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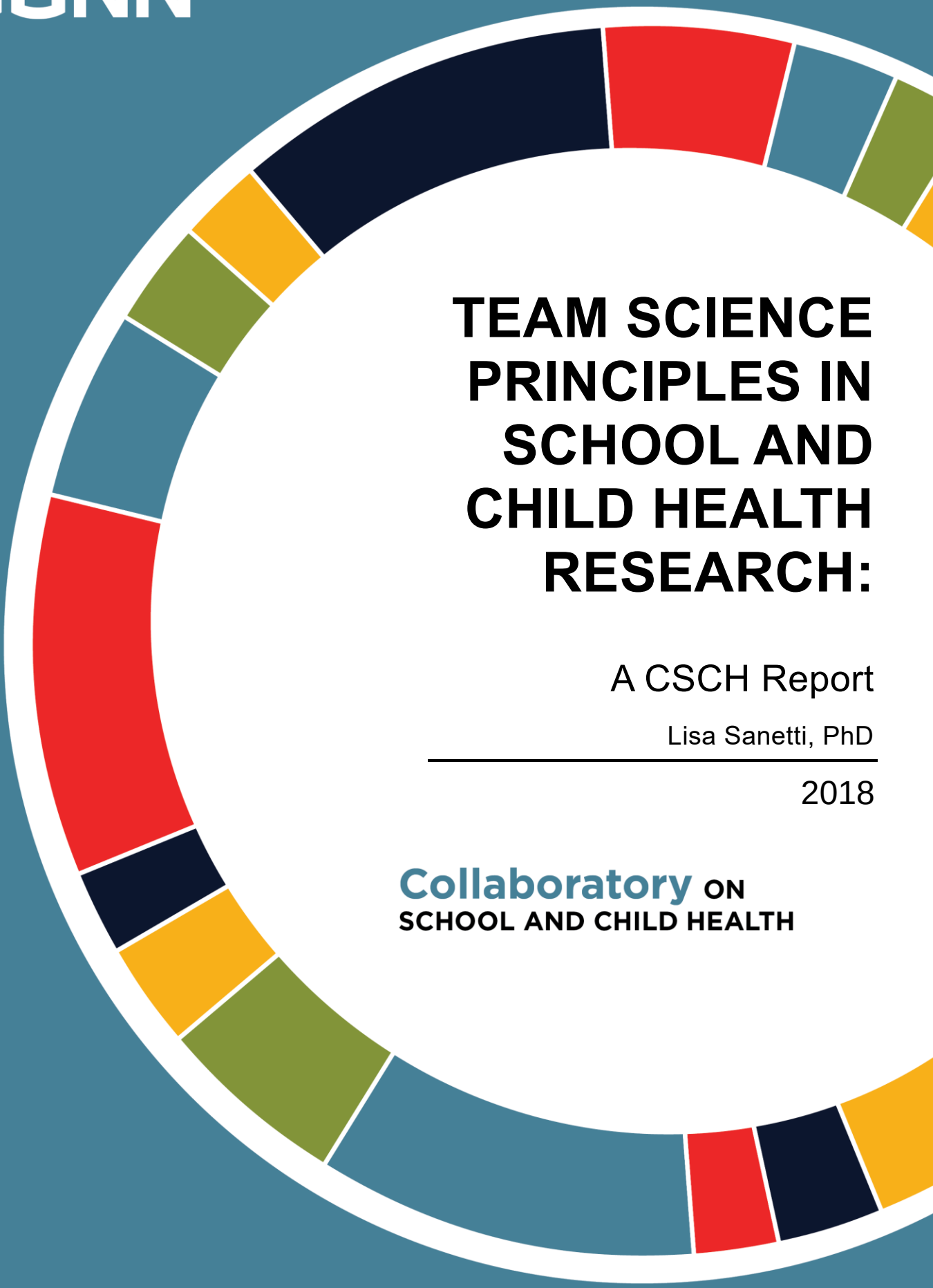


TEAM SCIENCE PRINCIPLES IN SCHOOL AND CHILD HEALTH RESEARCH:

A CSCH Report

Lisa Sanetti, PhD

2018

Collaboratory ON SCHOOL AND CHILD HEALTH

TEAM SCIENCE PRINCIPLES IN SCHOOL AND CHILD HEALTH RESEARCH

EXECUTIVE SUMMARY

Defining and Making the Case for Team Science

Team science can be defined as simply as scientific collaboration. There are four phases involved in creating successful cross-disciplinary research.

1. Teams ***develop*** their goals and interests.
2. Teams ***conceptualize*** their research questions and designs.
3. Teams ***implement*** the research they have planned.
4. Teams ***translate*** these findings.

