

COLLABORATION MATH:

Enhancing the Effectiveness of Multidisciplinary Collaboration

265 29th Street
Oakland, CA 94611
510.444.7738
fax 510.663.1280

www.preventioninstitute.org



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Applying Collaboration Math to the U.C. Berkeley Traffic Safety Center—A Case Study

This document was prepared by Prevention Institute with funding from the U.C. Berkeley Traffic Safety Center through the California Office of Traffic Safety. Principle authors are:

Larry Cohen, MSW

Manal J. Aboelata, MPH

Toni Gantz

Jennifer Van Wert

This paper applies *Collaboration Math* to the U.C. Berkeley Traffic Safety Center (TSC) (www.tsc.berkeley.edu). Their mission is to reduce traffic fatalities and injuries through multi-disciplinary collaboration in education; research; and outreach. A main goal of the Center is to strengthen the capability of government, academic institutions and local community organizations to enhance traffic safety.

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INTRODUCTION

Reducing the toll of traffic-related injuries requires a concerted effort, calling on the resources, commitment and expertise of diverse agencies, professionals and community members.^{1,2} Traffic safety is affected by numerous aspects of community life such as how neighborhoods are designed, how fast cars travel and how safe people feel walking or driving to key destinations. Preventing traffic-related injury is a responsibility shared by many. As evidenced by many federal, state and local efforts, partnerships, coalitions and networks have become common ways to address the incidence of traffic crashes, fatalities and other injuries.

The purpose of this paper is to describe *Collaboration Math*, a tool developed to help individuals and groups representing different disciplines, organizations or constituencies work together effectively. This practical tool was designed to make key differences and similarities within groups explicit, so that they are more likely to succeed in the challenging work of building and sustaining collaborations. In 2002, the Traffic Safety Center (TSC) at the University of California, Berkeley worked with *Collaboration Math* and this paper highlights the process for using the tool by providing specific examples from the TSC.

The mission of the TSC is “to reduce traffic fatalities and injuries through multidisciplinary collaboration in education, research and outreach.” Participants of the TSC represent disciplines of public health, engineering, transportation studies and optometry and include the Institute of Transportation Studies, UC Berkeley’s Schools of Public Health and Optometry, Partners for Advanced Transit and Highways (PATH), the Technology Transfer Program, Prevention Institute, and the Prevention Research Center. The California Office of Traffic Safety, through the Business, Transportation and Housing Agency is the primary funder of the TSC. Prevention Institute worked with members of the TSC to apply *Collaboration Math* with the goal of supporting and enhancing the group’s multidisciplinary approach.

“...The determinants of health are beyond the capacity of any one practitioner or discipline to manage....We must collaborate to survive, as disciplines and as professionals attempting to help our communities and each other.”

INSTITUTE OF MEDICINE³

WHY COLLABORATE?

Injuries remain the leading cause of death for Americans ages 1-34,⁴ and disproportionately affect rural, low-income and youth of color.^{5,6} Traffic-related injuries represent the largest proportion of injuries and involve a complex set of issues. No one organization possesses all of the resources, knowledge, or political will to identify and implement the range of effective countermeasures or prevention strategies needed to prevent traffic-related injuries. Addressing issues such as neighborhood design (do pedestrians have to cross high speed thoroughfares?); availability of products (are child passenger safety seats affordable?); access to services (are quality emergency services accessible?); and safety (do people feel safe? How much do injuries affect the community?) requires multiple partners and multi-faceted solutions.

