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A Survey of Prevention Science Training: Implications for Educating the Next Generation

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Several reviews of the emerging, transdisciplinary field of prevention science have identified the need for improved and expanded training of researchers as one of the central issues facing the field. A starting place for such an endeavor is an assessment of the current state of training. In that regard, we queried several groups of researchers about training in the prevention of mental disorders and closely related areas. Training experts from federally funded prevention intervention research and training centers were interviewed regarding the content of existing and ideal prevention science training programs. Based on these interviews and a literature search, we identified 13 content areas for prevention training. Through an internet-based survey, we interviewed trainees, early career researchers, and established researchers on their knowledge of and training in these areas. There was no content area in which the majority of early career researchers had a high level of training or knowledge. In contrast, the majority of established researchers were highly knowledgeable about each of six content areas that have represented the "traditional" areas of training in prevention science for the past several decades. Early career researchers had particularly low levels of knowledge and training in the history of prevention research and practice, how to obtain funding for prevention research, and how to conduct economic analyses. Implications of the findings for the education of the next cohort of prevention researchers are discussed.

KEY WORDS: prevention science; public health; graduate; postgraduate; education; training; career development.

Over the past several decades, the academic and practical training of U.S. researchers investigating the prevention of mental disorders, substance abuse, crime, and related problems has occurred within a variety of academic departments, including public health, sociology, psychology, social work, education, and medicine (Albee & Gullotta, 1997; Perry *et al.*, 1996). Given the different cultures within these departments, both the content and the process of prevention research training have varied greatly. Recently, as the "prevention science" of mental and behavioral dysfunction (Coie *et al.*, 1993) has been formally identified as an "umbrella" discipline (Cates, 1995) and an "interdisciplinary field" (Mrazek & Haggerty, 1994), there has been increased interest within the professional community at large for more standardized and coordinated education programs, especially for postdoctoral and mid-career scientists. Most notably, the landmark Institute of Medicine (IOM) report on prevention (Mrazek & Haggerty, 1994) included the need for improved and expanded training of researchers as one of the central issues facing the "new" field.

Despite the existence of some prevention research training opportunities within numerous academic specialties, the majority of active prevention research scientists researching mental disorders are psychologists (Mrazek & Haggerty, 1994). Prevention entered psychology via the community mental health movement that developed following World

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War II and crystallized during the 1960s (Rappaport, 1992). The topic of training in the new "community" psychology was addressed in 1965 at the Swampscott Conference (Elias, 1987), but prevention as a primary focus of training throughout the country did not come of age in psychology until the early 1980s. By that time, psychologist George Albee and colleagues had established an annual meeting on research on the "primary prevention of psychopathology" (e.g., Kessler & Albee, 1975), interest in the prevention of mental health problems had been strongly highlighted by a Presidential task force during the Carter administration, and divisions dedicated to prevention had been created within several federal agencies (Mrazek & Haggerty, 1994).

As professional and political interest in a prevention "science" grew, psychologists noted that traditional research training programs failed to provide students with a solid foundation in a variety of areas crucial to prevention research (Cowen, 1984). There was general agreement that such a foundation consisted of knowledge and skills in two main areas, generative research and executive research. Generative investigations produce scientific knowledge on the natural history of a given problem within a given population, and executive investigations use this knowledge as a base to create, test, and ultimately disseminate preventive interventions within that population.

Similarly, Price (1983) specified four interrelated domains at the core of prevention science research: problem analysis, innovation design, field trials, and innovation diffusion. During *problem analysis*, researchers search for modifiable risk and protective factors related to a problem of interest. Once such factors are found, during *innovation design* researchers attempt to develop an intervention technology that modifies the impact of risk factors or synergizes the effect of protective factors. Promising technologies are then rigorously tested in *field trials,* which often rely on randomization at one or more levels. Finally, technologies that are found to be effective are disseminated in appropriate forms to various populations during *innovation diffusion*. Price recommended training relevant to each of these domains, but acknowledged that most researchers would specialize in only one. Price noted that apprenticeship, coursework, and practical experiences within the fields of epidemiology and intervention research (e.g., clinical or community psychology) were probably most relevant to gaining expertise in the domains, but that a multidisciplinary education that went beyond these basic fields was highly desirable.

Price's recommendations about the education of prevention researchers were echoed a decade later in Mrazek and Haggerty (1994) and colleague's audit of the field for the IOM. The IOM workgroup's version of Price's prevention research domains is referred to as the "prevention intervention research cycle" (see also National Institute of Mental Health [NIMH], 1993, 1996) and is illustrated in Fig. 1. Mrazek and Haggerty noted that "a common inclination" in the field was to view prevention research as the implementation and evaluation of randomized controlled trials, and the IOM workgroup chose to highlight this point of view in their depiction of the research cycle. Weissberg and Greenberg (1998) labeled this inclination the "prevention science" view, and contrasted it with the "collaborative community action research" view of the prevention of mental disorders and related problems. Community action researchers may also conduct randomized trials, but tend to consider other intervention research designs, including uncontrolled trials, as important generators of scientific knowledge as well. In addition, community action research is grounded in a different history and academic and professional culture than prevention science (e.g., Kelly, 1988; Trickett *et al.*, 1996).