When effectively employed, team science can have a tremendous impact in addressing highly complex problems.

The Continua of Team Science

- Multidisciplinary teams - the contributions from each discipline are ***complementary***.
- Interdisciplinary teams - researchers ***integrate*** information and techniques.
- Transdisciplinary teams - researchers work toward shared goals using a ***shared framework***.

Considerations and Challenges of Team Science

Team Level

Working on teams can be challenging, especially for researchers who have been trained to conduct independent research. If researchers thoughtfully and proactively consider preparation, team development, team effectiveness, and team leadership, they can increase the likelihood of team effectiveness and decrease the likelihood of challenges.

Organization and Funding Levels

Organizational policies and extramural funding opportunities must be taken into consideration, especially since funding agencies may not support team-based research.

Need for Team Science to address School and Child Health Issues

Research to address school and child health is highly complex in that it necessitates collaboration across diverse disciplines, child-serving systems, stakeholders, and developmental levels. Given this complexity, research addressing school and child health issues necessitates a team science approach.

TEAM SCIENCE PRINCIPLES IN SCHOOL AND CHILD HEALTH RESEARCH:

A CSCH Report *by* Lisa Sanetti, PhD

Defining Team Science

Team science can be defined as simply as scientific collaboration. This collaboration occurs when more than one researcher is investigating a topic. The nature of team science is interdependent, and it can occur within the context of small teams or groups consisting of many people.[1]

There are four phases involved in creating successful cross-disciplinary research.[2]

1. Teams ***develop*** their goals and interests.
2. Teams ***conceptualize*** their research questions and designs while integrating each member's respective discipline and expertise. This helps teams address scientific problems in new ways.
3. Teams ***implement*** the research they have planned.
4. Teams ***translate*** these findings in order to address relevant problems in the world.

> "Team science is a collaborative and often cross-disciplinary approach to scientific inquiry that draws researchers who otherwise work independently… into collaborative centers and groups"
>
> **National Institutes of Health (2010)**

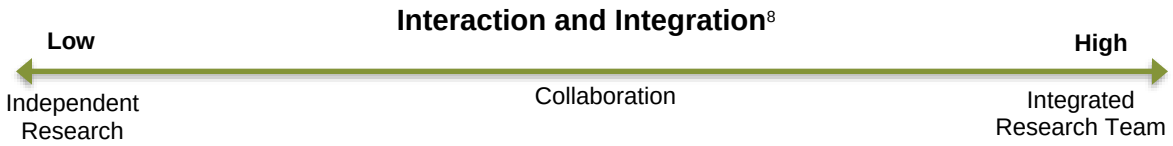
Need for Team Science

The highly complex problems faced by society cannot be addressed by solitary researchers or, often, multiple researchers in a single discipline. Rather, research to address highly complex problems necessitates cross-disciplinary, large-scale scientific collaborations, or team science.[3] The general types of problems that may require team science span across time and disciplines, and include, but are not limited to, problems that (a) are poorly defined, (b) are technically complex, (c) have ambiguous scientific findings, (d) are multi-systemic, (e) inherently require multiple disciplines, and (f) are unable to be addressed using available research approaches.[4]

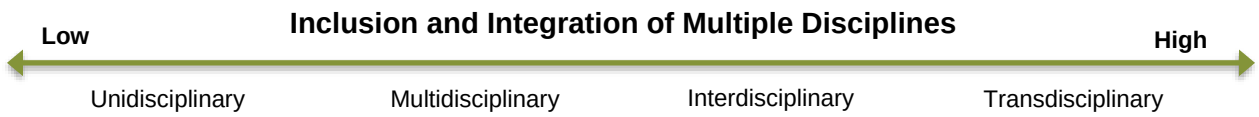
When effectively employed, team science can have a tremendous impact. Scientists in cross-disciplinary teams are more productive, publishing and presenting results more frequently and consistently.[5] Higher rates of dissemination across multiple disciplines have the potential to increase the speed of additional scientific discovery by other teams. Further, successful cross-disciplinary teams are responsible for numerous tremendously impactful results including discovery of the causative agent for Severe Acute Respiratory Syndrome (SARS)[6], which will facilitate prevention of another epidemic; and development of the HPV vaccine, which has reduced rates of cervical cancer incidence and mortality.[7]

Continua of Team Science

There is not a single way to engage in team science. Rather, collaborative teams engaging in team science vary with regard to their levels of interaction and integration, and inclusion and integrate multiple disciplines.



