

Multidisciplinarity, interdisciplinarity, and transdisciplinarity in health research, services, education and policy: 2. Promotors, barriers, and strategies of enhancement

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Abstract

Background/Purpose. Multidisciplinary, interdisciplinary and transdisciplinary teams are increasingly encouraged in health research, services, education and policy. This paper is the second in a series. The first discussed the definitions, objectives, and evidence of effectiveness of multiple disciplinary teamwork. This paper continues to examine the promotors, barriers, and ways to enhance such teamwork.

Methods. The paper is a literature review based on Google and MEDLINE (1982-2007) searches. “Multidisciplinarity”, “interdisciplinarity”, “transdisciplinarity” and “definition” were used as keywords to identify the pertinent literature.

Results. The promotors of teamwork success include: good selection of team members, good team leaders, maturity and flexibility of team members, personal commitment, physical proximity of team members, the Internet and email as a supporting platform, incentives, institutional support and changes in the workplace, a common goal and shared vision,

clarity and rotation of roles, communication, and constructive comments among team members.

The barriers, in general, reflect the situation in which the promotors are lacking. They include: poor selection of the disciplines and team members, poor process of team functioning, lack of proper measures to evaluate success of interdisciplinary work, lack of guidelines for multiple authorship in research publications, language problems, insufficient time or funding for the project, institutional constraints, discipline conflicts, team conflicts, lack of communication between disciplines, and unequal power among disciplines.

Conclusion. Not every health project needs to involve multiple disciplines. Several questions can help in deciding whether a multiple disciplinary approach is required. If multiple disciplinarity is called for, eight strategies to enhance multiple disciplinary teamwork are proposed. They can be summarised in the acronym TEAMWORK - Team, Enthusiasm, Accessibility, Motivation, Workplace, Objectives, Role, Kinship.

Although there is evidence demonstrating improved outcomes by virtue of good teamwork that involves multiple disciplines, there has been little work on the relationship between team process and outcomes.¹ In other words, it is not fully known why teamwork improves outcomes. Various attributes have been promoted as the essential qualities of successful multiple disciplinary health care teamwork, including diversity of team members, shared records, improved communication between doctors and patients, a clear role for the patient, specialist input, consensus on management, and close coordination.² It has also been argued that diversity of professional, cultural, and demographic characteristics provides varied perspectives on decision making and may improve problem solving and creativity.¹

A previous paper reviewed the definitions of the terms multidisciplinary, interdisciplinary and transdisciplinary, and discussed why and under what circumstances multiple disciplinary efforts are useful, with health examples.³ This paper continues to discuss their promoters and barriers, and proposes strategies to look for and nurture multiple disciplinary efforts. As the terms multidisciplinary, interdisciplinary and transdisciplinary refer to multiple disciplinary to varying degrees on the same continuum,³ this paper uses the term “multiple disciplinary” to denote all three terms when used in a general sense.

Methods

This is a comprehensive review of the literature based on Google and MEDLINE searches. The methods were described in detail in the previous paper.³ Google searches were performed using “multidisciplinarity”, “interdisciplinarity”, “transdisciplinarity” and “definition” as keywords to identify the pertinent online literature. MEDLINE searches using a similar search strategy were conducted from 1982 to early-2007 to identify relevant publications in the medical and scientific literature.

Results

1. Promotors (P) for Success

Good selection of team members (P1)

Teams formed to address multiple disciplinary problems are mostly temporary.⁴ Teams must be able to change as the problem changes or new problems are addressed. There are three ways in which teams are formed: (1) formal assignment of teams to address a problem; (2) serendipitous coming together of interested colleagues; and (3) choosing a team leader who then finds the team members. Assigned teams do not usually work. In this world with demands to solve complex problems in a short time frame, it may not always be possible to wait for the establishment of self-generated collaborations. Knowledge maps, showing what people are actually doing, may help the formation of ad hoc teams. In forming a team, the best success would come from the third way (choosing a leader), although one must watch out for and use measures to avoid a tendency towards a “tribal” situation.⁴

Good team leaders (P2)

