The Pennsylvania State University
The Graduate School
College of Health and Human Development

ISSUES IN COST ANALYSES OF PREVENTION SYSTEMS: CONSIDERING RESOURCE CONSUMPTION OF A DISSEMINATION MODEL FOR PREVENTION PROGRAMS

A Thesis in
Human Development and Family Studies

by

Daniel Max Crowley

© 2010 Daniel Max Crowley

Submitted in Partial Fulfillment of the Requirements for the Degree of

Master of Science

August 2010
The thesis of Daniel Max Crowley was reviewed and approved* by the following

Mark T. Greenberg
Bennett Chair of Prevention Research
Director, Prevention Research Center for the Promotion of Human Development

Mark E. Feinberg
Senior Research Associate, Prevention Research Center for the Promotion of Human Development

Damon E. Jones
Research Associate, Prevention Research Center for the Promotion of Human Development

Douglas M. Teti
Professor of Human Development and Psychology, and Professor of Pediatrics, Penn State College of Medicine

*Signatures are on file in the Graduate School
Abstract

It is increasingly clear that in order to achieve a public health impact from evidence-based substance abuse prevention programs, researchers must better understand how to cultivate sustainable delivery efforts (Glasgow, Kleges, Dzewaltowski, Bull & Estabrooks, 2004; Spoth & Greenberg, 2005). Consequently, many projects seek to foster sustainability by integrating programs into existing delivery systems (e.g., Hawkins, et al., 2009, Spoth, Greenberg, Bierman & Redmond, 2004). This integration may result in reallocation of resources and funding streams (Green et al., 2008; Romani, et al., 2007). Despite these efforts becoming more common, little research has formally examined this process or described how resource flow changes across time (i.e., resource infrastructures). Economic evaluation includes multiple analytic tools that may be used to analyze resource use and efficiency, which prevention researchers have recently begun to explore (e.g., O’Connell, Boat, & Warner, 2009).

This work will describe the resource consumption of a dissemination model known as the PROSPER project. PROSPER attempts to cultivate sustainable partnerships between communities and universities to promote implementation of evidence-based interventions (Spoth, Greenberg, Bierman & Redmond, 2004). PROSPER’s focus on sustainability, and careful prospective resource tracking, makes this model ideal for evaluating the impact of formal dissemination efforts on resource infrastructures. An examination of the fiscal and economic costs, from PROSPER’s implementation, on community, cooperative extension, and university resource infrastructures will be presented.
Results illustrate the diverse array of costs required for successful coordination of program dissemination and sustainability. It is clear that, from early on in the project, each system bears different proportions and types of costs. Across time, the resource infrastructures of community, cooperative extension and university partners become increasingly integrated as systemic efficiencies grow.

This work highlights the need to study program resource networks across time and broaden definitions of what is essential for successful implementation. In particular, application of economic evaluation offers an innovative methodology for analyzing the efficiency of prevention systems.
# Table of Contents

List of Figures ........................................................................................................ vi
List of Tables .......................................................................................................... vii
Acknowledgements .............................................................................................. viii

Chapter 1 Introduction ......................................................................................... 1
  Why Evaluate Resource Consumption ............................................................... 2
  Disseminating Sustained Programming: Prevention Systems & Partnerships ........ 3
  The PROSPER Project ......................................................................................... 4
  Evaluating Resource Consumption and Economic Costs of Partnership Models ... 7

Chapter 2 Methods .............................................................................................. 9
  Procedure ............................................................................................................ 9
  Identification, Quantification, Valuation & Sensitivity Analyses ......................... 11

Chapter 3 Results .............................................................................................. 17
  Analytic Framework ......................................................................................... 17
  Cost Estimate breakdown for Decision Makers .................................................. 24

Chapter 4 Discussion ......................................................................................... 26
  Development of the PROSPER Project’s Resource Infrastructure ..................... 27
  Issues in Cost Analyses of Prevention Systems ................................................ 30
  Conclusions ...................................................................................................... 33

References .......................................................................................................... 36
Appendix: Figures & Tables ................................................................................ 49
List of Figures

PROSPER Process-to-Outcome Model: Linking Partnership Processes to EBI Outcomes. ...........................................................................................................44

The PROSPER Project Sustainability Model .................................................................................................................................45

PROSPER Costs ➔ Processes ➔ Procedures ➔ Outcomes .......................................................................................................................46

Team-Level Expenditures by Activity ..........................................................................................................................................47

Program-Level Expenditures by Activity ...................................................................................................................................48

Tornado Diagram of PROSPER Project Cost Estimate .....................................................................................................................49

Intra-System Overlap of PROSPER Project Procedures ..................................................................................................................50
List of Tables

Analytic Steps for PROSPER Cost Analysis…………………………………………………………51

Integrative Cost Matric (ICM) of the PROSPER Project…………………………………………52

PROSPER Project-Level Cost Estimates by Procedure………………………………………53

Cost Estimates of PROSPER Project Implementation………………………………………54
Acknowledgments

I would like to acknowledge my committee, Mark Greenberg, Damon Jones and Mark Feinberg for their extensive support of my thesis project. Thank you.

This research was supported by NIDA grant 2 R01 DA13709-06A1 awarded to Dick Spoth & Mark Greenberg
Chapter 1

INTRODUCTION

It is increasingly clear that evidence-based preventive interventions need to be replicated on a much greater scale in order to achieve a significant public health impact (Glasgow, Kleges, Dzewaltowski, Bull & Estabrooks, 2004; Spoth & Greenberg, 2005). This recognition has spurred the development of community-based delivery systems capable of widely disseminating evidence-based prevention programs (Backer 2000; Hawkins, Catalano & Arthur, 2002). Despite growing evidence of the effectiveness of such delivery systems (e.g., Hawkins et al., 2009; Spoth et al., 2007), little research has explored the costs and economic efficiency of these formal dissemination efforts (i.e., prevention systems). In order to install these systems in the existing social service infrastructure, it is necessary to have accurate cost estimates of prevention systems’ resource consumption, allowing researchers and practitioners to effectively plan for their introduction, assess their efficiency, and advocate their use. Specifically, by evaluating the resource consumption of formal systems that deliver prevention programs, a more precise accounting of a given program’s resource needs can be considered. The importance of these estimates continues to grow as policymakers and funders become more concerned with accurate cost projections during times of fiscal uncertainty.

This paper presents a cost analysis of one such delivery system, known as PROSPER (*Promoting School Community University Partnerships to Enhance Resilience*), and considers broad methodological issues for assessing resource consumption of prevention systems. The importance of evaluating resource use in social service systems, and prevention systems in particular, as well as the procedures to
conduct accurate cost analyses are discussed. Lastly, the results of the PROSPER cost analysis and lessons learned about estimating the costs of prevention systems are described in order to facilitate future work.

**Why Evaluate Resource Consumption?**

The slow uptake of evidence-based prevention programs has demonstrated that program effectiveness alone does not guarantee widespread implementation (e.g., Backer, 2000; Ringwalt et al., 2009). Other factors, including concerns about program efficiency and the availability of funding, may influence decisions regarding program adoption. In particular, government and healthcare policymakers are increasingly interested in clear cost estimates when formulating policy (Donaldson, Mugford & Vale, 2002; Drummond, 2004; Lavis et al., 2005) and local program organizers have recognized the need to consider program efficiency in order to maximize limited resources (Eddma & Coast, 2008; Rancine, 2006). In light of new initiatives within the United States Executive Office of Management and Budget, which now place greater value on utilizing cost and economic analyses for decision-making (e.g., FY 2011 Evaluation Initiative & Analytical Perspectives Budget of the US Government, Office of Management & Budget, 2009, 2010), it is prudent that prevention scientists evaluate both the effectiveness and efficiency of prevention efforts in order to facilitate widespread program adoption.

Although there is growing recognition of the need to better understand the economic efficiency of prevention programs (e.g., Kellam & Langevin, 2003; O’Connell, Boat, & Warner, 2009), few studies have evaluated intervention efficiency, and thus the resources required for large-scale dissemination efforts remain unclear. Existing work often evaluates only limited aspects of program costs and tends to focus exclusively on
the resources required for ‘day of implementation’ (e.g., space, curricula, facilitator time), while the resources necessary for program adoption and sustainability remain largely unexplored (e.g., administrative costs, planning, evaluation, technical assistance, resource generation). These adoption and sustainability expenses may account for a substantial proportion of program costs, and their inclusion is crucial for accurate program cost estimates. Failure to accurately outline total programming costs can misinform implementers and lead to inadequate or wasteful spending in future programming efforts.

Disseminating Sustained Programming: Prevention Systems & Partnerships Models

Study of prevention system costs can elucidate what resources, expertise, and tools are required to replicate and disseminate prevention programs throughout communities and across multiple sites. These systems cultivate local community ownership and decision-making to promote adoption, faithful replication, and sustainability of evidence-based prevention programs (e.g., Hawkins, Catalano & Arthur, 2002; Spoth & Greenberg, 2005). Community-based prevention systems have increasingly demonstrated their ability to disseminate evidence-based programs in a manner that meets the needs of local stakeholders while maintaining high-quality programming (e.g., Chou, et al., 1998; Hawkins et al., 2009; Perry et al., 2002; Spoth et al., 2007; Spoth, Guyl, Trudeau, Goldberg-Lillehoj, 2002). In addition, these local initiatives are led by stakeholders who influence policy, community budgets, and often serve as early adopters of new ideas in their communities (Rogers, 1995).