Two decades after Price's recommendations and several years after the IOM report, it is unclear if or how these prescriptions for prevention science research training have impacted the field. Unfortunately, there currently exists no systematic documentation of what specific types of training prevention scientists receive, and even if such did exist, there is no previous documentation against which to compare. This gap in knowledge about training is due to a number of factors, including the continued diffusion of prevention science education across numerous academic disciplines as well as the diffusion of prevention researchers across numerous professional organizations. For example, Mrazek and Haggerty (1994) estimated that in 1993, 500 prevention researchers were active in the United States, but at that time no single professional organization with prevention interests, nor any prevention division within such an organization, claimed a membership that approached that number.

In this study, we addressed this gap in knowledge about the state of prevention research training by querying several groups of prevention researchers about training in the prevention of mental

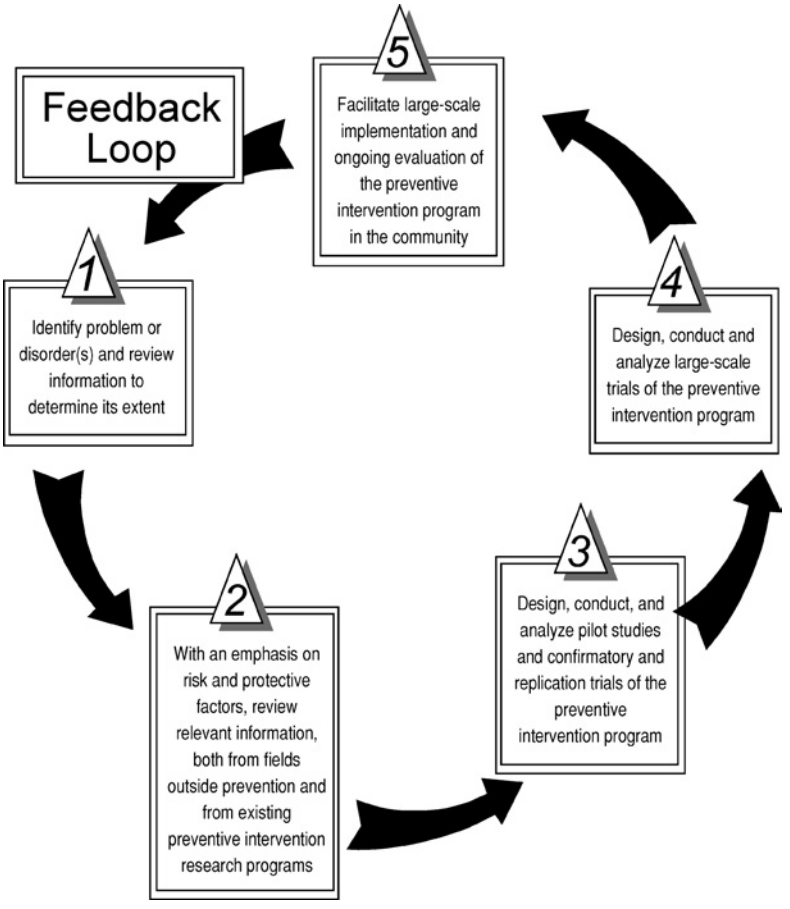

Fig. 1. The prevention research cycle.

disorders and closely related areas. We first interviewed training "experts" (i.e., trainees, research scientists, and professors) working at each of the currently funded NIMH sponsored prevention intervention research centers and/or training centers regarding their views on the most appropriate and necessary content for prevention science training programs. Based on these interviews, we expanded Price's domains to include other areas of perceived importance in prevention training. We then created a survey on the training experiences of preventionists, and surveyed the members of the only early career group (i.e., researchers who recently completed formal training) of prevention science researchers that existed at the time of the survey, the Early Career Preventionists Network (ECPN). ECPN continues to thrive and grow; it is now the largest organization of young investigators that is identified with prevention science.

METHOD

Participants

Participants were 262 self-identified prevention researchers at varying stages of their professional careers (i.e., 38 graduate students, 182 "early career" researchers, and 42 "mid-career" or "senior" researchers). These three groups are referred to in the remainder of this article as "Trainee," "Early Career," and "Established" prevention researchers. Although early career researchers with doctoral training (i.e., potential principal investigators on Federal grants) are of most interest here, researchers at other career levels were retained for comparison purposes. An additional 50 survey completers were excluded from these analyses due to their current professional status (i.e., 20 early career respondents with bachelors degrees who are currently not

participating in further prevention training, 26 respondents who identified themselves as "not a prevention researcher," and 4 respondents who did not classify themselves as any of the above). Demographic information on survey respondents is listed in Table 1. The majority of participants had attained their highest degrees in psychology departments, and the majority had attained their Ph.D. or was currently working towards such. The average age of participants varied by career status (Trainee: 29.6

