A. COVER PAGE

Project Title: Center for Health, Work & Environment	
Grant Number: U19OH011227	**Project/Grant Period**: 09/01/2016-08/31/2021
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Program Director/ Principal Investigator Lee S. Newman lee.newman@cuanschutz.edu	**Administrative Official Information**
Change of Contact PD/PI: no	
Human Subjects: no	**Vertebrate Animals:** n/a
hESC: n/a	**Inventions/Patents:** n/a

B. ACCOMPLISHMENTS

B.1. What are the major goals of the project?

1. Provide leadership and expertise in research and practice to integrate the protection from work-related safety and health hazards with the promotion of injury and illness prevention efforts to advance worker well-being. (Leadership/Expertise)
2. Extend the research evidence base regarding the integration of protection and promotion of worker-related safety, physical and mental health, and well-being. (Research)
3. Increase awareness, adoption, and implementation of *Total Worker Health*® best practices, programs, and policies across the region through communication and dissemination, education, and implementation that is evidence-based, accessible, feasible, effective, and culturally appropriate. (Research to Practice/Outreach)
4. Advance the adoption of policies that improve work-related safety, health, and well-being at local, state, and federal levels. (Policy)
5. Build *Total Worker Health* (TWH) workforce capacity in public and private sectors, in academia and practice through education and strategic partnerships. (Capacity)
6. Improve Center impact through a rigorous evaluation program. (Evaluation)

B.2. What did you accomplish under these goals?

In September 2016, we became the sixth and newest TWH Center of Excellence, working with an CDC/NIOSH award that was approximately 80% of the allowable, requested funding level, with a single large, randomized controlled intervention research project (Small+Safe+Well Study), a Research Pilot Projects Program(RPPP), an Planning and Evaluation (P&E) Core, and Outreach Core. Following a Strategic Planning meeting (August 2016), we made budgetary and operational adjustments and became a fully operational in less than 3 months. The Center has focused principally on TWH in small and medium enterprises. On March 15, 2020, three and a half years into our first cycle as a TWH Center of Excellence, the ColoradoSPH was closed due to COVID-19. All faculty and staff of CHWE began working from home indefinitely. Despite COVID-19 challenges, by the end of the current award period, we had exceeded our goals and objectives. A Year 05 funding supplement from NIOSH enabled us to respond to the urgent needs of employers and employees affected by COVID-19 both in Region 8 and nationally, and to respond to the need to increase efforts to address structural and systemic racism in the workplace, including addressing the challenges faced by the region's large, underserved, disproportionately affected Latinx workforce.

Planning and Evaluation Core

In addition to establishing the necessary processes, committees, and team responsibilities for conducting daily operations of the new Center, here are some highlights of the P&E Core's achievements over the past five years:

Coordination with Partner Organizations

Our Center has strength in coordination and integration with other centers, universities, government agencies and community partners in establishing common ground and creating opportunities for the improvement of worker safety, health, and well-being. Over the five-year funding period, CHWE collaborated closely with the NIOSH Western States Division (WSD); the Mountain and Plains Education and Research Center (MAP ERC); the High Plains Intermountain Center for Agricultura Health and Safety (HICAHS) at Colorado State University (CSU); the NIOSH Center for Workers' Compensation Studies (CWCS); and the NIOSH Small Business Assistance and Outreach Program among others. For example, in Y03-04, we partnered with NIOSH WSD to co-host the second national workshop on American Indian/Alaska Native occupational safety and health (OSH), held on our campus in July 2019. In partnership with NIOSH WSD, Dr. Brown and the E&P Core coordinated with our Outreach Core to provide full infrastructure support and hosting for USE 2017 "Understanding Small Enterprises" international conference held in Denver in September 2017, including co-editing a peer-reviewed special issue of *Ann Work Expo Health* and Conference Proceedings. In Y04 and 05, the Core forged stronger collaborations with the Center for Bioethics and Humanities and with the Latino Policy and Research Center to increase awareness and impact of working conditions on Black and Latinx health. Center Director Newman successfully petitioned for TWH Centers of Excellence to become chartered members of the Association of University Programs in Occupational Health and Safety (AUPOHS), joining all other NIOSH-supported Centers in communicating U.S. OSH needs to policymakers. In partnership with the NIOSH Office for TWH, Drs. Newman and Tenney launched the first exploratory committee for creation Society

for *Total Worker Health*, with the P&E Core's support. This is outlined further below and in the Outreach Core report.

Coordination of Center Response to COVID-19 and to Rising Awareness of Racial and Ethnic Health Disparities in the Workplace

Importantly, in year 04 and 05 the P&E Core coordinated the activities of the Research and Outreach Cores, including execution of a rapid needs assessment to 1) identify, prioritize, and execute TWH initiatives in response to COVID-19 and 2) raise societal awareness of race- and ethnicity-related workplace health disparities. In brief, based on Dr. Newman's past experience as CEO of a health IT start-up company, the Core applied principles of "agile development" to rapidly discover community needs, develop solutions, create self-organizing and cross-functional teams, and accelerated, rigorous evaluation with cycles of iteration. Regarding COVID-19, we hosted a series of highly attended (3,244 attendees) online COVID-19 Townhalls and Webinars, one-on-one COVID-19 advising for organizations and local labor unions, consultation for regional, national and international companies including meatpacking, manufacturing, retail, distribution, grocery, and health care, and enhanced media and social media engagement. Regarding racism in the workplace, COVID-19 has laid bare the tragic, disproportionate impact of working conditions and social determinants of health on Black, Latinx, and Native American workers. The P&E Core led a similar process of rapid needs assessment in Region 8, followed by a series of race and ethnicity-centered online webinars in partnership with the Outreach Core, the CU Center for Bioethics and Humanities, and the CU Depression Center, and identified priority topics for Outreach Core's communications strategy.

Evaluation Program

The Center Director has consistently shown a commitment to program evaluation. Evaluation Director, Dr. Brown, has been able to incorporate rigorous evaluation into the research, practice and outreach activities in CHWE, including Health Links, the SSWell research project, and other Center initiatives, such as the a continuing education needs assessment that had specific items related to TWH education. Specific examples include evaluation of the Health Links program through six-month evaluations, annual evaluation of the Health Links advising process, and evaluations of all events and training opportunities. Data are shared internally for program improvement, decision making, and to guide subsequent needs assessments to inform future programming.

Evaluation was also built into the SSWell research project from inception. This included designing and implementing a thorough program evaluation of the TWH Leadership Program, which was a core element of that intervention study as well as a promising product that is now being disseminated by the Outreach Core. As a methodologic advance, this has led to a new understanding of how to better apply dissemination and implementation evaluation tools like RE-AIM in the context of TWH intervention design. A manuscript is currently under preparation.

Research Core

Small + Safe + Well (SSWell) TWH Intervention Study

We began recruiting for the SSWell study in April 2017. We concluded recruitment in September 2019. We successfully recruited 132 small organizations to participate in the SSWell Study. This was approximately 62% of our goal for the study, but our statistician indicated that we had enough power with our sample size to perform our planned analyses. Thirty-eight (29%) of our participating organizations were in a rural area of the state. The mean size of participating businesses was 79 employees and the range is 4 to 430 employees. A variety of industries were represented. Of the organizations that were recruited, 128 organizations representing 13,374 employees completed the Health Links Healthy Workplace Assessment. Of these 128 organizations that completed the Healthy Workplace Assessment, 117 organizations representing 11,070 employees distributed the Employee Health and Safety Culture survey to their employees. We examined a number of research questions and published our findings in the following areas:

- Association between TWH policies and climate and employee motivations
- Association between TWH policies and programs and health and safety climates
- Profiles of TWH approaches in small businesses
- Program evaluation of our TWH leadership program
- Longitudinal changes in TWH policies and programs and associated changes to safety and health climates

- Randomized waitlist control comparison design to evaluate the added benefit of a TWH leadership development program

When the COVID-19 pandemic brought the planned TWH leadership trainings to an end, we pivoted and reached out to organizations who were participating in the SSWell study to learn more about the impacts of COVID-19. At two timepoints (May and September 2020), we surveyed employees at participating organizations and found that employee perceptions of safety and health climates were significantly related to their self-reported well-being during the first wave of COVID-19, even when there were changes to childcare, the ability to work, and limited social contacts. Perceptions of health and safety climates remained stable across all timepoints. However, employee well-being scores declined between the pre-pandemic period and subsequent COVID-19 timepoints.

The SSWell study shed light on the ways in which small businesses can implement a TWH approach that improves both safety and health programs and policies *and* associated improvements in workers' perceptions that their employer cares about their health and safety. For organizations that wish to create a culture where employees are proactively engaged in the TWH policies and programs, company leadership must demonstrate its commitment and support for TWH programming in day-to-day practice. Under these conditions, employees were more internally motivated to participate in TWH initiatives and this internal motivation drove their engagement even in the absence of incentives that employers commonly use to drive participation. A TWH leadership program that trains multiple individuals from an organization can help small business leaders develop a shared vision and goals for TWH through increased practice of TWH leadership skills.

The study wass an excellent illustration of the Center's commitment to r2p. There were two major outreach outputs of this project. The first was CHWE's Outreach TWH Leadership Programs. We created three training options to meet the needs of professionals, including an online self-paced training, an interactive live 1.5 hour workshop, and an executive style training that includes multi-month coaching. This was made possible in part by a grant from the Pinnacol Assurance Foundation. (URL: https://coloradosph.cuanschutz.edu/research-and-practice/centers-programs/chwe/training/total-worker-health-leadership-programs). Another output was the employee health and safety culture survey that is now part of Health Links services to businesses. Finally, and with only minor modification, we have implemented TWH Leadership training sessions as a service. For example, in 2019, we trained leaders of six US Federal Agencies housed at the Denver, Colorado Federal Center; the entire senior leadership group of the ColoradoSPH; and 170 company leaders and managers in an international agribusiness, Pantaleon, in Spanish, in Guatemala, Nicaragua, and Mexico. Program evaluations demonstrated efficacy and suggested strong generalizability of TWH Leadership training.

Research Pilot Projects Program

Over the past five years, we received 35 project proposals and we funded 11 pilot projects (6 research and 5 research to practice projects) ranging up to $25,000 (total costs) for one year of support for a total of $222,050 over the five year period. The projects ranged in scope from cross-sectional surveys to pilot intervention studies. Topics included work/family challenges, psychosocial hazard reporting, cardiovascular disease, fatigue, gig-work, well-being, functional movement screening, inequities, and air quality. Researchers studied these topics in a variety of industries including firefighting, early childhood education, public schools, and vape shops. Researchers covered several NIOSH NORA Sector and Cross-Sector goals, including Healthy Work Design and Well-being, Public Safety, Cancer, Reproductive Cardiovascular and other Chronic Disease Prevention, Traumatic injury prevention, Transportation, Warehousing, and Utilities, Healthcare and Social Assistance, Services, Respiratory Health.

Outreach Core

As a NIOSH-funded Center of Excellence for TWH, we had many accomplishments through outreach, including evidence-based designed interventions, collaborations, communications, training, and other dissemination activities over the past five years. Highlights are below, with more detail found in the Outreach Core report.

Communications

Our websites combined received over 1 million unique visits (142,721 CHWE, 932,119 Health Links) over the five-year period. Our content strategy for social media primarily focused on disseminating TWH information in

the form of shared posts, success stories from Health Links Certified Healthy Workplaces, tools and resources from our Center and other TWH Centers of Excellence, and current trends targeting employers, professionals, and partners. Our social media sites reach a total of 4,988 followers across Facebook, Twitter and LinkedIn. We continue to produce and publish two electronic newsletters: the quarterly CHWE newsletter reaches 4,171 contacts and the monthly Health Links newsletter reaches 3,481 contacts.

Health Links

Our signature outreach program, Health Links, had tremendous success in putting TWH into practice by translating and disseminating TWH to organizations and encouraging them to integrate their health and safety efforts. We have had 743 organizations participate in the program by completing a Healthy Workplace Assessment™, certification, and mentoring through personalized advising sessions. In this time, our team conducted 987 advising sessions, working with representatives from organizations to interpret the results of their Healthy Workplace Assessment™ and identify SMART-goals that align with the values and needs of both their workplace and their workforce.

Established TWH Core Competencies and Formal Educational Programs

Building on efforts that began at the first and second International TWH Symposia and at a November 2017 workshop, we coordinated the TWH Education, Training and Capacity Building Workgroup (TeTRAC). TeTRAC was a collaborative composed of representatives from the NIOSH Office for TWH, other Centers of Excellence, TWH affiliates, and academic institutions that are developing educational programs for this TWH. Dr. Newman directed the effort to develop and disseminate guidelines that academic institutions can use for defining the core principles, competencies, skills, and knowledge needs of future TWH professionals and practitioners, summarized in a peer-reviewed paper entitled *Education and Training to Build Capacity in Total Worker Health®: Proposed Competencies for an Emerging Field*. In past 5 years we made significant advances: 1) developed the nation's first TWH Certificate Program, now fully online, 2) developed TWH curriculum in graduate and post-graduate courses, 3) promoted the program that now has 16 graduates and 16 people currently enrolled from wide range of fields, 4) developed a TWH - Occupational Health track in the ColoradoSPH DrPH program, 5) helped create and promote a new TWH *Leadership* 101 online course for working professionals.

COVID-19 Response for Workplaces and Workers

Our teams' response to COVID-19 leaned heavily on our expertise in OSH. Drs Lee Newman and Mike Van Dyke consulted with local hospitals on appropriate personal protective equipment (PPE) protocols for health care workers. They worked with a Governor-directed statewide procurement group to connect them to appropriate facilities for quality testing on PPE obtained outside the normal supply chain. They consulted with a local hospital on design and best practices of homemade face covers for source control among COVID-suspected patients as well as methods for testing expired PPE. They worked with NIOSH and a large animal protein (meatpacking) company on assessing and implementing best practices to prevent COVID-19 transmission among their essential workers. They currently advise multiple other companies, labor organizations, and agencies on how to implement (and modify) COVID-19 pandemic guidance coming from local and federal governments. Our Center created a COVID-19 resource page to provide credible resources for international, national, and regional organizations, employers, and individuals. Our faculty and staff communicated trustworthy information to the general public through many media interviews. We are coordinating with other NIOSH Centers of Excellence to share and disseminate resources to benefit all stakeholders we serve, track activities, identify opportunities and needs for research and practice collaborations, and share common concerns as the pandemic continues.

Society for Total Worker Health

In collaboration with representatives from the NIOSH Office of TWH, professional associations, TWH Centers of Excellence and Affiliates, we formed the steering committee to solicit input and plan next steps to developing the structure, priorities, and activities. The society will serve as a hub, a new community, for individual professionals and both non-and for-profit entities to share ideas and collaborate around TWH research, training, dissemination, and real-world solutions. Dr. Robert McClellan from Dartmouth Hitchcock is chairing the committee to lead the process for identifying the governance structure, partners, policies, and articles of incorporations. We have representatives from professional associations including American College of Occupational and Environmental Medicine (ACOEM), American Industrial Hygiene Association (AIHA),

American Society for Safety Professionals (ASSP), Society for Occupational Health Psychology (SOHP) and National Safety Council (NSC) serving on the steering committee.

B.3. Competitive Revisions/Administrative Supplements

n/a

B.4. What opportunities for training and professional development did the project provide?

Research Core

We successfully trained 60 individuals through the TWH Leadership Training Program. Dr. Natalie Schwatka (Co-I) received a NIOSH K01 award during this project period that leveraged data collected as part of the SSWell study. A graduate student at Colorado State University used a subset of SSWell data to analyze as part of his master's thesis.

The RPPP provided an opportunity for academic researchers who are new to the field of TWH to conduct research in the field. Pilot project recipients came from a variety of university departments, such as a Department of Health and Exercise Science. This program provided support for these investigators to receive additional research training and professional development via conference presentations and attendance. This program provided research training for undergraduate and graduate students. As a result of the working parent study (PI: Fisher), two graduate students worked with the Colorado Department of Public Health and Environment to conduct literature reviews and assist with developing organizational and public policies to improve family-friendly work environments.

Outreach Core

In 2017, we founded the **Certificate in *Total Worker Health* Program.** To date, we have graduated 16 students and currently have another 16 enrolled with 7 starting in Spring 2022. Our students come from diverse backgrounds representing both graduate and post-graduate students and practicing professionals from the fields of public health, medicine, human resources, industrial hygiene, nursing, healthcare administration, and architecture.

We reached the business community through our free Health Links Webinar Series which offered expert content in the field of TWH. Beginning at the onset of the COVID-19 pandemic, we expand the webinars with special topics focused on mental health, antiracism in the workplace, chronic disease prevention and management, and mental health. The expanded reach resulted in attendees from 37 states representing professionals in HR, safety, occupational medicine, industrial hygiene, public health, and others. The one hour long virtual trainings expanded our center's reach and TWH dissemination by offering free continuing education credits for professionals in human resources, health education, and safety.

We partnered with local coalitions organized by public health agencies to deliver live community-based trainings on TWH 101, employee engagement, and mental health. Our collaboration with ECHO Colorado (Extension for Community Health Outcomes), based at CU Anschutz, led to a new series designed for employers—an innovative use of the ECHO platform. To launch ECHO's first employee-centric series, we planned and hosted a live event in August 2019 with 50 participants representing health care, government, and small business. The full online ECHO series, *Solutions for Workplace Behavior and Mental Health Challenges,* was held in Fall 2019, with an initial cohort of 27 participants representing diverse backgrounds and industries across 13 mainly rural counties in Colorado. Our focus in mental health continued in Fall 2019 when our satellite Utah Outreach office partnered with community groups in Utah, inviting local employers to share their perspectives on mental health in mountain communities. Representatives from the tourism and service industries expressed the significant mental health struggle their workforces and communities face. Over a two-day period, we trained 190 workers and managers from the ski and service industries on reducing stigma, identifying warning signs, gaining crucial conversation skills, and establishing adaptable workplace suppors.

We responded rapidly to the pandemic by hosting a COVID-19 Town Hall series that delivered 12 consecutive weekly webcasts for affected managers, enterprise-level decision makers, and workers on the topics of leadership, fatigue, personal protective equipment, supporting working parents, and legal issues. In summer 2020, we began an ongoing partnership with the CU Center for Bioethics and Humanities to put on a COVID-19 pandemic ethics webinar series where we addressed the topics of the impact of COVID-19 on vulnerable

workers, professional sports and COVID safety, OSH regulations under COVID (featuring former OSHA head, David Michaels), and the ethics of mandatory COVID vaccination by employers.

B.5. How did you disseminate the results to communities of interest?

P&E Core

Through the P&E Core, we disseminated information about our Center through participation in meetings such as those with NIOSH and other TWH Centers of Excellence, the Healthy Work Design and Well-being NORA Cross Sector, meetings with TWH Affiliates, and with our own EAC. Through the ISC, we facilitated connections between the Outreach Core, including our communications team, the pilot projects program and the SSWell research project to increase dissemination of research findings. The reports from those components, particularly the Outreach Core, highlight the extent of our dissemination activities.

Research Core

All organizations that participated in the SSWell study were provided with customized reports of their assessment results. This includes their Healthy Workplace Report Card, which contains their TWH programming elements score. It also includes an aggregated employee health and safety culture report. At the TWH Leadership training, we provide a booklet with the Healthy Workplace Report Card, employee health and safety culture report, and a TWH leadership self-assessment report. The SSWell study resulted in 10 peer-reviewed publications, two book chapters, 22 oral/poster presentations at regional, national, and international scientific and industry conferences, and one NISOH Science Blog post. The NIOSH Science Blog post described lessons learned: https://blogs.cdc.gov/niosh-science-blog/2022/02/18/small-biz-twh/.