One form of prevention system, known as the community partnership model, has evolved as a means of integrating the contributions of both practitioners and researchers
in preventing negative health outcomes (see Hawkins, Catalano & Arthur, 2002; Spoth & Greenberg, 2005). This model connects diverse stakeholders (e.g. educators, parents, local business, religious leaders, and politicians) in order to utilize existing resources, such as time and expertise that support program dissemination (Jasuja et al 2005; Perkins, et al., 2001). The partnership model aims to find common objectives across stakeholders and mobilize those individuals to form effective prevention teams. Tapping members of local communities for organized prevention efforts can facilitate integration of programming into local service infrastructures (e.g., schools, community settings, cooperative extension, and health centers). In turn, this integration often translates into increased stability and broader community ownership (Spoth & Greenberg, 2005), which is attractive to funders interested in supporting prevention efforts (Beery et al., 2005; Rancine, 2006).

The PROSPER Project

An example of the partnership model is the PROSPER project, which links stakeholders from state and local Cooperative Extension systems (CES) and local public schools for the purpose of implementing school- and family-based preventive interventions in early adolescence. An embedded CES agent and a school official comprise the core of community prevention teams that involve multiple members representing various community interests. The teams each select from a menu of evidence-based programs, implement and evaluate those programs as well as conduct resource generation activities. The local teams are supported by prevention coordinators within the CES and by university prevention teams (for a review, see Spoth, Greenberg, Bierman & Redmond, 2004). The PROSPER teams move through three developmental
phases over the first five years of operation (See Figure 1). The initial ‘organizational’ phase (6-12 months) consists of team formation activities, such as deciding programming goals, recruiting members, and being trained in the PROSPER model. The next phase focuses on ‘initial operations’ (e.g., implementing programs) and lasts between two and three years. During the third, ‘sustainability phase’, teams concentrate on sustaining programming, engaging other community organizations, and generating funding. This developmental process is indicative of the collaborative lifecycle observed in successful community partnerships (Livit & Wandersman, 2004; Stevenson & Mitchell 2003) and is a fundamental aspect of the PROSPER model.

In order to effectively implement and sustain programming, the PROSPER project is guided by a sustainability sub-model with two complementary goals: (1) to sustain growth and quality evidence-based programming, as well as (2) to sustain well-functioning local teams (Figure 2). Consequently, the PROSPER model considers sustainable prevention programming to be the maintenance of high-quality efforts that possess sufficient programming capacity as well as deliver evidence-based prevention programs, (Johnson, Hays, Center & Daley 2004; Mancini & Marek, 2004; Nilsen, Timpka, Nordenfeldt, & Lindqvist, 2005). These goals are realized through the implementation of eight strategies that support sustainable programming (i.e., program quality management, school positioning, and resource generation for programming) and team functioning (i.e., strengthening community partnerships, conducting effective meetings, monitoring teams, strategic communication planning, and planning for recognition and rewards; Figure 2). By implementing these strategies in the past, PROSPER has effectively mobilized community prevention efforts, delivered high-
quality prevention programming, and decreased youth substance use (Spoth, Randall, Trudeau, Shin, & Redmond, 2008; Spoth et al., 2007). It should be noted that actual delivery of programs is only one component of PROSPER’s ‘process to outcome model’, and that many other strategies make up program operations (Figure 2).

PROSPER’s focus, therefore, is not only to deliver programs, but also to cultivate sustainable prevention efforts that serve community needs (Sheliac-Rizkallah & Bone, 1998). Promoting sustainability is an integral part of PROSPER. This focus is contrary to traditional implementation models that initiate prevention efforts with limited seed funding, but to do not sustain support past the early operation’s phase—often resulting in a failure to maintain the effort (Adelman & Taylor, 2003). In contrast, PROSPER mobilizes early resource streams to foster self-sustaining local efforts so programs may be disseminated to a larger proportion of the population.

Development of the PROSPER model was informed by earlier dissemination efforts that demonstrated achieving sustained implementation requires not only the materials and actions immediately associated with programming (e.g., curricula, facilitators), but also the resources (e.g., fiscal, social, human capital) and infrastructure (e.g., strategic communication, local partnerships, recruitment initiatives, motivation) capable of continuing that effort (Foster-Fishman, & Berkowitz et al., 2001; Lerner, 1995; Lerner & Simon, 1998; Wandersman et al., 2008). These programming elements are strengthened through capacity-building, a process that cultivates local teams’ ability to deliver programs and meet the programming needs of local stakeholders (Johnson, Hays, Center, & Daley, 2004). Prevention coordinators within PROSPER build capacity by delivering program training and technical assistance at the local level. Thus, a wide
array of resources and expertise come together in order to impact the schools, families, and individuals within a PROSPER community.

Evaluating Resource Consumption and Economic Costs of Partnership Models

Prevention scientists have begun to conduct formal cost analyses in order to evaluate intervention efficiency and assist in decision-making regarding program implementation and sustainability (e.g., Bilukha et al, 2005; Foster, Dodge, & Jones, 2003; O’Connell, Boat, & Warner, 2009; Jones, Bumbarger, Greenberg, Greenwood, & Kyler, 2008). Cost analyses provide assessments of prevention efforts’ resource requirements and can be used to guide future work by describing costs in the context of program outcomes (i.e., cost-effectiveness analysis) (Drummond, O’Brian, Stoddart, & Torrance, 1997; Haddix, Teutch, & Corso, 2003). Additionally, cost analyses are requisite for researchers looking to quantify and describe the monetary savings of prevention over tertiary care (i.e., cost-benefit analysis) (e.g, Aos, Lee, Aos, Miller, 2008; Mayfield, Miller, & Yen, 2006).

Economic evaluation of family-based (Mihalopoulos, Sanders, Karen, et al., 2007; Spoth, Guyll, & Day, 2002) and school-based (Aos, Lieb, Mayfield, Miller, & Pennucci, 2004) preventive interventions demonstrates that sizeable savings can occur from delivery of evidence-based programs. Despite this work, there has yet to be a formal evaluation of prevention system efficiency. Specifically, prevention researchers have yet to assess whether these systems can deliver programs at a lower cost than traditional methods. One factor hindering this evaluation is insufficient tracking of fiscal, institutional, and human capital resources essential to accurate cost analyses. PROSPER was designed to allow for prospective tracking of the project’s resource use and
consequently represents a unique opportunity to begin studying prevention system efficiency.

Cost analyses are the first step in evaluating the economic efficiency of prevention systems such as PROSPER, and are essential for further economic work (i.e., cost-effectiveness & cost-benefit analysis) (Drummond, O’Brian, Stoddart, & Torrance, 1997). This analytic tool formally evaluates expenditures and accounts for indirect resource use and market failures that prevent traditional accounting methods from providing precise estimates of economic costs (Gold, Siegel, Russell, & Weinstein, 1996). An accurate cost analysis may foster greater understanding of PROSPER’s resource requirements and aid in decisions of resource management for future implementations. Additionally, the possibility that preventive interventions will have a positive public health impact has the potential for significant societal savings through the reduction of costly behaviors (e.g., substance abuse, violence). In order to estimate these potential resource savings, accurate cost estimates must first be calculated.

Consequently, this work seeks to describe and evaluate the PROSPER project’s resource consumption. First a methodological framework evaluating systemic costs is outlined. Then the results of applying this framework to evaluation of the PROSPER model is presented. Lastly we discuss the development of the project’s resource infrastructure, methodological issues raised by this work, and the implications of considering resource consumption on dissemination research.
Chapter 2

METHODS

Procedure

The resources consumed by implementing the PROSPER project were evaluated with a six-step framework for conducting cost analyses increasingly utilized in economic evaluations of health programs (for review see Drummond, O'Brian, Stoddart, & Torrance, 1997; Foster, Porter, Ayers, Kaplan, & Sandler, 2007). Using this approach, (1) the project was defined; (2) the perspective, analytic horizon, and scope were appropriately bounded; the resources essential to the project’s implementation were then (3) identified, (4) quantified, (5) valued; and lastly (6) estimation uncertainty was explored using sensitivity analyses. The application of this six-step framework is described in greater detail below and offered as a blueprint for evaluating the costs of prevention systems (see Table 1).

1. Definition. To define this cost analysis, we adopted the Costs $\rightarrow$ Procedure $\rightarrow$ Process $\rightarrow$ Outcome model for the analysis of human service systems (CPPOA; Yates, 1996, 2009). The CPPOA model conceptualizes a service system hierarchically, where project costs support specific project procedures (i.e., coordinated project activities employed for a specific purpose), which in turn support broader system processes that are believed to fulfill systemic goals (i.e., these processes represent the larger constructs that mediate an intervention and its subsequent outcomes). The CPPOA model is thus predicated on a belief that by providing the necessary resources and employing the appropriate procedures desired outcome(s) may be achieved. We sought to integrate the
CPPOA approach with PROSPER’s sustainability model that was previously introduced (Figure 2).