Table 1. Demographics by Career Phase

	Trainee ($n = 38$)	Early career ($n = 182$)	Established ($n = 42$)
U.S. citizen	95%	89%	86%
Gender			
Male	32	34	64
Female	68	66	36
Ethnicity			
African American	11	8	5
American Indian	3	1	0
Asian/Pacific islander	0	9	2
Latino	8	5	5
White	78	76	88
Current departmental affiliation			
Psychology	55	33	21
Human development	13	9	7
Psychiatry	3	9	10
Public health	8	8	10
Prevention research center	3	11	7
Research institute	0	8	5
Highest degree	(In progress)		
PhD	63	62	71
MA	10	22	5
MS	16	9	7
BA	0	0	2
BS	0	0	2
Department of highest degree			
Psychology	74	70	58
Public health	3	4	5
Human development	3	6	0
Education	3	3	17
Completed a formal postdoctoral fellowship	0	38	20
Current research specialty			
Psychology	55	44	19
Prevention	8	24	32
Human development	16	4	2
Public health	11	9	12
Have attended a professional meeting focusing on prevention research	56	88	86
Have had NIH-funded formal training in prevention research	14	31	15
Ever been a principal investigator on a prevention research grant	5	16	62
Ever worked on a prevention research project in another capacity	79	77	79
Any formal training in prevention research	84	67	69
Want more training	97	90	83
ECPN member	66	87	57

[SD = 9.3]; Early Career: 32.7 [SD = 5.6]; Established: 45.0 [SD = 7.9]) as did the number of years since attainment of highest degree (Trainee: 4.8 [SD = 5.4]; Early Career: 3.9 [SD = 5.7]; Established: 13.6 [SD = 8.1]).

Most participants (75%) were members of the internet-based ECPN, a group dedicated to providing new prevention professionals with career information and support. Membership was defined as joining the ECPN email list, which provided members with postings about prevention conferences and research opportunities as well as a communication medium for ongoing email "discussions" about prevention research issues. The list also provided opportunities to ask questions of "guest" senior preventionists. Most ECPN members joined after learning about ECPN at one of the NIMH sponsored National Conferences on Prevention Research or the National Institute on Drug Abuse (NIDA) sponsored Society for Prevention Research (SPR) annual meetings. After organizers from the NIMH and NIDA groups joined together to sponsor a prevention conference in 1997, ECPN became a standing committee of the SPR yet retained a degree of independence with its own elections and bylaws. Because the membership of ECPN was fluid during the survey period (i.e., membership varied from 200 to 300 between 1996 and 1998 with some members joining, leaving, and then returning), it is not possible to compute the response rate of ECPN members. However, the ECPN membership at this point did include 117 prevention researchers who had posted biographical information about themselves on the ECPN website, and 93% (n = 109) of these individuals completed the survey.

Measurement

Survey Creation and Piloting

Trainees, early career, mid-level, and senior researchers (n = 20) at all NIMH-funded Prevention Intervention Research Centers and prevention training sites funded in 1996 were interviewed about the current and desired content of their training programs. We qualitatively grouped areas of training mentioned by interviewees into clusters of similar content. We then created a survey that focused on the final content clusters, and piloted the survey with the ECPN steering committee and at least one representative from each of the aforementioned NIMH-funded sites (n = 24). Based on feedback from the pilot, additional content changes were made. The final survey comprised questions on training in 13 content areas. On the survey, five questions were asked within each area: "how much do you know about the area?," "have you had any training in this area?," "how adequately do you feel prepared to work as a prevention researcher within this area?," "how important is this area to your work as a prevention researcher?," and "how interested are you in further training in this area?." A five-point Likert scale was used for each question ranging from 1 = "nothing," "none," or "not," to 5 = "expert," "extensive," or "very."

Data Collection

Data were collected via a world wide web-based version of the survey. In this version, participants were presented with questions and responses via their web browsers, and were instructed to use their computer mouse to select their answers. At the completion of the survey, participants were instructed to click a button on the screen to send their data to a cumulative data file located on a protected area of the ECPN computer server. The web survey was piloted extensively with ECPN steering committee members, and Internal Review Board approval was granted from the University of South Florida prior to the survey going "live" on the web. At that point, participants were recruited via two primary means: the ECPN email list and personal contacts. In terms of list member recruitment, data collection commenced with the posting of an email to the ECPN list that requested members to either complete the survey on the web or to request that a hardcopy version of the survey be sent to them for completion and return via fax or overland mail. During the next month, weekly requests for participation were posted to the ECPN list. After one month, the list membership was divided amongst the 16 members of the ECPN Steering Committee and up to three personal email messages requesting participation were sent to members who had not yet completed the survey. Following this intense period of potential participant contacting, all new subscribers to the ECPN list (most new subscribers either heard about the list at a professional conference or found list information on the ECPN website) received an automatic message requesting their participation in the survey, and monthly reminders were sent out to the ECPN list for one year. Throughout this final process, each set of reminders

resulted in 5–20 new completers. At the same time that list recruitment was in progress, ECPN steering committee members contacted researchers at each of the NIMH-funded prevention research and training centers, as well as leaders in SPR (e.g., the Board of Directors) and the members of the Prevention Science and Methodology Group, and requested that these individuals request the participation of researchers and trainees within their respective departments and/or research centers.

