WAGs focus on writing as a hobby, while other WAGs focus on specific goals, such as writing grants, publishing manuscripts, or writing collaboratively [21]. Despite the many composites that may make up a WAG, a unique aspect of these groups is that they focus on the writing process itself and not the writing outcomes [6,8].

Writing accountability groups have also been effective means of providing professional development opportunities [22], positively contributing to the participants' professional growth, and increasing their chances of publishing, presenting data, and attaining extramural funding [6,9,20,23,24]. WAG participants have noted that the writing practices learned through WAGs can help minimize anxiety and lead to more productivity [22]. Not surprisingly, many WAG participants have stated that the WAG is a source of social support [8,21]. Similarly, WAGs can increase productivity in some cases [7].

These writing groups can also provide mentorship that is pivotal to strengthening a writer's career across many sectors including academia [25–29]. Mentorship is a well-known practice in academia that may assist in identifying and overcoming barriers that hold back individuals from achieving their career goals in STEMM especially those from underrepresented groups [28,30]. Different forms of mentoring exist in academia. Peer mentoring occurs when persons of the same or similar rank share information or expertise whereas traditional mentoring is characterized “by a top-down, one-on-one relationship between a senior and a junior” [31]. Through WAG participation, peer mentoring is fostered, resulting in the development of grit and resilience that will assist individuals through every phase of the STEMM pipeline [24,32,33]. Writing accountability groups can also be a source of community and provide a means of escape from certain stressors such as code-switching that underrepresented minorities experience in academia [20]. Code-switching is defined as an action or behavior that an individual from underrepresented groups consciously or unconsciously does as a way to adjust their communication (written and verbal), syntax, behavior, and appearance to acculturate to the dominant culture in society [34]. These reasons combined are why writing affinity groups are tools needed to catapult underrepresented minorities into writing spaces and to be successful in STEMM.

Based on these existing writing groups that are already discussed in the literature [6–9,19,20], we sought to combine many of these principles to have a group that incorporated both dedicated writing time, mentoring, professional development, and unique mechanisms of participant engagement. Beyond this, previously we have noted that WAGs may be specifically an important mechanism for minority individuals [35], yet few studies have examined the impact of WAGs specifically in a highly diverse STEMM population. In the next section, we discuss the specific framework involved in 1) creating our constructive WAG, and 2) outlining how to implement this framework. While WAGs may exist at one's institution, they may not be suitable for an individual's needs depending on the focus and support of the WAG. For example, one may desire a WAG that is interdisciplinary while their institution only has departmental

Table 1

Suggestions for WAG and strategies for how to conduct a successful WAG.

In creating a WAG and ensuring its success, the following questions should be considered	• Number of members? • Meeting frequency? • Meeting duration? • Meeting location? • WAG rules and norms? • Member affiliation requirements? • Group format? • Rule enforcement? • Departmental restrictions? • Specific type or all-purpose WAG? • Time layout of your WAG? • Balance of informativeness with community building? • Membership selectivity? • Trial-period length to officially join? • Hosting of career development or presentations? • Host for seminars? • Mechanisms to ensure a safe space?
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WAGs, or vice versa. Additionally, in our experience, WAGs may not always be welcoming to all individuals, thus necessitating the formation of a minority WAG [35]. If a specific existing WAG is not suitable, individuals can help establish a different WAG at their institution. However, specific guidelines on what a WAG is and how to implement them are limited. Here, we offer a potential layout that has been effective for our group in writing that allows for peer-to-peer and reverse mentorship. Beyond this specific framework, however, in creating a WAG, one should always be mindful of their goals with the WAG and work in a collaborative setting to create an effective group, as there are several considerations when developing a WAG (Table 1).

1.2. Our WAG framework

Traditionally, WAGs are primarily focused exclusively on dedicated time for writing and, sometimes, goal setting [8]. While our WAG includes these elements, it also includes several unique elements.

Our WAG has been in existence for at least the last ten years, but participants surveyed have been in attendance for up to a few years at the time of this survey. It is led by an underrepresented faculty member who has been running the WAG for over 10 years and is based out of the University of Pittsburgh. It should be noted, that while our specific WAG leader has substantial experience, this framework seeks to allow individuals with no prior experience the ability to run a WAG.

The WAG runs on an academic calendar, and only on rare occasions will meet during the summer months. WAG sessions occurred

