10-1997

Basics of research (Part 10): The grant application process

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Basics of Research (Part 10): The Grant Application Process

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Key Words: funding, grants, research

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1067-991X/97/$5.00 + 0

Reprint no. **74/1/8799**

As health care reform prompts revisions in health care delivery, basing practice decisions on research findings becomes ever more important. However, reform movements have created an unfortunate catch-22. Although applying research findings can improve the quality of care and decrease costs, fewer organizations are willing to fund research because of financial constraints. As research budgets are eliminated in the name of cost containment, researchers must become more creative in seeking funding for their work.

For transport programs whose research budgets have been cut or never even existed, two methods are available for funding research. The first method is to absorb the cost of the research within the normal operating budget. If the costs of the research are not too great, a program may not place research-related phone calls, copying, and staff time into a separate research category. This option allows transport team members to conduct their work without seeking funding from other sources.

If, however, the research project will require resources beyond those already available or otherwise allocated, other sources of funding need to be explored. The most common source of research funding is from grant monies, either internal or external to the organization. The purpose of this paper is to discuss methods for obtaining grant funds to support research. Sources of grant funding and techniques for writing a fundable proposal will be discussed.

Potential Sources

Sources of research funding may be either internal or external to the organization. In the case of air transport, air medical personnel may be eligible to apply for internal hospital funding of a research project. Hospitals may build research budgets into the organization as a whole and require that hospital personnel apply for the available funds. Other organizations may have a charitable group associated with the hospital that provides funding for research projects. Individuals who work for an agency not directly associated with a hospital may have internal sources of research funds available.

Local community groups may provide funding for health care research. These groups may be local chapters of national health care organizations, such as the American Lung Association or the National Flight Nurses Association. Other groups without a national presence also may provide small amounts of money for health care research.

Finding local sources of research funding may be challenging unless you are associated with a particular group that offers research grants. Local publications may be one of the best sources for learning about available funds. Be alert for news stories that report the findings from a study that a local group funded. You also may hear of groups conducting fund raising to support health care research. In that case, you may wish to contact the group directly to determine how to apply for those funds.

Many national health-related organi-

zations budget a portion of their funds each year for research. These organizations may have missions directed toward supporting a particular profession, a specific area of health care, such as air transport, or health care in general. A few organizations well known for their funding of health care research include the American Association of Critical Care Nurses, the Foundation for Aeromedical Research, the Kellogg Foundation, the Oncology Nursing Society, the Robert Wood Johnson Foundation, and Sigma Theta Tau International.

Although resources may not appear as plentiful as in the past, the federal government continues to be a major source of research funding. The National Institutes of Health (NIH) is the primary funding agency within the federal government for health care research. Most subdivisions of NIH provide funding in a specific area of interest. Institutes that may have an interest in air transport research include but are not limited to the National Institute of Nursing Research; the Heart, Blood, and Lung Institute; the Agency for Health Care Policy and Research; and the National Library of Medicine.

Corporations within the United States continue to have an interest in health care research, and many provide funds to support these activities. Pharmaceutical and medical equipment companies are two types of corporations commonly associated with funding health care research.

Although most institutions that provide research funding are ethical, a researcher must be careful that the promise of money does not compromise the scientific integrity of the research or create conflicts of interest. Before accepting funding from any source, the investigator must know if any "strings" are attached to the money. Corporations at times have required that they retain the right to approve all publications resulting from the funded research. The purpose of this stipulation is to allow the corporation to prevent the publication of results unfavorable to their interests. Corporations also may request input into the study design. In this event the researcher must be sure the scientific rigor and integrity of the study are not compromised. Although the acceptance of money from a corporation is generally without problem, the investigator must be sure to avoid even the appearance of impropriety or ethical violation. Otherwise the results will be suspect, and the research will have little if any impact on practice.

The above discussion has provided several ideas for sources of research funding. This discussion, however, has not been exhaustive. Many other sources of funding exist, including entire reference books listing granting agencies.[1-3] A local librarian may be able to help you find other resources.

Another way to locate possible grant monies is to ask other researchers, especially those involved in air transport, who may be able to steer you to agencies that are particularly interested in funding research in your area. A similar method is to look at recent publications. If a research study has been funded by a grant, the name of the granting agency should be provided somewhere in the article. If the reader does not know how to contact the specified agency, he or she can contact the paper's author for further information on locating the funding agency's phone number or address.