The sustainability model illustrates that the overarching purpose of the PROSPER project is to improve child and family well-being, and that this may be achieved by fulfilling two goals: (1) sustaining growth of quality programming (i.e., program-level) and (2) sustaining well-functioning teams (i.e., team-level). These two goals represent the desired outcomes for the PROSPER project, while the improvement of child and family well-being represent the ultimate participant-level outcome desired. To achieve these team- and participant-outcomes, four objectives are described within the sustainability model, which are further broken down into eight programming strategies (Figure 2). These objectives and strategies represent the hypothesized processes believed to produce the desired outcomes (Figure 2). The sustainability model thus represents the project’s outcomes and processes, but does not articulate the specific procedures and costs necessary to enact them. During the course of these analyses we identify the project procedures and their ultimate costs in order to improve understanding of PROSPER’s resource consumption.

2. Bounding. The process of bounding further defines specific parameters (i.e., perspective, analytic horizon, and scope) of the analysis and provides the consistency necessary to obtain accurate estimates. The perspective of a cost analysis is the viewpoint that guides what costs to include in the evaluation (e.g., buying intervention curriculum represents a cost to the program provider, but generally not a cost to the participant) (Gramlich, 1990; Haddix, Teutch & Corso, 2003; Homer, Drummond, French, 2008). Cost estimates in this analysis were considered from multiple perspectives, including the
local team, the Cooperative Extension System, the university team, and program participants. Additionally, a societal perspective was adopted to estimate the overall economic impact of the project. These five cost perspectives provide insight into the financial burden that PROSPER places on each respective party.

The second parameter to define, known as the analytic horizon, is the timeframe in which costs are included in the analysis, while the scope reflects the breadth of resource inputs that are considered during evaluation (Drummond et. al., 1997).

Estimates for this work were bounded between project fiscal years one through five of a randomized-control trial of the PROSPER project (i.e., analytic horizon). The first five years were selected as all teams had entered the sustainability phase of team development by their fifth year (Figure 1). The first project year spanned from April 1<sup>st</sup>, 2002 until November 30<sup>th</sup>, 2002, while Years 2-5 spanned from December 1<sup>st</sup> - November 30<sup>th</sup> (2002-2006) of each year. Additionally, only resource inputs directly related to the project’s goals of sustaining quality programming and well-functioning teams were included in the final cost estimates, which excluded expenditures related to first-copy and research costs (i.e., scope).

**Identification, Quantification, Valuation & Sensitivity Analyses**

The subsequent three steps identified, quantified, and valued the project’s costs through a process of qualitative cost analysis, activity-based costing, and the application of economic models, respectively.

**3. Identification.** First, all assets and activities that consume resources were identified through a qualitative cost analysis in order to capture the wide variety of inputs essential to programming goals (Rogers, Stevens & Boymal, 2009; Yates, 1996). This
methodology is especially adept at describing types of resource inputs that are difficult to capture, yet are essential to accurately considering the multitude of project activities. For instance, the donated time of unpaid personnel represents one such cost. The qualitative cost analysis mapped the hierarchical resource infrastructure (i.e., Local Team <-> Cooperative Extension System <-> University Team) utilized to support PROSPER’s programming strategies and identified resource consumptive activities.

Qualitative cost analyses are comprised of two parts, the development of an integrated-cost-matrix (ICM) and a participatory phase to refine that matrix (Rogers, Stevens & Boymal, 2009; Ziller & Phibbs, 2003). The ICM lists all costs incurred from the project’s implementation across levels of analysis (e.g., individual, group, etc.), regardless of the whether the cost can be monetized. The PROSPER ICM considered the eight program strategies by organizational level (i.e., Local Team <-> Cooperative Extension System <-> University Team). First, a preliminary ICM was developed from a variety of sources, including budgetary data, participant and team evaluations, prevention coordinator reports, project manuals, and grant applications. The matrix was then refined through interviews with university teams, prevention coordinators and community team leaders. This process resulted in a resource map that traced the systemic movement and transformation of program assets through the project, offering opportunities for visual analysis of its resource infrastructure (Table 2).

4. Quantification. The next step was to quantify the resource consumption of the PROSPER project. While the utilization of the CPPOA model provides a valuable conceptual structure to describe PROSPER, it remains difficult to link specific expenditures to the project’s procedures. In order to quantify resource consumption, a
technique known as Activity-Based Costing (ABC) was employed, which utilized the project activities identified by the qualitative cost analysis (Table 2). The ABC method assigns the costs of project assets and personnel time to specific project activities (Babad & Balachandran, 1993; Cooper & Kaplan, 1991; Drummond, O’Brian, Stoddart & Torrance, 1997 p. 68). In turn, these project activities may be assigned to specific project procedures (i.e., strategies) and thus integrated into the CPPOA framework. For instance, the costs of PROSPER’s resource generation process may be estimated by considering activity-costs (e.g., grant writing & fundraising) that support the ‘sustainability planning’ procedure. The use of the ABC approach facilitates resource tracking and provides information regarding the project’s organizational efficiency (Shank & Givindarajan, 1993).

Using the ABC method, PROSPER’s resource consumption was quantified and allocated to project activities from five information sources: (1) budgetary records, (2) team service-provision records, (3) resource generation logs, (4) personnel interviews, and (5) team-functioning evaluations. (1) The Budgetary Records collected included accounting information of the project’s budgets that listed expenditures on project personnel and assets. The majority of the project costs were measured from these records, as they included itemized invoices that made them suitable for activity-based costing. (2) Team Service-Provision Records included assessments of the frequency of program implementation as well as the amount of participation in PROSPER’s family (i.e., Strengthening Families Program: 10-14) and school interventions (i.e., All Stars, LST, Project Alert). (3) Resource Generation Logs were utilized, which prospectively tracked resources obtained by local teams and included the dollar value of monetary and in-kind
contributions from sustainability activities (e.g., fundraising, grant writing). The total
hours donated by implementers, recruiters, child-care providers, personnel, and
administrators were captured within these logs. Additionally, the total monetary and in-
kind donations received from federal, state, local, school district, nongovernmental,
foundation, business, individual, and extension sources were also measured. (4)

*Personnel Interviews* were utilized to evaluate yearly time allocation to project
procedures by salaried individuals at the university- and extension-levels. These
interviews provided estimates of the time individual personnel engaged in different
project procedures and personnel salaries that were allocated based upon these
proportions. (5) *Team-Functioning Evaluations* provided data gathered from community
team members, school administrators, and agency directors concerning their perceptions
of the PROSPER project’s costs. These measures were used to identify unexpected
consequences and costs of intervention activities, such as the perceived costs to project
personnel (i.e., intangible costs).

5. **Valuation.** After quantifying the project’s resource use, the next step was to
value the economic costs of PROSPER’s measured resource consumption. These
represent the difference in costs from using the same resources for the PROSPER project
instead of the next best alternative (i.e., opportunity cost) (Drummond et al., 1997). For
the purpose of our analysis, the next best alternative is the implementation of the same
prevention programs without the support of the PROSPER project (i.e., Strengthening
Families Program 10-14, Life Skills Training, All Stars and Project ALERT). The
emphasis on opportunity costs differentiates this analysis from being simply a matter of
general accounting, as these require an adjustment for market failures inherent in
traditional budgetary data (e.g., underemployment) (Drummond et al., 1997; Finkler, 1982). Opportunity costs therefore are especially important for resource consumption that is not generally captured in project budgets (e.g., volunteer or in-kind donations), but may be essential to the project’s overall success as is the case with PROSPER (Gold et al, 1996). In addition, adjustments were made for inflation, allowing cost estimates to account for the rise in prices between years.

6. Sensitivity Analyses. Sensitivity analyses determine the uncertainty of cost estimates in order to ascertain the robustness of that estimate (Haddix, Teutch, & Corso, 2003). The final step of costing PROSPER was to consider such uncertainty inherent in the estimation process. These analyses included evaluation of each assumption (i.e., multiple one-way sensitivity analyses) made concerning programming costs that resulted in variability in the cost estimate (i.e., final estimates are within a range) (Briggs, 2000). Specifically, sensitivity analyses explore the uncertainty of costs in order to ascertain the robustness of an estimate (Haddix, Teutch, & Corso, 2003). In this analysis uncertainty existed concerning four assumptions: (1) that university personnel expenditures should be allocated based upon the proportion of time each individual spent on implementation tasks (2) that 20% of university overhead expenditures should be allocated to implementation, (3) that expenditures on goods and services utilized by university personnel should be allocated at the same rate to implementation costs (4) that the cost of the family curriculum should be estimated based upon the current market price. This uncertainty was evaluated by constructing a graphical representation of several one-way sensitivity analyses, known as a tornado diagram. This diagram indicates changes in the overall cost estimate of the intervention as the allocation of individual costs were varied.
(Eschenbach, 1992). Additionally, extreme-scenario sensitivity analyses were conducted to describe the best- and worst-case cost estimates of PROSPER (see Briggs, 2000).
Chapter 3

RESULTS

Analytic Framework

Identification. As illustrated in Figure 3, the eight project strategies (i.e., processes) were utilized as the foundation of this analysis. As indicated in the Integrative Cost Matrix (Table 2), these strategies were disaggregated into 16 procedures necessary to accomplish each strategy. These procedures were further deconstructed and we identified 111 specific project activities that account for resource consumption. These activities were used to guide the subsequent analyses.