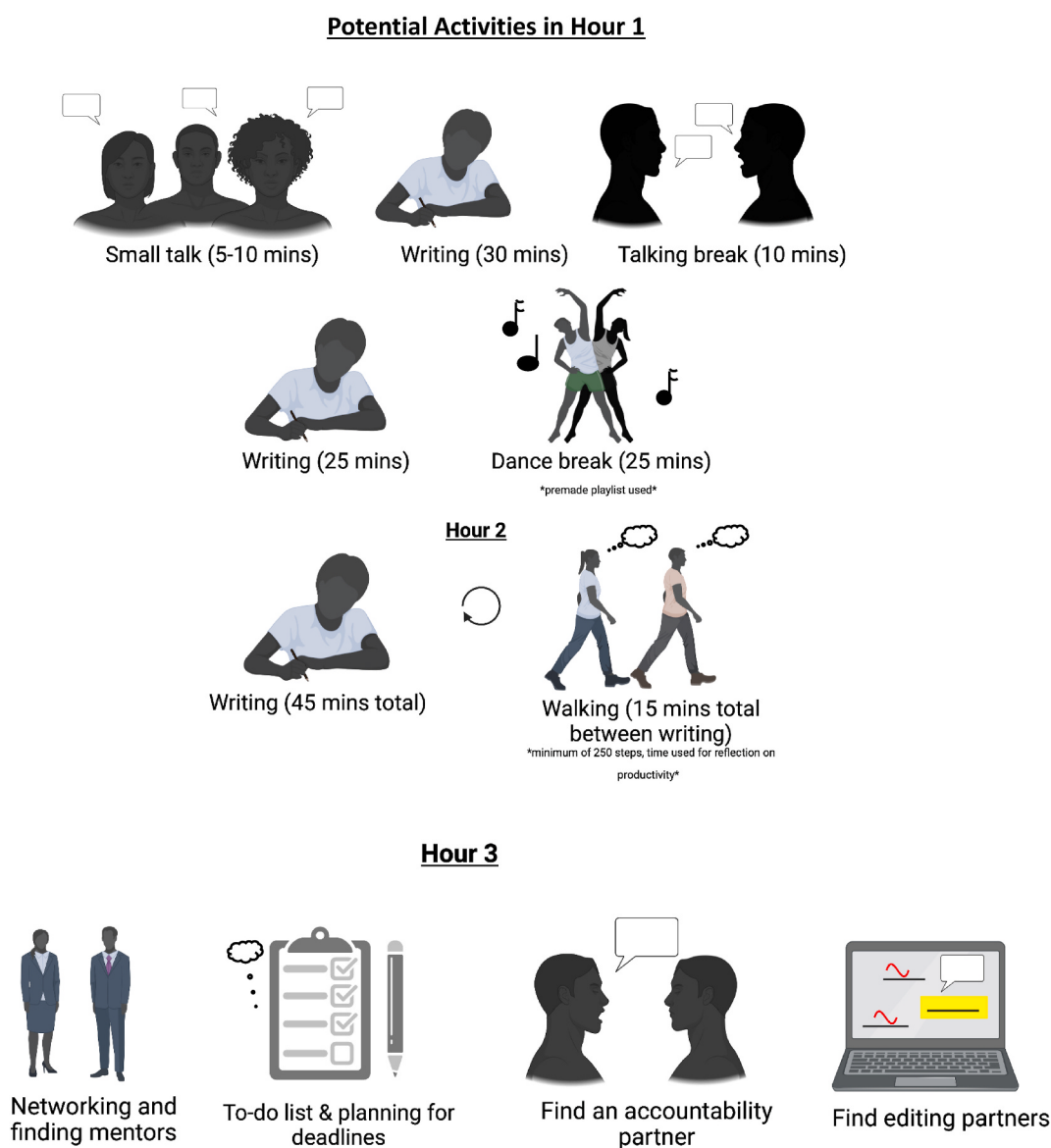


Fig. 1. Schematic depicting the layout of a typical WAG meeting administered for respondents.

each week, in the morning and afternoon, on Mondays, Wednesdays, and Fridays, but only participants who partook in the Friday morning WAG sessions were asked to take a survey assessing their participation in the WAG. Therefore, two distinct groups emerged, dependent on the necessity of time and guidance for working on grants, one of which typically attended only on Friday morning while another group attended up to 3 days a week, including the Friday morning session. While an initial invitation was required for participation in any of the WAGs, participation in the Mondays and Wednesdays WAGs was already set and closed. The requisite invitation was meant to keep the writing space safe and a positive experience for the excluded and underrepresented individuals who were already attending. The Friday morning WAGs were more flexible and allowed more individuals to attend, and continued participation was voluntary. Furthermore, the Friday morning WAGs allowed individuals to work on almost any type of writing relating to the academe. Not only did individuals work on grantsmanship, but they also wrote reports, academic papers, and so forth.

The WAG was always led by the same session leader to ensure that a schedule was observed and to monitor the writing beat within the group. The Friday morning WAG participants came from all walks of life and included trainees, undergraduates, graduates, and post-doctorate fellows. Some may have only participated in the WAG for several sessions, others participated for at least two years, and some may have been participating in the other WAGs on Mondays, Tuesdays, and Friday evenings. The only two characteristics shared by all participants were that they all were actively involved in the STEM field in some capacity and were attached to an institution of higher education (e.g., working at a university or was a student).

At the time when the survey was taken, our WAG sessions were conducted virtually due to COVID-19 restrictions; however, this framework can be applied to in-person, remote, and hybrid formats. A standard agenda (Fig. 1) was used in the WAG. The WAG typically would start approximately at 9:00 in the morning and last until the noon hour or 1 p.m.

The Friday morning WAGs began with brief small talk, which served as an ice breaker and period for checking in, before writing commenced for 45 min to an hour. Specifically, this writing was done independently. After 30 min, attendees took the first 10-min break. Following this break, writing continued for another 25 min, after which, attendees engaged in a 5-min dance alongside music. In the second portion, writing occurred for a total of 45 min, followed by 15 min of exercise. The third hour focused on planning and goal setting, such as making a to-do list, planning and organizing deadlines, and finding writing and editing partners to ensure productivity and a method of measuring progress. At the very least, the WAG provided individuals with 135 min of solid writing time.

While most sessions conformed to the standard agenda, sometimes, an allotted break might not occur if the writing was especially productive. Individual discussions or presentations of writing projects to the whole group were not expected but approximately every few weeks, the WAG session leader would ask for volunteers to present their writing projects, or they would choose someone to present. After a brief presentation of their writing projects, the other individuals in the WAG often provided affirmation, words of encouragement, or further discussions related to the writing. This helped individuals to be accountable for their respective writing projects.

A unique aspect of our WAG is that we incorporated exercise and breathing techniques as a pillar of our WAG and its impact. These exercise routines are intentionally aimed at reducing stress and encouraging individuals to regroup, ultimately aiming to promote an atmosphere of inclusion. The exercise consisted of brief moments of stretching and walking. In general, we strongly encouraged a minimum of 250 steps and encouraged participants to track their steps, using a pedometer.

Should a WAG member want individualized mentoring from the WAG's session leader, time could be scheduled in the morning prior to the start of the Friday WAG session or after the Friday WAG session ended. Individuals in the Friday WAGs also mentored one

Table 2
Potential career development seminar topics to discuss during weekly professional development talks.