The pilot projects recipients shared their results with other researchers and the communities in which they engaged with. They presented to a variety of academic, practitioner, and business leader audiences at multiple events, including international, national, and regional conferences, presentations to organizational leaders and stakeholders, and free webinars.

Outreach Core

Our dissemination activities included the use of email marketing, digital media, events, presentations, community outreach, and other communication strategies to reach employers, community partners, and stakeholder groups.

- Through the Center's and Health Links' social media pages on Facebook, Twitter and LinkedIn we've shared TWH research, r2p projects, free resources, pilot grant funding announcements, and current topics in the field of TWH. Through our social channels we were able to reach 4,988 followers.
- Through the Health Links website (healthlinkscertified.org), we featured TWH messaging, directed organizations to take the Healthy Workplace Assessment™, provided a user dashboard and a robust Resource Center featuring TWH evidence-based tools and resources.
- We've utilized our Newsroom on our Center's website to post featured stories from the media, new publications, and our blog. (https://coloradosph.cuanschutz.edu/research-and-practice/centers-programs/chwe)
- We exhibited at local, regional, national, and international events, where we promoted our TWH research, training, and programs. These annual events resulted in reaching large and diverse audiences and distributed program materials.
- We worked with our Chancellor's office to promote our outreach efforts as part of CU for Colorado, a searchable resource catalog that features nearly 800 programs by county, Congressional Districts, state legislative districts, keywords and broad categories. See more here: https://connections.cu.edu/stories/cu-colorado-showcases-outreach-programs-new-interactive-map

B.6 - What do you plan to do during the next reporting period to accomplish the goals?

The renewal of the CHWE TWH Center of Excellence resulted in new activities for the current five-year funding period. These are briefly highlighted in the component reports. In brief, through the E&P Core, we will facilitate essential interactions internally between researchers and the Outreach Core and externally with partners such as the External Advisory Committee, other TWH Centers of Excellence and Affiliates, and with professional organizations, community and industry partners.

Through our Research Core, we will continue to conduct high quality research in areas such as the intersection of oncology care and worker well-being, shared leadership and peer support in elementary education, and behavioral health supports for agricultural communities and workforces. The RPPP will continue to fund new small projects on an annual basis to build research capacity in TWH.

Through our Outreach Core, we will focus on disseminating high-quality evidence to partner organizations to improve TWH practices. Other major initiatives that will occur in the next reporting period include advancing the development of the Society for Total Worker Health and co-hosting the 3rd Annual Symposium to Advance Total Worker Health. Additionally, we will execute local events, such as the Annual Health Links event, which brings together practitioners from a wide range of businesses and industries. We will continue conduct outreach activities in conjunction with our partners to advance work with the Latinx worker community. We plan to increase our work in a few key initiatives including mental health in the workplace through. We plan to develop a new ECHO-type series for employers to support employees' behavioral health challenges through workplace supports. Finally, we will be working to increase the reach of TWH trainings and materials by translating existing materials into Spanish and developing new materials in both English and Spanish.

C. PRODUCTS

C.1. Publications, conference papers, and presentations

Publications

Book Chapters

1. Schwatka, NS, Tenney L, Newman LS. Health Protection and Health Promotion in Small Business. In: Burke R, Richardsen A. (eds.) Increasing occupational health and safety in workplaces: Research and Practice. Edward Elgar Publishing: 2019.
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Small + Safe + Well Research Project

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13. Shore E, Tenney L, Schwatka NV, Dally M, Dexter L, Brown CE, Newman LS. A pilot study of changes in Total Worker Health® policies and programs and associated changes in safety and health climates in small business. Am J Ind Med. 2021; 64(12): 1045-1052. NIHMS 1783526.
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15. Tenney L, Fan W, Dally M, Scott J, Haan M, Rivera K, Newman M, Newman L. Health Links™ assessment of Total Worker Health practices as indicators of organizational behavior in small business. J Occup Environ Med. 2019;61(8):623-34. PMCID: PMC6748381
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Education

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28. Jaramillo D, Krisher L, Schwatka NV, Tenney L, Fisher GG, Clancy RL, Shore E, Asensio C, Tetreau S, Castrillo ME, Amenabar I, Cruz A, Pilloni D, Zamora ME, Butler-Dawson J, Dally M, Newman LS. International Total Worker Health: Applicability to Agribusiness in Latin America. Int J Environ Resand Public Health. 2021; 18(5):2252. PMCID: PMC7956694.
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30. Krisher LK, Butler-Dawson J, Dally M, Jaramillo D, Newman LS. Chronic Kidney Disease of unknown cause: investigations in Guatemala and opportunities for prevention. Ciencia, Tecnología y Salud. Vol 7 Num. 1. 2020.
31. Krisher L, Butler-Dawson J, Schlosser K, Asensio C, Sinibaldi E, Yoder H, Dexter L, Dally M, Pilloni D, Cruz A, Jaramillo D, Newman LS. Body Composition, Anemia, and Kidney Function among Guatemalan Sugarcane Workers. Nutrients. 2021; 13(11): 3928. PMCID: PMC8621317.
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33. Amidon, TR, Lipsey, T. Blue-Collars/Tough Designs: UX Within Fire Service Occupational Safety and Health Programs. In International Conference of Design, User Experience, and Usability (pp. 573-588). Springer, Cham: 2018.
34. Amidon, TR., Williams, EA., Lipsey, T, Callahan, R, Nuckols, G, Rice, S. Sensors and gizmos and data, oh my: Informating firefighters' personal protective equipment. Commun Des Q Rev. 2018;5(4):15-30.
35. Amidon, TR., Arduser, L, Gouge, C, Hutchinson, L, Jones, J, Jones, N, Welhausen, CA. Examining usability in the communication design of health wearables. In Proceedings of the 35th ACM International Conference on the Design of Communication (pp. 1-3), 2017.
36. Crain, T L., Brossoit, RM, Robles-Saenz, F, Tran, M. Fighting fatigue: A conceptual model of driver sleep in the gig economy. Sleep Health. 2020;6(3):358-365. PMCID in process.
37. Farewell, CV, Powers, J, Puma, J. Safety and Health Innovation in Preschools: A Total Worker Health Pilot Project. J Occup Environ Med. 2020;62(5):e192-e199. PMCID in process.
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39. Simmons, WM, Amidon, TR. Negotiating research stance: An ecology of tensions in the design and practice of community-engaged research. In Proceedings of the 37th ACM International Conference on the Design of Communication (pp. 1-11), 2019.

40. Shore, E, Dally, M, Brooks, S, Ostendorf, D, Newman, M, Newman, L. Functional movement screen as a predictor of occupational injury among Denver firefighters. Saf Health Work. 2020;11(3):301-306. PMCID: PMC7502609
41. Holm, AK. (2021). Minority Stress, Work Stress, and Health Inequity for Hispanic/Latinx K-12 Teachers in Colorado: A Mixed Methods Study. Dissertation, Colorado State University, ProQuest Dissertations Publishing. https://www.proquest.com/openview/f011cab0877817ea43e7aab074a7a61f/1.pdf?pq-origsite=gscholar&cbl=18750&diss=y
42. Ekenga, C., Kim, B, Kwon, E, Park, S. Multimorbidity and employment outcomes among middle-aged US cancer survivors. JOEM. Published online Dec 2021. doi: 10.1097/JOM.0000000000002473

Presentations

1. Brown, CE, Schwatka, NV, Dally, M, Dexter, L, Tenney, L, Shore, E, Newman, LS. (2020, December). Applying the RE-AIM framework to a Total Worker Health intervention. Poster presentation at the 13th Annual Conference on the Science of Dissemination and Implementation in Health, Virtual.
2. Brown, CE, Dexter, L. (2021, October). Working through COVID-19: Takeaways for Organizational Leaders. Oral presentation, Health Links Annual Event. Virtual.
3. Brown, CE, Dexter, L, Schwatka, NV, Dally, M, Tenney, L, Shore, E, Newman, LS. (2021, November). "Total Worker Health® and Small Business Employee Perceptions of Health Climate, Safety Climate, and Well-Being during COVID 19." Poster presentation, Work, Stress & Health Conference. Virtual.
4. Schwatka NV, Tenney L, Dally M, Scott J, Brown CE, Weitzenkamp D, Shore E, Newman LS. (2018, May). A description of small business adoption of TWH policies and practices via business and employee assessments. Oral presentation at the 2nd International Symposium to Advance Total Worker Health. Bethesda, MD.
5. Schwatka, N. V. (September, 2019). "Using a Design Sprint to Develop an Intervention for a Latino Day Laborer Organization." Oral presentation, 12th Annual Western States Occupational Health Network (WestON) conference, Denver, CO.
6. Schwatka, NV, Fan, W, Dally, M, Scott, J, Shore, E, Brown, C, Tenney, L, Newman, L. (2019, November). "Total Worker Health® strategies, climate, and employee motivation." Oral presentation, Work, Stress, & Health conference, Philadelphia, PA.
7. Schwatka, NV, Scott, J, Tenney, L, Newman, L. (2019, November). "Evaluation of a small business Total Worker Health® leadership program." Oral presentation, Work, Stress, & Health conference, Philadelphia, PA.
8. Schwatka, NV., Tenney, L., Newman, L., & Shapiro, D. (2020, April). "Total Worker Health Leadership Workshop." Virtual workshop for 25 University of Colorado School of Public Health leadership.
9. Schwatka, NV. & Shapiro, D. (2020, November). "Total Worker Health Leadership Workshop." Virtual workshop for 14 leaders from diverse industries hosted by the Center for Health, Work & Environment.
10. Schwatka, N. V. (2020, November). "How Small Businesses Should Engage Employees to Achieve Total Worker Health." Invited presentation, Health Links Webinar Series, Virtual.
11. Schwatka, N. V. (2021, May). Interventions to foster leadership for safety, health, and well-being in small business. Invited presentation, NIOSH NORA Traumatic Injury Prevention Council, Virtual.
12. Schwatka, NV, Newman, LS, Tenney, L (2021, September). "Small Business Total Worker Health® Leadership Training." Poster presentation, XXII World Congress on Safety and Health at Work 2021, Virtual.
13. Schwatka, NV, Tenney, L, Krisher, L (2021, September). "Total Worker Health® leadership for the safety professional." Oral presentation, ASSP Safety21 Conference and Expo, Virtual.
14. Schwatka, NV, Jaramillo, D, Shapiro, D. (2021, September). "Total Worker Health® leadership for the safety and health professional." Oral presentation, 2021 AIHA-Rocky Mountain Section Fall Technical Conference, Arvada, CO.

15. Schwatka, NV, Dally, M, Dexter, L, Tenney, L, Brown, C, Newman, L. (2021, November). "Profiles of Total Worker Health in Small Business." Poster presentation, Work, Stress, & Health Conference, Virtual.
16. Schwatka, N. V. (2022, February). How to create leadership support in small business. Invited presentation, NYNJ ERC Occupational Health and Safety Center 42nd Annual Scientific Meeting, Virtual.
17. Schwatka, NV, Dally, M, Dexter, L, Tenney, L, Brown, C, Newman, L. (2022, February). "Small+Safe+Well: A small business Total Worker Health intervention." Poster presentation, 33rd International Congress on Occupational Health, Virtual.
18. Shore, E, Schwatka NV, Tenney L, Dally M, Scott J, Brown CE, Weitzenkamp D, Newman LS. (2018, May). The Small + Safe + Well (SSWell) study: A NIOSH Center of Excellence small business TWH intervention study. Poster presentation at the 2nd International Symposium to Advance Total Worker Health. Bethesda, MD.
19. Shore E, Schwatka NV, Dally M, Brown C, Scott J, Tenney L, Newman L. (2018, September). Do employee perceptions of health and safety climates differ by size of business in Colorado? Oral Presentation. AIHA-RMS/ASSP Fall Technical Conference. Arvada, CO.
20. Shore, E. (2019, July). The Small+Safe+Well (SSWell) Study: Improving TWH Culture in Small Businesses. 2019 Wyoming Workforce Services and Safety Summit.
21. Tenney L, Shore E, Scott J, Rivera K, Schwatka NV, Dally M, Brown C, Newman L. (2018, September). Health Links: Partnering with small business to improve worker health, safety and well-being. Oral Presentation. Rocky Mountain Safety Conference. Colorado Springs, CO.
22. Tenney, L, Newman, L, Schwatka, NV, Scott, J. (2018, November). Total Worker Health: An approach to promoting worker health, safety, and well-being. Poster presentation at the Collegium Ramazzini's Annual Ramazzini Days, Carpi, Italy.
23. Tenney, (November 2019) "A NIOSH Center of Excellence for Total Worker Health®: Advancing Health, Safety and Well-being of Workers through Research, Education and Practice" Poster presentation. Work, Stress & Health, Philadelphia, PA
24. Tenney, (November 2019) "Assessment of Total Worker Health® Strategies as Indicators of Organizational Behavior in Small Business" Oral presentation. Work, Stress & Health, Philadelphia, PA
25. Tenney, (November 2019) "Total Worker Health® (TWH) Professionals Collaborative Meeting" Work, Stress & Health, Philadelphia, PA
26. Thompson, J, Schwatka, NV, Tenney, L, Scott, J, Newman, LS. (2018, May). Total Worker Health Leadership: A small business leader perspective. Oral presentation at the 2nd International Symposium to Advance Total Worker Health. Bethesda, MD.

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27. Amidon, T.R., & Lipsey, T. (2018, March) Firefighter Physiological Monitoring Summit. Summit organized by National Fallen Firefighters Foundation and the SMARTER firefighter safety initiative. [Workshop participant]. Washington, DC.
28. Amidon, T.R., & Lipsey, T. (2018). Blue-collars/tough designs: UX within fire service occupational safety and health programs. In Design, User Experience, and Usability: Design Thinking and Methods - 7th International Conference, DUXU 2018 Held as Part ofHCI International 2018, Proceedings. (Vol. [Forthcoming], pp. [xx-xx 16 pages]. (Lecture Notes in Computer Science (including subseries Lecture Notes in Artificial Intelligence and Lecture Notes in Bioinformatics); Vol. 9746).
29. Crain, T. L, & Setters, C. (2018, September). Fighting fatigue. Presentation for the Association of General Contractors, Denver, CO.
30. Daigle, K., & Fisher, G. G. (2017, October) Parental Leave: Implications and Concerns in Small Enterprises. Oral presentation at the Understanding Small Enterprises (USE) Conference, Denver, CO.
31. Daigle, K. L. & Fisher, G. G. (2019, February). Planning for Parental Leave: Leveraging Total Worker Health to Support Pregnant Working Women. Presentation at Department of Psychology, Colorado State University.

32. Daigle, K. L. & Fisher, G. G. (2019, April). Planning for Parental Leave: A Qualitative Analysis Exploring Planning Decisions During Pre-Leave. Presentation at the MAP ERC Annual Research Day.
33. Farewell, C. (2019, April). Safety and Health Innovation in Preschools (SHIP): Cultivating the Well-being of the Early Childcare Workforce. Poster presentation at the Presentation at the MAP ERC Annual Research Day.
34. Fisher, G. G. (2018, April) Improving Employee Health-Related Decisions: Addressing the Barriers and Facilitators. In A. Jackson & J. Mazzola (C-Chairs), panel presentation and discussion at the Annual Conference of the Society for Industrial/Organizational Psychology, Chicago, IL.
35. Rynders, C. A., Morton, S., Broussard, J. L. (June, 2021). Impact of time-restricted feeding on metabolic homeostasis in healthy adults. Presented as a poster at the Cold Spring Harbor Conference on Biological Timing.
36. Shore, E. & Dally, M. (2019, April). The Functional Movement Screen (FMS) as a predictor of occupational injuries among Denver firefighters. Presentation at the MAP ERC Annual Research Day.
37. Tran M. (April, 2018). Contingent Work and the Gig Economy. American Occupational Health Conference. New Orleans, LA.
38. Tran M, Crain T, Bihl J.A (May 2018). Qualitative Study of the Occupational Health and Safety of On-Demand Drivers. Total Worker Health. 2nd International Symposium to Advance Total Worker Health. Bethesda, MD.
39. Shore, E. & Dally, M. (2019, June). The Functional Movement Screen (FMS) as a predictor of occupational injuries among Denver firefighters. Presentation submitted to the Society of Epidemiologic Research Annual Conference.

C.2. Website(s) or other Internet site(s) – include URL(s)

- Center for Health, Work & Environment website with content about programs, research, training, and a newsroom featuring stories: http://chwe.ucdenver.edu
- Pilot Projects Program: https://coloradosph.cuanschutz.edu/research-and-practice/centers-programs/chwe/research/pilot-projects
- Health Links™ website featuring a user platform for organizations to select plans, complete an online Healthy Workplace Assessment, access a dashboard with results and modules, and schedule advising: https://www.healthlinkscertified.org/
- Family-Friendly Workplace Toolkit: https://www.earlymattersgreateraustin.org/toolkit
- Get Outdoors Employers Toolkit: https://choosecolorado.com/programs-initiatives/get-outdoors-employer-toolkit/
- Health Risk Cost Calculator: http://www.ucdenver.edu/academics/colleges/PublicHealth/research/centers/CHWE/projects/Pages/Health-Risk-Calculator.aspx
- SSWell study page on our website that describes the study results: https://coloradosph.cuanschutz.edu/research-and-practice/centers-programs/chwe/research/sswell
- Total Worker Health® Leadership Training Program webpage: http://www.ucdenver.edu/academics/colleges/PublicHealth/research/centers/CHWE/Research/Pages/Total-Worker-Health-Leadership-Program.aspx
- LinkedIn: https://www.linkedin.com/company/chwe/
- Facebook: https://www.facebook.com/CHWENews/ and https://www.facebook.com/HealthLinksCertified/
- Twitter: twitter.com/chwenews and twitter.com/healthlinksnews

C.3. Technologies or techniques

n/a

C.4. Inventions, patent applications, and/or licenses

n/a

C.5. Other products and resource sharing

n/a

D. PARTICIPANTS

D.1. What individuals have worked on the project? Please include calendar, academic, and summer months.

Commons ID	S/K	Name	Degrees(s)	Role	Cal	Aca	Sum	Foreign	Country	SS

This information is reported separately in each component report.

D.2 Personnel updates

a. Level of Effort: n/a

b. New Senior/Key Personnel: n/a

c. Changes in Other Support: n/a

d. New Other Significant Contributors: n/a

E. IMPACT

E.1 - What is the impact on the development of human resources, if applicable?

n/a

E.2 - What is the impact the Public Health Relevance and Impact? The investigator should address how the findings of the project relate beyond the immediate study to improved practices, prevention or intervention techniques, legislation, policy, or use of technology in public health.

The Center for Health, Work & Environment had high public health impact by meeting Region 8 and national needs for healthy and safe worksites and workers through its program of research, r2p, education/training, partnerships and other dissemination activities. It advanced scientific knowledge by establishing new, innovative worksite programs to benefit both workers and employers, test relevant theoretical models, and emphasize helping those working in small enterprises and in other high-risk industries.

F. CHANGES

F.1 – Changes in approach and reasons for change, including changes that have a significant impact on expenditures

n/a

F.2 - Actual or anticipated challenges or delays and actions or plans to resolve them

Due to the COVID-19 pandemic, there were some challenges that we faced, as described in the component reports. In the P&E Core, we had to change in-person meetings of both the ISC and EAC to a virtual format, which proved to be successful. The Research Core faced challenges when in-person data collection could not continue. Due to the inability to hold in-person events, we had to cancel the remaining SSWell TWH leadership trainings that served as part of that intervention study. We were also able to pivot and collect new data related to the employee experience related to their organization and COVID-19. We published two studies related to this data. Some pilot projects were delayed in collecting data, but are all in position to complete their projects with slight extensions to timelines. Finally, in the Outreach Core, we pivoted to learning more about what organizations needed and developed a COVID-19 Townhall series and conducted a significant amount of outreach and technical assistance to organizations large and small.