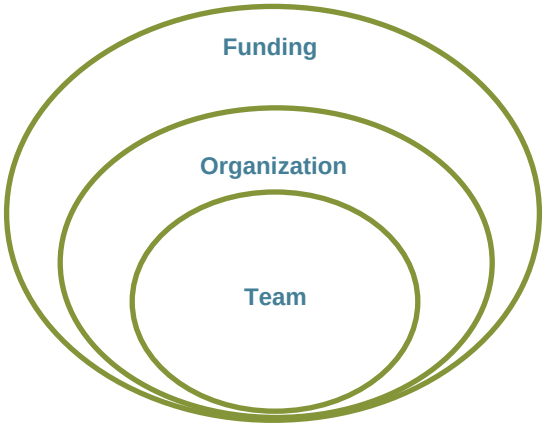
As indicated in the figure above, science occurs on a continuum of interaction and integration. At the low end of the continuum, researchers work independently on a research problem solely within their discipline. In the middle of the continuum, researchers from different disciplines come together, each bringing their own expertise to address a research problem. Typically, researchers work relatively independently on separate research questions and subsequently integrate findings. The extent to which leadership, brainstorming, data sharing, and credit is shared can vary greatly. At the high end of the continuum, researchers from different disciplines come together, each bringing their own expertise. At this end, however, all the researchers are meeting regularly, to define team goals, individual team members' objectives, and action plans for how to move forward to collaboratively address the research problem. Integrated research teams share leadership, responsibilities, decision-making authority, data, and credit for results. Factors aside from the research problem that may influence where a team is on the continuum of interaction and integration include the team's diversity, size, goal alignment, boundaries, proximity, and task interdependence.[9]



Research teams differ not only in their level of interaction and integration, but also in the extent to which they include multiple disciplines. Unidisciplinary teams consist of researchers from one discipline who work together to address a research problem. Multidisciplinary, interdisciplinary, and transdisciplinary teams all consist of researchers from different disciplines, but how they work to address a research problem varies.[10] On multidisciplinary teams, the researchers coordinate their efforts to achieve a common goal, but the contributions from each discipline are complementary rather than integrative, with researchers staying within their disciplinary boundaries.[11] On interdisciplinary teams, researchers integrate information, data, techniques, tools, perspectives, concepts, and/or theories to solve a research problem that is beyond the scope of a single discipline.[12] [13] On transdisciplinary teams, researchers work together to meet shared goals using a shared conceptual framework, which draws together discipline-specific knowledge. Further, researchers transcend their discipline's boundaries, often gaining knowledge and skills from other disciplines toward the goal of the project. Any of these types of research teams may be relatively small in scale, co-located, and led by one researcher or may be large in scale, geographically dispersed, and led by multiple individuals. The level of inclusion and integration of multiple disciplines should be driven by the problem to be addressed; highly integrated work across multiple disciplines is necessary to address some complex problems, but not necessary at all, or to a lesser extent to address other problems.

Considerations and Challenges of Team Science

Having multiple researchers, potentially from different disciplines, working across multiple organizations, and distributed across geographic space working toward a common goal can have tremendous impact. However, these characteristics can also contribute to the number and magnitude of challenges the team has to navigate. These challenges can be organized at the team, organizational, and funding levels.



Team Level

Working on teams can be challenging, especially for researchers who have been trained to conduct independent research. However, there are several areas that, when thoughtfully and proactively considered, can significantly increase the likelihood of team effectiveness and decrease the likelihood of challenges.

Preparation: Each potential member of the research team needs to reflect on their desire, ability, and readiness to work with on a collaborative research team. It is essential that each potential team member reflect on their ability or wiliness to, for example, share data and credit, accept constructive feedback and training, provide constructive feedback and training, be open with the team about concerns, and recognize and appreciate other people's viewpoints and ideas.[14]

Working on teams can be challenging, especially for researchers who have been trained to conduct independent research.

Developing a team: Members of a team should have diverse backgrounds and understand their individual responsibilities and expected contributions. Teams need to openly discuss team goals; establish group norms related to processes for data sharing, establishing and sharing credit, and managing authorship; determine how and how frequently they will communicate; and prepare for disagreement. Teams may be developed from the "top-down," for example when a granting agency selects researchers to collaborate to address a pressing area of need, or, more commonly, from the "bottom up" when researchers come together to address an area of common interest.