Potential Career Development Seminar Themes	Definition/Key Topics	Reference
Grant writing	Learning to write strong and compelling grant applications for extramural funding.	(Ding, 2008)
Leadership style training	Different styles of leadership and how to utilize them together to lead and inspire a team.	(Black, 2015)
Technology accountability groups	Learning about groups responsible for managing technostress.	(Baue and Murningham, 2011)
How to work in groups	Learn strategies and methods to work cohesively as a team and set boundaries.	(LaFasto et al., 2001)
How to manage work-life balance	Learn strategies including making to-do lists to ensure a healthy balance.	(Bolles and Brooks, 2021)
Grit	Learn how to persevere and continue to progress at goals in the face of failure.	(Duckworth et al., 2007; Eskreis-Winkler, 2013)
How to mentor minority students	Strategies that aid in effectively being an ally to minority students.	(Hinton Jr et al., 2020b)
Power of saying 'no'	Knowing how to and when to say 'no'	(Hinton et al., 2020)
Peer-to-peer and shadow mentorship	Considering the time-cost benefit of unrecognized mentoring.	(Davis-Reyes et al., 2022)
Time management	Making the most of time and better understanding how one spends their time.	(Murray et al., 2022a)
Cultural humility	Skills to work with individuals from a wide range of cultural backgrounds	(Murray et al., 2022b)
How to obtain a faculty position	Tips on crucial skills including negotiating for a faculty position	(Murray et al., 2022d)
Stress Management	Techniques including mindfulness to regulate and reduce stress	(Van den Bergh, 2021)
Technostress	Consideration of stress caused by technology and suggestions to reduce it.	(Bondanini et al., 2020; Murray et al., 2022c)
How to contribute to service	Employ techniques similar to service learning to merge working and service.	(Halberstadt et al., 2019)

Table 3

List of questions and scales utilized in pre- and post-surveys administered to WAG participants.

Questions						
Resilience	Brief Resilience Scale (Smith et al., 2008)					
Connectedness to University	Brief Sense of Belonging scale (Hagerty et al., 1995)					
Ability to Handle Stress	Brief Perceived Stress Scale (Cohen et al., 1984)					
Grit	Short Grit Scale (Duckworth et al., 2009)					
John Henryism	John Henryism Active Coping Scale 12 (James et al., 1983)					
Mentoring	I believe that I can find intentional mentors more easily if I participate in WAGs.	I believe that WAGs can help me find casual mentors with similar life experiences as myself.	I believe that WAGs can help me recognize healthy (intentional) and unhealthy mentoring.	I believe that without WAGs at my institution, I would have a more difficult time finding mentors.	I believe that WAGs can help me understand ways to increase my involvement in mentor-mentee relationships.	
Funding Preparedness	I believe that WAGs will improve my probabilities of securing extramural funding.	I feel confident in writing grants and awards, even if I may not get awarded.	I believe that WAGs are an effective method to improve grant-writing skills.	I feel I have mentors/networks I can reach out to who can aid me in the grant writing process.	I know strategies and techniques to write effective applications for extramural funding.	
Quality of Lifestyle	I believe that I get an adequate amount of exercise.	I believe that I get an adequate amount of sleep.	I believe that, in general, I am physically and mentally healthy.	I believe that WAGs, in general, can increase my personal/professional happiness.	I believe that WAGs can teach about healthy work-life balance.	
Satisfaction of WAGs	I believe that WAGs are important to participate in.	I believe that early-career researchers should join WAGs.	I feel that the time commitment required for WAGs are worth the benefits they bring professionally and/or personally.	I understand what WAGs are and the purposes they serve.	I would support dedicated resources at my institution to form and support WAGs.	

another during the third portion via break-out rooms to work on similar projects or discuss scientific interests. This led to peer mentoring and even reverse mentoring. On roughly a monthly basis, the WAG session leader may pair off individuals to work together on assignments based on mutual or scientific interests or grants, again leading to peer mentoring and reverse mentoring.

While here we focused on individuals who attended this Friday session, individuals could choose to also attend on Mondays and Wednesdays for up to three days a week of attendance of WAGs. This option typically existed for faculty members who needed additional intentional mentoring or time for writing. Given the smaller nature of these groups, these typically were more tailored to the individuals in them but followed a similar format to the weekly Friday WAG.

Finally, as an additional aspect to promote career development among WAG participants, our WAG had regular seminars and workshops focused on relevant issues both directly and indirectly relevant to work. While these workshops can be adapted relevant examples of topics for 1-h long interactive presentations can include “How to manage work-life balance,” and “How to obtain a faculty position”. A full list of potential topics as well as literature to draw on for these workshops is provided in Table 2 [25,36–51], while some of the workshops we previously used for *Project Strengthen* may be repurposed for these presentations [52]. Separate from the meetings, there were weekly optional debriefings to improve collaborations and encourage group cohesion. Typically, these debriefings, which on occasion included team-building activities, occurred later in the week, such as on weekends, and on social platforms like Google Hangouts. These may easily exist in the form of activities including a group lunch, which existed to primarily try to encourage individuals to have a healthy balance between writing and personal life.

2. Methodology

2.1. Study participants

We received responses from 21 participants (Table 4), all of whom were in STEMM fields. Individuals were asked to create a 4-digit alphanumeric identifier to ensure the same pool of individuals were considered for pre- and post-surveys. Fifteen identified as females, five identified as males, and one chose not to disclose. Their educational attainment levels ranged from high school level to having a Ph.D. or higher. There was also a wide range of ages and income levels. Almost half of the participants identified as African Americans.

Table 4
General demographics from WAG participants surveyed.