Collaborations provide the opportunity to generate broad-based support to improve traffic safety and prevent injuries. Collaborations can create a forum for research institutions, grassroots organizations, community members, government agencies and other participants to cooperate, share information and resources and minimize reinventing the wheel.⁷ The Institute of Medicine's landmark publication, *Reducing the Burden of Injury: Advancing Prevention and Treatment* underscores the value of collaboration in injury prevention: "To increase the impact and reach of injury prevention programs and to maximize the expertise and resources available, injury prevention and safety professionals have to expand collaborative activities and work together."⁸

Budgetary constraints may also provide the impetus for effective, purposeful collaborations. When fiscal challenges arise, the need to conserve resources, reduce unnecessary duplication of services, and achieve greater reach in a given community becomes even more pressing than in times of surplus. When state dollars for transportation, health, education and safety are all shrinking, shared approaches that are presented as a common cause have greater credibility to funders. When issues are presented by multiple interests, they can reach broader constituencies and as a result, may have greater success in communities and bureaucracies.⁹

Effective collaboratives that represent diverse agencies may also be more appealing to funders. Increasingly, federal and state funders are looking to support groups that represent multiple sectors (e.g., schools, health departments and community members) or multiple disciplines (e.g., law enforcement, health services, and city planners). Collaborations that are up and

Addressing issues such as neighborhood design; availability of products; access to services; and safety requires multiple partners and multi-faceted solutions.

EXAMPLE: OLDER ADULT MOBILITY

Developing safe intersections for senior pedestrians is a traffic safety issue best addressed with input from diverse disciplines. An effective and lasting solution to traffic safety for elders does not lie with any single organization.

Public health, optometry and human bio-dynamics research can inform planners and engineers about danger zones for older pedestrians, older adults' behaviors and their needs related to mobility. Transportation engineers can then develop longer crossing signals and city planners can ensure that traffic islands, larger and more visible signs, and attractive, safe resting stops are placed near intersections and along sidewalks. By tapping each other's expertise, professionals can improve traffic safety utilizing a more integrated approach. The likelihood that changes to the streets will be accepted by local constituents is enhanced greatly if proposed approaches are advanced and promoted by a community collaborative. Needless to say, it is not simple to figure out all of the key players interested in and capable of reducing pedestrian injuries to the elderly. At the same time, unless all potential stakeholders are engaged, it is likely that the full range of approaches and possible solutions will not emerge. On Queens Boulevard in New York City such an effort was developed. There were numerous deaths and injuries on this street and investigation revealed they were largely occurring among seniors. Further study showed those who had impaired mobility didn't have enough time to get across the streets. The signal timing was changed and the center islands were expanded. Deaths and serious injuries plummeted.¹⁰

running are best situated to respond to requests for proposals quickly. Existing collaborations are also more likely to present a cohesive structure and demonstrate to funders a history of effectively working together.

Innovations in data sharing, public-private sector partnerships and new legislation often result from diverse groups and agencies working together. Strategic collaborations can bring together individuals and organization with distinct, but complementary skills that allow the collaboration as a whole to use resources effectively, to advance research and practice and to use systems thinking to understand common problems and develop shared solutions.

COLLABORATION MATH: A TOOL FOR MULTIDISCIPLINARY COLLABORATIONS

Successful collaborations require developing a working knowledge of how other agencies (or disciplines) think, function and define success. Mandates, problem definitions, data sources, and stakeholders are likely to be different, especially when working across disciplines. *Collaboration Math* was designed to aid multidisciplinary groups and it can also be used to facilitate collaboration between similar organizations, such as multiple school districts, or agencies within a public health department. Specifically, *Collaboration Math* helps multidisciplinary groups:

- Identify common and divergent approaches and goals
- Better understand each other's perspectives
- Take stock of individual and collective resources
- Identify what (or who) is missing
- Forge comprehensive approaches and joint solutions
- Clarify how people from each discipline view and approach the issue
- Avoid the assumption that people from different disciplines think the same (or even similarly) about the issue
- Avoid incorrect assumptions about shared language or perceptions
- Orient new collaborative members to the breadth and depth of the organization
- Distinguish the added value and role of additional disciplines that join the group

Collaboration Math provides a structure for deepening a group's understanding of its own anatomy—starting with the basics, such as, “Who is ‘at the table’?”, “What resources do they bring?” and “How do they envision their role in developing solutions?”