Wilson et al found that in teams which lacked the personal commitment of a “player manager”, staff reported they were “coping”, “managing” or even “struggling” with situations in the team.⁵ Good team leaders can set examples and, in turn, have a “domino effect” on the rest of the team members by sharing their vision through working closely together.^{5,6} A good team leader must: have good ideas and vision, realize that multiple kinds of expertise are needed, know whom to call, have good interpersonal skills, have the humility to work with really good people, have enough familiarity with the disciplines involved to be able to communicate with the team members, and have the willingness to make the effort to keep everyone on the team.⁴ Some of these attributes can be taught or encouraged, but some are just inherent. If a team is already multiple disciplinary, the tendency to

look outside a single discipline is built-in. If the team is all from the same discipline, then a "bold thinker" is needed to introduce ideas from the outside world.⁴

Maturity and flexibility of team members (P3)

A truly integrated interdisciplinary perspective requires that the participants have a great "degree of maturity and flexibility with regard to their knowledge base".⁷ They recognize that an answer to the question requires examination by a variety of disciplines. A correct mix of personality types is important. A room full of iconoclasts isn't going to work – group dynamics matter.⁴

Personal commitment of team members (P4)

Committed team members are important to the success of multiple disciplinary teams.^{8,9} Successful multiple disciplinary teams often have the key ingredient of focus on a question of interest to members from different disciplines.⁴ Members are committed fully if their career goals depend on the team's success, e.g. the solution to the question can bring substantial recognition to the individual members and the team.⁴

Physical proximity of team members (P5)

To be able to work together, the team must be brought together, either physically (conventional teamwork)¹⁰ or virtually (electronical teamwork).¹¹ But as Clark points out, "putting people together in groups representing many disciplines does not necessarily guarantee the development of a shared understanding".¹²

The Internet and email as a supporting platform (P6)

The Internet is a logical platform for supporting multiple disciplinary teamwork.¹¹ The Internet and email are an effective communication system that serves to bring experts from different disciplines and from different parts of the world to work together. For example, a report that summarizes the experience of

chronic disease surveillance efforts in North, Central and South Americas, prepared by a multiple disciplinary team of 20 members from governments, universities and non-government organizations from nine countries, was completed entirely through email.¹³ An electronic team works best (and in some cases works only) if at least the key players already know (and hopefully therefore trust) one another.

Incentives (P7)

One incentive to working together is the challenge of finding answers to an interesting question.⁴ Actually finding an answer to the question can be inherently rewarding to the team members. Other incentives may also need to be explored and utilized, such as those offered by management to change the corporate culture.

Institutional support and changes in the workplace (P8)

Structural and cultural changes must happen in the workplace to encourage and create opportunities for different professions to work together.⁸ These may include implicit requirements of different professionals in work practices, and corresponding changes in the performance evaluation, incentives and reward system,¹⁴ as well as explicit support from the host organization.^{8,10}

A common goal and shared vision (P9)

It is important to develop a common goal and a shared vision with all team members.^{15,16} It is recommended that participants "understands the core principles and concepts of each contributing discipline and they are familiar with the basic language and mindsets of the various disciplines represented".¹² Synergy between people having different specialized skills produces breakthroughs when needed to achieve the common goal.⁴ However, the process to develop a shared vision can be laborious and time-consuming.^{8,9}

Clarity and rotation of roles (P10)

Team roles should be clearly negotiated with team members.⁸ Staff motivation is maintained by allocating and rotating team roles, forming what is called "a roles and responsibilities matrix".⁵ After a period of time it is important for team members to move on and pass the role on to someone who is coming to it fresh.⁵

Communication among team members (P11)

Communication is more than a one-way transfer of information. Through "now we both know a fact that only one of us knew before", minds interact, and new ideas emerge.¹¹ It is desirable to have team members work together like a family, showing care and cohesiveness. Team members should be encouraged to share information and insights with each other in an open and positive manner.⁸

Constructive comments among team members (P12)

Team leaders should constantly provide "feedback on performance" to the team members.⁵ Team members appreciate informal feedback and constructive suggestions - they like to be told they're doing things well, and will try if they're not.⁸