Age Range	Count	Percent
18–29	6	28.6
30–45	9	42.9
46–59	5	23.8
Over 60	1	4.8
<u>Total</u>	21	100
Gender		
Male	5	23.8
Female	15	71.4
Choose Not To Respond	1	4.8
Other	0	0
<u>Total</u>	21	100
Race		
African American	9	42.9
Asian	7	33.3
Native American or Alaskan	1	4.8
Caucasian	2	9.5
Two or More Races	2	9.5
<u>Total</u>	21	100
What is your current employment status?	Count	Percent
Full-Time Student	7	33.3
Employed Part-Time	0	0
Employed Full-Time	14	66.7
<u>Total</u>	21	100
What is your annual household income?		
Under \$25,000	3	14.3
\$25,000 – \$49,000	4	19
\$50,000 – \$74,000	4	19
\$75,000 – \$99,000	0	0
Over \$100,000	9	42.9
Prefer Not To Respond	1	4.8
<u>Total</u>	21	100
Highest Degree Obtained		
High School Diploma	5	23.8
Bachelor's Degree	3	14.3
Master's Degree	2	9.5
Ph.D. or higher	11	52.4
<u>Total</u>	21	100

Asian Americans were the next largest group. Then those that identified as Caucasians or Two or More Races. Lastly, one identified as Native American. All participants were affiliated with five different higher institutions of learning, representing HBCU, private, and public institutions.

2.2. Research design and procedures

This study employed a pre-post study design with a non-random sample. We conducted online pre- and post-surveys to gauge the perceptions and effectiveness of the Friday morning WAGs. All questions were on a 5-point Likert or similar scale [53–57]. Answering both pre- and post-surveys and answering each question on the surveys were optional and anonymous. The pre-survey was given on a Friday in July of 2022, where participants were instructed to answer their opinions prior to joining the WAG and asked to think back to their previous experiences. One month later, on another Friday WAG session, the post-survey was given where participants were asked to answer pertaining to their future and continuous involvement in WAGs. While participants were taking the survey, which occurred online, proctors were available to clarify any questions participants may have. All data collected pertains to those in Friday attendance; however, some of these individuals attended more regularly than 1 day a week.

We chose this survey format as past studies have demonstrated that interventions for dedicated writing time can be important mechanisms to alleviate issues including a sense of confidence in writing [58]. Previous studies have shown an effective way to measure sentiments on grant writing is through anonymized surveys [4]. Other past studies have also considered the rate duration of writing and peer-reviewed publications of individuals following participation in WAGs [6,59,60]. While these are important considerations, given variation not attributable to WAGs, peer-reviewed publications may not be the strongest marker of altered attitudes toward writing. Notably, time spent dedicated to writing individual grants is also not correlative with the likelihood of receiving a specific grant [3]. In contrast, other studies have asked simple questions of WAG participants including about feelings of creating community, providing support, and encouraging time allotment [31]. Thus, we took a multi-pronged approach that both considered how WAG groups supported self-perceived positive factors for grant writing as well as consideration of number of grant applications and relative success.

Given the small cohort of our WAG, only 21 non-random sample individuals were able to be surveyed, making this a pilot study to begin to understand the impact of our small WAG. While this is larger than some past studies on WAGs [6,31], it is much smaller than previous large-scale analyses of WAGs [8]. Yet, given the highly diverse population of our sample and the relatively unique structure of our WAG, it still offers valuable data for the effectiveness of WAGs for individuals coming from a range of backgrounds, and career stages, and with varied outcomes.

3. Instruments

A 75-question survey was utilized which was composed of both validated and unvalidated questions (Supplemental File 1). As indicated in Table 3, the first four sets of questionnaires were used to assess the participant's perception of the WAG as it relates to resilience [56], connectedness or sense of belonging [55] to the university that they were affiliated with, their ability to handle stress [53], and grit [57], in which we define as the ability to persevere in the face of obstacles and challenges [41]. We also used the John Henryism Active Coping Scale (JHACS) to measure the coping behaviors of participants that may lead to adverse physiological and adverse health outcomes [54] and whether the WAG may help with the participant's coping behaviors. While John Henryism was initially associated with African Americans, this phenomenon is experienced by many other marginalized groups [61,62], and the 12-item scale JHACS has been used in research beyond African Americans to measure the participants' behavioral predisposition to cope actively and persistently with difficult psychosocial stressors and barriers [63]. In these five sets of questionnaires, participants were orally prefaced to answer the questions as they relate to their participation before/after the WAG, but were not told to answer only relative to the WAG. Furthermore, these previously validated questions did not contain the word "WAG" nor reference the WAG, as they existed unaltered from the original scales.

The last four sets of questions in the survey asked about the participant's perspective of WAGs as it pertains to mentoring, funding and award preparedness, quality of lifestyle, and satisfaction with WAGs. These self-created questions were selected to measure several dimensions that previous studies have suggested that WAGs may be effective in improving. Since no reliable questions specifically about WAGs exist, we created these questions. Although unvalidated, these questions avoid biased language.

Finally, an independent text option as well as optional verbal delivery of notes delivered in a free-form manner was performed to allow individuals to elaborate on any of their answers.

3.1. Data analysis techniques

Responses were collected via Google Forms (IRB Number: 21-MortonD-HSR-SOM-01, See Backmatter for full details). Dots on plots represent the number of individuals who answered all the questions in a set of questions or scales. Data were analyzed using GraphPad Prism software, and pre- and post-surveys were compared via Student's T-test. *, **, ***, and **** represent significant difference of $p < 0.05$, $p < 0.01$, $p < 0.001$, and $p < 0.0001$, respectively.

4. Results

Qualitatively, participants responded very positively regarding their involvement in the WAG (Table 5). Students and early-career

faculty highlighted how they were able to learn from gifted faculty and noted that they were happy with the improvements in their writing despite the high time commitment to the WAG. Many participants also discussed how the WAG helped them understand the importance of mentorship and becoming more productive. For senior faculty, the WAG assisted in writing productively and decreasing procrastination.

In our pre- and post-survey, there was a significant increase in the self-perceived ability of participants to manage stress following participation in the WAG (Fig. 2A). Although we saw a slight increase in mean resilience and connectedness to the university, neither of these increases were statistically significant (Fig. 2B–C). Similarly, we saw an increase in self-perceived grit, the ability to persevere in the face of obstacles and challenges [41], but this too was not a statistically significant difference ($p = 0.055$) (Fig. 2D). Finally, we used a scale to measure John Henryism Active Coping, which showed no significant change across participation in the WAG (Fig. 2E).