Team effectiveness: To maximize team effectiveness, it is essential to understand team evolution and characteristics related to team performance. Decades of research suggest teams develop in stages. To achieve their highest potential, it is helpful for team members to be aware of these stages: ***forming***—the development of the team; ***storming***—the development of member roles and responsibilities, which may trigger disagreements, but can be moved through if members are able to openly discuss concerns; ***norming***—when team members begin working together effectively and developing trust in one another; ***performing***—the team is working together cohesively, focusing on the shared goal, and resolving issues that arise; and ***adjourning*** *or* ***transforming***—when the team either disbands because it has achieved its goals or takes on a new project. Teams that are characterized by open communication, trust, respect, optimism, tenaciousness, desire for collaboration, risk taking, and effectively handling uncertainty are more likely to maximize their effectiveness and achieve their goals.[15] When

teams achieve objectives throughout the project and overall project goals, the individual team members, and the team as a whole, experience more positive outcomes.[16]

Leadership: Strong leaders are essential to team science. Although there is no one formula for a "good research team leader" there are some common characteristics that appear essential. Strong leaders need to clearly and decisively communicate and share information with team members; articulate a vision to team members; model collaboration and inspire team members to work toward the shared goal; manage team member expectations; select team members who will thrive in a team context; and handle conflict and unexpected challenges.[17] [18]

Organization Level

When deciding whether or not to engage in team-based research, university faculty members have to take into consideration their organizational policies and extramural funding opportunities.[19] Organizations often encourage the idea of researchers collaborating within and across disciplines and organizations; however, policies and practices do not always support such collaborations. This is evident in the physical spaces in which research is conducted—one investigator has their own lab and success is measured by the amount of lab space and number of junior investigators in a lab. It is likewise evident in the promotion mechanisms of many organizations, the majority of which are individual-focused. For example, promotion committees may only reward only those publications published in an individual's discipline-specific journals and may be unaware of the individual's contribution to research that resulted in another team member receiving an important award or being invited to present at conference in their discipline. Likewise, many promotion committees focus on whether the researcher has obtained "independence," thus driving early and mid-career researchers away from collaborative projects.[20]

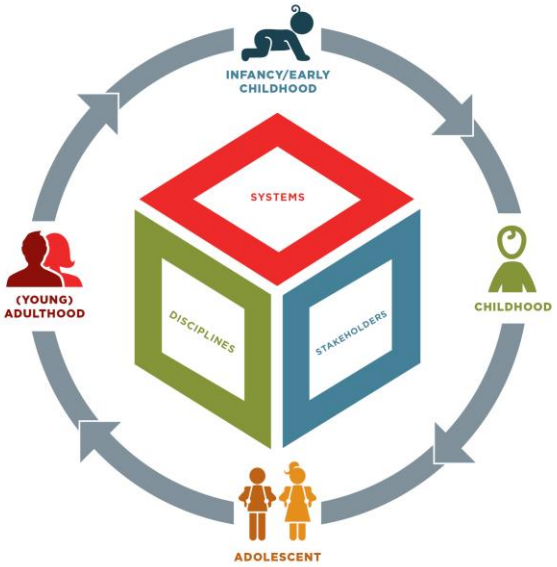
Funding Level

Funding agencies vary considerably in the level of support for team-based research. Many recognize the need for a high-quality team to address research questions of interest, yet funding levels and training opportunities are often not aligned with this need. Conducting team-based research is costly, especially as the team grows across sites and disciplines. Highly skilled, eager researchers may not be able to develop bottom-up teams to address their research problem because the budget caps for the appropriate grant competitions are too low to support a more inter- or transdisciplinary integrated approach. Further, most researchers are content area experts, not experts in developing and supporting integrated teams with members from multiple disciplines. Structured training opportunities, such as those provided by the National

Cancer Institute, enable researchers to develop the skills needed to effectively develop teams with common goals and research questions, execute innovative research methods to answer important questions, and translate the findings to relevant stakeholders.

Need for Team Science with CSCH Mission

Research to address school and child health to inform healthy, safe, supportive, and engaging environments for all children is highly complex in that it necessitates collaboration across diverse disciplines, child-serving systems, stakeholders, and developmental levels.



Multi-system, multi-stakeholder, and cross-developmental level nature of the work, research addressing school and child health issues necessitates a team science approach

The Whole School, Whole Community, Whole Child (WSCC) model, developed in 2014 by the ASCD and U.S. Centers for Disease Control and Prevention, highlights 10 interconnected domains that significantly contribute to child health: social emotional climate; physical environment; physical education and activity; nutrition environment and services; health services; family engagement; health education; employee wellness; counseling, psychological, and social services; and community involvement.