Quantification. Quantification of PROSPER’s costs included multiple analyses of PROSPER’s amassed budgetary data. These data, which represent the project’s direct capital outlays, were first analyzed using a micro-costing procedure, with each invoice being coded according to its role in the project (i.e., research v. implementation). This initial analysis of budgetary data facilitated the distinction and removal of first-copy costs (i.e., expenditures on research and the development of prototypes, such as manuals), which would otherwise have distorted cost estimates. Personnel salary or wage expenditures were apportioned based upon each individual’s project tasks, with personnel expenses resulting from implementation of PROSPER being retained, while expenditures from those that worked on research tasks were not included in subsequent analysis. Fiscal costs from individuals involved in both PROSPER’s implementation and research were allocated based upon the proportion of time they were compensated for either research or implementation tasks. Equipment, goods, and purchased services directly linked to research or prototype development (e.g., manual writing) were also coded as first-copy
costs and excluded from these analyses, while expenses directly related to implementation of the PROSPER project were retained. Expenditures (i.e., copying costs) that had a dual role in the project (i.e., mixed costs) were allocated proportionally based upon the overall ratio of research and implementation personnel that utilized these resources. Overhead costs were allocated at the traditional rate of 20% to implementation costs (Foster & Jones, 2006; additional sensitivity analyses were carried out to test the impact of these approaches). Total research costs removed from the project (i.e., direct and mixed) represented 44.1% of all budgetary expenditures.

Implementation expenditures were then further analyzed using the Activity-Based Costing approach (ABC) described earlier (see Table 2). The cost activities identified in the qualitative cost analysis were used to reanalyze and assign expenditures on equipment, goods, and services to specific project activities. Hourly-wage personnel expenditures were assigned to activities based upon the services they rendered for the project (e.g., program facilitation, fidelity observation). Salaried- and student-personnel reimbursements were allocated based upon the proportion of time they spent on a specific project activity. This analysis allowed expenditures to be categorized and evaluated using the project procedures previously described (Table 3). In particular, team-level and program-level expenses could be evaluated separately (Figure 4 & 5). Team-level expenses (Figure 4) included activity expenditures incurred from team-level project procedures and included: team formation, team functioning, team supervision, school mobilization, sustainability planning, extension linking, recruiting schools, university operations and oversight, public relations, and recognizing and rewarding successes. Program-level expenditures (Figure 5) represented activity expenditures incurred from
program-level project procedures and included: *program selection, facilitator training, participant recruitment, program delivery, program fidelity monitoring, and program evaluation*. Over half of all project costs (59.70%) were attributable to team-development and maintenance costs (team-level), and 40.30% were attributable to program-implementation (program-level) activity costs. The greatest proportion of resources were consumed by *University Operations & Oversight* (29.58%), *Facilitator Training* (9.17%), and *Program Delivery* (8.82%).

The quantification step highlighted expected trends in how project resources are used. At the program level, initial outlays for program selection and training dominated the first year expenditures, but were lower during the subsequent years. Additionally, expenditures on ‘program delivery’, and to a lesser extent ‘program fidelity monitoring’, increased during the second and third project years, but declined in Years 4 and 5 as teams’ programming capacity grew (Spoth, Clair, Greenberg, Redmond, & Shin, 2007). At the team-level, ‘team formation’ expenditures were higher in the first two project years and then fell, while expenditures on ‘sustainability planning’ were minimal during the early years and became one of the largest expenses in the latter years.

**Valuation.** As part of the valuation process, we assessed the opportunity and intangible costs of the PROSPER project. The evaluation of opportunity costs to personnel is especially important when compensation (e.g., wage or salary) does not represent what the individual would receive for their work in a competitive market. Personnel reimbursement throughout the project generally represented competitive market compensation, except with two personnel groups: the local team co-leaders and team members. The time costs to these individuals (i.e., the potential loss in wages from
donated time to PROSPER tasks) were estimated. Across the five project years, the amount of time the personnel worked and the occupations of these individuals were measured in the annual personnel interviews. A targeted wage approach was undertaken to estimate these costs (Drummond, O’Brian, Stoddart, & Torrance, 1997). Personnel time costs were estimated as:

\[
\text{Personnel time cost} = \text{total time (hours)} \times \text{estimated wage based on current occupation}.
\]

These two personnel groups’ time allotment to project activities (e.g., participant recruitment, program preparation, sustainability planning) was also tracked across the project years allowing for costs to be decomposed and considered in the larger analysis of activity-based resource consumption. Team co-leaders volunteered an average of 4.7 hours per week, while team members volunteered an average of 2.1 hours a week. In particular, both co-leader and team members spent over a third of their time involved in preparation for program implementation. The total time was estimated to represent an average opportunity cost to co-leaders of $104.61 per week and to team members of $34.17 per week.

Additionally an analysis of the intangible costs experienced by team co-leaders and members was undertaken. Across all project years, on average, 20.22% (SD=20.31%) of team co-leaders believed that participation in PROSPER negatively impacted their work schedule a great deal, while fewer felt it reduced their family time (M = 18.14%, SD = 15.40%) and personal free time (M = 18.34%, SD = 17.68%). Slightly fewer team members believed that the PROSPER project negatively impacted their work schedule (M = 10.02%, SD = 8.82%), family time (M = 14.50%, SD = 14.30%) and personal free time (M = 15.08%, SD = 15.94%) a great deal. These costs
represent the perceived burden of participating in the PROSPER project by team co-leader and members’, but were not monetized and are not included in the final cost estimate.

The opportunity costs to family program participants’ time and travel costs were also evaluated. Because of the large number of participants a gross method of estimation was utilized. All participants in the first cohort had their residence and implementation site geo-coded (see Environmental Systems Research Institute, 2005). Then the shortest road distance for each family from home to the school site was calculated. Participants’ travel costs from attending the family program were estimated based upon:

\[
\text{Participant time costs resulting from participation in the family program included both time spent in SFP sessions (} M = 3 \text{ hours}) \text{ and travel time. These costs were estimated as:}
\]

\[
\begin{align*}
\text{(Family’s Distance to Implementation Site)} & \times \text{(Average Time Cost per Gallon of Gasoline in 2006)} \\
& \times \text{(Time Cost per Gallon of Gasoline in 2006)}
\end{align*}
\]

The average cost to a family of attending one SFP session was between $79.29 to $79.46 (SD=$2.01 - $2.60), which represents the travel and time costs incurred by the family. If participants attended every SFP session (i.e., seven session), the total cost to families would comprise roughly 1.1% of the families’ average median income ($49,200) (Census Bureau, 2010). Utilizing this geographic-information-systems approach allowed for greater sensitivity to geographic specific costs (Homer, Drummond, French, 2008). We do not believe meaningful costs were incurred by youth participating in school programs, as substance abuse and violence prevention programs are a mandatory part of school curriculum. Additionally, costs to teachers were negligible as they received
reimbursement for personal expenses from training as well as incentives for each session of the school program they delivered ($50.00). Total participant costs were estimated to range between $555.03 and $556.08 per family that attended all seven sessions. The sum of family participant costs were included in the estimate of PROSPER’s economic costs (n=1127 family program participants). Costs to the local school system (beyond that of co-leaders time) were also believed to be minimal, as school districts were reimbursed by the project for substitute costs when teachers were absent due to training and also received pro-rated payments for use of school facilities when applicable. Consequently, no additional participant costs were included in final estimates.

As a result of project sustainability planning efforts, the PROSPER teams began to receive substantial monetary and in-kind inputs in Year 4 (e.g., grant writing and fundraising). These resources entered the project at the community-level and were utilized by the local teams for both program delivery and team functioning expenditures and represent an economic cost from PROSPER’s implementation. The resources generated by each team were tracked. The resulting 2004-2005 revenue totaled $156,534.63 and each team generated an average of $12,074.94 (SD=$7699.80). Pooled across all communities, the largest sources of revenue were from the local school systems (32%), private foundations (15%), businesses (13%), and state-level (13%) sources.

Lastly, as part of the valuation process, all costs were adjusted for inflation (all costs are in 2002 dollars). It is assumed that all expenditures were inflated at the same rate and standard adjustments were utilized (Drummond, O’Brien, Stoddart, & Torrance, 1997).
Sensitivity Analyses. The four assumptions made regarding PROSPER projects’ resource consumption were evaluated. (1) The first assumption was that expenditures on university personnel with dual research and implementation roles could be distinguished-to the extent that research costs could be removed from their total salaries. The proportion of each individual’s time spent on implementation v. research tasks was estimated separately through interviews with project accountants and university prevention faculty. This approach resulted in an average annual total allocation rate for university personnel of 40.39% \((SD = 6.7\%)\). To assess the sensitivity of the overall estimate, we varied this rate \(\pm 10\%\) (30.39\%-50.39). (2) The second assumption was that university overhead should be allocated to implementation tasks at the traditional rate of 20%. Because the majority of the PROSPER projects activities occurred outside of university space, an allocation rate of 10% was considered to be more appropriate. In contrast, an argument could be made that overhead should be allocated based upon the overall proportion of university personnel engaged in implementation tasks (i.e., 40.39\%). Both these rates were adopted in order to consider estimation uncertainty of overhead allocation. (3) The third assumption was that the university expenses (i.e., mixed supplies, space, communication services and equipment) should be allocated based upon the proportion of university personnel engaged in implementation activities. In light of the uncertainty identified in assumption 1, university expenses were allocated within the same range (i.e., 30.98-50.98\%) as university personnel expenditures. (4) The fourth assumption explored the variability in family curriculum costs between state sites. To test this variability an allocation of 0-100% of maximum curriculum costs ($298.00 per
family program curriculum purchased) were evaluated to determine the impact on total project costs and family program costs.