We further sought to explore whether a participant's perceptions in the WAG were specifically helpful and/or impactful to their goals in STEMM academia. There was a significant increase in participants' understanding of the role of mentors, with participants indicating that they thought the WAG increased their access to mentors (Fig. 3A). Furthermore, there was a significant increase in the participants' confidence in applying for grants and their belief that the WAG was a valuable tool that helped them improve their grant-writing skills (Fig. 3B). Following the WAG, participants also noted a holistic increase in their health, happiness, and sleep, and agreed that WAGs could effectively teach and promote a healthy work-life balance (Fig. 3C). Additionally, participants reported a higher general understanding of what WAGs are and agreed that they were important and worth the time and resource commitment they require as a means of professional development in STEMM (Fig. 3D). From there, we sought to understand general award or grant attainment amongst the surveyed WAG participants ($n = 21$); many members showed high grant attainment (Fig. 4). Fig. 4, which shows grant and award attainment, the top portion of data showing the attainment of faculty members is specific to individuals who attended 3 sessions a week, who were people that typically were interested in writing grants. For undergraduates ($n = 5$), they applied for an average of two grants or awards, and all awards were granted. For post-doctoral fellows ($n = 5$), they applied for an average of slightly over three grants, and 64 % of grants were successfully funded. Finally, looking specifically at faculty who attended all 3 meetings weekly ($n = 11$), as opposed to a mixture of attendance across other participants, we showed that they applied for an average of eight grants or awards, and 40 % of applications were successfully funded.

5. Findings and discussions

Previous programs have focused on mentoring techniques and mechanisms to increase grant-writing skills and attainment for underrepresented individuals [64]. However, many of these mentoring techniques rely on one-directional mentoring where information is only being passed from faculty to students. We believe mentoring can evolve to ensure bi-directional information flow between early- and senior-level faculty, as well as trainees [65]. We view WAGs as an important mechanism to increase the productivity of faculty and trainees at every career level, bridging the gap between the academic strata. Currently, WAGs exist at numerous institutions, and the NIH also offers grant-writing workshops throughout the year (see <https://www.niddk.nih.gov/research-funding/at-niddk/training-employment/choose-niddk/grant-writing-workshops>, accessed January 1st 2023). This pilot study was to assess the impact of our Friday WAGs on its participants, considering that it is varied in its format, and the participants are just as diverse and varied. We wanted to determine if our WAG was a source of professional development, especially for our sample which was made up primarily of underrepresented individuals at different career levels. We found that found underrepresented individuals, WAGs improved confidence and funding preparedness, concomitant with a relatively high rate of grant attainment across career levels.

We asked several questions about the participants' resilience, connectedness, ability to handle stress, grit, and John Henryism as it relates to the WAG. From these five sets of questionnaires, the participants' perceived ability to handle stress was statistically significant. This may be due to the participants having interaction with one another before and in between the writing sessions, in which they not only talk and share about their respective writing projects, but also what may be occurring in their professional and personal lives. Writing grants is a well-known stressful and time-consuming process that may deter some from beginning or finishing applications [66]. Talking may have helped the participants handle their stress.

Table 5

Quotes from post-survey in an optional open-ended question administered to WAG participants.

Quotes of Feedback	
"... Sometimes the level of expectation is difficult, but it has made me a better person."	"It has shaped my perspective on writing and honed my skills in applying to applicable awards."
"I learned how to express my thoughts onto paper better by working with patient and gifted faculty."	"I think they are important in every step of the academic journey."
"Participating in WAGs has been extremely instrumental in achieving my professional goals and I have made many collaborative relationships that have led to publishing in high impact journals and presenting materials at conferences. Without this group of professionals, I would have a harder time achieving my goals and brainstorming ideas."	"Participating in a WAG has served me on many levels. I feel confident in my opinion. I feel supported. I appreciate the support of the mentor-mentee relationship. I look forward to mentoring because of what I have gained from being mentored."
"WAGs have shown me that I can mix my professional and personal life without any having to worry about any setbacks or backlashes."	"... WAG help with balancing time to get things done. They get projects started and decrease procrastination."
"WAGs have given me the opportunity to grow personally and professionally. With a team of mentors and support, we can move mountains."	"Great experience and I would highly recommend it!"