F.3 - Significant changes to human subjects, vertebrate animals, biohazards, and/or select agents

n/a

G. Special Reporting Requirements

G.1 Special Notice of Award Terms and Funding Opportunities Announcement Reporting Requirements

n/a

G.2 Responsible Conduct of Research
n/a

G.3 Mentor's Research Report or Sponsor Comments
n/a

G.4 Human Subjects
G.4.a Does the project involve human subjects? yes
G.4.b Inclusion Enrollment Data reported in SSWell Study component
G.4.c ClinicalTrials.gov reported in SSWell Study component
Does this project include one or more applicable clinical trials that must be registered in ClinicalTrials.gov under FDAAA? reported in SSWell Study component

G.5 Human Subject Education Requirement
Are there personnel on this project who are newly involved in the design or conduct of human subject's research? no

G.6 Human Embryonic Stem Cells (HESCS)
Does this project involve human embryonic stem cells (only hESC lines listed as approved in the NIH Registry may be used in NIH funded research)? no

G.7 Vertebrate Animals
Does this project involve vertebrate animals? no

G.8 Project/Performance Sites
University of Colorado Denver
DUNS: 041096314-0000
Congressional District: CO-006
Address: Mail Stop F428 Anschutz Medical Campus Fitzsimons Building
13001 E. 17th Place, Room 1124
Aurora, CO 80045-2571
United States

G.9 Foreign Component
n/a

G.10 Estimated Unobligated Balance
G.10.a Is it anticipated that an estimated unobligated balance (including prior year carryover) will be greater than 25% of the current year's total approved budget? no

G.11 Program Income
Is program income anticipated during the next budget period? no

G.12 F&A Costs
Is there a change in performance sites that will affect F&A costs? no

I. OUTCOMES

I. Provide a concise summary of the outcomes or findings of the award, written for the general public in clear and comprehensible language, without including any proprietary, confidential information or trade secrets

Note: project outcome information will be made public in NIH RePORTER

The Center for Health, Work & Environment had high public health impact by meeting Region 8 and national needs for healthy and safe worksites and workers through its program of research, r2p, education/training, partnerships and other dissemination activities. It advanced scientific knowledge by establishing new, innovative worksite programs to benefit both workers and employers, test relevant theoretical models, and emphasize helping those working in small enterprises and in other high-risk industries. Specific outcomes from the five-year grant period include:

- Hosted meetings of the Internal Steering Committee, External Advisory Committee, NIOSH externally funded centers to advance TWH through sharing of knowledge and expansion of collaborations
- Coordinated the workgroup that established TWH core competencies

- Over 100 small businesses participated in our study and 60 of their leaders engaged in our TWH leadership development program. Small business leaders who engaged in the TWH leadership development program improved their leadership practices by 10%, on average, but they found it challenging to transfer what they learned in the program to their job sites.
- We found that employee perceptions of safety and health climates were significantly related to their self-reported well-being during the first wave of COVID-19, even when there were changes to childcare, the ability to work, and limited social contacts. Perceptions of health and safety climates remained stable across all timepoints. However, employee well-being scores declined between the pre-pandemic period and subsequent COVID-19 timepoints.
- Funded 11 pilot projects ranging up to $25,000 for one year of support for a total of $222,050 over the five-year period. The projects ranged in scope from cross-sectional surveys to pilot intervention studies. The pilot projects program helped to build TWH workforce capacity by advancing the careers of research investigators who are new to TWH and by funding graduate students and other junior investigators who gained valuable experience by working on these projects.
- Over 1 million unique visits to our websites.
- 743 organizations participated in Health Links, with 987 advising sessions conducted.
- 3,244 people attended the Health Links COVID-19 Townhall series.
- 32 people enrolled in the *Total Worker Health* Certificate Program, with 16 graduates.

A. COVER PAGE

Project Title: Center for Health, Work & Environment – Planning and Evaluation Core	
Grant Number: U19OH0111227	**Project/Grant Period**: 09/01/2016-08/31/2021
Reporting Period: 09/01/2016-08/31/2021	**Date Submitted**: 03/15/2022
Program Director/ Principal Investigator Lee S. Newman	**Administrative Official Information**
Change of Contact PD/PI: no	
Human Subjects: no	**Vertebrate Animals:** n/a
hESC: n/a	**Inventions/Patents:** n/a

B. ACCOMPLISHMENTS

B.1. What are the major goals of the project?

The goals of the Planning and Evaluation (P&E) Core were to:
1) Create and maintain an environment for supporting core research and outreach activities that integrate protection from work-related safety and health hazards with promotion of injury and illness prevention efforts to advance worker well-being. (Center Coordination and Management);
2) Foster essential interactions internally between Center projects and personnel and externally with advisors and partners. (Advisory Committees);
3) Improve program effectiveness through the utilization of a strategic center-wide and project-specific evaluation program. (Evaluation Program)

These goals remained unchanged through the 2016-2021 funding period.

B.2. What did you accomplish under these goals?

Successful Launch of a New Center of Excellence: Execution of CHWE's First Strategic Plan

In September 2016, we became the sixth and newest *Total Worker Health*® Center of Excellence, working with an CDC/NIOSH award that was approximately 80% of the allowable, requested funding level. The P&E Core immediately engaged in a process to stand up all Center processes and programs. We convened the Internal Steering Committee (ISC), established the ISC's operating principles, schedule, and agenda. We organized our first retreat in August 2016, where we reviewed our mission, vision, and values, and approved a set of goals and logic models, revised budgets, executed subcontracts, and restructured our center administration team to accommodate the funding level. We established all operations including our processes for collecting data on metrics for the evaluation program, established and convened the first meeting of the External Advisory Committee (EAC) in November 2016, facilitated on-time launch of the Research Core's principal research study (SSWell), the Research Pilot Projects Program, and all components of the Outreach Core. In less than three months, the Center was fully operational. In the subsequent years, we provided the necessary infrastructure for all funded activities of the center. Even in the face of the COVID-19 pandemic, the P&E Core met its goals, resulting in the successful completion of the Center's major longitudinal intervention research study, five cycles of Pilot Project applications and reviews resulting in funding of 10 projects, and infrastructure support for the Outreach Core to enable it to be on target to exceed its goals.

In 2018, CHWE underwent a goal setting process across all of the components of the Center, including the Outreach Core and Health Links, the SSWell Research Project, and Overall Center goal setting. Finally, in October 2019, we held our second CHWE retreat which focused on the changing nature of work, evaluating burden, need, and impact of our current and future work. Other topics included brainstorming future directions, including the partners and resources we need to be successful.

Response to COVID-19

In March 2020, three and a half years into the grant period, the ColoradoSPH closed its buildings due to COVID-19 and all faculty and staff of CHWE were instructed to work-from home indefinitely. The P&E Core responded immediately, leading a process to accomplish two major objectives: 1) To continue to provide the structure and services needed to accomplish all specific aims and goals of the U19 and 2) To lead an agile, iterative process for the Research and Outreach Cores to respond to the needs of employers and employees affected by COVID-19.

To convert to fully remote operations and support the goals of the Center, we instructed faculty and staff on how to set up home offices, including not only logistics of using university systems remotely, but also including home office ergonomics, information on mental health and infection prevention services. We established procedures for activities to that were conducted on and off campus, established communication channels including Zoom and Slack, among others. We established weekly managers' meetings to discuss leadership challenges, messaging, and solutions to problems that arose. We also reorganized teams to increase effectiveness, increased check-ins on goals, increased connectedness in the new remote environment. In June 2020, we converted our typical in-person EAC meeting to a virtual meeting that was quite successful. We continued to host the EAC virtually in 2021.

Additionally, the P&E Core helped lead a process to help the Research and Outreach Cores establish community needs, conduct COVID-relevant research, and add important services identified by community

stakeholders, such as small business advising, informational webinars, and a resource page on the CHWE website. Specifically, we hosted 12 COVID-specific webinars as part of our Townhall Series that ran from March to June 2020. These webinars addressed topics such as promoting mental health and resilience, risk reduction and PPE, and reopening your organization. The webinars had an average attendance of 270 people, with close to 3,000 views on YouTube. We also partnered with the Center for Humanities and Bioethics at the CU Anschutz Medical Campus to host a webinar series with experts discussing topics ranging from *Vulnerable Workers in the Time of COVID*, *What's Next for Worker Health and Safety*, and *Should Employers Require the COVID Vaccine?.* Finally, the P&E Core was able to provide administrative support for coordinating important services identified as community needs, including consulting to community and industry groups, such as meatpacking, grocery store chains, healthcare organizations, and manufacturing.

Response to Structural and Systemic Racism

The events of 2020, including the societal awareness of race- and ethnicity-based workplace health disparities, raised by the Black Lives Matter movement and highlighted by COVID-19 laid bare the tragic, disproportionate impact of working conditions and social determinants of health on Black, Latinx, and Native American workers. In response, the P&E Core led an assessment of our existing research, educational programs, and partnerships. This was followed by a series of race and ethnicity-focused online Townhalls and Webinars, as well as a change in priority topics for Outreach Core's communications strategy. It influenced the decision making and focus of the Center, in recognition of the high proportion of at-risk Latinx and other minority workers in Region 8 and who stand to most benefit from *Total Worker Health* (TWH) solutions.

Center Administration

The assembled team for the Center has leadership experience in all areas of center coordination and management, including administration, finance, recordkeeping, partnerships, evaluation, communications, and outreach support. This team was highly successful in prioritizing and executing new, unanticipated TWH initiatives in response to emerging issues. Our processes for recordkeeping, included the recording and maintenance of Center meeting minutes, evaluation results, and pilot project tracking and follow-up. There was also close and ongoing coordination with the Mountain and Plains Education and Research Center (MAP ERC) to eliminate redundancies and make more effective use of resources.

Our Center has strength in coordination and integration with other centers, universities, government agencies and community partners in establishing common ground and creating opportunities for the improvement of worker safety, health, and well-being. Over the five years of the cooperative agreement, CHWE has collaborated closely with the NIOSH Western States Division (WSD); the MAP ERC; the High Plains Intermountain Center for Agricultural Health and Safety (HICAHS); the NIOSH Center for Workers' Compensation Studies (CWCS); and the NIOSH Small Business Assistance and Outreach Program (SBAO), among others. Examples of those interactions include:

- We successfully incorporated TWH curriculum in the MAP ERC training for trainees in Occupational Medicine, Occupational Health Psychology, Industrial Hygiene, Health Physics, and Occupational Ergonomics and Safety. The MAP ERC now funds tuition support for TWH certificate students.
- In 2017, we hosted a meeting of the leadership of all currently funded TWH Centers of Excellence, ERCs, and Agricultural Research Centers here in Denver, and prepared the summary report for NIOSH on that meeting's findings and recommendations.
- In partnership with the NIOSH SBAO, we co-hosted the Understanding Small Enterprises International Conference in 2017. This conference brought together researchers and practitioners interested in OSH in smaller organizations. We developed a track specific to TWH and small enterprises. A NIOSH Conference Proceedings and a special issue of the journal Annals of Work Exposures and Health guest edited by CHWE and NIOSH were products of this conference.
- In partnership with the NIOSH WSD, we convened the second workshop focused on the well-being of American Indian and Alaska Native (AI/AN) workers. The output of this workshop was the development of an AI/AN worker safety and health strategic plan.
- Delivered invited lectures at multiple TWH Program-sponsored conferences, webinars, and events including current TWH Centers of Excellence and Affiliates.

- Forged additional state and regional partnerships, including with chambers of commerce, insurers, community groups, local public health agencies, economic development groups, and state agencies.
- Coordinated with the MAP ERC, which led the development of an all-ERC continuing education needs assessment. We were able to include items to measure TWH continuing education needs and partner with the other Centers of Excellence to distribute the needs assessment through Center distribution channels. A peer-reviewed publication provided details from this needs assessment.
- The P&E Core, through the ISC, was instrumental in identifying needs and proposing activities for the additional funds received in Year 5 through a supplemental award. We identified the following priorities:
    - We identified a need to increase our reach to Latinx businesses and workers. We've partnered with the CU Latino Policy and Research Center to conduct outreach and develop resources that are relevant to Latinx businesses.
    - We've also translated the NIOSH Worker Well-Being Questionnaire (WellBQ) into Spanish and blind back-translated it into English. We reconciled identified differences and completed a series of cognitive interviews during Spring 2021.
    - We devoted funds to support the development of the Society for Total Worker Health, including outreach to professional associations, website development and marketing. We've formed a steering committee, headed by Dr. Robert McLellan from Dartmouth Hancock.
    - Funds were also allocated to support the further development of an employer toolkit focused on mental health and suicide prevention in the workplace. This initiative also included support for a subject matter expert to assist in the development of a training. This toolkit launched in May 2021.

Advisory Committees

We effectively relied upon both the ISC and EAC to guide programmatic decision making over the past five years. The ISC met on a monthly basis with a set agenda that included round robin updates and focused discussion on identified topics to allow the Cores and projects to share relevant information. Examples include: 1) Discussing NIOSH strategic plan, research agenda, and initiatives that impact the Center, such as the recently developed WellBQ and the common outreach logic model developed by the NIOSH Centers of Excellence and how that impacts our evaluation activities; 2) Having the Research Pilot Projects Director present recommendations for funding each year; and 3) The Evaluation Director presenting results from data analyses, such as the continuing education needs assessment where we included TWH-relevant items.

The EAC met nine times between September 2016 and August 2021. This included three in-person meetings and two virtual meetings. Additionally, we hosted four briefer conference calls. The agendas for these meetings were structured based on the needs of the Cores and projects. Specific topics of EAC meetings included input on recruitment for the SSWell research project, advice and considerations for the formation of the Society for TWH, suggestions to pilot project recipients on next steps of their research and other funding opportunities. In addition, members of the EAC worked directly with personnel on Cores and projects in more directed ways on an ad hoc basis. Examples include participation on the pilot project review committee and working with the SSWell research team on the development of leadership training and on data analysis projects. Administrative support from CHWE allowed for the coordination of travel, communication with the EAC, and recording of minutes. Prior to each meeting, the EAC was sent materials to review to focus discussions on relevant questions. Those materials included annotated versions of the minutes from the previous meetings to let the EAC know how we specifically addressed their recommendations.

Evaluation Program

The Center Director has shown a commitment to and prioritization of program evaluation. Prior to the creation of the TWH Center of Excellence, Dr. Newman recruited Carol Brown, PhD, to become the Associate Director for Research for CHWE. Prior to that, she had worked part-time with the MAP ERC since 2009, leading the evaluation activities. In her role, Dr. Brown has been able to incorporate more rigorous evaluation into many of the research, practice and outreach activities in CHWE, including Health Links, the SSWell research project, and other TWH Center initiatives. Specific examples include:

Health Links Health Links is a TWH program aimed at assessing, certifying, and advising organizations using a TWH approach at the organizational level. As part of the Outreach Core, the Health Links program had a rigorous evaluation plan in place. Through the process of advising and certifying businesses, the Health Links program collected baseline, mid-point, and follow-up data related to what business are doing and how they are doing it. These data were then examined across businesses, industries, and geographic areas to determine how the program is implemented and what programmatic improvements can be made. This feedback has helped the Health Links program identify and address barriers to implementation that can be addressed through advising and the provision of evidence-based resources. Evaluation processes also led to critical programmatic changes that has led to program expansion nationally and a model that has founded the success of TWH research projects including SSWell. Additionally, after the organizational contact completes an advising session, they are asked to provide feedback about the usefulness of the advising process. The Evaluation Director meets quarterly with the Health Links program manager to discuss evaluation results and suggested actions, based on results from these surveys. Manuscripts based on the Health Links program were published in 2021 and 2022.

In addition, all events and trainings that occur through Health Links have an evaluation associated with them. In 2020 alone, Health Links held eight education webinars (in addition to the 12 COVID-specific webinars) with 4,098 total participants. The highest attended webinar was *Racism in the Workplace*, with over 1,000 attendees and an additional 1,000 views on YouTube. Nearly 80% of attendees of this webinar indicated that they intended to make changes at their workplace based on what they learned. For all 2020 webinars, mean satisfaction scores for both content and speakers was 4.7/5.0. These evaluations also included a question asking about additional training needs, which was used to help inform new programming. For example, during COVID-19, Health Links hosted a townhall webinar series attended by 3,244 people, averaging 270 attendees per webinar. Feedback provided by participants identified new topics such as safely reopening a business and mental health needs of employees.

Small + Safe + Well Research Project From the very beginning, we built evaluation into the SSWell research project. We used the RE-AIM framework to evaluate reach, effectiveness, adoption, implementation, and maintenance of the intervention. In brief, we found that organizations that participated in the TWH Leadership Training improved, as compared to those organizations who participated in Health Links only. Further, we had measures of adoption and implementation. The intervention was well implemented. Of those who participated, 92% set goals during the training and 79% logged into the online goal tracking platform after the course. In the future, we will rethink how post-training engagement occurs, substituting the goal tracking platform and encouraging coaching.

In a program evaluation study of our TWH Leadership Program for small business leaders, participants reported that the course was of high quality (M= 4.8/5.0, SD = 0.5), was useful (M= 4.6/5.0, SD = 0.5), and that they would apply the knowledge gained in the training to enhance their organization's culture of safety and health (M= 4.7/5.0, SD = 0.5). Further, we learned that the program helped leaders improve their TWH leadership practices. We also learned from our program implementation data that leaders chose goals that were foundational to integrating a TWH approach, specifically employee engagement goals, into their business rather than implementing a specific policy or program. A manuscript describing the TWH Leadership Program was published in Occupational Health Science in 2021.

Finally, as part of the study, the Evaluation Director developed and conducted an exit survey with the main contacts from the organization to further evaluate their experience of participating in the study. Importantly, as a measure of maintenance, 90% of organizations reported that they will continue to enroll in Health Links and 84% outlined specific employee safety and health activities that they were planning for their organizations. This information is valuable and allowed us to learn more about the process of implementing interventions in small enterprises and the information gained is already being used when developing new interventions. A manuscript outlining the RE-AIM analysis is in preparation and another describing the overall analysis of the SSWell project has been accepted. We are finalizing the process for making the dataset available to researchers, upon request.

We integrated the SSWell project through the Outreach and P&E Cores and developed new outreach projects which we've since disseminated, including TWH leadership trainings outside of the study and webinars. The knowledge generated was used to create and deliver TWH leadership trainings in Latin America.

Research Pilot Projects Program (RPPP) The director of the RPPP worked closely with Dr. Brown over the course of the five-year funding period. We tracked outputs and outcomes for the awards process itself, as well as for funded projects. Over five-year period, we funded 11 projects totaling $222,050. Recipients published 10 peer reviewed manuscripts and delivered 14 presentations at international, national, and regional conferences. Some investigators went on to apply for additional grant funding, including the SHIP research project (Farewell), pursued doctoral education (Shore) and obtained new TWH-relevant positions (Crain, Tran).

Total Worker Health Certificate Program We developed and launched the TWH Certificate Program in 2017 and through the P&E Core, we implemented an evaluation program that includes tracking of student success metrics (e.g., recruitment, retention, time to completion), participation in program components such as optional interdisciplinary educational opportunities, exit interviews, alumni surveys, and career follow-up to learn how the certificate graduates are using their knowledge in their varied disciplines. Since students first enrolled in 2017, we have had 16 graduates and currently have 16 enrolled students. Graduates are currently working in occupational medicine, urban planning, architecture, nursing, human resources, occupational ergonomics and safety, among other professions, demonstrating that we have expanded the reach of TWH into both traditional OSH and other professions.