RESULTS

The 13 content areas identified by the training experts who participated in the survey development process are listed in Table 2. Descriptions for these areas are listed in Appendix A. The 13 areas can be classified into three categories: "traditional," which are clearly within the prevention research "domains" noted in Price (1983) and parallel the phases of the "prevention research cycle" in the IOM report (Mrazek & Haggerty, 1994); "developing," which are areas of inquiry in prevention science that have recently come into prominence; and "practical," which are areas of skill and/or knowledge that are important in the day-to-day conduct of a prevention research program.

Answers to the five questions within each of the thirteen content areas are summarized by career level in Table 3. For each question, the percentage of individuals within a career level who answered "4" or "5" (i.e., the most affirmative answer) are listed.

Table 2. Expert Identified Training Areas in Prevention Research

Traditional areas
Basic research
Prevention program design
Developmental timing of preventive interventions
Design of preventive intervention trials
Prevention program evaluation
Community collaboration on prevention projects
Developing areas
Gender and cultural issues in prevention science
Economic analyses of preventive impact
Practical areas
History and context of preventive efforts
Scientific collaboration on prevention projects
Funding of prevention science
Administrative and management skills
Ethics in prevention science

Percentages that are significantly greater than or less than expected by chance are noted with a positive or negative sign, respectively. Within each content area, training, knowledge, and preparation tended to increase by career level, but perceived importance of the area and desire for further training in the area did not. In general, knowledge, training, and preparedness tended to be high in the traditional areas, intermediate to low in the practical areas, and low in the developing areas. The lowest areas in terms of knowledge, training, and preparation were History, Funding, and Economic Analyses for early career researcher participants, and Economic Analyses for established researcher participants. The largest reported gaps between training and knowledge were by established participants, with the most sizeable of these in Community Collaboration on Prevention Projects (60% knowledgeable vs. 20% trained), Scientific Collaboration on Prevention Projects (55% vs. 18%), and Funding of Prevention Science (44% vs. 5%).

Given the publicized importance over the past several decades of the traditional areas to the conduct or prevention research (e.g., Mrazek & Haggerty, 1994), we examined to what degree early career participants perceived themselves as knowledgeable in these areas relative to established participants (see Table 4). As in the prior table, the percentages of respondents who answered "4" or "5" (i.e., the highest perceived degree of knowledge) are listed. Also listed in Table 4 are the ranks of these percentages relative to the percentages for all 13 content areas. Survey content areas are sorted by the prevention research domain (Price, 1983) or phase (Mrazek & Haggerty, 1994) with which they are most closely aligned. For established participants, the traditional content areas were the only areas besides Administration that a majority (i.e., greater than 50%) indicated they had a high degree of knowledge. For early career participants, the traditional content areas tended to be the areas of highest knowledge as well, but there was no single content area where a majority of participants perceived they had a high degree of knowledge. The largest differences between the rankings (i.e., highest percentage to lowest percentage) for established and early career researchers were in the Design of Preventive Intervention Trials (ranked first by established and sixth by early career) and Community Collaboration on Prevention Projects (ranked second by established and eighth by early career).

Table 3. Percentage Affirmative Responses to the Five Questions by Content Area and Career Phase