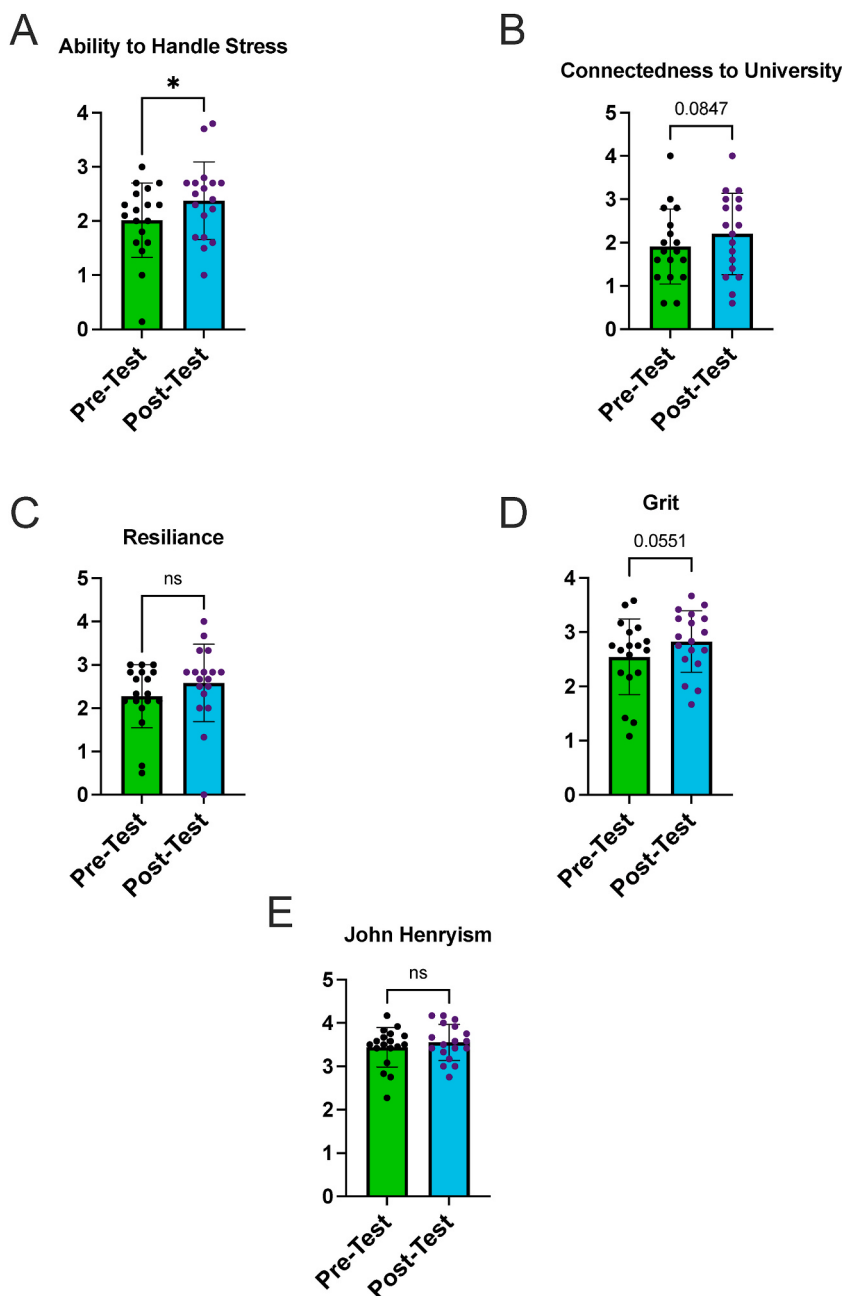


Fig. 2. Pre- and post-WAG participation survey results for (A) brief resilience scale, (B) brief sense of belonging scale, (C) reversed brief perceived stress scale, (D) short grit scale, and (E) John Henryism Active Coping Scale 12.

The questions regarding connectedness, ability to handle stress, grit, or John Henryism were not statistically significant. There is a possibility that a better measurement of these four may require participants to have had more participation in the WAG. While we did not ask how long the participant had participated in the WAG, as stated above, participation in the Friday morning WAG ranged from a session to years, which may affect to results.

The questions relating to mentoring, funding preparedness, quality of lifestyle, and satisfaction with WAGs were all statistically significant. Since different types of mentoring occurred in the WAG, it is not surprising that participants found a positive connection between the WAG and mentoring. Effective mentoring requires an intentional approach and training for everyone involved followed by strategic metrics to test its efficacy. There are a variety of mentoring strategies that could be used, including intentional mentoring [27,67], shadow mentoring [44], and casual mentoring, which allows established colleagues to informally advise mentees on “academia’s hidden curriculum” [68]. Beyond this, our WAG format attempted to prioritize peer mentoring and reverse mentoring through