The results of the extreme scenario analysis estimated the direct costs of implementing the PROSPER project over five years to range from $2,852,084.16 (best-case) to $3,717,846.00 (worst-case) and a tornado diagram was constructed to demonstrate the robustness of these estimates (Figure 6). This represents a cost of roughly $81,488.12 - $106,224.17 per year, per community site. Further analyses were undertaken to better estimate the systemic impact of the PROSPER project. Total societal costs for the PROSPER project were estimated at between $4,531,996.89-5,397,758.73 (this includes all personnel and participant opportunity costs as well as additional inputs from sustainability planning during Years 1-5). Cost estimates and inclusion criteria for all perspectives are presented in Table 4.

**Cost Estimate Breakdown for Decision-Makers**

To increase the utility of these analyses for decision-makers and potential adopters, multiple cost perspectives were explored in order to consider the PROSPER project’s systemic resource consumption (Figure 7). The PROSPER project mobilized resources in local communities, in the local and state Cooperative Extension Systems as well as in the partner universities. Because expenditures were largely reimbursed by the parent grant, and additional project costs were tracked through a variety of other measures, insight may be gained regarding the resource consumption of different project systems. Local systems consumed 13.51% of the overall project budget (43.11% of total economic costs), while the university utilized 50.35% of all fiscal inputs (33.12% of all economic costs). In traditional cost analyses, which do not generally include systemic
transfer costs in final estimates, the extension system would have received a positive influx of resources (i.e., they would generate revenue) by participating in the PROSPER project (between $184,000 and $313,500 per year). For the sake of understanding the resource flow within the project, if costs to extension were not reimbursed by the parent grant, extension consumed 36.14% of the total project costs (23.77% of the total economic costs). The greatest cost to the community system was due to facilitator time. The largest costs for the university system came from prevention faculty time and university overhead, while the greatest cost to extension resulted from prevention coordinator and team leader salaries.

Based upon these estimates, initial service costs of the PROSPER project were calculated. The direct program cost per family that graduated from the family intervention (n = 1177) was between $278.56 and $348.25 and the direct program cost (per student) to deliver the school program (n = 8049) ranged from $8.94 to $26.74 per student (Table 4). These estimates are the ‘day of implementation costs’--pooled across communities and the five project years--traditionally considered in cost analyses. Additionally, this represents a total project cost of between $311.28 and $405.63 per youth served (i.e., cost to PROSPER project) and an economic cost that ranged from $486.18 and $580.53 per youth served (total societal cost).
Chapter 4

DISCUSSION

This cost analysis of the PROSPER project represents one of the first formal analyses of prevention system resource consumption. Consequently, this work provides an excellent opportunity to consider the strengths and weaknesses of current cost methodology and how prevention scientists might plan to evaluate prevention systems in the future.

These estimates compare favorably to costs previously projected for the family program (Strengthening Families Project 10-14) and school programs (Life Skills Training, Project Alert, and All Stars) delivered by the PROSPER project. Specifically, previous evaluations estimated the direct costs of delivering the Strengthening Families Program 10-14 to one family at approximately $851.00 and have an estimated benefit to participants worth $2,413 and a societal benefit worth $6,656 (Aos, Lieb, Mayfield, Miller & Pennucci, 2004). Additionally, the direct costs of the three school programs implemented in PROSPER (Life Skills Training, Project Alert, or All Stars) were estimated to be $49.00, $3.00, and $29.00 per student, respectively with societal benefits of approximately $746.00, $58.00 and $169.00, respectively (Aos, Lieb, Mayfield, Miller & Pennucci, 2004). For instance, delivered within the PROSPER project, the direct costs of implementing SFP 10-14 were between $502.75 and $572.44 less than implementing outside of PROSPER. Assuming SFP 10-14 was as effective as it was in previous implementations, this would represent a societal net-benefit worth between $6,307.75 and 6,377.44 per person.
Development of the PROSPER Project’s Resource Infrastructure

The qualitative and quantitative cost analyses of PROSPER’s implementation illustrated the development of a broad resource infrastructure that integrated the three project systems through strategic resource sharing (i.e., Local Team<->Cooperative Extension System<->University Team). Initially this infrastructure began to develop with the decision to adopt the PROSPER project at the university level. At this point resources were consumed for the explicit purpose of implementing the PROSPER partnership. In particular, personnel time, space, supplies, and equipment were reallocated to facilitate early planning. These resources were mobilized for two general activities, preparation of project uptake into the existing university system, and securing the parent grant. Upon receipt of initial funding, resources were allocated to facilitate partnerships between extension and prevention faculty, identification of potential prevention coordinators and community sites as well as a variety of administrative tasks (i.e., University Operations & Oversight: 22.3%).

This nascent infrastructure continued to integrate involved prevention and extension faculty as resources were funneled by both to cultivate prevention coordinator capacity (PC). As the PCs became conversant, they utilized the resources of the Cooperative Extension System to recruit local-extension agents (Extension Linking: 4.9%) and school administrators to lead the community teams (School Recruitment: 1%). As PCs and team leaders built team membership (Team Formation: 3.8%), new resources entered the project from unpaid team co-leaders and members’ time and local knowledge. While teams coalesced, resources were directed through the school co-leader in order to strengthen partnerships between the team and school district (School Mobilization,
6.0%). Teams from different sites came together to learn about and select the family prevention program from the PROSPER program menu (Program Selection: 1.9%). The university team organized training opportunities for the family program, and project resources were utilized to facilitate travel and bring expert trainers to local teams (Facilitator Training: 24.75%).

As training ramped up, PC’s and university prevention faculty began to provide technical assistance regarding program recruitment as well as resources to create recruitment materials and purchase incentives (Participant Recruitment: 3.9%). By the end of the first year, teams began delivery of the family program to local families (6.4%). The year was capped with the first annual ‘state-wide’ meeting that brought together teams from across the state to recognize and reward the successes of that year (Recognize & Reward Successes: 4.0%).

During the second and third years, resources began to be allocated to sustainability planning (Year 2 = 1.2%, Year 3 = 5.8%). Expenditures to facilitate team formation and supervision fell from Year 2 (2.7%, 6.4%) relative to Year 3 (.5% and 6.26%, respectively), while expenditures allocated to team functioning remained stable. Additionally, resources allocated to school mobilization began to fall in Year 2 (3.2%) and 3 (2.9%). At the program-level, facilitator training continued (Year 2 = 11.3%, Year 3 = 10.2%) and teams selected their school program (Year 2 = .8%). Increased emphasis was placed on participant recruitment (Year 2 = 11.3%, Year 3 = 13.9%) as larger amounts of resources were expended on incentives (1.1%), child care (.3%), and meals (2.4%) for the family program. The expenditures on program delivery more than tripled in the second year as program delivery ramped up and the school program began
With this rise in delivery, the amount of resources expended on program fidelity monitoring also grew (Year 2 = 5.4%).

Overall, expenditures on team activity costs decreased in Year 4, except for sustainability planning, which increased (10.4%). In Year 5, team-level expenditures reached their highest point, as the project began expansion into new communities (Year 5 Total Costs $464,463.82). Proportionally, university operations and oversight (27.7%) expenditures rose most rapidly in Year 5. Despite increases in team-level expenditures, program-level activity-costs began to fall during Year 4 (23.7%). Additionally, the resources generated by the local teams appeared to offset delivery expenditures from the parent grant, which dropped during the last two years of the analysis.

From a cost perspective, the major distinction of delivering preventive interventions in the context of the PROSPER project--as opposed to without the support of a prevention system--is the additional resources necessary to develop the project’s infrastructure and build local capacity (i.e., over 50% of project expenditures are a result of team-level activities). Many local prevention initiatives do not continue long after initial funding ends (Adelman & Taylor, 2003); these infrastructure-building and local-team activities are designed to overcome that problem by sustaining local efforts and maintaining quality programming. We hypothesize that these greater initial investments will lead to improvements in programming quality--and subsequently greater impact--and over time these outlays will result in a reduction in the overall costs as local efforts become sustainable. These efficiencies may lower the costs needed to make a substantial, sustained impact on local public health.
Issues in Cost Analyses of Prevention Systems

The development of PROSPER’s resource infrastructure demonstrates the dynamic nature of the project’s resource consumption. There were multiple methodological questions raised during the course of this analysis. Specifically when evaluating the costs of a prevention system: (1) How should research and implementation costs be disentangled? (2) When do budgetary data fail to capture opportunity costs? (3) What are the most meaningful approaches for assessing intangible costs? and (4) What is the role of sustainability planning and the ensuing resource generation?