Established TWH Core Competencies Building on efforts that began at the first and second International Total Worker Health (TWH) Symposia and at a November 2017 workshop, we led the coordination of the TWH Education, Training and Capacity Building Workgroup (TeTRAC). TeTRAC is a collaborative composed of representatives from the NIOSH Office for TWH, other Centers of Excellence, TWH affiliates, and academic institutions. Dr. Newman directed the effort to develop and disseminate guidelines that academic institutions can use for defining the core principles, competencies, skills, and knowledge needs of future TWH professionals and practitioners. The workgroup published a manuscript in the Journal of Occupational Environmental Medicine titled, *Education and Training to Build Capacity in Total Worker Health®: Proposed Competencies for an Emerging Field.* The P&E Core facilitated meetings and the manuscript writing process to advance this activity.

TWH Continuing Education Needs Assessment In 2017, in conjunction with the MAP ERC and the other NIOSH-funded ERCs, we incorporated TWH-specific items into the planned OSH continuing education needs assessment. Other TWH Centers were enlisted to help distribute the survey to their networks. We had 2,064 respondents from across the country. For general education in TWH, 45% of respondents indicated interest in basic offerings and 37% indicated interest in advanced offerings. Respondents also showed significant interest in other TWH-related options including health and safety leadership (82%) and health and safety culture (78%). Our center used the results from the needs assessment to develop additional TWH educational offerings. A summary was published in the American Journal of Industrial Medicine.

B.3. Competitive Revisions/Administrative Supplements

n/a

B.4. What opportunities for training and professional development did the project provide?

The other sections of this final RPPR outline training and professional development activities. The P&E Core was not directly responsible for training and professional development.

B.5. How did you disseminate the results to communities of interest?

The P&E Core played a coordinating role in the writing, design, and production of the Center's annual report each year, in close partnership with the Outreach Core. The most report was published online (https://indd.adobe.com/view/860f3ecc-361d-4965-b9aa-20eb0be9a4cf) in February 2022.

Through the P&E Core, we disseminated information about our Center through participation in meetings such as those with NIOSH and other TWH Centers of Excellence, the Healthy Work Design and Well-being NORA Cross Sector, meetings with TWH Affiliates, and with our own EAC. Through the ISC, we facilitated connections between the Outreach Core, including our communications team, the pilot projects program and

the SSWell research project to increase dissemination of research findings. The reports from those components, particularly the Outreach Core, highlight the extent of our dissemination activities.

B.6 - What do you plan to do during the next reporting period to accomplish the goals?

Q1 Sep – Nov

- Host virtual meeting (2 hours) of the EAC to provide updates on all aspects of the center, with specific questions posed to the EAC for their input. Addresses all aims. Measures of effectiveness include EAC attendance, # of issues identified and solutions offered, recommendations and action plans developed.
- Provide logistical support to the 3rd International Symposium to Advance Total Worker Health, to be held in October 2022 in Bethesda, MD. Our Center has taken a lead role in the coordination of the Symposium and will continue to do so through the event, as well as after the event through ongoing collaborations and evaluation activities. Addresses all aims. Measures of effectiveness include # of attendees and sessions, support provided, feedback from the event.
- Item-level validation of the Spanish WellBQ, including a publication. Addresses aim 1. Measures of effectiveness include publishing a final version and making available to other researchers and practitioners.

Q2 Dec – Feb

- The P&E Core will contribute to the development and distribution of the CHWE annual report. Addresses aims 1 and 2. Measures of effectiveness include reach of annual report.

Q3 Mar – May

- In conjunction with the Mountain and Plains ERC, we will coordination participation in the annual Research Day Symposium, to be held each year in April. Addresses aims 1 and 2. Measures of effectiveness include # of TWH topics, # of attendees, reaching new trainees to participate in TWH initiatives.

Q4 Jun – Aug

- Each June, convene the center's EAC for a full day meeting where the EAC will provide feedback and guidance to the center's leadership team in areas related to evaluation and planning, pilot projects, outreach, and research. Addresses all aims. Measures of effectiveness include EAC attendance, # of issues identified and solutions offered, recommendations and action plans developed.

Ongoing, All Quarters

- The P&E Core will hold monthly ISC meetings to ensure that ongoing center coordination across Cores and projects occurs. Addresses all aims. Measure of effectiveness include # of meetings and attendance,
- The P&E Core will continue to coordinate activities of the center around events. We will continue to incorporate TWH into other conferences where possible including our Center's annual Research Day that is held in partnership with the Department of Environmental and Occupational Health at Colorado School of Public Health and the MAP ERC. Planning and Evaluation Core faculty and staff will serve on planning committees for other future conferences.
- Participate in quarterly meetings of the NORA Healthy Work Design and Well-Being Cross Sector. Addresses aims 1 and 2. Measures of effectiveness include # of meetings attended, information shares, partnerships strengthened.

C. PRODUCTS

C.1. Publications, conference papers, and presentations

Book Chapters

1. Schwatka, NS, Tenney L, Newman LS**.** Health Protection and Health Promotion in Small Business. In: Burke R, Richardsen A. (eds.) Increasing occupational health and safety in workplaces: Research and Practice. Edward Elgar Publishing: 2019.
2. Tenney L, Newman LS. Total Worker Health® Approaches in Small to Medium-Sized Enterprises. In: Chosewood C. (ed.) Total Worker Health® American Psychological Association: 2019.

3. Newman, LS, Schwatka, NV. Total Worker Health. In LaDou and Harrison (Eds.), Current Occupational & Environmental Medicine, Sixth Edition, McGraw Hill: 2021.

Evaluation & Education

4. Newman LS, Scott JG, Childress A, Linnan L, Newhall WJ, McLellan DL, Campo S, Freewynn S, Hammer LB, Leff M, Macy G, Maples EH, Rogers B, Rohlman DS, Tenney L, Watkins C. Education and Training to Build Capacity in Total Worker Health®: Proposed Competencies for an Emerging Field. J Occup Environ Med. 2020;62(8):e384-e391. PMCID: PMC7409771
5. Scott JG, Shore E, Brown C, Harris C, Rosen MA. Highlights from occupational safety and health continuing education needs assessment. Am J Ind Med. 2019;62(10):901-907. PMCID: PMC7427339
6. Brown, CE, Cunningham, TR, Newman, LS, Schulte, PA. Understanding Small Enterprises Conference Summary. Ann Work Exp Health. 2018;62(S1):S1-S11. PMCID: PMC6350517
7. NIOSH [2018]. Understanding small enterprises: proceedings from the 2017 conference. Cunningham T, Schulte P, Jacklitsch B, Burnett G, Newman L, Brown C, Haan M, eds. Cincinnati, OH: US Department of Health and Human Services, Centers for Disease Control and Prevention, National Institute for Occupational Safety and Health, DHHS (NIOSH) Publication No. 2019-108, https://doi.org/10.26616/NIOSHPUB2019108external icon

C.2. Website(s) or other Internet site(s) – include URL(s)
Main CHWE website:
https://coloradosph.cuanschutz.edu/research-and-practice/centers-programs/chwe
SSWell Project website:
https://coloradosph.cuanschutz.edu/research-and-practice/centers-programs/chwe/research/sswell
Pilot Projects website (shares site with MAP ERC Pilot Projects)
https://coloradosph.cuanschutz.edu/research-and-practice/centers-programs/chwe/research/pilot-projects

C.3. Technologies or techniques
n/a

C.4. Inventions, patent applications, and/or licenses
n/a

C.5. Other products and resource sharing
n/a

D. PARTICIPANTS

D.1. What individuals have worked on the project? Please include calendar, academic, and summer months.

Commons ID	S/K	Name	Degrees(s)	Role	Cal	Aca	Sum	Foreign	Country	SS
CE.BROWN	Y	Brown, Carol	PhD	Co-I	1.0			N		N
gwenithf	Y	Fisher, Gwenith	PhD	Co-I	1.2			N		N
	N	Foxcroft, Jennifer		Other, administrative	2.4			N		N
	N	Habeych, Giselle		Other, finance	1.5			N		N
	N	Higgins, Sara		Other, finance	3.5			N		N
	N	Johnston, Victoria	BS	Other, finance	1.8			N		N
LEE_NEWMAN	Y	Newman, Lee	MD, MA	PI	1.0			N		N
L.TENNEY	Y	Tenney, Liliana	DrPH	Co-I	0.9			N		N

D.2 Personnel updates
- **a. Level of Effort**: n/a
- **b. New Senior/Key Personnel**: n/a
- **c. Changes in Other Support**: n/a
- **d. New Other Significant Contributors**: n/a

E. IMPACT

E.1 - What is the impact on the development of human resources, if applicable?
n/a

E.2 - What is the impact the Public Health Relevance and Impact? The investigator should address how the findings of the project relate beyond the immediate study to improved practices, prevention or intervention techniques, legislation, policy, or use of technology in public health.

This P&E Core had high public health impact by addressing regional and national needs for healthy and safe worksites and workers. It provided infrastructure and coordination of the Center's program of research, research-to-practice (r2p), outreach, communication, education/training, partnerships, and other dissemination activities. The P&E Core brought together stakeholders from labor, business, government, and academia in our focus on the burden, need, and potential for impact in industries including education, agriculture, and small businesses across all sectors.

F. CHANGES

F.1 – Changes in approach and reasons for change, including changes that have a significant impact on expenditures
n/a

F.2 - Actual or anticipated challenges or delays and actions or plans to resolve them
The P&E Core did not experience any delays. Some challenges arose due to COVID-19 and we had to move some events that were typically in-person to a virtual format. We found these changes to be relatively seamless. For instance, our EAC meeting was held virtually in both 2020 and 2021 and we had high attendance and engagement from EAC members. ISC meetings also moved to a virtual format, which has proved to be successful and we've decided to continue in this format.

F.3 - Significant changes to human subjects, vertebrate animals, biohazards, and/or select agents
n/a

G. Special Reporting Requirements

G.1 Special Notice of Award Terms and Funding Opportunities Announcement Reporting Requirements
n/a

G.2 Responsible Conduct of Research
n/a

G.3 Mentor's Research Report or Sponsor Comments
n/a

G.4 Human Subjects
G.4.a Does the project involve human subjects? no
G.4.b Inclusion Enrollment Data n/a
G.4.c ClinicalTrials.gov n/a
Does this project include one or more applicable clinical trials that must be registered in ClinicalTrials.gov under FDAAA? no

G.5 Human Subject Education Requirement

Are there personnel on this project who are newly involved in the design or conduct of human subject's research? no

G.6 Human Embryonic Stem Cells (HESCS)
Does this project involve human embryonic stem cells (only hESC lines listed as approved in the NIH Registry may be used in NIH funded research)? no

G.7 Vertebrate Animals
Does this project involve vertebrate animals? no

G.8 Project/Performance Sites
University of Colorado Denver
DUNS: 041096314-0000
Congressional District: CO-006
Address: Mail Stop F428 Anschutz Medical Campus Fitzsimons Building
13001 E. 17th Place, Room 1124
Aurora, CO 80045-2571
United States

G.9 Foreign Component
n/a

G.10 Estimated Unobligated Balance
G.10.a Is it anticipated that an estimated unobligated balance (including prior year carryover) will be greater than 25% of the current year's total approved budget? no

G.11 Program Income
Is program income anticipated during the next budget period? no

G.12 F&A Costs
Is there a change in performance sites that will affect F&A costs? no

I. OUTCOMES

I. Provide a concise summary of the outcomes or findings of the award, written for the general public in clear and comprehensible language, without including any proprietary, confidential information or trade secrets

Note: project outcome information will be made public in NIH RePORTER

The P&E Core provide an organizational structure to support our TWH research and outreach activities, helping increase the impact of both. The P&E Core connected internal and external stakeholders in the following ways: 1) hosted a meeting of all NIOSH-funded Agricultural Safety and Health Centers, Education and Research Centers, and Total Worker Health Centers of Excellence; 2) Hosted the Understanding Small Enterprises Conference; 3) Support the development of the Society for Total Worker Health; 4) Hosted nine meetings of the Center's External Advisory Committee; 5) Hosted monthly meetings of the Center's Internal Steering Committee; 6) Coordinated a workgroup to establish TWH core competencies; and 7) Collaborated with partner organizations including other Centers of Excellence for TWH, TWH Affiliates, the NIOSH Western States Division, the Mountain and Plains ERC; the High Plains Intermountain Center for Agricultural Health and Safety (HICAHS); the NIOSH Center for Workers' Compensation Studies (CWCS); and the NIOSH Small Business Assistance and Outreach Program (SBAO), among others.

A. COVER PAGE

Project Title: Center for Health, Work & Environment – Small + Safe + Well (SSWell) Research Project	
Grant Number: U19OH0111227	**Project/Grant Period**: 09/01/2016-08/31/2021
Reporting Period: 09/01/2016-08/31/2021	**Date Submitted**: 03/15/2022
Program Director/ Principal Investigator Lee S. Newman	**Administrative Official Information**
Change of Contact PD/PI: no	
Human Subjects: yes	**Vertebrate Animals:** no
hESC: no	**Inventions/Patents:** no

B. ACCOMPLISHMENTS

B.1. What are the major goals of the project?

Specific Aims. The specific aims of the Small + Safe + Well (SSWell) project did not change since the start of this center's first funding period.

1. **Specific Aim 1**. Determine the association between small business Total Worker Health (TWH) programming elements and organizational climates related to safety, organization of work/benefits, and health, prior to participation in a TWH Intervention.
2. **Specific Aim 2**. Conduct a Switching Replications design study to determine how different doses of established TWH intervention, Health Links™, result in improvement and maintenance of TWH programming and organizational climates for safety and health, in small enterprises, over a 36-month period.
3. **Specific Aim 3**. Assess the effectiveness of organizational change in improving individual workers' safety, health, and well-being in small enterprises, over a 36-month period.

B.2. What did you accomplish under these goals?

Specific Aim 1.

Recruitment activities. We began recruiting for the SSWell study in April 2017 after obtaining IRB approval. We concluded recruitment in September 2019. We successfully recruited 132 small organizations to participate in the SSWell Study. This was approximately 62% of our goal for the study, but our statistician indicated that we had enough power with our sample size to perform our planned analyses. Thirty-eight (29%) of our participating organizations were in a rural area of the state. The mean size of participating businesses was 79 employees and the range is 4 to 430 employees. A variety of industries were represented. The most common industry represented was Health Care and Social Assistance (n=24, 25%), followed by Public Administration (n=11, 11%), Non-Profit (n=8, 8%), Services (n=8, 8%), Manufacturing (n=7, 7%), Educational Services (n=7, 7%), and Construction (n=7, 7%).

Completion of Assessments. Of the organizations that were recruited, 128 organizations representing 13,374 employees completed the Health Links Healthy Workplace Assessment. Of these 128 organizations that completed the Healthy Workplace Assessment, 117 organizations representing 11,070 employees distributed the Employee Health and Safety Culture survey to their employees.

- The Health Links Healthy Workplace Assessment is based on six benchmarks: organizational support, workplace assessments, health programs and policies, safety programs and policies, engagement, and evaluation. In the SSWell study, the Healthy Workplace Assessment is the main measure of TWH programming elements.
- The Employee Health and Safety Culture survey had approximately 100 items and took about 15 to 20 minutes to complete. It asked employees questions regarding leadership commitment to safety and health, employee motivation to participate in TWH programs, employee behaviors toward health and safety, satisfaction and meaning at work and life, and supervisor and coworker supports at work. This survey served as the measure of organizational climates related to safety, organization of work/benefits, and health for the SSWell study.

Analyses and research manuscripts resulting from Specific Aim 1.

Application of Mixed Methods: Qualitative Analysis of TWH Leadership Practices.

Thompson, J, Schwatka, NV, Tenney, L, Newman, L. (2018). Total Worker Health: A small business leader perspective. International Journal of Environmental Research and Public Health. 15(11): 2416.

Given the important relationship between leadership and organizational climate, and the paucity of published studies on TWH leadership practices, we conducted a qualitative study as part of Aim 1 with small business leaders.

- The aim of this sub study was to understand how small business leaders (owners/senior managers) applied TWH leadership skills to facilitate employee health, safety, and well-being.
- We conducted semi-structured interviews with 20 small business leaders from a variety of industries. Each interview lasted approximately 40 minutes.

- We learned that small business leaders understand the importance of leadership, but rarely practice leadership for TWH.

Differences in Health and Safety Leadership and Climates by Size of Business.
Shore E, Schwatka N, Dally M, Brown CE, Tenney L, Newman LS. Small Business Employees' Perceptions of Leadership are Associated with Safety and Health Climates and their Own Behaviors. Journal of Occupational and Environmental Medicine, 62(2): 156-162.
In this paper we examined whether employee perceptions of leadership commitment to safety health were associated with safety and health climates and with employee participatory safety and health behaviors. Further, we sought to determine if these associations differed by size of small business.

- Hypothesis 1: Employees working in small organizations who perceive higher levels of leadership commitment to safety will have higher scores on safety climate and participatory safety behavior.
- Hypothesis 2: Employees working in small organizations who perceive higher levels of leadership commitment to health will have higher scores on health climate and participatory health behavior.
- Hypothesis 3: The associations seen in Hypotheses 1 and 2 will not differ by gradation of organization size

Our analyses supported Hypotheses 1 and 2. Employees who perceived better leadership commitment to safety also reported higher levels of safety climate and were more likely to report participatory safety behaviors. And likewise, employees who perceived better leadership commitment to safety reported higher levels of health climate and were more likely to report participatory health behaviors. There were no differences in these associations across gradations of organization size.

Association between TWH Polices and Climate and Employee Motivations.
Schwatka NV, Sinclair R, Fan W, Dally M, Shore E, Brown CE, Tenney L, Newman LS. How does Organizational Climate Motivate Employee Safe and Healthy Behavior in Small Business? A Self Determination Theory Perspective. Journal of Occupational and Environmental Medicine. In press.

- Hypothesis 1: Employees who report better perceptions of safety climate will report higher levels of external (1a), intrinsic (1b), and identified (1c) safety motivation.
- Hypothesis 2: Employees who report better perceptions of health climate will report higher levels of external (2a), intrinsic (2b), and identified (2c) health motivation.
- Hypothesis 3: Employees who report higher levels of external (3a), intrinsic (3b), and identified (3c) safety motivation will report better safety participation.
- Hypothesis 4: Employees who report higher levels of external (4a), intrinsic (4b), and identified (4c) health motivation will engage in more health participation.
- Hypothesis 5: The relationship between safety climate and safety participation will be mediated by external (5a), intrinsic (5b), and identified (5c) safety motivation.
- Hypothesis 6: The relationship between health climate and health participation will be mediated by external (6a), intrinsic (6b), and identified (6c) health motivation.

We found that safety climate was associated with all three types of safety motivation and that all types of safety motivation were associated with safety participation behaviors. All types of safety motivation mediated the association between safety climate and safety participation behaviors. We also found that health climate was associated with all types of health motivation and that each type of health motivation was associated with health participation behaviors. All types of health motivation mediated the association between health climate and health participation behaviors.

Determination of the Association between TWH Policies and Programs and Health and Safety Climates.
Schwatka NV, Dally M, Tenney L, Shore E, Brown CE, Newman LS. Total Worker Health Leadership and Business Strategies Are Related to Safety and Health Climates in Small Business. **Int. J. Environ. Res. Public Health *2020 Mar* 17(6): *2142.***

- Hypothesis 1: Small businesses that have business strategies for health and safety have better safety climate and health climate than do small businesses that have fewer strategies for health and safety

- Hypothesis 2: The relationship between business health and safety strategies and safety and health climate is moderated by leadership commitment to safety and leadership commitment to health

We found that small business leadership commitment to safety was related to safety climate, but that leadership commitment to safety did not moderate the relationship between TWH strategies and safety climate. However, leadership commitment to health moderates the relationship between TWH strategy and health climate. Leadership commitment is a common antecedent to safety climate and health climate.