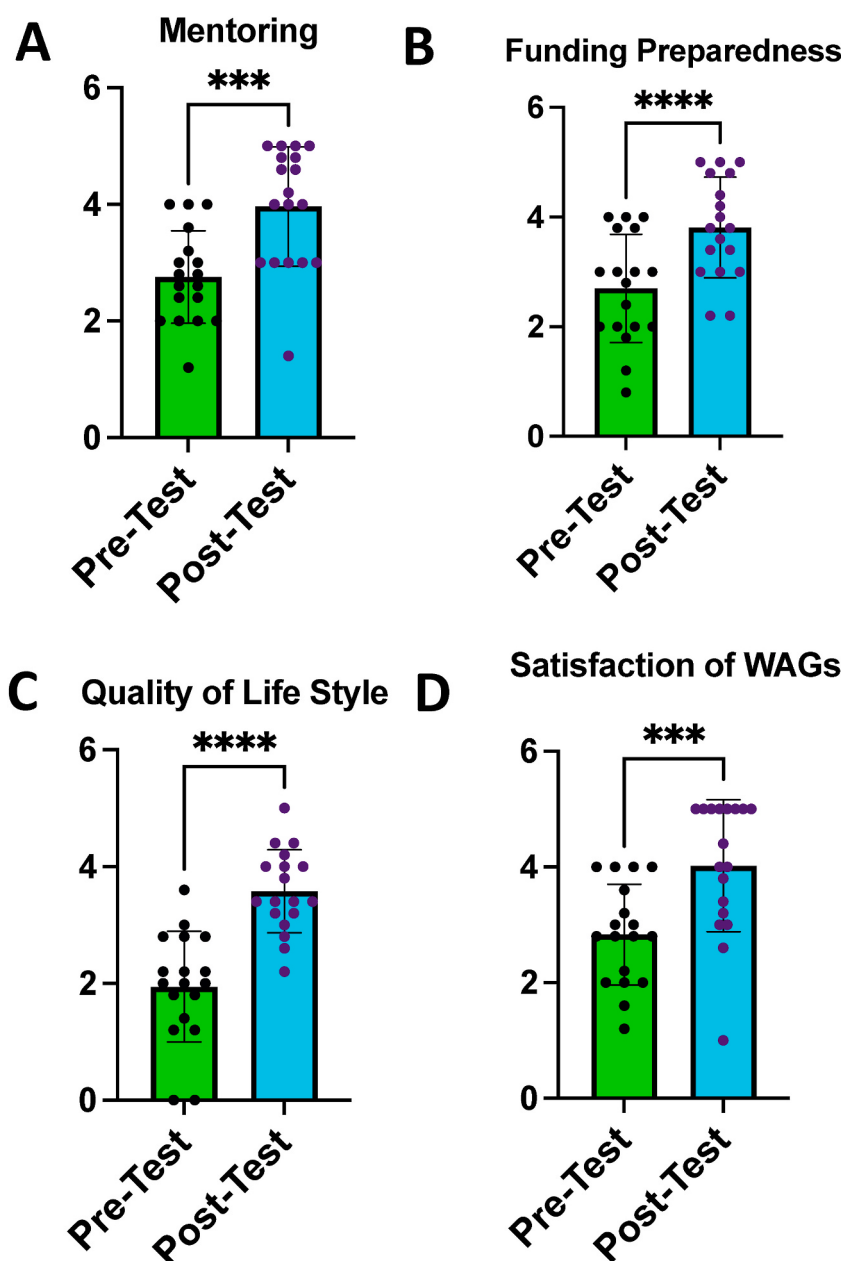


Fig. 3. Pre- and post-WAG participation survey results for questions created to measure (A) how well WAGs improved finding mentors and understanding mentorship, (B) how well WAGs improved obtaining funding and understanding the grant process, (C) current lifestyle and improving lifestyle balance, and (D) understanding of what WAGs are and why they are important.

group-based discussions [31,65]. Beyond this, in general, participants were very satisfied with their time commitment in the WAGs. While some noted the time commitment was intimidating at first, participants concluded that the WAG was worth the investment. Quality of lifestyle and preparedness for funding and awards also increased following the WAG (Fig. 3B–C). While the ability to manage stress, identify supportive mentors, establish a strong work-life balance, and become more confident in grant writing likely increased productivity, we also sought to examine the grant application rate of our WAG. Our WAG showed high grant and award attainment during the time participants were involved in the WAG, as many individuals applied for a high number of grants or awards at each career level (Fig. 4).

Traditionally, grant coaching programs have been shown to be highly effective for early career-stage investigators. Following participation in grant coaching programs, attendees were likely to submit the grant prior to the deadline due to more consistently devoting time to working on grants [59], which resulted in participants having high relative rates of obtaining grants [60]. However, grant coaching programs such as those hosted by the National Research Mentoring Network [59,60] may not be widely available,

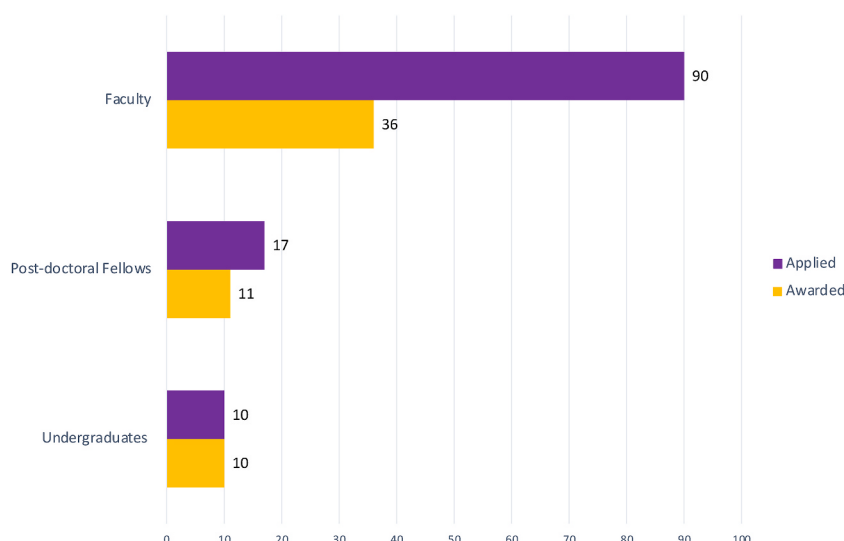


Fig. 4. Sample of grant attainment among our WAG. This includes undergraduates ($n = 5$), post-doctoral fellows or equivalent ($n = 6$), and faculty members ($n = 10$).

whereas WAGs may implemented at a variety of institutions. Beyond a pilot study that primarily considers a highly diverse sample, here we also present our unique format for a WAG group that goes beyond only dedicating time to writing.

Generally, past studies show that even a small writing retreat has been beneficial for participants by offering them a sense of community and giving them structured time for writing [58]. However, some past studies have shown that WAGs for faculty may not have a significant impact on either the frequency of writing or the duration of writing of participants [6]. This may be a career-level dependent change, as other findings show that writing groups are positive factors for graduate students by encouraging publishing papers on their degree research [70,71]. Generally, large-scale studies focused on WAGs have shown tremendous success [8], such as at Indiana University which includes hundreds of faculty who report increases in productivity and greater satisfaction with their writing [19]. Based on these findings, in the past, it has been suggested that WAGs can be targeted at minority populations [35]. One study has done this by WAGs targeting specifically female faculty, which showed significant improvements including in peer mentoring and attitudes towards writing [31]. We show that many underrepresented individuals report positive outcomes with our specific WAG format. While our findings show that a WAG is useful for many individuals who are underrepresented, future studies may further evaluate if WAGs have specifically increased effectiveness for underrepresented faculty and students by expanding the implementation of WAGs, such as by comparing primarily white institutions and HBCUs.

6. Conclusion

Overall, WAGs are not a common method used to improve grant attainment and writing productivity, especially for underrepresented individuals. Our framework outlines a WAG focused on both increasing collective productivity and community building. Cumulatively, our results suggest that participants in our WAG were able to better manage stress, and recognize in support of effective mentoring, concomitantly with relatively high grant attainment. Therefore, WAGs may be a valuable mechanism to support mentoring and improving grant attainment for underrepresented individuals at every stage of the pipeline and throughout academia. If one decides to formulate or utilize a WAG, individuals should ask themselves several important questions before starting (Table 1). Furthermore, WAGs can progress to include professional development opportunities. Past literature has suggested that WAGs may be self-determining [69], where the success rate depends on the structure and participation of WAG attendees. This may explain the heterogeneity in WAG effectiveness in past literature. Cumulatively, our results suggest that participants in our WAG took value in being able to better manage stress, recognize effective mentoring, and have a high rate of grant attainment. Future studies may consider expanding WAGs to include other populations within an institution, such as administrative staff. Secondly, as technologies such as ChatGPT may be used for writing [72], WAGs may serve as important mechanisms to consider how these technologies can be used ethically while balancing traditional grant writing and avoiding technostress [50]. Other future avenues should also directly compare similar faculty groups involved and independent from WAGs to better measure their effectiveness. Based on this pilot study, WAGs may be highly beneficial to increase the grant writing success of underrepresented individuals, but further work must be performed to quantify larger WAGs and WAG formats.