A major concern of this analysis was how to parse research and implementation costs. While some expenditures were clearly due to research (e.g., data collection) or implementation (e.g., program curriculum) activities, a meaningful amount were not (e.g., university overhead, space and equipment) Many of these were at the university-level, where the majority of the research activities and first-copy costs occurred. The first type of mixed expenditure we assessed was university personnel costs (i.e., administrators, prevention faculty and graduate students). Little prospective tracking of the university personnel’s time was available. The method that provided the most intra-individual variability was to apportion each individual retrospectively based upon gross estimates of time spent on research and implementation activities. This was accomplished through an iterative interview process with project administrators, multiple prevention faculty, and project graduate students. While this process was adequate for the relatively small implementation of PROSPER--as demonstrated by the sensitivity analysis-- it would be infeasible in a state- or nation-wide implementation. Alternatively, future utilization of a prospective tracking tool to capture these proportions on an annual or bi-
annual basis may be more effective. Of greater concern was the allocation of university-level expenses to research or implementation. In particular, the allocation of university overhead was particularly difficult. University overhead comprised 21.5% of total expenditures (i.e., research and implementation) from the parent grant and thus the rate of allocation had a substantial impact on the final estimates of implementation costs. In general, there exists “no unambiguously right way” to apportion overhead costs (Drummond et al., 1997 p. 63). Unfortunately, most university and community partners do not have the capacity to utilize many of the overhead allocation techniques that would provide the greatest detail (e.g., simultaneous allocation and step-down with iterations). In order to carry out these approaches, more sophisticated cost tracking systems will be necessary. In addition, sensitivity analyses will remain a key tool for exploring this area of uncertainty.

The second methodological question articulated during the analysis was at what point are budgetary data insufficient to estimate economic costs and what additional measurement is necessary to assess the opportunity costs of the system? In the current work, we assessed the direct opportunity costs of three parties (i.e., team co-leaders, team members and participants). These individuals were targeted because they received no compensation for their time costs and thus we employed additional assessment tools to estimate their opportunity costs. All other project personnel received monetary compensation for their labor, which was commensurate with their expertise and experience. Because PROSPER and other prevention systems rely on partnerships, the costs to stakeholders with ancillary connections to the project remain unclear (e.g., local policy-makers). We limited the scope of the analysis to not include such stakeholders, but
understanding the burden placed on these individuals by the project could be valuable for understanding their willingness to support PROSPER’s activities.

The third question, loosely related to the second, was how we should consider the intangible costs of implementing PROSPER. For instance, further exploration of the intangible costs to participants may be beneficial to understanding participant engagement (Corso, 2010). A more abstract question involves greater exploration of prevention systems’ systemic impact outside of its internal resource infrastructure (i.e., Local Team<->Cooperative Extension System <->University Team). For instance, the PROSPER model employs a relatively organized approach to sustainability planning and marketing, which positions local teams to be strong competitors for local- and state-funding streams. Consequently, PROSPER teams may capture local resources that would have otherwise funded other local health initiatives. While these broader systemic costs may be difficult to capture, tracking community shifts in resource allocation may facilitate a greater understanding of a prevention system’s impact.

Lastly, an interesting dynamic encountered during the course of this analysis regarded the sustainability planning procedure and resource generation process. The grant writing and fundraising activities, which partially comprise this procedure, utilize project resources for the purpose of generating future revenue. Consequently, resources consumed for sustainability planning are less comparable to a traditional fiscal expenditure and more appropriately may represent a coordinated investment (although with a much less predictable rate of return). Little is known about this process and, in light of its apparent role in project sustainability, it may be beneficial to further explore how resources allocated to resource generation are ‘spent’ (e.g., applying for large or
small grants, fundraisers, local solicitation), at what rate do these inputs return resources to the project (e.g., within the same year or many years after initial investment), and in what form are they most likely to take when they return (e.g., grants, donations, sponsorship)? The growing awareness that prevention and health promotion programs must not only be delivered with fidelity--but also sustained--makes these questions increasingly relevant.

Conclusions

The primary reasons to conduct a cost analysis, and economic analyses in general, are to assess efficiency as well as to project realistic costs for future implementation. Increases in efficiency within a multi-layered project such as PROSPER can occur at a variety of levels. The local teams can become more efficient at delivering programs or carrying out activities that support the team. Prevention coordinators may develop better methods of delivering technical assistance and become more attuned to team leaders’ needs. The Cooperative Extension and university systems may increase their operational efficiency as they build working relationships, pool resources, and develop new tools to facilitate project objectives. Additionally, over time the entire system may see improvements in efficiency as local teams become more willing to accept university support, lines of communication become entrenched, and initial turn-over selects the most compatible individuals for the project.

While this analysis lacks the information to make conclusions about many of these specific increases in efficiency, it provides preliminary evidence that within the PROSPER project efficiencies are occurring. Specifically, we see a decrease in the direct costs per family of delivering the family program over time. While less pronounced, it
appears--based upon previous estimates of program benefits--there may be increases in school program delivery efficiency, which is impressive as these programs are presently regarded as some of the most efficient prevention programs available (Aos, Lieb, Mayfield, Miller & Pennucci, 2004). These efficiencies are masked by the higher systemic and societal costs of the PROSPER project--specifically it is the team-level resource consumption which appears to ‘drive-up’ the costs of implementing the program. This poses interesting questions for researchers studying the economic efficiency of prevention. Specifically, are we interested in understanding the cost of a program as it ‘sits on the shelf’, or the cost of getting the program to those who would benefit from its sustained implementation? When we estimate the costs of prevention programs, are we doing enough to consider the costs (both tangible and intangible) of disseminating these programs?

Prevention systems, including the PROSPER project, not only deliver evidence-based programs, but they attempt to ensure that facilitators can implement the program with fidelity and evaluate its impact (e.g., program fidelity monitoring, program evaluation). These systems spread the word about available programs and focus on getting participants ‘in the door’ (e.g., project marketing and participant recruitment). Maybe of greatest importance is prevention systems’ ability to cultivate local capacity and sustainability so that community efforts have the opportunity to achieve a public health impact. Yet, rarely are the resources needed for these activities included in program cost estimates. The neglect of these costs is, in many ways, analogous to the child during the holidays--who receives his most desired present--only to learn that his or her parents forgot the batteries. As we build the science of dissemination it may be time
to make evaluation of dissemination efficiency a higher priority—if for no other reason—so we can put the batteries in the box.
REFERENCES


Practice: The Interactive Systems Framework for Dissemination and Implementation.

*American Journal of Community Psychology* 41:171–181


APPENDIX

Figure 1. PROSPER Process-to-Outcome Model: Linking Partnership Process to EBI Outcomes
Figure 2. The PROSPER Project Sustainability Model
Figure 3. PROSPER Costs → Processes → Procedures → Outcomes
Figure 4. Team-Level Expenditures by Activity

![Graph showing team-level expenditures by activity over project years.]
Figure 5. Program-Level Expenditures by Activity
Figure 6. Tornado Diagram of PROSPER Project Cost Estimate

Note: This 'tornado diagram' represents the results of the extreme-scenario sensitivity analysis and four one-way sensitivity analyses for each analytic assumptions made regarding the PROSPER cost analysis. Each assumption is listed down the Y axis, with the total estimate at the top. The X axis at the top represents the variation in the cost estimate in millions. For instance, the University Overhead is allocated to PROSPER’s implementation costs at a rate of 10% to 41.1%. Using this allocation, the total costs of University Overhead for PROSPER’s implementation vary due to this uncertainty from $132,626.72 to $535,616.68, which causes the total cost of PROSPER’s implementation to vary between 3.07 million and 3.47 million when all other assumptions are held constant.
Figure 7. Intra-System Overlap of PROSPER Project Procedures

Note: The above diagram denotes overlap between the three project systems (i.e., Local Team <-> Cooperative Extension System <-> University Team) in project procedures utilized to implement PROSPER. To estimate systemic costs of implementation, procedures were further disaggregated based upon specific activities in order to differentiate between system resource consumption.
<table>
<thead>
<tr>
<th>Step</th>
<th>Method</th>
<th>Result</th>
</tr>
</thead>
<tbody>
<tr>
<td>(1) Definition</td>
<td>Integrate PROSPER Sustainability and CPPOA Models</td>
<td>Analytic CPPOA Structure</td>
</tr>
<tr>
<td></td>
<td>Project Goals &amp; Purpose</td>
<td>Outcomes</td>
</tr>
<tr>
<td></td>
<td>Project Objectives &amp; Strategies</td>
<td>Processes</td>
</tr>
<tr>
<td></td>
<td>Project Procedures</td>
<td>Procedures</td>
</tr>
<tr>
<td></td>
<td>Project Activity-Costs</td>
<td>Costs</td>
</tr>
<tr>
<td>(2) Bounding</td>
<td>Delineate Bounds of Analysis</td>
<td>Boundries of Analysis</td>
</tr>
<tr>
<td></td>
<td>Perspective: Local Team, Cooperative Extension, University Team, Participant, &amp; Society</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Analytic Horizon: Project years 1-5--2002-2006</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Scope: Costs directly related to sustaining quality programming and well-functioning teams</td>
<td></td>
</tr>
<tr>
<td>(3) Identification</td>
<td>Conduct Qualitative Cost Analysis</td>
<td>Integrative Cost Matrix (ICM)</td>
</tr>
<tr>
<td></td>
<td>Classification of 16 Project Procedures</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Classification of 116 Project Activities</td>
<td></td>
</tr>
<tr>
<td>(4) Quantification</td>
<td>Account for Project Fiscal Costs and Resource Consumption</td>
<td>Estimates of Project Expenditures by Activity</td>
</tr>
<tr>
<td></td>
<td>Removal of First Copy &amp; Research Expenditures</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Application of Activity-Based Costing Procedure (ABC)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Allocation of Resource Consumption to Team- &amp; Program-Level Procedures</td>
<td></td>
</tr>
<tr>
<td>(5) Valuation</td>
<td>Estimate Opportunity Costs and Adjust for Market Imperfections</td>
<td>Estimate of Economic Costs</td>
</tr>
<tr>
<td></td>
<td>Opportunity Costs: Team Co-leader, Team Member, Participants</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Market Adjustments: Inflation</td>
<td></td>
</tr>
<tr>
<td>(6) Sensitivity Analysis</td>
<td>Employ Extreme-Scenario Sensitivity Analysis</td>
<td>Final Cost Estimate</td>
</tr>
<tr>
<td></td>
<td>Assumption 1: Allocation Rate of University Personnel Costs to Implementation Activities</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Assumption 2: Allocation Rate of University Overhead to Implementation Activities</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Assumption 3: Allocation Rate of University Expenses to Implementation Activities</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Assumption 3: Cost of Family Curriculum</td>
<td></td>
</tr>
</tbody>
</table>
### Table 2. Integrative Cost Matrix (ICM) of the Prosper Project