*2. Barriers (B) to Success**Poor selection of the disciplines and team members (B1)*

The structure of a team is determined by the membership composition and their hierarchic organization.¹¹ Selection of the disciplines and the team members to represent the selected disciplines can make or break, or change the direction of the research process. The right people can work together to overcome barriers, so it is important to get the right people together.⁴ However, sometimes the required expertise may not be available,¹⁷ and a single member is unlikely to be able to adequately represent the perspective of a discipline.¹⁸

Poor process of team functioning (B2)

Team process is determined by which methods are used for team communication, by the hierarchic nature of the team, by the values of team members concerning power sharing, and by idiosyncratic relationships that develop within the team.¹¹ How do researchers from different disciplines work together during the different stages of the research?¹⁸ Can scientists and policy makers work together?¹⁴ Are there clear leadership, coordination and communication?¹⁷ Management's lack of understanding of the need to take a broad interdisciplinary approach to problem solving can result in team members from different disciplines having to find ways to breach this barrier before moving forward with the project.⁴

Lack of proper measures to evaluate success of interdisciplinary work (B3)

It is hard to become an expert in two or more disciplines. Who is qualified to evaluate multiple disciplinary work? The notion of peer review entails the idea that the work is evaluated by someone who works on similar topics. But what if peers in that sense do not exist?¹⁹ Because nobody can judge the content of interdisciplinary work, most evaluators systematically rely on indirect quality indicators, or "field-based measures" (e.g. number of patents and publications, or type of journals and funding agencies associated with the research work).²⁰ Measures that directly address epistemic dimensions of interdisciplinary work (e.g. explanatory power, aesthetic appeal, comprehensiveness) are rare, as they are difficult to obtain.²¹ Team members can lose interest if it is not clear whether a multiple disciplinary team is doing better than people working by themselves.

Lack of guidelines for multiple authorship in research publications (B4)

Authorship and intellectual property rights can be a concern.²² The traditional emphasis on first and solo

authorship as a criterion for tenure and promotion consideration is a disincentive to multiple authorship.²³ Many institutions place an emphasis on single author publications as their reward structure. This discourages scientists from tackling projects that require an interdisciplinary team. Conflicts could arise because of what is considered the "norm" in ordering the author's names within each discipline. The prestige of authorship position varies within and across disciplines. For example, first authorship is generally the most valued status in nursing^{22,24} and psychology.²⁵ In medicine, the final author is often the principal investigator and thus this position is also highly valued.^{22,23} But in economics, authors are considered to have equally contributed to the paper and are likely to be listed alphabetically.²⁶ Additionally, there are not as many outlets to publish interdisciplinary work.⁴ Disciplines differ dramatically in the acceptance rate of articles in their professional journals and in the average length of time between submission and acceptance of a study for publication.²³ For example, the average acceptance rates in the top five journals of several disciplines were: 9% in economics, 22% in psychology, 69% in physics;²⁷ and 42% in 75 health-related journals.²⁸

Language problems (B5)

Experts from different disciplines and backgrounds usually speak different languages and use different jargon and acronyms.^{14,19} For example, terms like "sensitivity" or "significance" may mean different things in different disciplines. It takes time for team members to learn the other "languages", and in some cases, "knowledge brokers" or "translational scientists" are required to go between team members of different disciplines.¹⁴ Fedor-Freybergh proposes that a new common language needs to be developed, a language that would be understood across disciplines and would be able to assist in getting beyond semantic problems.²⁹

Insufficient time for the project (B6)

Multiple disciplinary research may require a longer timeframe, due to inherent differences among team members, working in a collaborative manner, and in an area new to them.¹⁷ Developing transdisciplinarity takes time and commitment; understanding the language of other disciplines also takes time. Therefore, sufficient time must be allocated to complete the project. Patience is a virtue that everyone needs when working in a multiple disciplinary team.³⁰

Insufficient funding for the project (B7)

Funding barriers result from no one entity being responsible for funding multiple disciplinary projects and the reluctance of disciplinary bodies to fund "on-the-edge" work.⁴ Furthermore, teamwork often costs more and demands more resources.