Profiling small business TWH approaches.
Schwatka, NV, Dally, M, Shore, E, Dexter, L, Tenney, L, Brown, CE, Newman, LS. (2021). Profiles of Total Worker Health in United States small business. BMC Public Health. 21(1010).

- Hypothesis 1: There would be four profiles: 1) A beginner profile with the lowest indicator scores, 2) A business strategy-focused profile where scores on the TWH business strategy indicators were high but scores on climate and leadership indicators were low, 3) A culture-focused profile where scores on climate and leadership indicators were high but scores on TWH business strategy indicators were low, and 4) An advanced profile where scores on all indicators were high.
- Hypothesis 2: Employees who worked for businesses with higher TWH business profile scores would report better safety and health behaviors than employees who worked for businesses with lower TWH business profiles scores.

We found that there were two profiles characterized by the lowest (33% of all businesses) and highest (9%) levels of the indicators. There were also two profiles with higher scores on two of the different foci on either TWH business strategies (27%) or leadership and climate (31%). Employees working for a business with a profile that focused on leadership and climate, in addition to having a business strategy, reported the best safety and health behaviors.

COVID-19 and small business.
Brown, C, Schwatka, NV, Dexter, L, Dally, M, Shore, E, Tenney, Liliana, Newman, LS (2021). The Importance of Small Business Safety and Health Climates during COVID-19. Journal of Environmental and Occupational Medicine. 63(2): 81-88.

Brown, C, Dexter, L, Schwatka, NV, Dally, M, Tenney, L, Shore, E, Newman, LS (2021). Total Worker Health® and Small Business Employee Perceptions of Health Climate, Safety Climate, and Well-Being during COVID-19. International Journal of Environmental Research and Public Health. 18: 9702.

In two separate studies, we described small business safety and health climates during the start of the COVID-19 pandemic, in May and September 2020. We found that employee perceptions of safety and health climates were significantly related to their self-reported well-being during the first wave of COVID-19, even when there were changes to childcare, the ability to work, and limited social contacts. Perceptions of health and safety climates remained stable across all timepoints. However, employee well-being scores declined between the pre-pandemic period and subsequent COVID-19 timepoints.

Specific Aim 2 and Specific Aim 3.
TWH Leadership Program. The TWH leadership training program was the cornerstone of aims 2 and 3. The program included in-person and virtual components, and was based on validated leadership theories and best practices. Small business owners/senior leaders spent a total of 10 hours in the TWH leadership training over the course of four months. To facilitate attendance at the in-person training, we offered small group trainings at least four times per year. The class size was limited to attendees (up to two people) from 15 businesses. The goal of the training was to promote transformational behavioral change around workplace health, safety, and well-being.

We followed our original schema for randomizing participating organizations to either an early or lagged condition for receiving the TWH leadership program. Ultimately, 60 individuals from 39 organizations participated in the program. In a post-training evaluation, participants rated the course as high quality (4.7/5),

indicated they increased their awareness (4.8/5) and knowledge (4.3/5) about TWH leadership, and that the course provided useful information (4.6/5). The overall rating for this course by participants was 4.4 out of 5.

We had three trainings scheduled in the Spring of 2020. We were expecting 18 individuals from 15 organizations at these trainings. Due to the COVID-19 outbreak and the social distancing orders in the state of Colorado, we were forced to cancel all trainings. This impacted the sample size of our study and power to test Aims 2 and 3 hypotheses. However, we still published one study highlighting a program evaluation of the leadership program and two studies using two years of data collected as part of these aims to address important organizational change questions.

Analyses and research manuscripts resulting from Specific Aim 2 & 3.

Program evaluation of our TWH Leadership Program.
Schwatka, NV, Brown, C, Tenney, L, Scott, JG, Shore, E, Dally, M, Newman, LS. (2021). Evaluation of a Total Worker Health Leadership Development Program for Small Business. Occupational Health Science. 5: 163-188.

- Hypothesis 1: From one month before to three months after the TWH leadership development program, leaders would improve their TWH leadership practices and modifiable health risk factors.
- Research question 1: Do leaders would report changes to their intentions to transfer the training to the job from immediately after to three months after the program?
- Research question 2: Did leaders have favorable reactions to the TWH leadership development program, including what do leaders identify as barriers and facilitators to their behavior change?
- Research question 3: What goals did leaders set for themselves during the program and did they meet their goals (as a means of both understanding what leaders were focused on working on as a result of our training and as a means of tracking transfer of training)?
- Research question 4: Were each of the components of the program were implemented as planned?

Our results suggest that the TWH leadership development program is effective at improving leaders' self-reported TWH leadership practices and that the in-person training was implemented successfully. However, leaders did not report improvements in their personal health and in fact reported increased levels of work-related stress after the program. We also observed some challenges when implementing our training transfer strategies. Our study suggests that leaders may benefit from attending TWH leadership trainings alongside other colleagues in their organization to facilitate a shared vision and goals for TWH in their organization.

Longitudinal changes in TWH policies and programs and associated changes to safety and health climates.
Shore, E, Tenney, L, Schwatka, NV, Dally, M, Dexter, L, Brown, CE, Newman, LS. (2021). A pilot study of changes in Total Worker Health® policies and programs and associated changes in safety and health climates in small business. American Journal of Industrial Medicine. 64(12): 1045-1052.

- We hypothesized that when businesses make positive changes to their TWH policies and programs, their employees will report improved safety climate and health climate perceptions from baseline to one year later.

The mean Healthy Workplace Assessment overall score changed by 11.3 points (SD = 11.8) from baseline to Year 1. From baseline to Year 1, the mean scores of each benchmark changed in a positive direction within this sample. The mean safety climate score and health climate score changed by +0.1 points (SD = 0.2) and +0.1 points (SD = 6.4) from baseline to Year 1, respectively. The associations between changes in the overall Healthy Workplace Assessment score and health climate and safety climate scores were negligible [$\beta = 0.01$ (95% confidence interval [CI]: 0.002, 0.02), and $\beta = 0.01$ (95% CI: 0.002, 0.02), respectively]. Our study suggests that when small businesses improve upon their TWH policies and programs they experience marginal measurable improvements in employee perceptions of their workplace safety climate and health climate.

Randomized waitlisted control comparison design (RCT) to evaluate the added benefit of a TWH leadership development program.
Schwatka, NV, Dally, M, Shore, E, Tenney, L, Brown, CE, Scott, JG, Dexter, L, Newman, LS. Small+Safe+Well: Lessons learned from a Total Worker Health® randomized intervention to promote organizational change in small business. BMC Public Health. In Press.

- Our hypotheses were that small businesses that participate in a TWH leadership development intervention for owners and other senior-level leadership positions will demonstrate more positive change in their (H1) business TWH policies and programs and (H2) employee reported safety leadership and health leadership practices, and that their workers will report better (H3) safety climate and health climate perceptions, (H4) safety and health behaviors and (H5) self-reported well-being from baseline to one-year later, compared to businesses whose leaders did not participate in a TWH leadership development program.

Ultimately, 36 businesses (37% retention) and 250 employees (9% retention) met the RCT study inclusion criteria and were included in the analysis. Businesses improved their TWH policies and programs score from baseline to one-year later, regardless of leadership intervention group assignment. Neither intervention group demonstrated improvements in employee-reported outcomes. This study sought to address a gap in the literature regarding small business senior leadership development for TWH. Our study demonstrates many of the challenges of conducting studies focused on organizational change in workplaces, specifically in small businesses. When designing TWH intervention studies, researchers should consider how to best engage small business leaders in interventions and implementations early on, as well as methods that are well matched to measuring primary and secondary outcomes longitudinally. Future research is needed to test the feasibility and sustainability of TWH interventions in small business.

B.3. Competitive Revisions/Administrative Supplements
n/a

B.4. What opportunities for training and professional development did the project provide?
We successfully trained 60 individuals through the TWH Leadership Training Program. Dr. Natalie Schwatka (Co-I) received a NIOSH K01 award during this project period that leveraged data collected as part of the SSWell study. A graduate student at Colorado State University used a subset of SSWell data to analyze as part of his master's thesis.

B.5. How did you disseminate the results to communities of interest?
All organizations that participated in the study were given customized reports of their assessment results. This includes their Healthy Workplace Report Card, which contains their TWH programming elements score. It also includes an aggregated employee health and safety culture report. At the TWH Leadership training, we provide a booklet with the Healthy Workplace Report Card, employee health and safety culture report, and a TWH leadership self-assessment report.

The study resulted in 10 peer-reviewed publications, two book chapters, 22 oral/poster presentations at regional, national, and international scientific and industry conferences, and one NISOH Science Blog post. The NIOSH Science Blog post described lessons learned: https://blogs.cdc.gov/niosh-science-blog/2022/02/18/small-biz-twh/

The study also resulted in the Center's TWH Leadership Development Programs. The leadership program tested in the study is now offered as an executive style program. We also translated the program into two other formats to meet stakeholder needs for shorter trainings, including online and hybrid trainings. In addition to using this leadership program with SSWell participants, we have also used our new programs with federal agencies, an international agrobusiness, the legal community, among others.

B.6 - What do you plan to do during the next reporting period to accomplish the goals?
The SSWell study concluded at the end of the five-year funding period. The only ongoing activities are preparation and submission of manuscripts, and finalizing the dataset and processes to make that available to researchers upon request.

C. PRODUCTS

C.1. Publications, conference papers, and presentations

Publications

1. Schwatka, NV, Tenney, L, Dally, M, Scott, J, Brown, C, Weitzenkamp, D, Shore, E, Newman, L. (2018). Small business Total Worker Health: A conceptual and methodological approach to facilitating organizational change. Occupational Health Sciences. 2(1): 25-41.
2. Thompson, J, Schwatka, NV, Tenney, L, Newman, L. (2018). Total Worker Health: A small business leader perspective. International Journal of Environmental Research and Public Health. 15(11): 2416.
3. Schwatka, NV, Tenney, L, Newman, L. (2019). Health protection and health promotion in small business. In Burke, R. & Richardsen, A. (Eds.), Increasing Occupational Health and Safety in Workplaces: Individual, Work, and Organizational Factors. Edward Elgar Publishing: Cheltenham, UK.
4. Tenney, L., & Newman, L. (2019). Total Worker Health approaches in small to medium-sized enterprises. In H. Hudson, J. Nigam, S. Sauter, L. Chosewood, A. Schill, & J. Howard (Eds.), *Total Worker Health*: American Psychological Association.
5. Shore, E., Schwatka, NV, Dally, M, Brown, C, Tenney, L, Newman, LS. (2020). Small business employees' perceptions of leadership are associated with safety and health climates and their own behaviors. Journal of Environmental and Occupational Medicine. 62(2): 156-162.
6. Schwatka, NV, Sinclair, R, Fan, W, Dally, M, Shore, E, Brown, C, Tenney, L, Newman, LS. (2020). How does organizational climate motivate employee safe and healthy behavior in small business? A Self Determination Theory perspective. Journal of Environmental and Occupational Medicine. 62(5): 350-358.
7. Schwatka, NV, Dally, M, Tenney, L, Shore, E, Brown, C, Newman, LS. (2020). Total Worker Health leadership and business strategies are related to safety and health climates in small business. International Journal of Environmental Research and Public Health. 17(6), 2142.
8. Brown, C, Schwatka, NV, Dexter, L, Dally, M, Shore, E, Tenney, Liliana, Newman, LS (2021). The Importance of Small Business Safety and Health Climates during COVID-19. Journal of Environmental and Occupational Medicine. 63(2): 81-88.
9. Schwatka, NV, Brown, C, Tenney, L, Scott, JG, Shore, E, Dally, M, Newman, LS. (2021). Evaluation of a Total Worker Health Leadership Development Program for Small Business. Occupational Health Science. 5: 163-188.
10. Schwatka, NV, Dally, M, Shore, E, Dexter, L, Tenney, L, Brown, CE, Newman, LS. (2021). Profiles of Total Worker Health in United States small business. BMC Public Health. 21(1010).
11. Shore, E, Tenney, L, Schwatka, NV, Dally, M, Dexter, L, Brown, CE, Newman, LS. (2021). A pilot study of changes in Total Worker Health® policies and programs and associated changes in safety and health climates in small business. American Journal of Industrial Medicine. 64(12): 1045-1052.
12. Brown, C, Dexter, L, Schwatka, NV, Dally, M, Tenney, L, Shore, E, Newman, LS (2021). Total Worker Health® and Small Business Employee Perceptions of Health Climate, Safety Climate, and Well-Being during COVID-19. International Journal of Environmental Research and Public Health. 18: 9702.
13. Schwatka, N, Tenney, L, Dally, M; Brown, C, & Newman, L. (2022). NIOSH Science Blog. Feb 18, 2022: https://blogs.cdc.gov/niosh-science-blog/2022/02/18/small-biz-twh/

Presentations:

1. Schwatka NV, Tenney L, Dally M, Scott J, Brown CE, Weitzenkamp D, Shore E, Newman LS. (2018, May). A description of small business adoption of TWH policies and practices via business and employee assessments. Oral presentation at the 2nd International Symposium to Advance Total Worker Health. Bethesda, MD.
2. Shore, E, Schwatka NV, Tenney L, Dally M, Scott J, Brown CE, Weitzenkamp D, Newman LS. (2018, May). The Small + Safe + Well (SSWell) study: A NIOSH Center of Excellence small business TWH intervention study. Poster presentation at the 2nd International Symposium to Advance Total Worker Health. Bethesda, MD.

3. Thompson, J, Schwatka, NV, Tenney, L, Scott, J, Newman, LS. (2018, May). Total Worker Health Leadership: A small business leader perspective. Oral presentation at the 2nd International Symposium to Advance Total Worker Health. Bethesda, MD.
4. Tenney, L, Newman, L, Schwatka, NV, Scott, J. (2018, November). Total Worker Health: An approach to promoting worker health, safety, and well-being. Poster presentation at the Collegium Ramazzini's Annual Ramazzini Days, Carpi, Italy.
5. Tenney L, Shore E, Scott J, Rivera K, Schwatka NV, Dally M, Brown C, Newman L. (2018, September). Health Links: Partnering with small business to improve worker health, safety and well-being. Oral Presentation. Rocky Mountain Safety Conference. Colorado Springs, CO.
6. Shore E, Schwatka NV, Dally M, Brown C, Scott J, Tenney L, Newman L. (2018, September). Do employee perceptions of health and safety climates differ by size of business in Colorado? Oral Presentation. AIHA-RMS/ASSP Fall Technical Conference. Arvada, CO.
7. Shore, E. (2019, July). The Small+Safe+Well (SSWell) Study: Improving TWH Culture in Small Businesses. 2019 Wyoming Workforce Services and Safety Summit.
8. Schwatka, NV, Fan, W, Dally, M, Scott, J, Shore, E, Brown, C, Tenney, L, Newman, L. (2019, November). "Total Worker Health® strategies, climate, and employee motivation." Oral presentation, Work, Stress, & Health conference, Philadelphia, PA.
9. Schwatka, NV, Scott, J, Tenney, L, Newman, L. (2019, November). "Evaluation of a small business Total Worker Health® leadership program." Oral presentation, Work, Stress, & Health conference, Philadelphia, PA.
10. Schwatka, NV., Tenney, L., Newman, L., & Shapiro, D. (2020, April). "Total Worker Health Leadership Workshop." Virtual workshop for 25 University of Colorado School of Public Health leadership.
11. Schwatka, NV. & Shapiro, D. (2020, November). "Total Worker Health Leadership Workshop." Virtual workshop for 14 leaders from diverse industries hosted by the Center for Health, Work & Environment.
12. Schwatka, N. V. (2020, November). "How Small Businesses Should Engage Employees to Achieve Total Worker Health." Invited presentation, Health Links Webinar Series, Virtual.
13. Brown, CE, Schwatka, NV, Dally, M, Dexter, L, Tenney, L, Shore, E, Newman, LS. (2020, December). Applying the RE-AIM framework to a Total Worker Health intervention. Poster presentation at the 13th Annual Conference on the Science of Dissemination and Implementation in Health, Virtual.
14. Schwatka, N. V. (2021, May). Interventions to foster leadership for safety, health, and well-being in small business. Invited presentation, NIOSH NORA Traumatic Injury Prevention Council, Virtual.
15. Schwatka, NV, Newman, LS, Tenney, L (2021, September). "Small Business Total Worker Health® Leadership Training." Poster presentation, XXII World Congress on Safety and Health at Work 2021, Virtual.
16. Schwatka, NV, Tenney, L, Krisher, L (2021, September). "Total Worker Health® leadership for the safety professional." Oral presentation, ASSP Safety21 Conference and Expo, Virtual.
17. Schwatka, NV, Jaramillo, D, Shapiro, D. (2021, September). "Total Worker Health® leadership for the safety and health professional." Oral presentation, 2021 AIHA-Rocky Mountain Section Fall Technical Conference, Arvada, CO.
18. Schwatka, NV, Dally, M, Dexter, L, Tenney, L, Brown, C, Newman, L. (2021, November). "Profiles of Total Worker Health in Small Business." Poster presentation, Work, Stress, & Health Conference, Virtual.
19. Brown, CE, Dexter, L, Schwatka, NV, Dally, M, Tenney, L, Shore, E, Newman, LS. (2021, November). "Total Worker Health® and Small Business Employee Perceptions of Health Climate, Safety Climate, and Well-Being during COVID 19." Poster presentation, Work, Stress & Health Conference. Virtual.
20. Brown, CE, Dexter, L. (2021, October). Working through COVID-19: Takeaways for Organizational Leaders. Oral presentation, Health Links Annual Event. Virtual.
21. Schwatka, N. V. (2022, February). How to create leadership support in small business. Invited presentation, NYNJ ERC Occupational Health and Safety Center 42nd Annual Scientific Meeting, Virtual.

22. Schwatka, NV, Dally, M, Dexter, L, Tenney, L, Brown, C, Newman, L. (2022, February). "Small+Safe+Well: A small business Total Worker Health intervention." Poster presentation, 33rd International Congress on Occupational Health, Virtual.

C.2. Website(s) or other Internet site(s) – include URL(s)

- We have a SSWell study page on our website that describes the study results: https://coloradosph.cuanschutz.edu/research-and-practice/centers-programs/chwe/research/sswell
- We developed a TWH Leadership Program page on our website that describes the TWH Leadership programs we offer: https://coloradosph.cuanschutz.edu/research-and-practice/centers-programs/chwe/training/total-worker-health-leadership-programs

C.3. Technologies or techniques

- We developed two enrollment forms using Qualtrics, one for the study itself and one for the TWH Leadership Program.
- Each organization that participated in the study had their own database in REDCap, where we collected the individual responses to the Employee Health and Safety Culture Survey. After all responses were collected, our statistician used these data to generate a report of the aggregated results that was then sent to the organization.
- We created a SSWell informational webinar that briefly described the goals of the study and what was required of organizations to participate. The link to the webinar was on our study's webpage.
- The Health Links team already used the platform Insightly to track businesses, so we also used that to track businesses in the SSWell study. Using this platform, we stored their Health Links Healthy Workplace Assessment and the Healthy Workplace Report Card. This platform also allowed us to tag businesses that were in SSWell, and which ones had been randomized to receive the TWH Leadership Program (early v. lagged) and set reminders to contact businesses about taking the survey or other study related events.
- We customized the platform www.Stickk.com to facilitate goal setting after the in-person portion of the TWH Leadership Program.
- We created a culturally-appropriate, Spanish language version of SSWell study survey.

C.4. Inventions, patent applications, and/or licenses

n/a

C.5. Other products and resource sharing

n/a

D. PARTICIPANTS

D.1. What individuals have worked on the project? Please include calendar, academic, and summer months.