	Trainee	Early	Established	X^2		Trainee	Early	Established	X^2
Basic Research					*Prevention program design*				
Knowledgeable	14^{-}	44	56^{+}	15.9***	Knowledgeable	18^{-}	42	67^{+}	18.4***
Trained	10^{-}	40^{+}	42	12.8**	Trained	13^{-}	38	49^{+}	11.7**
Prepared	16^{-}	36	59^{+}	15.5***	Prepared	18^{-}	37	69^{+}	21.8***
Importance	71	78	87	5.0	Importance	82	87	95	3.2
Further training	71	72	80	.9	Further training	87	87	77	2.5
Developmental timing of preventive interventions					Design of preventive intervention trials				
Knowledgeable	8^{-}	32	51^{+}	17.0***	Knowledgeable	16^{-}	30^{-}	67^{+}	25.8***
Trained	8^{-}	24	36	8.5*	Trained	21	29	54^{+}	11.3**
Prepared	10^{-}	26	53^{+}	17.6***	Prepared	16^{-}	33	69^{+}	25.8***
Importance	82	76	80	.8	Importance	87	81	82	.7
Further training	79	77	59^{-}	5.8†	Further training	84	80	74	1.1
Prevention program evaluation					Community collaboration on prevention projects				
Knowledgeable	16^{-}	37	54^{+}	12.1**	Knowledgeable	21	27^{-}	60^{+}	18.5***
Trained	16^{-}	35	49^{+}	9.4**	Trained	8	21	20	3.6
Prepared	19^{-}	34	59^{+}	14.1***	Prepared	18	29	56^{+}	14.8***
Importance	90	90	92	.2	Importance	82	73	85	3.0
Further training	92	88	82	1.8	Further training	84	69	72	3.4
Gender and cultural issues in prevention science					Economic analyses of preventive impact				
Knowledgeable	18	29	38	5.1†	Knowledgeable	3	5	13	4.2
Trained	16	19	18	.2	Trained	3	2	10^{+}	6.0*
Prepared	18	26	38	4.1	Prepared	5	7	15	3.6
Importance	84	76	64	4.4	Importance	74	68	74	.9
Further training	84	74	67	3.2	Further training	76	70	64	1.4
History and context of preventive efforts					Scientific collaboration in prevention projects				
Knowledgeable	5	8^{-}	42^{+}	36.0***	Knowledgeable	11^{-}	22	55^{+}	22.9***
Trained	8	8	12	.98	Trained	14	15	18	.4
Prepared	10	12^{-}	46^{+}	28.6***	Prepared	8^{-}	25	55^{+}	22.6***
Importance	53	35^{-}	54^{+}	7.46*	Importance	84	79	80	.6
Further training	58	51	34^{-}	4.8†	Further training	76	76	54^{-}	8.1*
Funding of prevention science					Administrative and management skills				
Knowledgeable	8	14^{-}	44^{+}	22.7***	Knowledgeable	26	36	56^{+}	8.2*
Trained	5	10	5	1.7	Trained	16	23	26	1.3
Prepared	8	16	38^{+}	14.0***	Prepared	26	37	56^{+}	7.9*
Importance	87	87	76	2.8	Importance	86	86	72	5.1
Further training	84	86^{+}	59^{-}	16.1***	Further training	68	69	49^{-}	6.0*
Ethics in prevention science									
Knowledgeable	24	27	49^{+}	7.9*					
Trained	10	16	31^{+}	6.0*					
Prepared	21	30	45^{+}	5.2†					
Importance	87	80	82	1.0					
Further training	76	64	62	2.4					

Note. $^{+}$, standardized adjusted residual >+2.00; $^{-}$, standardized adjusted residual < −2.00.
$^{\dagger}p < .10$; $^{*}p < .05$; $^{**}p < .01$; $^{***}p < .001$.

Table 4. Rank and Percent of High Degree of Knowledge of Traditional Prevention Science Content Areas by Career Phase

Content area	Early career	Established
IOM phases 1 and 2: "problem analysis"		
Basic research	1 (44%)	3 (56%)
IOM phase 3: "innovation design"		
Prevention Program Design	2 (42%)	1[a] (67%)
Developmental timing of preventive interventions	5 (32%)	6 (51%)
IOM phase 4: "field trials"		
Design of preventive intervention trials	6 (30%)	1[a] (67%)
Prevention program evaluation	3 (37%)	5 (54%)
IOM phase 5: "innovation diffusion"		
Community collaboration on prevention projects	8 (27%)	2 (60%)

Note. Ranked within career phase and by highest percentage amongst all 13 content areas.
[a]Tie.

Since prevention research requires skills in multiple areas, we examined the extent to which participants at the various career phases reported training and preparedness across areas. The total number of the six traditional areas in which participants reported receiving a considerable amount of training and in which they felt prepared to work is listed in Table 5. As in the other tables, the percentages in the table represent participants who rated the questions of training or preparedness across the specified number of content areas as a "4" or "5" (i.e., high levels) and percentages that differ from chance are noted. There was a statistically significant relationship between career phase and the total number of areas with a high degree of training as well as between career phase and the total number of areas in which a researcher felt he/she was adequately prepared to work. A majority of established researchers reported a high level of training in at least two areas, and preparedness in at least four. In contrast, a majority of early career researchers reported a high level of training in at least one area, and preparedness in at least two.

DISCUSSION

Our interviews with prevention training experts elaborated and expanded upon the content areas previously suggested as important for prevention science. Although these interviews pointed to several new areas of interest, as well as numerous areas of practical skill, our survey results affirmed the continuing importance of the "traditional" content areas of prevention science (e.g., Price, 1983). Most survey participants who considered themselves "established" felt that they had a high degree of knowledge about the traditional content areas, and were prepared to work in a majority of those areas. However, most early career participants did not rate themselves as either highly knowledgeable or prepared for work in most of the traditional areas. This suggests that prevention training is largely an "on the job" activity, rather than something that occurs during graduate training. For some, "on the job" means a series of apprenticeships that may begin in graduate school and continue during a postdoctoral fellowship and/or other postdoctoral experiences. For others (and we suspect for most), "on the job" means "learn as you need to know in any way that you can." This probably means a combination of personal study, informal mentorships, and workshops at conferences. Such is to be expected given the transdisciplinary nature of prevention and the fact that there are no institutions that grant degrees specifically in the field of "prevention science."