Collaboration Math illustrates the range of strategies, solutions, and outcomes that each participating group uses and can help diverse groups combine their various definitions, goals, and strategies through such processes as *averaging* definitions, *adding* data sources, *multiplying* training efforts, and *averaging* solutions. The remainder of this document describes the tool and its application at the TSC.

Collaboration Math is designed to eliminate misconceptions, clarify the benefits of collaboration and suggest what needs to be better understood or studied.

HOW COLLABORATION MATH WORKS

Collaboration Math uses a matrix in which each collaborative member provides key information according to a common set of categories (See below).

SAMPLE COLLABORATION MATH MATRIX (PARTIAL)

	Problem Definition	Key Issues	Data	Funding	Training	Partners	Approaches/ Outcomes
Group A							
Group B							
Group C							
Implications							

A representative from each group or discipline should provide the information in each category as it pertains to his/her agency or discipline. The representative will fill in the row moving from left to right, starting with the name of his/her discipline in the far left column of the table (listed as Group A, B, C above). All of the information from each discipline should be filled in or transcribed onto one table. Once the information is compiled, a facilitator can work with the group to compute the “math.” Because the process can be rather complex and the tool is still new, a facilitator who is familiar with the tool and skilled in its application can provide guidance and encourage groups to give candid answers. The facilitator can address any unanswered questions related to the tool and can help provide guidelines that may be useful to the group.

Specific matrix categories can vary based on the particular collaboration; however, suggested, useful categories are:

Problem Definition

How does each participant define the issues? What language do participants use to define the issues?

Key Issues

What are each participant’s priority areas related to the issues?

Data/Evidence

What information does each participant collect, and how? What is the information to which each reacts with concern? What evidence affirms that efforts are succeeding?

Funding

What funding sources or other resources does each participant bring?

Training

What expertise can each participant share with other participants? Who does each participant typically train? From whom does each participant receive training?

Partners

To what other types of groups is each participant connected? In what other networks do partners participate?

Approaches/Outcomes

What specific results is each participant seeking?

The information entered in the matrix provides the raw material for a discussion of implications. Use of the matrix allows collaborators to see the 'big picture' and lays the groundwork for an organized discussion of the implications of the table's contents. The following paragraphs discuss types of *Collaboration Math* that can be applied to the different columns as viewed by the TSC.

Entries in the **PROBLEM DEFINITION** column can be *averaged* to arrive at a common way of defining and speaking about the problem at hand. The shared definition usually represents an agreed upon description that the entire group can utilize. Technical terms should be discussed thoroughly, as sometimes the same word may hold different meanings for different disciplines. For example, traffic engineers and police officers both use the term "warrants" differently. The police officer issues warrants to make arrests, but to a traffic engineer a warrant is the guideline needed to put a traffic safety device in place.

KEY ISSUES help characterize the main elements of work for each discipline and describe how different members of a collaborative think about the topic at hand. For example, some of the key concerns of optometry representatives of the TSC might be issues like signage and headlight illumination whereas law enforcement or health representatives might focus on a topic like driving under the influence (DUI). To identify the group's key issues, the facilitator may *average* the information in the Key Issues column to arrive at a common set of concerns.

Information in the **DATA** column should represent data regularly used by the members rather than data each discipline is responsible for collecting. This may reveal some levels of collaboration that are already taking place. For example, public health professionals working in traffic safety regularly use Fatality Accident Reporting System (FARS) data. Although FARS data is collected by the National Highway Traffic Safety Administration—not public health departments—a public health professional may include FARS among the list of data sources used by public health. Once filled in, the Data column provides a foundation for better understanding the existing data sources used by each group, those that are potentially available to the group as a whole, and also sheds light on the key indicators that each discipline relies on to measure impact and/or effectiveness of intervention

The Collaboration Math matrix allows people to see the 'big picture' and lays the groundwork for an organizational discussion.

strategies. By scanning down the Data column, the breadth of data that is available to the group becomes apparent. Data can be *added*, revealing a list of all available data sources that may be shared across disciplines.