Commons ID	S/K	Name	Degrees(s)	Role	Cal	Aca	Sum	Foreign	Country	SS
CE.BROWN	Y	Brown, Carol	PhD	Co-I	1.8			N		N
M.DALLY	Y	Dally, Miranda	MS	Statistician	7.3			N		N
	N	Dexter, Lynn	MPH	Non-Student Research Assistant	6.0			N		N
	N	Guthmiller, Katie	MPH	Non-Student Research Assistant	2.0			N		N
	N	Habeych, Giselle		Other, finance	0.4			N		N
	N	Kujawa, Amanda		Other, communications	3.1			N		N

Lee_NEWMAN	Y	Newman, Lee	MD	PI	2.1			N		N
nvschwatka	Y	Schwatka, Natalie	PhD	Co-I	1.7			N		N
	N	Shapiro, David		Non-Student Research Assistant	4.6			N		N
L.TENNEY	Y	Tenney, Liliana	DrPH	Co-I	1.3			N		N
	N	Van Dyke, Mike	PhD	Co-I	0.3			N		N
	N	Veith, Laura		Other, communications	3.9			N		N

D.2 Personnel updates

a. Level of Effort: n/a
b. New Senior/Key Personnel: n/a
c. Changes in Other Support: n/a
d. New Other Significant Contributors: n/a

E. IMPACT

E.1 - What is the impact on the development of human resources, if applicable?
n/a

E.2 - What is the impact the Public Health Relevance and Impact? The investigator should address how the findings of the project relate beyond the immediate study to improved practices, prevention or intervention techniques, legislation, policy, or use of technology in public health.
Half of working Americans are employed by small businesses, including large numbers of workers who have not been reached by TWH or even by traditional occupational safety and health preventive services. This project advanced scientific knowledge and advance public health practice by testing new concepts to understand how a TWH intervention can improve safety, health, and well-being among workers in small business.

F. CHANGES

F.1 – Changes in approach and reasons for change, including changes that have a significant impact on expenditures
n/a

F.2 - Actual or anticipated challenges or delays and actions or plans to resolve them
Generally, we were successful with business enrollment as enrolled 132 organizations agreed to participate. However, it took two years to achieve this number and when coupled with the pandemic and our yearly follow-up schema, we had a challenge of getting businesses through our TWH leadership program and collecting enough follow up data to assess the effectiveness of the program.

From the leadership training standpoint, we found it difficult to get business leaders to commit to a full day training, along with follow-up activities. To address this, we scheduled multiple trainings throughout the year to make it as easy as possible for leaders to attend. We also designed follow-up activities to be completed online and made them as engaging as possible. Prior to the pandemic, we had to cancel two trainings due to inclement weather and still had one training on a snowy day, where half of the participants could not make it due to road conditions. It was a challenge to get those individuals to re-enroll in a training on a later date.

The outbreak of COVID-19 was a major challenge for our study. We had to cancel several TWH leadership trainings scheduled for March 2020 and later. Additionally, we were concerned that this might bias the rest of the data we collected from businesses for the remainder of the study after the start of the pandemic. Small businesses would have needed to survive the economic fallout of this pandemic to remain in the study. The data we would have collected from the employee survey after the start of the pandemic could have also been biased both because laid off employees would not have been represented and because the pandemic may have fundamentally changed the way the business operated as well as its culture. For these reasons, we chose to conclude data collection early.

However, we quickly adapted to the evolving pandemic situation by developing and collect COVID-19 impact surveys from participating businesses and their employees. The pandemic presented a unique opportunity to understand organizational culture and employee well-being during a global emergency. We collected surveys from 491 employees from 30 businesses in May 2020 to understand whether employee perceptions of safety climate and health climate were associated with higher levels of well-being. We further hypothesized that higher ratings of employees' perceptions of organizational response to COVID-19 and changes to employee work/life experiences would moderate the relationship between employee perceptions of safety and health climates and well-being. In another study with follow-up survey data with this same sample of workers, we examined how these climate perceptions and well-being changed over time and whether employees at organizations that received our TWH leadership development program prior to the pandemic would have better maintained their pre-pandemic perceptions of safety climate and health climate, as well as maintain their well-being scores during the pandemic. The results are described in Section B2.

F.3 - Significant changes to human subjects, vertebrate animals, biohazards, and/or select agents
n/a

G. Special Reporting Requirements

G.1 Special Notice of Award Terms and Funding Opportunities Announcement Reporting Requirements
n/a

G.2 Responsible Conduct of Research
n/a

G.3 Mentor's Research Report or Sponsor Comments
n/a

G.4 Human Subjects
G.4.a Does the project involve human subjects? yes
G.4.b Inclusion Enrollment Data see included final inclusion enrollment report
G.4.c ClinicalTrials.gov yes
Does this project include one or more applicable clinical trials that must be registered in ClinicalTrials.gov under FDAAA?
The trial was retrospectively registered with ClinicalTrials.gov on 15/07/2021 (ID NCT04965415). It was conducted in accordance with CONSORT guidelines.

G.5 Human Subject Education Requirement
Are there personnel on this project who are newly involved in the design or conduct of human subject's research? no

G.6 Human Embryonic Stem Cells (HESCS)
Does this project involve human embryonic stem cells (only hESC lines listed as approved in the NIH Registry may be used in NIH funded research)? no

G.7 Vertebrate Animals
Does this project involve vertebrate animals? no

G.8 Project/Performance Sites
University of Colorado Denver
DUNS: 041096314-0000
Congressional District: CO-006

Address: Mail Stop F428 Anschutz Medical Campus Fitzsimons Building 13001 E. 17th Place, Room 1124 Aurora, CO 80045-2571 United States
G.9 Foreign Component n/a
G.10 Estimated Unobligated Balance G.10.a Is it anticipated that an estimated unobligated balance (including prior year carryover) will be greater than 25% of the current year's total approved budget? no
G.11 Program Income Is program income anticipated during the next budget period? no
G.12 F&A Costs Is there a change in performance sites that will affect F&A costs? no

I. OUTCOMES

I. Provide a concise summary of the outcomes or findings of the award, written for the general public in clear and comprehensible language, without including any proprietary, confidential information or trade secrets

Note: project outcome information will be made public in NIH RePORTER

Half of working Americans are employed by small businesses, including large numbers of workers who have not been reached by Total Worker Health (TWH) or even by traditional occupational safety and health preventive services. Small businesses are committed to addressing employee well-being, but they may lack the necessary resources and infrastructure to provide for it. Senior-level decision-makers in small businesses are especially important in driving these efforts. The Small+Safe+Well study aimed to help small business leaders change their organizational practices to advance employee health, safety, and well-being. Over 100 small businesses participated in our study and 60 of their leaders engaged in our TWH leadership development program. We learned that small businesses need a business strategy for how they are going to implement TWH approaches. Also, their leadership needs to show daily support of this strategy. This signals to employees that their health and safety is valued. The combination of a TWH business strategy and leadership support brings together the best employee engagement in TWH policies and programs. However, only 9% of small businesses in the study did this, suggesting there is a need for methods to help small businesses integrate the TWH approach into their business. Small business leaders who engaged in the TWH leadership development program improved their leadership practices by 10%, on average, but they found it challenging to transfer what they learned in the program to their job sites. Additionally, they experienced an increase in work-related stress in the process. We did not find that the TWH leadership program helped to change the business's TWH business strategy or indicators of their health and safety culture. The Small+Safe+Well study ultimately generated a significant amount of knowledge about how to engage small businesses in TWH, specifically how to engage their leadership. We suggest that, if researchers and practitioners wish to engage owners and other senior leaders of small businesses, they need to consider the minimum effective dose of leadership intervention that aligns with the leaders' capacity to engage.

The COVID-19 pandemic contributed to our findings as we had to cancel several leadership program cohorts and follow-up data collection activities. However, we quickly pivoted to understand the impact of the COVID-19 pandemic on small business safety and health climates and employee well-being. We found that employee perceptions of safety and health climates were significantly related to their self-reported well-being during the first wave of COVID-19, even when there were changes to childcare, the ability to work, and limited social contacts. Perceptions of health and safety climates remained stable across all timepoints. However, employee well-being scores declined between the pre-pandemic period and subsequent COVID-19 timepoints.

Cumulative Inclusion Enrollment Report

This report format should NOT be used for collecting data from study participants.

Study Title: Small+Safe+Well: A Longitudinal Study of Total Worker Health in Small Business

Comments:

Racial Categories	Ethnic Categories									Total
	Not Hispanic or Latino			Hispanic or Latino			Unknown/Not Reported Ethnicity			
	Female	Male	Unknown/ Not Reported	Female	Male	Unknown/ Not Reported	Female	Male	Unknown/ Not Reported	
American Indian/ Alaska Native	11	6	0	13	7	0	1	0	0	**38**
Asian	26	12	1	1	0	0	1	0	0	**41**
Native Hawaiian or Other Pacific Islander	3	2	1	0	2	0	0	0	0	**8**
Black or African American	35	12	3	5	4	0	3	2	1	**65**
White	1,619	713	19	195	77	2	7	5	1	**2,638**
More Than One Race	32	25	4	8	5	0	1	0	0	**75**
Unknown or Not Reported	14	10	2	75	19	0	7	1	520	**648**
Total	**1,740**	**780**	**30**	**297**	**114**	**2**	**20**	**8**	**522**	**3,513**

A. COVER PAGE

Project Title: Center for Health, Work & Environment – Research Pilot Projects Program	
Grant Number: U19OH0111227	**Project/Grant Period**: 09/01/2016-08/31/2021
Reporting Period: 09/01/2016-08/31/2021	**Date Submitted**: 03/15/2022
Program Director/ Principal Investigator Natalie Schwatka	**Administrative Official Information**
Change of Contact PD/PI: no	
Human Subjects: yes	**Vertebrate Animals:** n/a
hESC: n/a	**Inventions/Patents:** n/a

B. ACCOMPLISHMENTS

B.1. What are the major goals of the project?

The Specific Aims of the Research Pilot Project Program (RPPP) were to: 1) help increase the research evidence base regarding the integration of protection and promotion of worker-related safety, health, and well-being; 2) foster innovative new research directions in health promotion, health protection and integration; 3) increase awareness, adoption, and implementation of *Total Worker Health*® best practices, programs, and policies across Region 8; and 4) help facilitate building *Total Worker Health* (TWH) workforce capacity in public and private sectors, in academia and practice through pilot research funding.

B.2. What did you accomplish under these goals?

1) Help increase the research evidence base regarding the integration of protection and promotion of worker-related safety, health, and well-being

Each year we developed a request for proposals (RFP). We distributed the RFP with the assistance of the P&E Core and Outreach Core. We formed a diverse pilot project review committee composed of standing and ad hoc members that had experience in fields related to TWH and the proposed projects. We developed a scoring system based on the National Institute of Health study section review criteria. The review committee was tasked with reviewing 1-2 pilot projects each using these criteria. We then met to discuss the merits of each proposal and to determine which project(s) to recommend to Center leadership for funding.

In total we received 35 project proposals and we funded 11 pilot projects (6 research and 5 research to practice projects) ranging up to $25,000 (total costs) for one year of support for a total of $222,050 over the five year period. The projects ranged in scope from cross-sectional surveys to pilot intervention studies. Topics included work/family challenges, psychosocial hazard reporting, cardiovascular disease, fatigue, gig-work, well-being, functional movement screening, inequities, and air quality. Researchers studied these topics in a variety of industries including firefighting, early childhood education, public schools, and vape shops. Researchers covered several NIOSH NORA Sector and Cross-Sector goals, including Healthy Work Design and Well-being, Public Safety, Cancer, Reproductive Cardiovascular and other Chronic Disease Prevention, Traumatic injury prevention, Transportation, Warehousing, and Utilities, Healthcare and Social Assistance, Services, Respiratory Health.

2) Foster innovative new research directions in health promotion, health protection and integration

The pilot projects advanced new research in health promotion, health protection, and integration. All projects funded to date supported researchers new to the field of TWH. The innovative research priorities of the projects were:

- Issues related to the reporting of safety hazards, to focus on employees' reporting of psychosocial hazards at work (PI: Sinclair).
- Knowledge and best practices about work during pregnancy, planning for parental leave, and transitioning back to work (PI: Fisher).
- Identifying social, cultural, geographic, and economic barriers that impact firefighters' participation in occupational medical monitoring programs and evaluating whether firefighters believe that the AvidCor device and app might improve participation rates (PI: Amidon).
- Investigating an important and growing population of vulnerable "gig economy" workers: on-demand drivers, with a goal of identifying safety and psychosocial risk factors for these drivers (PI: Tran).
- Evaluating a new device designed to address the health protection and promotion of workers subject to fatigue who work in safety-sensitive jobs (PI: Crain).
- Investigating the predictive validity of the Functional Movement Screening tool in relation to work-related injuries and workers compensation claims (PI: Shore).
- Adapting best practices in TWH to a strategic planning process to improve safety, health, and well-being and among early childhood education workers (PI: Farewell).
- Identifying benefits and challenges (including feasibility and validity) of using medical devices, wearables, apps, and other tools to protect and promote worker health (PI: Crain; PI: Amidon; PI: Shore).
- Investigating a novel countermeasure to circadian misalignment to improve metabolic functioning among shift workers (PI: Broussard).

- Identifying modifiable factors to facilitate and remove barriers and foster organizational and public policies so that low-income breast cancer patients can effectively return to work (PI: Ekenga).
- Investigating the association between sleep and cardiovascular disease (PI: Richards)
- Developing an intuitive, accessible mobile application to capture, in real-time, measures of workload from hospitalists (PI: Burden)
- Pilot an intervention to reduce vape shop workers' exposure to elevated levels of nicotine within and outside of the workplace (PI: Oni)

3) Increase awareness, adoption, and implementation of Total Worker Health best practices, programs, and policies across Region 8

Investigators leading these projects presented results at regional, national, and international professional conferences, published findings in scholarly journals, translated findings into practice, and sought additional funding for these research topics. For example, one pilot project led to the investigator using their findings regarding racial disparities in education in their new role as a data scientist for a public school district (PI: Holm). Another pilot grant led to a subsequent five-year grant from the Administration for Children and Families to study an intervention for the early education workforce in low-resourced locations.

4) Help facilitate building Total Worker Health workforce capacity in public and private sectors, in academia and practice through pilot research funding

It was a stated aim of the RPPP to build TWH workforce capacity. The pilot projects program helped to build TWH workforce capacity by advancing the careers of research investigators who are new to TWH and by funding graduate students and other junior investigators who will gain valuable experience by working on these projects. For example, Dr. Charlotte Farewell's pilot project resulted in a new five year grant from the Administration for Children and Families titled "Wellbeing of the ECE workforce in Low-resourced Locations (WELL)." In addition to the project PIs, collaborations with private industry have increased workforce capacity to partners such as early childhood care centers (PI: Farewell). Another pilot recipient (Shore) enrolled in a PHD program in occupational epidemiology.

B.3. Competitive Revisions/Administrative Supplements

n/a

B.4. What opportunities for training and professional development did the project provide?

The RPPP has provided an opportunity for academic researchers who are new to the field of TWH to conduct research in the field. Pilot project recipients came from a variety of university departments, such as a Department of Health and Exercise Science. This program provided support for these investigators to receive additional research training and professional development via conference presentations and attendance. For example, Dr. Ekenga participated in a virtual workshop on an Introduction to the Health and Retirement Study at the University of Michigan.

This program provided research training for undergraduate and graduate students. As a result of the working parent study (PI: Fisher), two graduate students worked with the Colorado Department of Public Health and Environment to conduct literature reviews and assist with developing organizational and public policies to improve family-friendly work environments. Finally, this program supported training for workers. Vape shop workers will receive workplace health and safety training as part of a funded pilot intervention project (PI: Oni).

B.5. How did you disseminate the results to communities of interest?

The pilot projects recipients shared their results with other researchers and the communities in which they engaged with. They presented to a variety of academic, practitioner, and business leader audiences at multiple events, including international, national, and regional conferences, presentations to organizational leaders and stakeholders, and free webinars. The directors of the RPPP and the Outreach Core also worked closely together to coordinate on ways that the center could disseminate project findings, extending their reach to workplaces and industries.

B.6 - What do you plan to do during the next reporting period to accomplish the goals?

The plan for the next reporting period is two-fold. First, we expect that the three projects currently in progress will be successfully completed. As projects are underway, interim and final reports will be collected, and follow-up tracking will occur, providing information about the outputs, outcomes, and r2p products that result from funded projects. However, in the event that their project is delayed, especially due to COVID-19, the two

current projects may need to continue with a no-cost extension into the following grant period. Additional translation and dissemination activities will likely continue into the following year, including writing and submitting manuscripts for academic publication. To monitor progress on this work, the pilot projects program director remains in contact with project investigators to periodically receive updates on project progress.

Sept – Dec
- Revise request for proposals
- Finalize review committee membership
- Begin distributing request for proposals
- Communicate with existing award recipients – continue tracking of outputs and outcomes

Jan – Mar
- Continue marketing request for proposals
- Answer proposal questions
- Schedule review committee meeting
- Communicate with existing award recipients – continue tracking of outputs and outcomes and request progress reports

Apr – Aug
- Review submitted proposals for completeness
- Assign and distribute proposals and scoring instructions and criteria to reviewers for review and scoring, and recruit ad hoc reviewers as needed based on proposal topics
- Review committee meets to discuss merits of each proposal and to determine which proposals to submit to Center leadership for funding consideration
- Center leadership determines which proposals to fund
- Communicate feedback to all proposal PIs and award notices to all funded project PIs
- Communicate with existing award recipients – continue tracking of outputs and outcomes and request final reports

C. PRODUCTS

C.1. Publications, conference papers, and presentations

Presentations

1. Daigle, K., & Fisher, G. G. (2017, October) Parental Leave: Implications and Concerns in Small Enterprises. Oral presentation at the Understanding Small Enterprises (USE) Conference, Denver, CO.
2. Fisher, G. G. (2018, April) Improving Employee Health-Related Decisions: Addressing the Barriers and Facilitators. In A. Jackson & J. Mazzola (C-Chairs), panel presentation and discussion at the Annual Conference of the Society for Industrial/Organizational Psychology, Chicago, IL.
3. Amidon, T.R., & Lipsey, T. (2018, March) *Firefighter Physiological Monitoring Summit*. Summit organized by National Fallen Firefighters Foundation and the SMARTER firefighter safety initiative. [Workshop participant]. Washington, DC.
4. Amidon, T.R., & Lipsey, T. (2018). Blue-collars/tough designs: UX within fire service occupational safety and health programs. In *Design, User Experience, and Usability: Design Thinking and Methods - 7th International Conference, DUXU 2018 Held as Part ofHCI International 2018, Proceedings*. (Vol. [Forthcoming], pp. [xx-xx 16 pages]. (Lecture Notes in Computer Science (including subseries Lecture Notes in Artificial Intelligence and Lecture Notes in Bioinformatics); Vol. 9746).
5. Crain, T. L, & Setters, C. (2018, September). *Fighting fatigue.* Presentation for the Association of General Contractors, Denver, CO.
6. Tran M. (April, 2018). Contingent Work and the Gig Economy. American Occupational Health Conference. New Orleans, LA.