<table>
<thead>
<tr>
<th>PROJECT STRATEGIES</th>
<th>PROJECT PROCEDURES</th>
<th>PROJECT ACTIVITIES</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Program Quality Management</strong></td>
<td><strong>COMMUNITY (Local Teams)</strong></td>
<td><strong>EXTENSION (Prevention Coordinator)</strong></td>
</tr>
<tr>
<td>* Programming: Program Selection</td>
<td>* Attend Selection Workshop, Attend Follow-up Team Meeting (LT)</td>
<td>* Organize and Facilitate Selection Workshops</td>
</tr>
<tr>
<td>* Programming: Facilitator Training</td>
<td></td>
<td>* Maintain Evidence-Based Program Menu (PF)</td>
</tr>
<tr>
<td>* Programming: Participant Recruitment</td>
<td></td>
<td>* Attend Program Training</td>
</tr>
<tr>
<td>* Programming: Program Delivery</td>
<td></td>
<td>* Provide Training Opportunities for Local Facilitators</td>
</tr>
<tr>
<td>* Programming: Fidelity Monitoring</td>
<td></td>
<td>* TA: Recruitment</td>
</tr>
<tr>
<td>* Programming: Program Evaluation</td>
<td></td>
<td>* Emphasize Program Fidelity’s Importance, Monitor &amp; Collect Data on Program Quality</td>
</tr>
<tr>
<td>* Sustainability Planning</td>
<td>* Facilitate Data Collection Efforts (TL)</td>
<td>* Analyze Data on Family &amp; School Program Fidelity (PF)</td>
</tr>
<tr>
<td><strong>School Positioning</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>* School Mobilization</td>
<td>* Present to Prospective School Districts, Secure School Support (TL), Secure School Building for Family Program, Maintain Communication with Teachers, Work with School Administration to select programs (CL), Provide Incentives to Classrooms (LT), Build Community Partnerships, Share PROSPER Information with Community Leaders (LT)</td>
<td>* Present to Prospective School Districts, Facilitate Communication with School District, Mediate Interactions Between Schools &amp; Teams, Assess Local Community Needs, Identify Niche Areas for PROSPER Efforts</td>
</tr>
<tr>
<td><strong>Resource Generation</strong></td>
<td></td>
<td>* Provide Guidance Through PC’s</td>
</tr>
<tr>
<td><strong>Strengthening School &amp; Community Partnerships</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>* Extension Linking</td>
<td>* Search for Funding (TL), Write Grants (TL), Plan and Execute Fundraisers (LT)</td>
<td>* TA: Locating Funding Sources, TA: Grant Writing &amp; Fundraising</td>
</tr>
<tr>
<td>* Recruiting Schools</td>
<td></td>
<td>* TA: Locating Funding Sources, TA: Fundraising, Organize Learning Community Meetings (UT)</td>
</tr>
<tr>
<td>* Team Formation</td>
<td></td>
<td></td>
</tr>
<tr>
<td>* Team Functioning</td>
<td>* Initiate Meetings with School and Health Service Professionals, Community Youth &amp; Family Representatives (LT), Recruit Promising Individuals to Join Team (TL)</td>
<td>* TA: Assist with Team Selection, Build Rapport with Community Leaders, TA: Assist with Team Selection, Build Rapport with Community Leaders</td>
</tr>
<tr>
<td><strong>Conducting Effective Meetings</strong></td>
<td></td>
<td>* Build Rapport with Local Extension Agents (UT), Provide Guidance Through PC’s</td>
</tr>
<tr>
<td>* Team Functioning</td>
<td>* Hold Regular Team Meetings, Develop Team Vision &amp; Mission (LT), Learn PROSPER Model, Determine Member Roles (TL), Develop Decision-Making Process (TL), Attend LC meetings &amp; Share Information with Teams (TL)</td>
<td>* TA: Provide Templates of Effective Organizational Procedures, Aid in Developing and Facilitating Learning Community Meetings, TA: Team Functioning</td>
</tr>
<tr>
<td><strong>Monitoring Teams</strong></td>
<td></td>
<td>* Develop Templates of Effective Organizational Procedures (UT)</td>
</tr>
<tr>
<td>* Team Supervision</td>
<td>* 'Check in’ with Team Members (TL), Report on Team Functioning to PC (TL), Attend Process Report Presentations (LT), Incorporate Findings into Team Procedures (TL)</td>
<td>* Attend Monthly Community Meetings, Communicate Regularly with Team Leader, Aid Teams in Interpreting Program Evaluations</td>
</tr>
<tr>
<td><strong>Strategic Communication Planning</strong></td>
<td></td>
<td>* Data Collection of Team Functioning (PF), Disseminate Information to PC’s, Provide Administrative Oversight (UT)</td>
</tr>
<tr>
<td>* University Operations &amp; Oversight</td>
<td></td>
<td>* Communicate with University and share information with teams</td>
</tr>
<tr>
<td><strong>Planning for Recognition &amp; Rewards</strong></td>
<td></td>
<td>* University team meetings, cross-site meeting, planning and oversight of PC’s and teams</td>
</tr>
<tr>
<td>* Public Relations</td>
<td></td>
<td>* Garner Community Support, Facilitate Marketing Activities</td>
</tr>
<tr>
<td>* Recognition &amp; Reward Successes</td>
<td>* Engage Team Members at Statewide Meeting (TL), Contribute to Newsletter (TL), Engage Other Extension Personnel (TL), Attend Outcome Report Presentations (LT)</td>
<td>* Assist in Developing Statewide Agenda, Contribute to Newsletter, Update Extension Administration Regularly, Process Team Successes with Team Leader</td>
</tr>
<tr>
<td><strong>Notes:</strong></td>
<td></td>
<td>* Communication between state sites and with PCs &amp; communities regarding goals and operations, Provide Materials for Social Marketing Campaigns (UT)</td>
</tr>
</tbody>
</table>

**Abbreviations:** Entire Local Prevention Team (LT), Team Leader (TL), Co-leader (CL), Entire University Prevention Team (UT) Prevention Faculty (PF), Extension Faculty (EF), Graduate Student (GS); Activity Specific Abbreviations: Technical Assistance (TA), Learning Community Meeting (LC).
### Table 3. PROSPER Project-Level Cost Estimates By Procedure