The **FUNDING** column may be ‘added’ once each participant identifies funders and sources of funding. The group may not want to start out revealing funding sources during initial conversations. The decision to discuss funding should be considered in light of the possibility that collaborators may unknowingly be competing for the same pots of money. In some cases funding would best be addressed once group members are comfortable with each other, due to the sensitive and potentially politically-charged nature of the topic. A facilitated and structured discussion might yield the best results. For example, several members of the group may be interested in seeking funding for reducing impaired driving and identify ways to add value to funding proposals, rather than working in competition.

The **TRAINING** column is an opportunity for participants to delineate who they train, who trains them, and the subject(s) and format of trainings. The information in the Training column can be *multiplied* to reflect the capacity of the group and individual members to reach others as participants share expertise and methodologies. The matrix also outlines the potential for cross-training as individuals learn and apply each other’s methods. Training is also *multiplied* as the group begins to identify a much broader group of potential trainers and trainees beyond collaborative members. All members might benefit from a better understanding of the kinds of road enhancements and signage that improve walkability and level of service through a training from traffic engineers and optometrists.

The **PARTNERS** column can be *added* to reflect the network that the group collectively represents. There may be overlap between partnering agencies. The group should decide ahead of time whether or not to include both formal and informal partnerships. In any case, once the partners are added, it becomes clear that the reach of the group is larger than that of any individual or organization.

APPROACHES/OUTCOMES are the types of efforts a group uses to achieve results and the outcomes that they are seeking. This column may include typical strategies and/or an overall statement about what the group envisions as a solution to the problem. The Approaches/Outcomes column can be *added* to reflect the desired outcomes of all participants in the group or *averaged* to arrive at a common desired solution or outcome. Thus the TSC describes its overall objective as a multidisciplinary collaboration in research, education and outreach.

IMPLICATIONS: When the columns in the matrix are filled in by all members, the facilitator works with the group to analyze and calculate the results of the table. The analysis is summarized in the Implications section of the matrix, which can be an ongoing resource and reference to the group.

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THE TRAFFIC SAFETY CENTER AND COLLABORATION MATH

THE FIVE GOALS OF THE TRAFFIC SAFETY CENTER

The Traffic Safety Center uses a collaborative approach to advance interdisciplinary methods for understanding and preventing injuries as illustrated by its five strategic goals.

1. ORGANIZATION: To maintain a multidisciplinary focus through a broad-based and active staff, Steering Committee and Advisory Board.

The **ORGANIZATION** of the TSC supports its multidisciplinary mission by ensuring that staff, steering committees, and advisory boards have a broad understanding of the overall approach and its value. Meeting agendas and collaborative materials reflect a mix of items relevant to each discipline to emphasize the added value of a multidisciplinary approach. By holding meetings at different organizations, the TSC encourages its members to become familiar with, and better understand the work of, other members.

2. EDUCATION AND TRAINING: To introduce current and future researchers and practitioners in public health, engineering, planning and other disciplines to issues in traffic safety and injury control, and to provide them with appropriate skills, tools and knowledge.

EDUCATION AND TRAINING present opportunities to broaden the knowledge-base of students and professionals as they educate and train across disciplines. Such an approach has the potential to result in a new cadre of practitioners and researchers that is skilled at working across disciplinary boundaries. However, promoting a meaningful, multidisciplinary training agenda requires the development of new materials and approaches.

3. RESEARCH: To capitalize on the wide variety of nationally recognized transportation, vehicle, public health, and safety research and to leverage these multiple disciplines and investigators to a distinctly identifiable set of research products aimed at traffic safety issues facing communities in California.

RESEARCH at the Center focuses on advancing a multidisciplinary research agenda. By engaging multiple disciplines, new areas for study can be defined and explored jointly. In addition, new analytic tools, data linkage and research methods can be applied across disciplines, bringing about new innovation and increasing the knowledge-base for future researchers.

4. TECHNICAL ASSISTANCE: To provide public and private organizations with technical assistance in the areas of data collection and analysis; program development, implementation, and evaluation; grant development; and other project activities.