However, there are a few content areas where a lack of knowledge and preparedness amongst early

Table 5. Percent of Total Number of Traditional Prevention Science Content Areas with a High Degree of Training and Preparation by Career Phase

	Trained, $\chi^2(12) = 32.2, p < .01$			Prepared, $\chi^2(12) = 64.4, p < .001$		
	Trainee	Early career	Established	Trainee	Early career	Established
0	55^{+}	30	21	53^{+}	32	12^{-}
1	26	21	7^{-}	29^{+}	15	2^{-}
2	11	18	24	11	17	17
3	3^{-}	14	14	3^{-}	16	12
4	3	9	24^{+}	0^{-}	15	19
5	0	5	10	3	3^{-}	21^{+}
6	3	3	0	3	3^{-}	17^{+}

Note. $^{+}$, standardized adjusted residual $>+2.00$; $^{-}$, standardized adjusted residual < -2.00.

career researchers was especially troubling to us. Most notably, few early career preventionists reported that they feel they are sufficiently prepared in the design of preventive field trials or in establishing and maintaining community partnerships. Thus, a major difficulty with the prevailing prevention science training model is that it may leave a significant number of early career researchers at a distinct disadvantage in terms of their ability to provide quality contributions to the field.

Skills in trial design and partnering are absolutely necessary (but not sufficient) for carrying out a rigorous program of prevention research. Trial design is important in terms of ensuring the scientific rigor and advancement of the science of prevention. Skills in partnering are essential in terms of enabling community stakeholders to assist with ensuring the success of a research project as well as ensuring the sustainability of prevention efforts once a project is completed (Kellam, 2000). High levels of skills in both areas are needed to successfully carry out designs involving multiple levels of randomization (Brown & Liao, 1999) and to maintain the integrity of a research project over time.

Further, competence in these two key areas may be a key factor in terms of the ultimate contribution of the research to the scientific and lay communities. Design characteristics are crucial determinants of the influence of the study findings on the field at large. Failure to integrate the goals of the community of interest into a preventive intervention program may mean that despite the rigorousness of the study and the strength of the findings, the intervention may not be accepted by the target population, and thus attempted replications and dissemination efforts may fail. The success or failure of a community partnership sets the context for future prevention science work, not only for members of the project research team, but also for other researchers in the geographic area. If the study has a high enough profile, it may also set the context for the work of other researchers around the country. Each prevention research project can be viewed as an opportunity to build a spirit of collaboration between scientists and community members. One way we have attempted to do this is to routinely provide informal and formal training to community members about the content area of interest and the scientific method, as well as areas of identified community interest (Eddy *et al.*, 2002). One outcome of this type of work, if accepted as standard practice by researchers, could be the development of a sizeable population of well-informed prevention science consumers and advocates.

In addition to leading to deficits in trial design and community collaboration, the predominant training model also appears to be lacking in terms of providing early career trainees with the historical context of preventive work. As George Albee, a key figure in the development of the field of prevention, strongly noted at a talk where we presented a preliminary version of these results, "prevention scientists" represent only a subgroup of the broader field of prevention. Work in prevention has been flourishing within numerous academic disciplines for many years, and in some disciplines for almost 150 years (Albee & Gullota, 1997). Without an adequate knowledge of the past, early career prevention scientists may end up not only repeating the mistakes of the past but also missing opportunities to build on past successes.

On the flip side to the past, preparation relevant to creating the future of prevention science also appears to be lacking. Early career prevention participants tended to give themselves quite low ratings in terms of their knowledge, preparation, and training in how to fund prevention projects. Key skills related to getting prevention projects funded are certainly acquired over time, but fundamentals could be taught in a variety of forums, including graduate school classes, multiday workshops, and conference breakout meetings, as well as in more traditional apprenticeships.

Finally, the "learn as you go" training model appears to be deficient in its ability to respond quickly when new content areas arise. Training and knowledge in the relatively new areas of gender and cultural issues in prevention science and economic analyses appears to be lacking not only for early career researchers, but for established researchers as well. Training modules in these areas need to be developed for both graduate and postgraduate training settings as well as for conference and continuing education settings.

Despite the gaps in readiness that were highlighted in the survey results, participants at all career phases indicated a strong desire to continue training in nearly all of the 13 content areas. We believe that this reflects the tremendous passion and importance that researchers with interests in prevention science have placed on improving outcomes for children, families, and communities. However, despite the efforts that individual researchers will make in terms of ensuring their knowledge, training,

and preparation, it is clear that we are at a significant turning point in the training of new prevention scientists.