Each of these domains is addressed in one or more systems that serve youth such as families, schools, healthcare, child welfare, justice, mental health, food, and housing. Further, there are numerous stakeholders who influence and are influenced by these domains and youth-serving systems including, but not limited to, families, policy makers, and practitioners (e.g., educators, medical professionals, mental health professionals, judges). Finally, the issues that arise in school and child health can vary as children develop. As such, this work is relevant from prenatal care to post-secondary transition.

Given the interconnected, multi-discipline, multi-system, multi-stakeholder, and cross-developmental level nature of the work, research addressing school and child health issues necessitates a team science approach. Teams will likely need to include researchers from multiple disciplines, be conducted across multiple systems of care, engage diverse stakeholders throughout the research to ensure contextual relevance, and determine the developmental level(s) their work will target.

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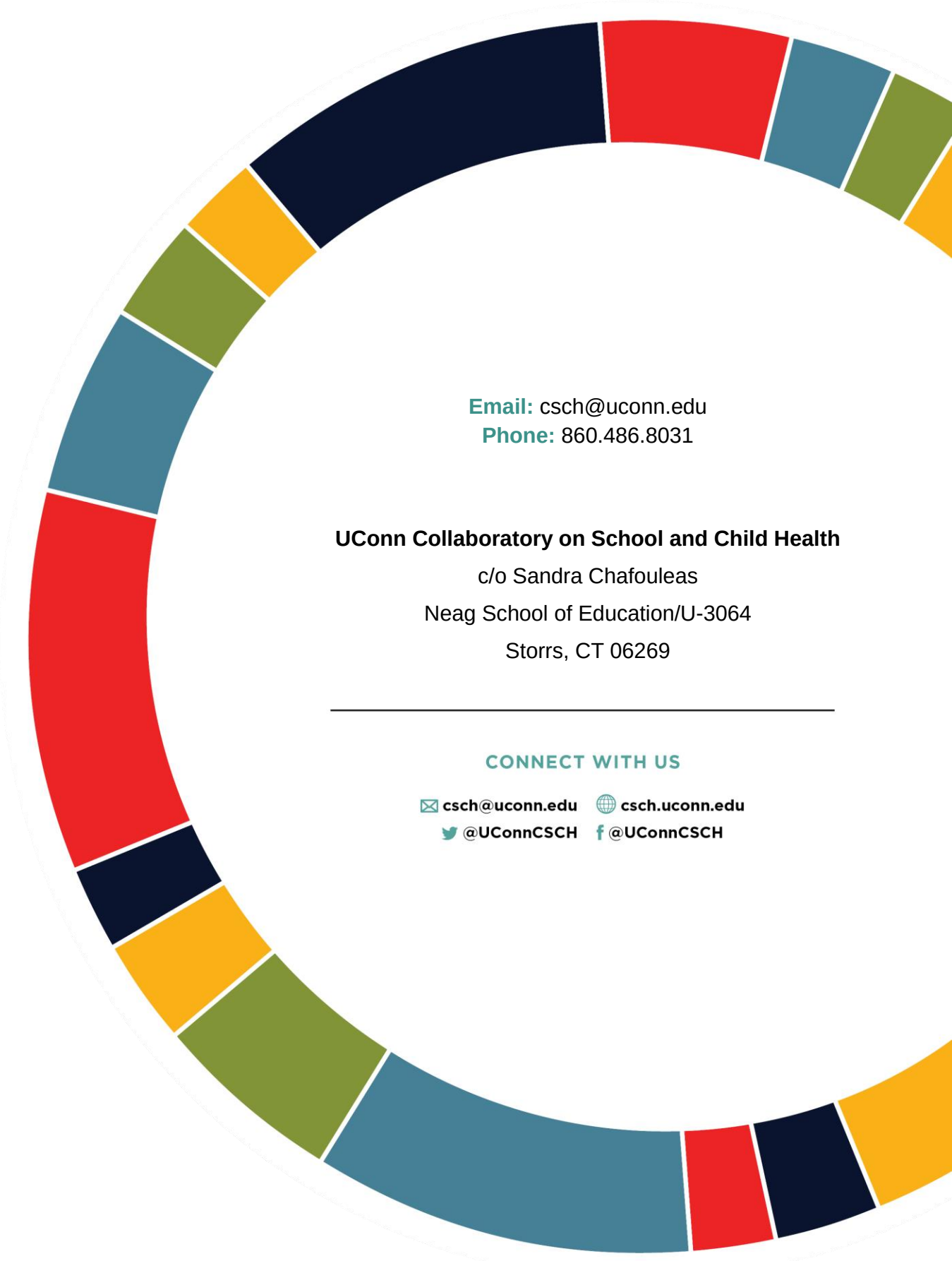

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