TECHNICAL ASSISTANCE is an important mechanism for providing other organizations with the tools and skills to be effective in traffic safety. As the TSC builds its base of research products and tools, it will need to continually train those who can use these approaches successfully in professional and community settings.

5. PUBLIC INFORMATION: To be a source of information on traffic safety issues for government, professional, academic, and community programs and departments, as well as for the general public.

PUBLIC INFORMATION provides the opportunity to disseminate information to a diverse audience. Public information in traffic safety is critical because constituents need to be made aware of the magnitude of the problem and effective solutions and political resources. Public information is also an important vehicle for communicating to legislators and decision-makers that there are proven and effective strategies for reducing traffic-related injuries that can save lives and money. Public information is most effective when it is tailored to specific audiences so that they can clearly see how traffic safety is an issue they should be concerned about.

COLLABORATION MATH IN ACTION: TSC APPLIES THE TOOL

The TSC is committed to fostering a collaborative approach by bringing together the participants necessary to enhance the likelihood of decreasing traffic crashes and fatalities. For example, one meeting was held at a location where new auto technologies are tested. The meeting enriched member knowledge of technical aspects of traffic safety previously unfamiliar to many participants. This approach distributes the responsibility of hosting meetings among participants, but more importantly creates an opportunity for participants to better understand each other.

Prevention Institute worked with other members of the TSC to use the *Collaboration Math* tool. The goal of the process was to support and advance the TSC's multidisciplinary efforts by clarifying and documenting the diverse elements and perspectives of participating disciplines.

The *Collaboration Math* matrix (on the next page) reflects information provided by participants of the Traffic Safety Center. Prevention Institute staff collected the information from lead participants in the Center. The table shows a partial *Collaboration Math* chart (the **FUNDERS** and **KEY ISSUES** columns have been omitted for simplicity).

THE TRAFFIC SAFETY CENTER'S COLLABORATION MATH MATRIX (PARTIAL)

Participant	Problem Definition	Data	Training	Approaches/ Outcomes
Public Health	Traffic safety is a community health problem	Morbidity and mortality rates Hospital admissions Emergency Rm data Fatality Accident Reporting System (FARS)	Identifying at-risk communities and individuals Effects of transportation on health	Education campaigns Community participation Environmental and policy change
Law Enforcement	Traffic violations are a community safety issue	Moving violations Crash reports	Promoting use of occupant restraint systems Enforcement techniques Crash investigations	Check points Patrolling and citations Education campaigns
Transportation Engineering	Transportation infrastructure should promote safe and efficient travel	Police reports Crash reports Speed volume and congestion studies FARS	Identifying dangerous roads Safer road and sidewalk design	Improved vehicle safety devices Safer roads and sidewalks Traffic calming
Optometry	Optimal visibility of signals and hazards improves traffic safety	Human factors studies of acuity and driver performance Reaction time to various signals and signs	Identifying how people visualize traffic signs and signals	Better vehicle display, signal and road designs Better driver assessment for licensing purposes
Planning	Traffic safety can be affected by transportation system design and travel behavior	Surveys of travel behavior Census data Zoning maps Traffic congestion and speed counts	Transportation demand Transportation behavior Effect of infrastructure on length and types of trips	Create "safe havens" for vulnerable users Create transportation systems that minimize conflict between users (i.e., pedestrians, bicyclists, and motorists).
Math	Average	Sum	Product	Sum/Average
Implications				

Arriving at a **PROBLEM DEFINITION** helped each discipline (public health, law enforcement, transportation engineers, optometry, and planning) learn how the others defined traffic safety. This way the group became better equipped to arrive at a definition for the center that would be inclusive and fully reflective of the group's diversity.