We feel that the aspiration of many prevention scientists to a transdisciplinary and integrative field requires prevention scientists at large to take training more seriously, and to identify, launch, and test various training models and mediums in an effort to find out what works best in terms of training new scientists. It is difficult to construct successful transdisciplinary training programs at a single site given the difficulties in building a multidisciplinary faculty that shares a theoretical perspective and common objectives. It is more likely that cross-site collaborations will provide the breadth of training in prevention that is necessary to address the key questions of implementing and sustaining effective prevention programs. However, such collaborations require significant investments of time and energy, as well as considerable skill to initiate, nurture, and maintain. Annual training workshops at major conferences in the skills needed to make these collaborations work would be very useful to the field at large. Of particular interest would be case studies of collaborations that have succeeded and those that have failed in significant ways.

Within the past 20 years, multiple new media have become widely available for knowledge and technology transfer, such as the world wide web and distance learning. Committing professional time and effort to improve and increase knowledge and technology transfer between established and early career researchers via these media seems to us to be a vital part of making the field of prevention science maximally relevant and useful. Combining the advantages of the web with the advantages of face-to-face meetings seems to have especially high potential for the training of future cohorts of preventionists. For example, based on the results of this survey and with the support of the SPR, we planned an early career day at an SPR annual meeting that included training workshops in economic analyses and community collaboration. We videotaped the proceedings, transcribed the talks and discussion, and posted the information on the ECPN website. With this type of strategy, the proceedings of conferences can go beyond a specific time and place and continue in cyberspace, with ongoing "discussions" taking place via email. Such communications can be logged on the web, and become part of an ongoing multiple medium "dialogue" that is renewed by in person interactions and talks at professional conferences.

As new training models are developed, a number of issues need to be considered. A large randomized field trial takes 1–3 years to develop; the intervention period can last up to a few years, and the follow-up period may last a decade or more. Trainees at one trial site may get excellent experience over a period of 2–3 years in one or perhaps two phases of such a study. However, they are likely to have little preparation in other phases. To remedy this deficiency, we recommend that training programs incorporate experiences on research protocols that are in different phases of development and that involve different research methods. Since relatively few prevention centers have multiple trials going on simultaneously, it seems that one of the best ways to get this type of experience is to rotate through multiple sites. A useful prelude to a set of rotations is an initial shared "core" training program for all participants, followed by periodic "reunions" during the course of training.

The timing and specificity of training are also critical. Some of the core training could be obtained during graduate school within various disciplines. The Gordon framework of universal, selective, and indicated prevention, which is espoused in Mrazek and Haggerty (1994), forces a researcher to deal with prevention within defined populations. This epidemiological perspective could well be taught at the graduate level; however, it is essentially untaught in many graduate programs in the social and behavioral, health sciences, and in education, even to the point that these terms are virtually absent from the major texts in these respective fields.

More narrowly, although each of the individual disciplines that comprise the field of prevention science already have well developed training programs, these disciplines could improve the ability of their members to contribute to the field through the addition of coursework and experiences. For example, someone who has a doctorate in a quantitative methodology should be exposed to an advanced set of statistical methods relevant to prevention but also needs extensive experience learning to collaborate on complex studies within a multidisciplinary research workgroup. In addition, these trainees need a basic understanding of the "problem" that the team is attempting to prevent. These elements of training are clearly linked to the overall success of the research team. Similarly, psychology trainees from the various subfields of the discipline such as developmental, clinical, and social psychology could benefit greatly from courses in public health. These

same trainees need further education in the practical application and interpretation of advanced statistical models so that they can effectively partner with a methodology team seeking to answer sophisticated questions such as the longitudinal effects of prevention programing exposure on individuals with various risk profiles.

Our findings are qualified by our sample. The various samples in this report were all of convenience, and thus our findings may be limited in their generalizability to the field at large. However, the sample of researchers who helped us generate the content areas for the survey were involved in high quality prevention science work, and although many were closely affiliated to the NIMH, many of them also had funding from other agencies and foundations with strong interests in prevention, such as the NIDA, the Robert Wood Johnson Foundation, and the National Institute of Alcoholism and Alcohol Addiction.

The sample of survey responders was relatively large compared to the estimated size of the field, and reflects the training, knowledge, and preparedness of groups of early and established researchers with keen interests in prevention. Our sample includes many members from the early career subgroup of the SPR, which is clearly aligned with the prevention science model. However, other professional groups with varying views on the field of prevention, such as the American Public Health Association, the American Medical Association, the American Psychological Association (and various associated divisions, such as the Society for Community Research and Action), and the American Psychiatric Association, were not systematically surveyed. Future surveys should include a broader sampling from these various groups, both in terms of generating the content areas for prevention and in assessing training strengths and weaknesses. In this regard, perhaps it is time for prevention scientists with strong interests in training to attempt to bring the various parts of the field together for a conference in the tradition of the American Psychological Association's 1949 Boulder Conference. The recommendations from this conference have played a key role in setting an agenda for research training within the field of clinical psychology for the past 50 years. A transdisciplinary conference dedicated to prevention training might have a similar long-term effect.