7. Tran M, Crain T, Bihl J.A (May 2018). Qualitative Study of the Occupational Health and Safety of On-Demand Drivers. Total Worker Health. 2nd International Symposium to Advance Total Worker Health. Bethesda, MD.
8. Shore, E. & Dally, M. (2019, April). *The Functional Movement Screen (FMS) as a predictor of occupational injuries among Denver firefighters*. Presentation at the MAP ERC Annual Research Day.
9. Farewell, C. (2019, April). *Safety and Health Innovation in Preschools (SHIP): Cultivating the Well-being of the Early Childcare Workforce*. Poster presentation at the Presentation at the MAP ERC Annual Research Day.
10. Shore, E. & Dally, M. (2019, June). *The Functional Movement Screen (FMS) as a predictor of occupational injuries among Denver firefighters*. Presentation submitted to the Society of Epidemiologic Research Annual Conference.
11. Daigle, K. L. & Fisher, G. G. (2019, February). *Planning for Parental Leave: Leveraging Total Worker Health to Support Pregnant Working Women*. Presentation at Department of Psychology, Colorado State University.
12. Daigle, K. L. & Fisher, G. G. (2019, April). *Planning for Parental Leave: A Qualitative Analysis Exploring Planning Decisions During Pre-Leave*. Presentation at the MAP ERC Annual Research Day.
13. Rynders, C. A., Morton, S., Broussard, J. L. (June, 2021). Impact of time-restricted feeding on metabolic homeostasis in healthy adults. Presented as a poster at the Cold Spring Harbor Conference on Biological Timing.

Publications

1. Amidon, T. R., & Lipsey, T. (2018). Blue-Collars/Tough Designs: UX Within Fire Service Occupational Safety and Health Programs. In International Conference of Design, User Experience, and Usability/Human-Computer Interaction (pp. 573-588). Springer.
2. Amidon, TR., Williams, EA., Lipsey, T, Callahan, R, Nuckols, G, Rice, S. Sensors and gizmos and data, oh my: Informating firefighters' personal protective equipment. Commun Des Q Rev. 2018;5(4):15-30.
3. Amidon, TR., Arduser, L, Gouge, C, Hutchinson, L, Jones, J, Jones, N, Welhausen, CA. Examining usability in the communication design of health wearables. In Proceedings of the 35th ACM International Conference on the Design of Communication (pp. 1-3), 2017.
4. Simmons, WM, Amidon, TR. Negotiating research stance: An ecology of tensions in the design and practice of community-engaged research. In Proceedings of the 37th ACM International Conference on the Design of Communication (pp. 1-11), 2019.
5. Crain, T L., Brossoit, RM, Robles-Saenz, F, Tran, M. Fighting fatigue: A conceptual model of driver sleep in the gig economy. Sleep Health. 2020;6(3):358-365. PMCID in process.
6. Farewell, CV, Powers, J, Puma, J. Safety and Health Innovation in Preschools: A Total Worker Health Pilot Project. J Occup Environ Med. 2020;62(5):e192-e199. PMCID in process.
7. Farewell, CV, Puma, J, Bergling, E, Webb, J, Quinlan, J, Shah, P, Maiurro, E. An exploration of constructs related to dissemination and implementation of an early childhood systems-level intervention. Health Educ Res. 2020;35(6):574-583. PMCID in process.
8. Shore, E, Dally, M, Brooks, S, Ostendorf, D, Newman, M, Newman, L. Functional movement screen as a predictor of occupational injury among Denver firefighters. Saf Health Work. 2020;11(3):301-306. PMCID: PMC7502609
9. Holm, AK. (2021). Minority Stress, Work Stress, and Health Inequity for Hispanic/Latinx K-12 Teachers in Colorado: A Mixed Methods Study. Dissertation, Colorado State University, ProQuest Dissertations Publishing. https://www.proquest.com/openview/f011cab0877817ea43e7aab074a7a61f/1.pdf?pq-origsite=gscholar&cbl=18750&diss=y
10. Ekenga, C., Kim, B, Kwon, E, Park, S. (Published Online December 29, 2021). Multimorbidity and employment outcomes among middle-aged US cancer survivors. JOEM. doi: 10.1097/JOM.0000000000002473

Grants

1. Farewell, CV. 2021-2026. Wellbeing of the ECE workforce in Low-resourced Locations (WELL). Funder: Administration for Children and Families.

C.2. Website(s) or other Internet site(s) – include URL(s)

A webpage for the Pilot Projects Program that includes additional information and the RFP can be found here: https://coloradosph.cuanschutz.edu/research-and-practice/centers-programs/chwe/research/pilot-projects

C.3. Technologies or techniques

n/a

C.4. Inventions, patent applications, and/or licenses

n/a

C.5. Other products and resource sharing

n/a

D. PARTICIPANTS

D.1. What individuals have worked on the project? Please include calendar, academic, and summer months.

Commons ID	S/K	Name	Degrees(s)	Role	Cal	Aca	Sum	Foreign	Country	SS

n/a

D.2 Personnel updates

a. Level of Effort: n/a
b. New Senior/Key Personnel: n/a
c. Changes in Other Support: n/a
d. New Other Significant Contributors: n/a

E. IMPACT

E.1 - What is the impact on the development of human resources, if applicable?

n/a

E.2 - What is the impact the Public Health Relevance and Impact? The investigator should address how the findings of the project relate beyond the immediate study to improved practices, prevention or intervention techniques, legislation, policy, or use of technology in public health.

The Pilot Projects Program provided a mechanism for funding small-scale innovative research or research to practice projects that could lead to larger, more impactful projects and position recipients to apply for funding independent from the Center. This program funded new endeavors rather than provide additional resources for existing Center projects. We prioritized projects that used community participatory methods to address the needs of underserved populations of workers. Projects aimed to benefit workplaces *and* employees, not just one or the other. The Research Pilot Projects Program and Outreach Core coordinated the dissemination of results, both to promote future research and to impact changes to workplaces.

F. CHANGES

F.1 – Changes in approach and reasons for change, including changes that have a significant impact on expenditures

n/a

F.2 – Actual or anticipated challenges or delays and actions or plans to resolve them

The COVID-19 pandemic made research challenging, resulting in data collection delays. Pilot project investigators had the option, on a case-by-case basis, to continue their projects with a no-cost extension.

F.3 - Significant changes to human subjects, vertebrate animals, biohazards, and/or select agents
n/a

G. Special Reporting Requirements

G.1 Special Notice of Award Terms and Funding Opportunities Announcement Reporting Requirements
n/a

G.2 Responsible Conduct of Research
n/a

G.3 Mentor's Research Report or Sponsor Comments
n/a

G.4 Human Subjects
G.4.a Does the project involve human subjects? yes
G.4.b Inclusion Enrollment Data n/a
G.4.c ClinicalTrials.gov n/a
Does this project include one or more applicable clinical trials that must be registered in ClinicalTrials.gov under FDAAA? no

G.5 Human Subject Education Requirement
Are there personnel on this project who are newly involved in the design or conduct of human subject's research? no

G.6 Human Embryonic Stem Cells (HESCS)
Does this project involve human embryonic stem cells (only hESC lines listed as approved in the NIH Registry may be used in NIH funded research)? no

G.7 Vertebrate Animals
Does this project involve vertebrate animals? no

G.8 Project/Performance Sites
University of Colorado Denver
DUNS: 041096314-0000
Congressional District: CO-006
Address: Mail Stop F428 Anschutz Medical Campus Fitzsimons Building
13001 E. 17th Place, Room 1124
Aurora, CO 80045-2571
United States

G.9 Foreign Component
n/a

G.10 Estimated Unobligated Balance
G.10.a Is it anticipated that an estimated unobligated balance (including prior year carryover) will be greater than 25% of the current year's total approved budget? no

G.11 Program Income
Is program income anticipated during the next budget period? no

G.12 F&A Costs
Is there a change in performance sites that will affect F&A costs? no

I. OUTCOMES

I. Provide a concise summary of the outcomes or findings of the award, written for the general public in clear and comprehensible language, without including any proprietary, confidential information or trade secrets

Note: project outcome information will be made public in NIH RePORTER

The Research Pilot Projects Program provided a mechanism for funding small-scale innovative research or research to practice projects that could lead to larger, more impactful projects and position recipients to apply for funding independent from the Center. This program funded new endeavors rather than provide additional resources for existing Center projects. It also focused on supporting junior investigators, as well as graduate students or academic faculty members of any rank who were new to the field of TWH. Ultimately, we funded 11 pilot projects ranging up to $25,000 for one year of support for a total of $222,050 over the five-year period. The projects ranged in scope from cross-sectional surveys to pilot intervention studies. Topics included work/family challenges, psychosocial hazard reporting, cardiovascular disease, fatigue, gig-work, well-being, functional movement screening, inequities, and air quality. Researchers studied these topics in a variety of industries including, firefighting, early childhood education, public schools, and vape shops. Investigators leading these projects have presented results at regional, national, and international professional conferences, published findings in scholarly journals, translated findings into practice, and sought additional funding for these research topics. The pilot projects program helped to build TWH workforce capacity by advancing the careers of research investigators who are new to TWH and by funding graduate students and other junior investigators who gained valuable experience by working on these projects. In addition to the project PIs, collaborations with private industry have increased workforce capacity of our partners.

A. COVER PAGE

Project Title: Center for Health, Work & Environment – Outreach Core	
Grant Number: U19OH0111227	**Project/Grant Period**: 09/01/2016-08/31/2021
Reporting Period: 09/01/2016-08/31/2021	**Date Submitted**: 03/15/2022
Program Director/ Principal Investigator Lee S. Newman	**Administrative Official Information**
Change of Contact PD/PI: no	
Human Subjects: no	**Vertebrate Animals:** no
hESC: no	**Inventions/Patents:** no

B. ACCOMPLISHMENTS

B.1. What are the major goals of the project?

The goals of the Outreach Core were to 1) increase *Total Worker Health*® awareness, knowledge, and practice through outreach and dissemination.; 2) build capacity for *Total Worker Health* (TWH) through training and education and strategic partnerships; and 3) increase adoption, implementation and maintenance of the best evidence and practice on worker health and safety. We aim to deliver science-based information to stakeholders across Federal Region 8and nationally including reaching underrepresented groups, and to evaluate the success of these outreach activities.

Through partnerships and outreach activities, we engaged with key stakeholders to better understand the needs of communities, employers, and workers. We aimed to: 1) disseminate across disciplines and industries to reach occupational groups not typically reached by occupational and safety and health (OSH), 2) have a positive and measurable impact on worker safety and health, and 3) evaluate the success of our outreach.

B.2. What did you accomplish under these goals?

Communications

Monthly newsletters. Our websites combined received over 1 million unique visits (142,721 CHWE, 932,119 Health Links) over the five-year period. Our content strategy for social media primarily focused on disseminating TWH information in the form of shared posts, success stories from Health Links Certified Healthy Workplaces, tools and resources from our Center and other TWH Centers of Excellence, and current trends targeting employers, professionals, and partners. Our social media sites reach a total of 4,988 followers across Facebook, Twitter and LinkedIn. We continue to produce and publish two electronic newsletters: the quarterly CHWE newsletter reaches 4,171 contacts and the monthly Health Links newsletter reaches 3,481 contacts. The most popular stories in our newsroom were a summary of a visiting scholar lecture given by Dr. Laura Linnan from University of North Carolina – Chapel Hill Gillings School of Global Health on the changing nature of work; a spotlight on our Certificate of TWH program and its impact on those in healthcare professions pursuing the certificate; and a personal memoir from a CHWE team member about her experience of mental health in the workplace. Our Small + Safe + Well (SSWell) study webpage that ended recruitment in September 2019 received an average of 237 unique visits/year. Our marketing efforts to promote webinars resulted in a 150% increase in registration and uptake in cross-promotion with other TWH Centers of Excellence. See more on our training impact below.

Health Links™

Our signature outreach program, Health Links, had tremendous success in putting TWH into practice by translating and disseminating TWH to organizations and encouraging them to integrate their health and safety efforts. We have had 743 organizations participate in the program by completing a Healthy Workplace Assessment™, certification, and mentoring through personalized advising sessions. In this time, our team conducted 987 advising sessions, working with representatives from organizations to interpret the results of their Healthy Workplace Assessment™ and identify SMART-goals that align with the values and needs of both their workplace and their workforce. Through process evaluation we gained new knowledge about employer motivations, learned how TWH is adopted and implemented in different contexts, and how TWH needs to be designed to be relevant to diverse audiences in workplace settings, specifically small businesses (<500 employees). We published new research from Health Links in the Journal of Occupational and Environmental Medicine that showed that implementation of TWH differs by business size, with larger businesses having more robust programming and policies across health and safety. Most notable, we expanded Health Links nationally in 2018 and developed modules focused on supporting caregivers in the workplace, promoting outdoor recreation for worker well-being, supporting mental health, and chronic disease prevention and management.

Partnerships

We fostered and strengthened partnerships with industry, business groups, and local public health to expand our reach and capacity building for TWH in diverse communities and across different disciplines. We established new and strengthened existing partnerships with many groups, including with the Colorado Office of Economic Development and International Trade (OEDIT), Colorado's Small Business Development Center (SBDC) Network, the Society for Human Resource Management (SHRM), local public health agencies, local chambers of commerce, tech startups, the National Mental Health Innovation Center (NMHIC) and Executives

Partnering to Invest in Children (EPIC). These relationships resulted in key channels to reach small employers in urban and rural areas that have trusted affiliations with these groups.

TWH COVID-19 Response

Our team's response to COVID-19 was an exercise in TWH field application. We leaned heavily on our expertise on the integration of OSH, company benefits, employee communications, and behavioral health services. Drs Lee Newman and Mike Van Dyke consulted for local hospitals on appropriate personal protective equipment (PPE) protocols for healthcare workers. Additionally, they worked with a Governor-directed statewide procurement group to connect with appropriate facilities for quality testing on PPE obtained outside the normal supply chain. They consulted with a local hospital on design and best practices of homemade barrier face coverings for source control among COVID-19 suspected patients, as well as methods for testing expired PPE. As early as March 2020, they worked with NIOSH and an international meat production company to develop, assess, implement, and disseminate best practices to prevent COVID-19 transmission among essential workers in the hard-hit meat packing workforce. Other consultations included national grocery chains, high-tech manufacturers, distributors, construction, and national retailers. Our Center created a COVID-19 resource page to provide credible resources for international, national, and regional organizations, employers, and individuals. This page also linked to the *Health Links COVID-19 Town Hall series*; weekly virtual webcasts we hosted to address the current state of the pandemic and guidance addressing employer and employee concerns. The town halls were attended by 3,244 participants over four months who tuned in to hear information from experts on crisis communication and emergency preparedness, leadership for reducing stress and fatigue, supporting working parents, mental health, and return to work public health guidelines. Our faculty and staff communicated trustworthy information to the general public through many media interviews. We are coordinating with other NIOSH TWH Centers of Excellence to share and disseminate resources to benefit our stakeholders, track activities, identify opportunities and needs for research and practice collaborations, and share common concerns.

Engaging Small Business in Disease Prevention

Through a partnership with the Colorado Department of Public Health and Environment (CDPHE), we worked to engage organizations to support chronic disease prevention and management programs to improve worker health and well-being using a TWH approach. The primary goal of the project was to promote evidence-based diabetes and cardiovascular disease prevention and management programs among Colorado employers. The collaboration focused on providing options through existing providers and programs for employers and their at-risk employees in different industries and across urban and rural areas of Colorado. Events, meetings, and communications with employers served as a significant facilitator to increasing the access to the National Diabetes Prevention Program (DPP), a proven lifestyle-change program that reduces the risk of type 2 diabetes. To do this, we provided education to business leaders on the National DPP and provided virtual advising to answer questions about options and help employers make decisions for offering and promoting the National DPP to employees. Health Links, via its Healthy Workplace Network of employers, created new inroads for organizations across the state that were well positioned to provide a DPP to become a part of their overall workplace strategy for health and wellness. Over the course of the project, we hosted virtual events that benefited 197 webinar participants and completed 35 advising sessions on DPP education. Through direct outreach and consultation, many employers have expressed strong interest in promoting or offering the DPP to individual workers. We also identified key themes in implementing DPP in workplaces. There is a general understanding that diabetes is a major cost driver of health care costs. Colorado employers that are committed to workplace health as a top business priority were most likely to express interest in diabetes and cardiovascular disease prevention and management programs as a covered benefit. Organizations were also more motivated when they had a wellness specialist or HR representatives that had a personal connection to diabetes, for example, they themselves were at risk of type 2 diabetes or family member had type 2 diabetes.

This project helped increase employer engagement and interest in offering chronic disease prevention and management programs. Having Health Links as a trusted program continues to be successful in helping employers navigate the flood of information and different options available to them. This project is continuing in the net funding cycle.

Society for Total Worker Health®

We took steps to spearhead the development of the **Society for Total Worker Health**. to The Society will launch officially in Spring 2022 - LINK.

3rd International Symposium to Advance Total Worker Health

At the request of the NIOSH TWH Office, our Center has taken a leadership role, along with NIOSH, to plan and co-host the **3rd International Symposium to Advance Total Worker Health** in 2022. It will be held at the National Institutes of Health Campus in Bethesda, MD from October 11-14, 2022. Over the past year, we assembled the full planning committee with representatives from NIOSH and the other TWH Centers of Excellence. The planning committee helped determine the theme, speakers, and session tracks and invite a scientific committee to participate in the reviewing of abstracts. The event will bring together researchers, academics, business leaders, labor leaders, and professionals across a range of disciplines to attend workshops and present on leading research. We will work with the steering committee for the TWH Professional Society and promotional partners including national and international associations to help market the event to their members. Event information can be found here.

Collaboration for Impact

Our Center has continued to have a primary focus on engaging community partners from public health, industry, workers' compensation, health care, academia, and government to conduct effective outreach. We have both strengthened existing partnerships and developed new ones, including:

- We collaborated with **local public health** to reach employers in an effort to expand TWH in practice. For five years, we partnered with Tri-County Health Department (TCHD) in Colorado to engage employers as part of a statewide strategy for promoting workplace initiatives to prevent chronic disease and improve overall health and well-being. We have worked directly with TCHD to provide outreach to businesses participating in five coalitions housed in chambers of commerce throughout the region, presented at coalition meetings and conducted direct assistance to coalition members. The meetings focused on providing free and low-cost resources to business members, especially in the areas of family-friendly workplace policies and practices (lactation support and age-friendly workplaces) and healthy food and beverage policies.
- Building on efforts that began at the first and second International Total Worker Health (TWH) Symposia and at a November 2017 workshop held at the University of North Carolina, we helped coordinate the **TWH Education, Training and Capacity Building Workgroup (TeTRAC)**. TeTRAC was a collaborative composed of representatives from the NIOSH Office for TWH, other Centers of Excellence, TWH affiliates, and academic institutions that were developing educational programs in TWH. Dr. Lee Newman led the effort to develop and disseminate guidelines that academic institutions can use for defining the core principles, competencies, skills, and knowledge needs of future TWH professionals and practitioners. The workgroup has published a manuscript, ***Education and Training to Build Capacity in Total Worker Health,*** in Journal of Occupational and environmental Medicine (2020).
- We collaborated with the **Colorado Governor's Office of Outdoor Recreation to develop a cross-sector framework** that aimed to connect new research to businesses for implementing opportunities to promote safe, responsible use of outdoor spaces as part of workplace initiatives. This report served as the launchpad for continuing to work with the Office of Outdoor Recreation based at the Office of Economic Development and International Trade to develop and launch the **Get Outdoors Employers Toolkit** in February 2020. We had 62 businesses participate.
- We collaborated with the **NIOSH Western States Division to host the American Indian and Alaska Native Workshop** for OSH professionals across the West. TWH cut across the agenda with presentations on the integrative way in which many of the tribal nations conceptualize their approach to health, safety and well-being. The program focused on "Building Bridges to Enhance the Well-being of American Indian and Alaska Native Workers." The event brought together members from many tribes across the U.S. including the Cochiti, Lumbee, Tohono O'odham, Shoshone-Bannock, Ojibwe, and Oneida people, as well as representatives from NIOSH and academia. It culminated in strategic planning for advancing a collaborative agenda to improve American Indian and Alaska Native worker health, safety, and well-being.