Institutional constraints (B8)

Institutions are often disciplinarily organized, and may become an impediment to multiple disciplinary teamwork.¹⁹ Decisions about tenure, promotion, merit pay, course release, and sabbatical leave usually depend on academic departments' and university committees' assessment of individuals' productivity. This may discourage faculty members from being involved in multiple disciplinary efforts.²³

Discipline conflicts (B9)

In some cases a common methodology may be impossible given that disciplines differ in the concepts that are considered foundations of their analyses, in the questions they seek to answer, and in their research methods.^{19,31} With respect to concepts and objectives, social sciences have a preference for experiences and qualitative methods, while natural and medical sciences have a preference for systematic observations and measurement.^{32,33} Besides preference, there is a problem of possibility. Even though everyone would prefer experimental evidence, experiments have been

problematic for a lot of the social sciences. Different disciplines may have a stronger preference for, and expectation toward, the use of more qualitative vs. quantitative methods.²³ Depending on their disciplinary backgrounds, personal education and experience, members of the team may understand the questions differently, or choose to answer different parts of a question.²³

Team conflicts (B10)

Team conflicts can develop because of internal or external stresses, individual issues or a corporate problem,³⁴ such as role ambiguity, role overload, interpersonal conflict, inadequate communication and leadership dilemmas.³⁵ A longstanding team may become self-sufficient, or resistant to new ideas. Underground communication (e.g. rumour, gossip) may destroy the trust and openness required to function as a team. Conflict between two team members and problems such as a dominant member, an isolated member, team factions and team secrets are all potent means of disrupting team function.³⁶ Poor definition of authority and individual responsibilities and roles, poor performance feedback processes, and reluctance to cooperate, collaborate and compromise can undermine a team's capacity to achieve its goals.³⁶

Lack of communication between disciplines (B11)

Lack of communication prevents the full realization of the benefits of interdisciplinary teamwork.¹⁷ Good communication promotes a good working relationship.

Unequal power among disciplines (B12)

Power is associated with disciplines, and not all disciplines are equal in a multiple disciplinary process.^{8,18} As Becher suggests, some disciplines "are so strongly defended as to be virtually impenetrable; others are weakly guarded and open to incoming and outgoing traffic".³⁷ Inevitably one discipline will dominate and

drive the teamwork process. This can eventually lead to group rivalry and end the multiple disciplinary effort, as Bailey describes, "the Big-endians fought with the Little-enders, the chickens starved".³⁸ The lack of respect for other disciplines can also be a problem. Perceptions and stereotypes can colour and even poison multiple disciplinary relationships.

3. To Pursue or Not to Pursue Multiple Disciplinarity

Not every research project needs to involve multiple disciplines. As Sperber suggests, "Interdisciplinarity is not always a good thing, nor specialisation a bad thing, for the advancement of science".³⁹ One must be careful that there may be no need or rationale for such a team. The management may read a paper like this, decides it is the flavour of the month, and mandates teams when, in fact, there is no basis for a multiple disciplinary team to exist.

Whitfield and Reid provide a list of six questions to help guide the decision on whether and why a multiple disciplinary process is needed:¹⁸

- Is a single discipline approach insufficient, and why?
- Are there disciplines potentially useful, and which ones?
- Are there experts who can represent those disciplines, and how?
- Does the project require various disciplinary experts to work together (instrumental) or to create new theory or method (epistemological), and which one?
- Are there good managers to ensure success of the process, and how?
- Is there an evaluation of success, and how?

Discussion

From this review, the promoters (P) of teamwork success include: P1. good selection of team members, P2. good team leaders, P3. maturity and flexibility of team members, P4. personal commitment of team members, P5. physical proximity of team members, P6. the Inter-

TABLE 1. Strategies to enhance multiple disciplinary teamwork, summarized in an acronym TEAMWORK.