In closing, any program of training needs to provide new prevention scientists with enough knowledge and problem solving skills within the key content areas of the field so that they are prepared to make informed decisions. In prevention science, such decisions can be extremely complicated. For example, to mount a "state-of-the-art" randomized controlled preventive intervention field trial, a research team must have (1) a theoretical model that specifies etiologic pathways in development and across ecological systems; (2) an epidemiologic quantification of risk factors in space and time within the target population; (3) appropriate theories of intervention change given the demographic composition of the target population; (4) a preventive intervention that reflects (1), (2), and (3); (5) community and institutional relationships that are robust enough to be sustained over time; (6) measures that are appropriate to test the theory and are sensitive to change within the target population; (7) knowledge of and practical skills in intervention trial design and analytic methods that will allow valid inferences about intervention impact on participant behaviors, cognitions, and affect, as well as on hypothesized mediational variables; and (8) knowledge of how to collect information for appropriate economic analyses.

In our experience, key decisions in any one of these areas can significantly decrease or increase the number of possible decisions in other areas. Although each member of a research team need not be an expert in each area, it is critical that each member not only be aware of the key issues in each of the areas, but also be informed about how specific decisions in one area impact decisions in other areas. To this end, it seems that it would behoove prevention scientists to commit time and energy towards developing a variety of materials (e.g., text books, web sites) that present the core set of knowledge and practical skills that drives the cutting edge prevention science of today. Such resources are sorely needed to assist in the training of new generations of prevention scientists. We hope that our findings can provide a starting place not only for the generation of such materials, but for a new set of discussions within the field on how best to educate the next generation.

APPENDIX: CONTENT AREA DESCRIPTORS

History and Context of Preventive Efforts

History of prevention programs and research in the United States and throughout the world; progress and pitfalls; societal and political trends; key

organizations and agencies; important people in prevention, past and present.

Basic Research in Prevention

Basic research findings from the core sciences of neuroscience, genetics, epidemiology, psychiatry and the behavioral sciences that aid in the understanding of the development of mental disorders and related problems; theoretical and practical conceptions of mental health, resilience, and health promotion.

Prevention Program Design

Standard classifications of prevention interventions (i.e., universal, selected, indicated); how to develop a preventive intervention; how to develop reliable and valid assessment instruments; basic methodology and design for prevention research projects.

Developmental Timing of Preventive Interventions

How to deliver developmentally appropriate interventions which consider life-course timing and transitions as important criteria in the design and development of an intervention; life-course development, continuities and discontinuities which affect intervention timing and strategies.

Gender and Cultural Issues in Prevention Science

How to incorporate the competencies of relevant communities (whether defined by sex, ethnicity, race, sexual orientation, social class, religion, or some other demographic or combination of such) to enhance the success of preventive interventions; how to adapt preventive intervention programs to meet the differing needs of individuals within specific demographic groups.

Scientific Collaboration on Prevention Projects

How to establish and maintain research projects with a collaborative agenda within professional communities, across departments and institutions, and across scientific disciplines. Disseminating information within the scientific community, particularly across disciplines.

Community Collaboration on Prevention Projects

Developing and maintaining relationships with study communities; how to establish cross-agency interventions; how to implement interventions and measure effects within communities and other related topics; how to work in partnership with communities; how to consult with various stakeholder groups, including policy makers, and how to negotiate within and between such groups; how to disseminate information within various stakeholder groups, to the community-at-large, and to the media.

Design of Preventive Intervention Trials

Conceptualizing, planning, and executing methodologically sound, controlled prevention trials.

Funding of Prevention Science

Information about the funding infrastructure for prevention-related efforts, including Federal agencies and private foundations; traditional sources of funding and likely future trends; state and local opportunities; how to work within existing political and social systems to build support for a public health model that supports preventive efforts in the mental health domain.

Administrative and Management Skills for the Prevention Scientist

Organizational aspects of prevention research and implementation of programs; practical management skills; building and maintaining a research team; working efficiently as an individual researcher and as part of a research team.

Economic Analyses of Preventive Impact

Measuring and analyzing the costs and benefits of prevention; communicating this information effectively to various audiences, including study communities and policy makers.

Prevention Program Evaluation

Qualitative/ethnographic data collection and analysis of preventive interventions; quantitative data collection and analytic techniques which are especially suited to prevention research, including multimethod, multitrait assessment; statistical methods, including growth curve methodologies; visualizing data; understanding and interpreting differential intervention effects.

Ethics in Prevention Science

Dealing with ethical dilemmas in each of the previously mentioned areas, including issues such as how to understand, interpret, and deal with unanticipated negative effects; who owns the intervention in a community-based project; who determines what measures are used (norms, appropriateness, validity); population-based screening and possible negative effects; when is intervention necessary; which analyses most adequately describe the data; who determines what gets published and where; what are appropriate ways to give something back to study participants and study communities.

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