By filling in the **DATA** column, transportation engineers and public health professionals at the TSC saw that both groups identified FARS data as a resource. Interestingly, this data is generated by neither group but by NHTSA and comes from information collected by law enforcement. But it reaffirms to the group the value of sharing information. Awareness of this common data use can help TSC members to identify a common language for discussing traffic safety issues and to help focus prevention/intervention efforts. Having multiple data sources at the ready broadly illustrates the traffic safety problem and can strengthen grant proposals, which often require a clear and concise definition of the problem and its impact on communities. The TSC can now use the matrix to quickly see what data is available (or conversely what may be missing) to define and address key traffic safety issues.

The **TRAINING** column provides TSC participants with a menu of training opportunities. TSC members can provide training for each other, enhancing each member's capacity. The Training column also shows the collective capacity of the group to train others. Training is *multiplied* because members can cross-train each other or can offer trainings external to the group. Once groups effectively train each other, the work of delivering external trainings can then be divided among group members, lessening the work for any one group member.

The *Collaboration Math* tool allowed the Traffic Safety Center to define commonalities among various **APPROACHES/OUTCOMES**. Each group has its own mandates, but scanning down the Approaches/Outcomes column quickly reveals joint approaches and synergy of TSC members. The Approaches/Outcomes column demonstrates considerable overlap and distinct approaches between disciplines. *Averaging* this column revealed that multiple disciplines view environmental change as a plausible solution while others employ different solutions such as educational campaigns to raise awareness. *Adding* together these educational campaigns (i.e., choosing a common theme and time) can maximize effectiveness.

INITIAL IMPLICATIONS OF TSC'S COLLABORATION MATH MATRIX AND NEXT STEPS

Once the matrix was filled out, it became available to the group as a catalyst for discussion and analysis. As noted earlier, each of the five strategic goals of the TSC—Organization, Education and Training, Research, Technical Assistance, and Public Information—demonstrate an intentional

emphasis on and commitment to multidisciplinary collaboration. Carrying out each goal with an emphasis on multidisciplinary work is challenging; therefore, the tool can be a useful resource for further discussion and reflection as the Center evolves. The tool can be a “reflection piece” to ensure that each of its five strategic goals continue to reflect the multidisciplinary foundation upon which the center was created.

The TSC has shared their *Collaboration Math* matrix with the TSC’s Advisory Board to give them a sense of the broad capacities of the TSC and to help members more clearly envision ways to build upon the Center’s multidisciplinary strength. The *Collaboration Math* tool also proved useful to the TSC as a means of orienting Advisory Board members to the breadth and depth of the group’s goals, definitions and strategies.

In the future, the *Collaboration Math* matrix can provide TSC members with a record so that they can identify next steps, additional partners or shared approaches. As representatives to TSC change over time, the *Collaboration Math* tool is a physical record to help them understand others’ perspectives and languages. If new disciplines join the Traffic Safety Center, the group may choose to update the *Collaboration Math* chart. This process is critical because it demonstrates that each discipline’s understanding of and contribution to the problem is valued by the group and relevant to the work.

CONCLUSION

One of the reasons groups join together is to achieve successes that none is likely to achieve in a stand-alone effort. Multidisciplinary collaborations take a special level of skill and commitment. Harnessing the skills, momentum and commitment of individuals with distinct skill sets, funding streams, analytical tools, and goals can be challenging. While tools and processes do not make the challenges of collaboration disappear, they do provide strategies for acknowledging and addressing difficult issues.¹⁴

This paper described *Collaboration Math* and its utility at the University of California Berkeley's Traffic Safety Center, a multidisciplinary collaboration focused on preventing traffic-related injuries and fatalities. The tool can also be applied to different disciplines and during a "visioning" process. Like all tools, it must be used in the right situation, with skill and creativity. Certainly, no tool is a substitute for effective, committed people. Ultimately, it is the people in the collaborative and their efforts, vision, and relationships that will determine the collaborative's effectiveness. *Collaboration Math* was developed to assist groups and individuals working in collaboration to be more effective. When a collaborative works well, the result can be a powerful force for mobilizing individuals to action, bringing health and safety issues to prominence, forging joint solutions and developing effective policies.

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Assistant Director,
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Irvine, CA

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ENDNOTES

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