	Strategy	Promoting the promotors (P)	Barring the barriers (B)	The 14 C's of teamwork
T	Team	P1. good selection of team members P2. good team leaders P3. maturity and flexibility of team members	B1. <i>avoid</i> poor selection of the disciplines and team members B2. <i>avoid</i> poor process of team functioning	- Coordination of efforts - Conflict management
E	Enthusiasm	P4. personal commitment of team members	B3. <i>avoid</i> lack of proper measures to evaluate success of interdisciplinary work B4. <i>avoid</i> lack of guidelines for multiple authorship in research publications	- Commitment
A	Accessibility	P5. physical proximity of team members P6. the Internet and email as a supporting platform	B5. <i>avoid</i> language problems	- Cohesiveness (team sticks together) - Collaboration
M	Motivation	P7. incentives	B6. <i>avoid</i> insufficient time for the project B7. <i>avoid</i> insufficient funding for the project	- Contribution (feeling this is being made)
W	Workplace	P8. institutional support and changes in the workplace	B8. <i>avoid</i> institutional constraints	- Corporate support
O	Objectives	P9. a common goal and shared vision	B9. <i>avoid</i> discipline conflicts	- Confronts problems directly
R	Role	P10. clarity and rotation of roles	B10. <i>avoid</i> team conflicts	- Cooperation - Consensus decision making - Consistency
K	Kinship	P11. communication among team members P12. constructive comments among team members	B11. <i>avoid</i> lack of communication between disciplines B12. <i>avoid</i> unequal power among disciplines	- Communication - Caring - Chemistry (personality, "good fit")

net and email as a supporting platform, P7. incentives, P8. institutional support and changes in the workplace, P9. a common goal and shared vision, P10. clarity and rotation of roles, P11. communication among team members, and P12. constructive comments among team members.

The barriers (B) reflect the situation in which the promotors are lacking. These include: B1. poor selection of the disciplines and team members, B2. poor process of team functioning, B3. lack of proper measures to evaluate success of interdisciplinary work, B4. lack of guidelines for multiple authorship in research publications, B5. language problems, B6. insufficient time, B7. insufficient funding for the project, B8. institutional constraints, B9. discipline conflicts, B10. team conflicts, B11. lack of communication between disciplines, and B12. unequal power among disciplines.

This paper, the second in a series, examines the promotors and barriers for successful multiple disciplinary teamwork. Wiecha and Pollard provide a list of "12 Cs of teamwork",¹¹ or 12 processes which, when applied to a team, might reasonably be expected to produce creative synergies among team members. The 12 Cs are: (1) Communication, (2) Cooperation, (3) Cohesiveness (team sticks together), (4) Commitment, (5) Collaboration, (6) Confronts problems directly, (7) Coordination of efforts, (8) Conflict management, (9) Consensus decision making, (10) Caring, (11) Consistency, (12) Contribution (feeling this is being made). Based on our literature review, we add two additional Cs: (13) Corporate support, (14) Chemistry (personality, "good fit").

The first step in developing a strategy for multiple disciplinary teamwork is to decide whether it is needed.

Multiple disciplinary teamwork does not always work, nor is it always called for. Obviously it is not necessary to involve multiple disciplines in every single project. The list of 6 questions provided by Whitfield and Reid can help guide decisions on whether to engage multiple disciplinary teamwork.¹⁸

If multiple disciplinarity is called for, then we propose eight strategies to enhance multiple disciplinary teamwork, based on findings of our literature review as presented in this paper. These strategies may be summarised in the acronym TEAMWORK - for Team (which includes promoters P1-P3), Enthusiasm (P4), Accessibility (P5-P6), Motivation (P7), Workplace (P8), Objectives (P9), Role (P10), Kinship (P11-P12) (Table 1). The eight strategies also correspond to the avoidance of the barriers to success, such as Team (barriers B1-B2), Enthusiasm (B3-B4), Accessibility (B5), Motivation (B6-B7), Workplace (B8), Objectives (B9), Role (B10), Kinship (B11-B12) (Table 1). The 14 Cs of teamwork also form part of the strategies (Table 1).

A third paper will describe the concepts of discipline and inter-discipline distance (epistemological proximity), and propose a view of the knowledge universe to help us decide where to look for multiple disciplinary collaboration.

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