7. Limitations and future directions

Historically, it is challenging to evaluate WAGs given that they may vary in structure, format, and rules. Here, we present feedback from participants of our WAG. We had a sample of only participants from our WAG, which was comprised of underrepresented WAG

(Table 4) hosted on digital platforms. Therefore, we are uncertain if other WAGs, with separate group dynamics, and different formats (i.e., in-person, hybrid) may have similar effects as ours. Past studies have established guidelines specifically for standard in-person and virtual WAGs which differ from our standards [21,73]. Similarly, since our WAG has a unique format (see **WAG Framework Section**), future comparisons may better consider the impact of this format in comparison to other WAG formats.

Although individuals came from a wide-career range, the small sample size ($n = 21$) evaluated makes these findings serve best as a pilot study, underscoring the importance of wider-scale studies to investigate the impacts of WAGs in greater depth. Furthermore, we did not require all questions on the surveys to be answered, allowing individuals to withdraw from some questions, which limited the sample number. Similarly, while this is a diverse sample set, this may not be representative of the general population of academia since it is a non-random sample composed of individuals already participating in our WAG. Given the pilot nature of this study, we are unable to compare the outcomes of WAGs on underrepresented individuals as opposed to their well-represented counterparts. While we believe WAGs offer benefits for both underrepresented and well-represented individuals, future studies may seek to see if underrepresented faculty and students have a heightened benefit from WAGs.

There are multiple confounding factors that should be kept in mind for analysis of all data. Many of these participants began the WAG during the Covid-19 period which created periods of uncertainty in STEMM [28,29], so while participants were asked to answer questions in relation to WAG, these external circumstances may have shaped options. We also did not formally track the attendance of the Friday WAG members, even though the Friday WAG sessions continue to meet. Additionally, we were unable to evaluate members' performance against individuals in similar positions, which future studies may seek to do through having a control group. Future studies may also consider how WAGs are effective in combination with other techniques. Although there was not a significant difference in some metrics, a general trend in the data suggested that WAGs, in combination with other career development interventions, may prove to significantly affect outcomes, especially regarding tenure. Secondly, for these specific sets of questionnaires (displayed in Table 3; Fig. 2), while participants were asked to answer pertaining to the WAG, the scales were left unchanged. Since the questionnaire neglected to connect these questions to the WAG specifically, some individuals may not have responded to the questions based on their experience in the Friday morning WAGs. For the questions that specifically referenced WAGs (Table 3; Fig. 3), given no validated scales exist to evaluate WAGs, these questions remain unvalidated.

Ethics

This study was approved by the Ethics Committee of Kaiser Foundation Research Institute and New Mexico Highlands University, with specific references detailed below. All participants/patients (or their proxies/legal guardians for individuals under 18) provided informed consent to participate in the study.

Project Title: Promoting Engagement in science for underrepresented Ethnic and Racial minorities (P.E.E.R), 21-MortonD-HSR-SOM-01, Kaiser Foundation Research Institute FWA: FWA00002344.

Project Title: Promoting Engagement in science for underrepresented Ethnic and Racial minorities (P.E.E.R), 015–2022 Chia Vang, New Mexico Highlands University.

Ethics approval and consent to participate

Yes.

Informed consent for publication

Yes.

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Data availability statement

Raw data is available upon request.

CRediT authorship contribution statement

Kit Neikirk: Writing – review & editing, Writing – original draft, Visualization, Resources, Methodology, Investigation, Formal analysis, Data curation, Conceptualization. **Taylor Barongan:** Writing – review & editing, Visualization, Methodology, Investigation. **Bryanna Shao:** Writing – review & editing, Validation, Methodology, Investigation. **Elsie C. Spencer:** Formal analysis, Data curation,

Conceptualization. **Kinutha Kabugi**: Writing – review & editing, Visualization. **Zachary Conley**: Writing – review & editing, Methodology. **Larry Vang**: Resources, Project administration. **Mein Vue**: Methodology. **Nancy Vang**: Writing – original draft. **Edgar Garza-Lopez**: Writing – original draft. **Amber Crabtree**: Writing – original draft, Formal analysis. **Stefanie Alexander**: Writing – review & editing. **Heather K. Beasley**: Writing – review & editing. **Andrea G. Marshall**: Writing – review & editing, Project administration. **Mason Killion**: Writing – review & editing. **Dominique Stephens**: Writing – review & editing, Project administration. **Beverly Owens**: Methodology, Investigation. **Denise Martinez**: Writing – review & editing. **Caroline B. Palavicino-Maggio**: Writing – review & editing. **Felysha Jenkins**: Writing – review & editing, Project administration. **Chia Vang**: Conceptualization. **Derrick J. Morton**: Conceptualization. **Haysetta Shuler**: Validation, Methodology, Investigation. **Sandra A. Murray**: Writing – review & editing, Project administration, Methodology, Data curation, Conceptualization. **Steven Damo**: Writing – review & editing, Validation, Resources, Project administration, Data curation, Conceptualization. **Zer Vue**: Writing – review & editing, Visualization, Project administration, Funding acquisition, Conceptualization. **Antentor Hinton**: Writing – review & editing, Visualization, Validation, Supervision, Software, Resources, Project administration, Methodology, Investigation, Funding acquisition, Formal analysis, Data curation, Conceptualization.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.heliyon.2023.e22335>.

Abbreviations

DEI	Diversity, equity, and inclusion
NIH	National Institutes of Health
R01	NIH Research Project Grant Program
STEMM	Science, technology, engineering, mathematics, and medicine
WAG	Writing Accountability Group

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