- We collaborated with the **five other TWH Centers of Excellence** to revise the TWH outreach core logic model. This work involved meetings to discuss goals, activities, outputs and short and long-term outcomes for outreach activities that reflected the comprehensive objectives of the centers. The logic model will be used by the NIOSH TWH to provide guidance and common examples and outreach measures in the new funding announcement.

Conferences

We participated in the planning and hosting of national and international conferences including the Association for Occupational Health Professionals in Healthcare (AOHP) National Conference in 2017-2020 and the Understanding Small Enterprises (USE) Conference (www.useconference.com) in October 2017. The USE Conference brought together over 140 attendees representing industry, public health, workers' compensation, health care, academia, and others from around the globe to understand the unique needs of small businesses and to share strategies for cultivating healthier and safer work environments.

We exhibited at local, regional, national and international events, where we had booths to promote our TWH programs, research and training. These events reached large audiences and we distributed program materials including 600 annual reports, 2,500 continuing education and training brochures, 650 SSWell recruitment flyers, and over 1,600 Health Links flyers. Conferences included: the Western States Occupational Network (WestON) conference, the Association for Occupational Health Professionals in Healthcare (AOHP) National Conference, the American Industrial Hygiene Association Rocky Mountain Section (AIHA-RMS) Fall Technical Conference, the USE Conference, Elevate Safety: Rocky Mountain Safety Conference, Granby Chamber of Commerce Business Breakfast: Mental Health and Resiliency in Grand County, the American Heart Association's Worksite Health event, Transforming Health Care Lecture Series: Creating Healthy Workplaces.

B.3. Competitive Revisions/Administrative Supplements

n/a

B.4. What opportunities for training and professional development did the project provide?

Our Outreach Core developed and delivered robust TWH training and professional development opportunities to professionals across a range of disciplines including occupational safety and health, public health, health education, management, human resources, worksite wellness and others. Some of these most notable activities include:

- In 2017, we founded the **Certificate in *Total Worker Health* Program.** To date, we have graduated 16 students and currently have another 16 enrolled with 7 starting in Spring 2022. Our students come from diverse backgrounds representing both graduate and post-graduate students and practicing professionals from the fields of public health, medicine, human resources, industrial hygiene, nursing, healthcare administration, and architecture. These backgrounds are not typical of the traditional professional or student entering the occupational safety and health (OSH) field. Thus, we are broadening the reach of OSH through TWH as these trainees thoughtfully consider ways TWH can be applied and integrated into their fields. We were the first in the nation to move our program fully online. We offer students scholarships to complete the program in partnership with our sister NIOSH MAP ERC training grant. Students that have graduated from the program have gone on to careers in consulting, corporate health and safety management, public health, and occupational medicine. One student began a doctoral degree in public health. The increasing number of working professionals joining our program from inside and outside of Colorado is notable and demonstrates our progress towards meeting the needs of working professionals seeking to integrate the TWH approach into the way they advance worker well-being.
- We reached the business community through our free Health Links Webinar Series which offered expert content in the field of TWH. We advertised through the Center's website, newsletters and social media channels. Beginning at the onset of the COVID-19 pandemic, we expand the webinars with special topics focused on mental health, antiracism in the workplace, chronic disease prevention and management, and mental health. The expanded reach resulted in attendees from 37 states representing professionals in HR, safety, occupational medicine, industrial hygiene, public health, and others. The one hour long virtual trainings expanded our center's reach and TWH dissemination by offering free continuing education credits for professionals in human resources, health education, and safety.

- We developed online TWH trainings: "Nutrition in the Workplace", "Working off Stress", and "Family-Friendly". The courses are self-paced and are accessible through our learning management platform (learn.chwe.ucdenver.edu) where learners can register and receive continuing education contact hours for professionals that are Certified Health Education Specialists (CHES®) and certifications through the Society for Human Resource Management (SHRM).
- We hosted a live ECHO workshop in Colorado which brought together 50 participants across different industries. The workshop presented current issues around mental health and workplace stigma and facilitated group discussions on approaches to identify risks and increase supports and services in the rural region. The event was followed by a full online ECHO series training a cohort of 27 participants representing 13 counties in Colorado. The five sessions focused on depression, suicide prevention, and workplace strategies for TWH.
- We partnered with the CU Depression Center to offer workshops for managers in the tourism and service industry to develop skills for preventing suicide through workplace supports that address depression and other mental health conditions. We conducted four workshops in Utah, training 225 individuals.
- We held six TWH Leadership trainings as part of the SSWell Study. The full day events trained owners, executives, and senior managers on skills that reflected on findings from their Healthy Workplace Assessment™ and the Employee Health and Safety Culture Survey™. Leaders discussed priorities for addressing strengths and gaps and set goals for advancing TWH in workplace practice and also personal TWH goals.

B.5. How did you disseminate the results to communities of interest?

Our dissemination activities included the use of email marketing, digital media, events, presentations, community outreach, and other communication strategies to reach employers, community partners, and stakeholder groups.

- Through the Center's and Health Links' social media pages on Facebook, Twitter and LinkedIn we've shared TWH research, r2p projects, free resources, pilot grant funding announcements, and current topics in the field of TWH. Through our social channels we were able to reach 4,988 followers.
- Through the Health Links website (healthlinkscertified.org), we featured TWH messaging, directed organizations to take the Healthy Workplace Assessment™, provided a user dashboard and a robust Resource Center featuring TWH evidence-based tools and resources.
- We've utilized our Newsroom on our Center's website to post featured stories from the media, new publications, and our blog. (https://coloradosph.cuanschutz.edu/research-and-practice/centers-programs/chwe)
- We exhibited at local, regional, national, and international events, where we promoted our TWH research, training, and programs. These annual events resulted in reaching large and diverse audiences and distributed program materials including 250 annual reports, 150 continuing education and training brochures, and 200 Health Links flyers. Conferences included the Western States Occupational Network (WestON) meeting, the Association for Occupational Health Professionals in Healthcare (AOHP) National Conference, the American Industrial Hygiene Association Rocky Mountain Section (AIHA-RMS) Fall Technical Conference, the Colorado Safety Association Conference, the 2019 Crossroads Utah Society for Human Resource Management Conference, the 2019 Work, Stress & Health Conference, and local chamber of commerce events.
- We promoted our pilot projects program through our online newsletter and email marketing that is sent to over 13,000 subscribers to our mailings.
- We collaborated with other Centers of Excellence for TWH to share posts through social media on upcoming webinars and new TWH resources.
- We worked with our Chancellor's office to promote our outreach efforts as part of CU for Colorado, a searchable resource catalog that features nearly 800 programs by county, Congressional Districts, state legislative districts, keywords and broad categories. See more here: https://connections.cu.edu/stories/cu-colorado-showcases-outreach-programs-new-interactive-map

B.6 - What do you plan to do during the next reporting period to accomplish the goals?

The renewal of the TWH Center of Excellence resulted in new activities for the current five-year funding period. Additionally, we were finishing some of the activities that were funded under the first five-year period. These core outreach activities include executing our annual Health Links event that brings together practitioners from a large range of industries; continuing outreach to the Latinx work community through activities with community partners such as providing community-based trainings which build upon the results of a community needs assessment that was recently conducted. We will also continue facilitating the Society for TWH Steering Committee which involves drafting bylaws, incorporation, and branding and website development. Finally, the Outreach Core will continue to coordinate with the SSWell research team to disseminate findings and outputs of the study.

C. PRODUCTS

C.1. Publications, conference papers, and presentations
Total Worker Health

Schwatka, NV & Newman, LS (2021). Total Worker Health. In LaDou and Harrison (Eds.), Current Occupational & Environmental Medicine, Sixth Edition, McGraw Hill: New York.

Kelly, KM, Newman, LS, Cherniack, M, Punnett, L, Hammer, LB. Critical points in Lemke's Total Worker Health Calculus. J Occ Environ Med. 2021 LINK

Total Worker Health in Small Enterprises

Brown, CE, Schwatka, N, Dexter, L, Dally, M, Shore, E, Tenney, L, Newman, LS. The Importance of Small Business Safety and Health Climates during COVID-19. J Occup Environ Med. 2021; 63(2): 81-88. LINK

Schwatka, NV, Brown, CE, Tenney, L, Scott, JG, Shore, E, Dally, M, Newman, LS. Evaluation of a Total Worker Health® Leadership Development Program for Small Business. Occup Health Sci. 2021; 5: 163-188. LINK

Shore, E, Tenney, L, Schwatka, NV, Dally, M, Dexter, L, Brown, CE, Newman, LS. A Pilot Study of Changes in Total Worker Health® Policies and Programs and Associated Changes in Safety and Health Climates in Small Business. Am J Ind Med. 2021. LINK

Brown, CE, Dexter, L, Schwatka, NV, Dally, M, Tenney, L, Newman, LS. Total Worker Health® and Small Business Employee Perceptions of Health Climate, Safety Climate, and Well-Being during COVID-19. Int J Environ Res Public Health. 2021; 18: 9702. LINK

Schwatka, NV, Dally, M, Shore, E, Dexter, L, Tenney, L, Brown, CE, Newman, LS. Profiles of Total Worker Health® in United States Small Businesses. BMC Public Health. 2021; 21: 1010. LINK

Tenney L, Dexter L, Shapiro DC, Dally M, Brown CE, Schwatka NV, Huebschmann AG, McMillen J, Newman, LS. Impact of Advising on Total Worker Health Implementation. J Occup Environ Med. 2021; 63(8): 657-664. LINK

Tenney, L, Huebschmann, AG, Brown, CE, Schwatka, NV, Newman, LS. Leveraging an Implementation Science Framework to Measure the Impact of Efforts to Scale Out a Total Worker Health® Intervention to Employers. Int J Environ Res Public Health. 2022; 19(3): 1372. PMCID: PMC8834848.

International Total Worker Health

Krisher L, Butler-Dawson J, Yoder H, Pilloni D, Dally M, Johnson EC, Jaramillo D, Cruz A, Asensio C, Newman, LS. Electrolyte Beverage Intake to Promote Hydration and Maintain Kidney Function in Guatemalan Sugarcane Workers Laboring in Hot Conditions. J Occup Environ Med. 2020; 62(12): e696-e703. LINK

Krisher LK, Butler-Dawson J, Dally M, Jaramillo D, Newman LS. Chronic Kidney Disease of unknown cause: investigations in Guatemala and opportunities for prevention. Ciencia, Tecnología y Salud. Vol 7 Num. 1. 2020. LINK

Butler-Dawson, J, Krisher, L, Dally, M, James, KA, Johnson, RJ, Jaramillo, D, Yoder, H, Johnson, E, Pilloni, D, Asensio, C, Cruz, A, Newman, LS. Sugarcane Workweek Study: Risk Factors for Daily Changes in Creatine. Kidney Int Rep. 2021; 6(9): 2404-2414. LINK

Pilot Projects

Shore, E, Dally, M, Brooks, S, Ostendorf, D, Newman, M, Newman, L. Functional movement screen as a predictor of occupational injury among Denver firefighters. Saf Health Work. 2020;11(3):301-306. LINK

Conference Papers

Shore, E. (July, 2019). The Small+Safe+Well (SSWell) Study: Improving TWH Culture in Small Businesses. 2019 Wyoming Workforce Services and Safety Summit.

Tenney, (November 2019) "A NIOSH Center of Excellence for Total Worker Health®: Advancing Health, Safety and Well-being of Workers through Research, Education and Practice" Poster presentation. Work, Stress & Health, Philadelphia, PA

Tenney, (November 2019) "Assessment of Total Worker Health® Strategies as Indicators of Organizational Behavior in Small Business" Oral presentation. Work, Stress & Health, Philadelphia, PA

Tenney, (November 2019) "Total Worker Health® (TWH) Professionals Collaborative Meeting" Work, Stress & Health, Philadelphia, PA

Schwatka, N. V. (November, 2019). "Total Worker Health® strategies, climate, and employee motivation." Oral presentation, Work, Stress, & Health conference, Philadelphia, PA.

Tenney, (November 2019) "Approaches that Accelerate Research to Practice: Lessons learned from NIOSH Total Worker Health Centers" Oral panel presentation Work, Stress & Health, Philadelphia, PA

Schwatka, N. V. (November 2019) "Evaluation of a small business Total Worker Health leadership program." Oral presentation, Work, Stress, & Health conference, Philadelphia, PA.

Schwatka, N. V. (September, 2019). "Using a Design Sprint to Develop an Intervention for a Latino Day Laborer Organization." Oral presentation, 12th Annual Western States Occupational Health Network (WestON) conference, Denver, CO.

C.2. Website(s) or other Internet site(s) – include URL(s)

- Center for Health, Work & Environment website with content about programs, research, training, and a newsroom featuring stories: http://chwe.ucdenver.edu
- Health Links™ website featuring a user platform for organizations to select plans, complete an online Healthy Workplace Assessment, access a dashboard with results and modules, and schedule advising: https://www.healthlinkscertified.org/
- Family-Friendly Workplace Toolkit: https://www.earlymattersgreateraustin.org/toolkit
- Get Outdoors Employers Toolkit: https://choosecolorado.com/programs-initiatives/get-outdoors-employer-toolkit/
- Health Risk Cost Calculator: http://www.ucdenver.edu/academics/colleges/PublicHealth/research/centers/CHWE/projects/Pages/Health-Risk-Calculator.aspx
- Total Worker Health® Leadership Training Program webpage: http://www.ucdenver.edu/academics/colleges/PublicHealth/research/centers/CHWE/Research/Pages/Total-Worker-Health-Leadership-Program.aspx
- LinkedIn: https://www.linkedin.com/company/chwe/
- Facebook: https://www.facebook.com/CHWENews/ and https://www.facebook.com/HealthLinksCertified/
- Twitter: twitter.com/chwenews and twitter.com/healthlinksnews

C.3. Technologies or techniques

n/a

C.4. Inventions, patent applications, and/or licenses

n/a

C.5. Other products and resource sharing
n/a

D. PARTICIPANTS

D.1. What individuals have worked on the project? Please include calendar, academic, and summer months.

Commons ID	S/K	Name	Degrees(s)	Role	Cal	Aca	Sum	Foreign	Country	SS
CE.BROWN	Y	Brown, Carol	PhD	Co-I	0.8			N		N
	N	Crepeau, Madison		Other, staff	4.8			N		N
	N	Cuff, Cortney		Other, staff	4.1			N		N
	N	Foxcroft, Jennifer		Other, staff	2.9			N		N
	N	Guthmiller, Kaite		Non-Student Research Assistant	2.0			N		N
	N	Jaramillo, Diana		Non-Student Research Assistant	4.0			N		N
	N	Krisher, Lyndsay		Non-Student Research Assistant	3.8			N		N
	N	Kujawa, Amanda		Other, Communications	2.1			N		N
	N	Litvin, Kira		Other, staff	3.5			N		N
	N	Shapiro, David		Non-Student Research Assistant	3.8			N		N
L.TENNEY	Y	Tenney, Liliana	DrPH	PI	2.4			N		N
MIKE_VANDYKE	N	Van Dyke, Mike	PhD	Co-I	0.5			N		N
	N	Veith, Laura		Other, Communications	3.1			N		N

D.2 Personnel updates

a. Level of Effort: n/a
b. New Senior/Key Personnel: n/a
c. Changes in Other Support: n/a
d. New Other Significant Contributors: n/a

E. IMPACT

E.1 - What is the impact on the development of human resources, if applicable?
n/a

E.2 - What is the impact the Public Health Relevance and Impact? The investigator should address how the findings of the project relate beyond the immediate study to improved practices, prevention or intervention techniques, legislation, policy, or use of technology in public health.
The Outreach Core is the hub for translating and disseminating information to address public health issues that improve worker safety, health, and well-being. Our outreach activities focused on communication and

dissemination, education, and implementation strategies that were critical to increasing the reach, adoption and implementation of TWH evidence-based practices to prevent injury, illness, and fatalities of workforces, specifically vulnerable working populations. This work was strongly aligned with public health goals to prevent disease and improve the health of people and their communities through workplace interventions, education, and research-to-practice.

F. CHANGES

F.1 – Changes in approach and reasons for change, including changes that have a significant impact on expenditures

n/a

F.2 - Actual or anticipated challenges or delays and actions or plans to resolve them

In September 2016, we became the sixth and newest TWH Center of Excellence and the only Center in the Rocky Mountain West. The Outreach Core immediately engaged in a process to execute planned activities in coordination with the E&P core, internal steering committee, and external resources. On March 15, 2020, just three and a half years into our Center's first cycle as a TWH Center of Excellence, the ColoradoSPH's buildings were closed due to COVID-19 and all faculty and staff of CHWE were instructed to work from home indefinitely. The Outreach Core responded immediately, leading a process to accomplish two major objectives: 1) continue to disseminate, educate, and implement TWH initiatives needed to accomplish all specific aims and goals of the U19 and 2) lead an agile, iterative process to respond to the needs of employers and employees affected by COVID-19.

F.3 - Significant changes to human subjects, vertebrate animals, biohazards, and/or select agents

n/a

G. Special Reporting Requirements

G.1 Special Notice of Award Terms and Funding Opportunities Announcement Reporting Requirements

n/a

G.2 Responsible Conduct of Research

n/a

G.3 Mentor's Research Report or Sponsor Comments

n/a

G.4 Human Subjects

G.4.a Does the project involve human subjects? no

G.4.b Inclusion Enrollment Data n/a

G.4.c ClinicalTrials.gov n/a

Does this project include one or more applicable clinical trials that must be registered in ClinicalTrials.gov under FDAAA? no

G.5 Human Subject Education Requirement

Are there personnel on this project who are newly involved in the design or conduct of human subject's research? no

G.6 Human Embryonic Stem Cells (HESCS)

Does this project involve human embryonic stem cells (only hESC lines listed as approved in the NIH Registry may be used in NIH funded research)? no

G.7 Vertebrate Animals

Does this project involve vertebrate animals? no

G.8 Project/Performance Sites

University of Colorado Denver

DUNS: 041096314-0000

Congressional District: CO-006

Address: Mail Stop F428 Anschutz Medical Campus Fitzsimons Building

13001 E. 17th Place, Room 1124

Aurora, CO 80045-2571 United States
G.9 Foreign Component n/a
G.10 Estimated Unobligated Balance G.10.a Is it anticipated that an estimated unobligated balance (including prior year carryover) will be greater than 25% of the current year's total approved budget? no
G.11 Program Income Is program income anticipated during the next budget period? no
G.12 F&A Costs Is there a change in performance sites that will affect F&A costs? no

I. OUTCOMES

I. Provide a concise summary of the outcomes or findings of the award, written for the general public in clear and comprehensible language, without including any proprietary, confidential information or trade secrets

Note: project outcome information will be made public in NIH RePORTER

Over the past five years as a NIOSH-funded Center of Excellence for *Total Worker Health*, we met our goals and achieved significant impact through our Outreach Core. We've increased TWH awareness, adoption, implementation, and capacity through education. We strengthened and formed new collaborations with stakeholders and community partners in industry, public health, and government. We focused on dissemination and training through our communications, TWH small business interventions, and TWH leadership and certificate programs. Notably, we demonstrated our ability to adapt, innovate, and expand high-quality TWH outreach activities in response to the COVID-19 pandemic, providing thousands of employers and workers guidance on how to implement federal, state and local recommendations to protect workers. Specific outcomes from the five-year grant period include:

- Over 1 million unique visits to our websites
- 743 organizations participated in Health Links, with 987 advising sessions conducted
- 3,244 people attended the Health Links COVID-19 Townhall series
- 32 people enrolled in the *Total Worker Health* Certificate Program, with 16 graduates