<table>
<thead>
<tr>
<th>Procedure</th>
<th>Year 1</th>
<th>%</th>
<th>Year 2</th>
<th>%</th>
<th>Year 3</th>
<th>%</th>
<th>Year 4</th>
<th>%</th>
<th>Year 5</th>
<th>%</th>
<th>Total Procedure Costs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Program Selection</td>
<td>$7,866.36</td>
<td>1.93%</td>
<td>$6,094.65</td>
<td>0.81%</td>
<td>$83,716.20</td>
<td>10.19%</td>
<td>$40,105.53</td>
<td>6.74%</td>
<td>$11,392.91</td>
<td>1.84%</td>
<td>$25,353.92</td>
</tr>
<tr>
<td>Facilitator Training</td>
<td>$100,699.60</td>
<td>24.75%</td>
<td>$85,242.05</td>
<td>11.28%</td>
<td>$114,469.41</td>
<td>13.93%</td>
<td>$35,700.84</td>
<td>6.00%</td>
<td>$33,821.16</td>
<td>5.47%</td>
<td>$332,085.29</td>
</tr>
<tr>
<td>Partic. Recruitment</td>
<td>$15,840.95</td>
<td>3.89%</td>
<td>$85,142.01</td>
<td>11.26%</td>
<td>$114,469.41</td>
<td>13.93%</td>
<td>$35,700.84</td>
<td>6.00%</td>
<td>$33,821.16</td>
<td>5.47%</td>
<td>$284,974.37</td>
</tr>
<tr>
<td>Program Delivery</td>
<td>$26,221.75</td>
<td>6.44%</td>
<td>$171,161.81</td>
<td>22.64%</td>
<td>$136,344.25</td>
<td>16.60%</td>
<td>$26,330.28</td>
<td>4.43%</td>
<td>$44,012.56</td>
<td>7.11%</td>
<td>$404,070.65</td>
</tr>
<tr>
<td>Fidelity Monitoring</td>
<td>$14,752.63</td>
<td>3.63%</td>
<td>$40,999.08</td>
<td>5.42%</td>
<td>$40,655.63</td>
<td>4.95%</td>
<td>$30,712.94</td>
<td>5.16%</td>
<td>$32,218.02</td>
<td>5.21%</td>
<td>$159,338.30</td>
</tr>
<tr>
<td>Program Evaluation</td>
<td>$1,302.87</td>
<td>0.32%</td>
<td>$2,445.40</td>
<td>0.32%</td>
<td>$9,219.75</td>
<td>1.12%</td>
<td>$8,095.35</td>
<td>1.36%</td>
<td>$10,438.43</td>
<td>1.69%</td>
<td>$31,501.81</td>
</tr>
<tr>
<td><strong>Total Program Level</strong></td>
<td>$166,684.16</td>
<td>40.96%</td>
<td>$391,085.01</td>
<td>51.73%</td>
<td>$384,405.25</td>
<td>46.80%</td>
<td>$140,944.94</td>
<td>23.69%</td>
<td>$154,204.99</td>
<td>24.93%</td>
<td>$1,237,324.34</td>
</tr>
<tr>
<td>School Mobilization</td>
<td>$24,537.51</td>
<td>6.03%</td>
<td>$23,916.12</td>
<td>3.16%</td>
<td>$23,769.81</td>
<td>2.89%</td>
<td>$43,409.44</td>
<td>7.30%</td>
<td>$28,723.82</td>
<td>4.64%</td>
<td>$144,356.70</td>
</tr>
<tr>
<td>Sustainability Planning</td>
<td>$9,230.04</td>
<td>1.22%</td>
<td>$47,313.57</td>
<td>5.76%</td>
<td>$61,973.10</td>
<td>10.42%</td>
<td>$72,721.52</td>
<td>11.75%</td>
<td>$191,238.23</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Extension Linking</td>
<td>$19,788.75</td>
<td>4.86%</td>
<td>$20,614.39</td>
<td>2.73%</td>
<td>$19,423.99</td>
<td>2.36%</td>
<td>$19,854.53</td>
<td>3.34%</td>
<td>$24,279.99</td>
<td>3.92%</td>
<td>$103,961.65</td>
</tr>
<tr>
<td>Recruiting Schools</td>
<td>$3,908.61</td>
<td>0.96%</td>
<td>$3,908.61</td>
<td>0.96%</td>
<td>$3,908.61</td>
<td>0.96%</td>
<td>$3,908.61</td>
<td>0.96%</td>
<td>$3,908.61</td>
<td>0.96%</td>
<td>$3,908.61</td>
</tr>
<tr>
<td>Team Formation</td>
<td>$15,273.11</td>
<td>3.75%</td>
<td>$20,185.02</td>
<td>2.67%</td>
<td>$3,864.85</td>
<td>0.47%</td>
<td>$1,869.04</td>
<td>0.31%</td>
<td>$1,908.95</td>
<td>0.31%</td>
<td>$43,100.96</td>
</tr>
<tr>
<td>Team Functioning</td>
<td>$28,753.38</td>
<td>7.07%</td>
<td>$68,132.32</td>
<td>9.01%</td>
<td>$92,463.25</td>
<td>11.26%</td>
<td>$96,054.53</td>
<td>16.14%</td>
<td>$87,655.91</td>
<td>14.17%</td>
<td>$373,059.39</td>
</tr>
<tr>
<td>Team Supervision</td>
<td>$35,868.06</td>
<td>8.81%</td>
<td>$48,086.90</td>
<td>6.36%</td>
<td>$51,443.82</td>
<td>6.26%</td>
<td>$46,443.07</td>
<td>7.81%</td>
<td>$47,822.28</td>
<td>7.73%</td>
<td>$229,664.13</td>
</tr>
<tr>
<td>University Operations &amp; Oversight</td>
<td>$90,737.62</td>
<td>22.30%</td>
<td>$134,917.85</td>
<td>17.85%</td>
<td>$155,246.18</td>
<td>18.90%</td>
<td>$144,770.88</td>
<td>24.33%</td>
<td>$171,588.92</td>
<td>27.74%</td>
<td>$697,261.47</td>
</tr>
<tr>
<td>Public Relations</td>
<td>$4,924.35</td>
<td>1.21%</td>
<td>$18,149.71</td>
<td>2.40%</td>
<td>$20,578.84</td>
<td>2.51%</td>
<td>$20,356.65</td>
<td>3.42%</td>
<td>$15,159.65</td>
<td>2.45%</td>
<td>$79,169.19</td>
</tr>
<tr>
<td>Recognition &amp; Rewards</td>
<td>$16,440.82</td>
<td>4.04%</td>
<td>$21,622.68</td>
<td>2.86%</td>
<td>$22,944.71</td>
<td>2.79%</td>
<td>$19,288.77</td>
<td>3.24%</td>
<td>$14,602.78</td>
<td>2.36%</td>
<td>$94,899.86</td>
</tr>
<tr>
<td><strong>Total Team Level</strong></td>
<td>$240,232.21</td>
<td>59.04%</td>
<td>$364,855.04</td>
<td>48.27%</td>
<td>$437,049.01</td>
<td>53.20%</td>
<td>$454,020.11</td>
<td>76.31%</td>
<td>$464,463.82</td>
<td>75.07%</td>
<td>$1,960,620.20</td>
</tr>
<tr>
<td>Project Year Totals</td>
<td>$406,916.37</td>
<td>100.00%</td>
<td>$755,940.05</td>
<td>100.00%</td>
<td>$821,454.26</td>
<td>100.00%</td>
<td>$594,965.05</td>
<td>100.00%</td>
<td>$618,668.81</td>
<td>100.00%</td>
<td>$3,197,944.54</td>
</tr>
</tbody>
</table>

Note: Estimates reflect resources consumed directly by the PROSPER project, but do not reflect total economic costs of project implementation.
Table 4. Cost Estimates of PROSPER Project Implementation

<table>
<thead>
<tr>
<th>Cost Perspective</th>
<th>Low Estimate</th>
<th>High Estimate</th>
<th>Inclusion Criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>Societal Costs</td>
<td>$4,531,996.89</td>
<td>$5,397,758.73</td>
<td>Total opportunity cost of implementing the PROSPER project to partner universities, the Cooperative Extension System and local communities (i.e., includes team co-leader, team member and participant costs)–excludes systemic transfer costs</td>
</tr>
<tr>
<td>The PROSPER Project</td>
<td>$2,852,084.16</td>
<td>$3,717,846.00</td>
<td>All resources consumed by the PROSPER system (i.e., university, Cooperative Extension and local teams)–excludes team co-leader, team member and participant opportunity costs</td>
</tr>
<tr>
<td>University Prevention Team (n=1)</td>
<td>$1,435,959.61</td>
<td>$1,871,851.04</td>
<td>All resource consumed by the University Prevention Team, including all prevention personnel salary and wage expenditures as well as all operations costs (including university overhead)—excludes cooperative extension and local costs</td>
</tr>
<tr>
<td>Cooperative Extension System Costs (n=1)</td>
<td>$1,030,876.38</td>
<td>$1,343,803.13</td>
<td>All resources consumed by the Cooperative Extension System, including all extension faculty, prevention coordinator and local team leader salaries as well as direct expenditures by the cooperative extension system for operations (e.g., travel, copying &amp; printing)—excludes university and local community costs</td>
</tr>
<tr>
<td>Local Prevention Team Costs (n=7)</td>
<td>$55,035.45</td>
<td>$71,741.69</td>
<td>All resources consumed by the Local Prevention Teams (per team) including team functioning, and direct costs of program implementation (e.g., facilitators, materials, meals), but not program-level capacity building expenditures (i.e., curriculum and training)</td>
</tr>
<tr>
<td>Participant Costs (n=1127)</td>
<td>$555.03</td>
<td>$556.08</td>
<td>All travel and time costs incurred by family program participants (per participant)</td>
</tr>
</tbody>
</table>

Service Costs

<table>
<thead>
<tr>
<th>Service Costs</th>
<th>Low</th>
<th>High</th>
<th>Inclusion Criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>Direct Family Program Costs (per family) (n=1127)</td>
<td>$278.56</td>
<td>$348.25</td>
<td>All incentives (recruitment, prizes, meals, child care), curriculum, and facilitator costs (training and implementation); (High Estimate also includes curriculum and supplies)—divided by the number of families graduating from family program</td>
</tr>
<tr>
<td>Direct School Program Costs (per student) (n=8049)</td>
<td>$8.94</td>
<td>$26.74</td>
<td>All curriculum and training costs (High estimate also includes facilitator incentives and program supplies) divided by the number of students participating in the school program</td>
</tr>
<tr>
<td>Project Costs (per youth) (n=9176)</td>
<td>$311.28</td>
<td>$405.63</td>
<td>All resources consumed by the PROSPER system (i.e., university, Cooperative Extension and Local teams)–excludes team co-leader, team member and participant opportunity costs—divided by total youth serve</td>
</tr>
</tbody>
</table>