Finally, researchers are encouraged to take advantage of the resources available on the Internet. A search using one of the Internet search engines, such as Yahoo!, WebCrawler, or Lycos, may lead you to unexpected sources of funding. However, the Web is a new and growing entity. As such, information reliability may vary. For example, a recent search for air medical transport research funding provided many sources, but few links were actually relevant. In addition, many of the sites listed were no longer available. However, the Internet is a unique source of information and may provide information on a funding agency that you might not otherwise locate.

Selecting the Appropriate Agency

Because grant writing is a time-consuming process, researchers need to direct their grants to the agency with the highest possibility of funding the proposal. Unfortunately, knowing which agency to select is not always easy. Many criteria can assist you in selecting the best one or two agencies to which to apply for funding. First, select an agency that has an interest in health care, preferably air transport or another component of your proposal (such as an interest in children for a grant relating to pediatrics).

Second, select an agency that provides funding in an amount close to what you will need for your research. Applying to the federal government for $500 probably is not appropriate because most of their grants are for much greater sums. Similarly, applying to your state nurses association for $500,000 is also not productive because its total research budget is undoubtedly much smaller.

When possible, select an agency that offers you the best chance of getting funded. Local organizations may look more favorably on residents of their community. Newer groups may have fewer applicants and thus offer a greater chance that your grant will be selected for funding. You may want to consider sending a letter of inquiry to an agency before sending an entire proposal. In the letter you should briefly outline your research question and the amount of money you are requesting. This initial contact will provide the agency with an opportunity to say yours is not an area they fund or you need more money than they usually provide. If so, you will have saved yourself the effort of writing an entire application only to be turned down.

Grant Application Process

Most institutions offering research grants, either internal or external, require researchers to complete an application when requesting grant money. Agencies have only a limited amount of money that can be spent on grants in a given year. The application process allows the funding agency to select projects that most closely match the funding organization's goals and are of the highest quality.

The first step in this process is to obtain a copy of the grant application. Most agencies will accept a request for an application in writing, over the phone, in person, or through E-mail or the World Wide Web. When requesting an application, be sure to ask if additional instructions should be obtained. If possible obtain the phone number or E-mail address of an individual to whom questions can be addressed during the grant-writing process. The contact person also may be able to answer questions regarding topics in which the agency has an interest

Table 1 **Partial Grant Application Plan (assuming a July 1 deadline)**

Obtain grant from Foundation for Aeromedical Research (2 weeks)	Jan. 15
MEDLINE search for relevant literature (1 week)	Jan. 22
Write background and review of literature (2 weeks)	Feb. 7
Meet with chief flight nurse to discuss idea (1 week)	March 1
Contact chief flight nurse from three other programs (1 month)	April 1
Write methods section (1 week)	April 1
Obtain letter of agreement from all chief flight nurses (1 month)	May 1
Create consent form (1 day)	May 1
Application back from team members after review (2 weeks)	May 1
Revise grant (2 weeks)	May 21
Application back from hospital research committee (2 weeks)	June 4
Type final copy (5 days)	June 20
Mail application	June 25

and may be willing to provide general feedback on your proposed topic. Although the contact person may not review grant applications, he or she may be able to provide you with hints or suggestions for improving your application.

After receiving them, read the application and instructions in their entirety. This first read through the application allows you to plan your grant-writing project. Pay particular attention to application due dates because most agencies will discard or return applications received after the published deadline. Also note whether the deadline is the date the application must be postmarked or the date it must be received.

At some point early in the application process, you need to contact the individuals at your hospital or organization directly involved with research. These individuals will inform you of the specific steps needed to meet your own institution's requirement for research. Many organizations require researchers to have budget and/or project approval by a research committee before they are allowed to apply for grant funding.

Next, using your outline for the project and the instructions from both the funding agency and your own institution, make a list of everything that must be done before submitting the grant. The list should consist of many small steps rather than a few large steps. For example, you should have a separate item for each part of the grant. List "write abstract," "write specific aims," and "write methods section" rather than just "write grant." Be sure to include as steps contacting the medical director for permission to do a study, obtaining a letter of support from the chief flight nurse, and creating consent form. Breaking the process down into small steps facilitates better planning.

Be sure to allow time for internal and/or external review of the grant application. After you have completed a first draft, ask colleagues to read the grant and provide feedback. After you revise the grant, ask a senior researcher who has submitted successful grant applications to review yours. Whenever possible, at least one of your reviewers should be unfamiliar with air transport. This person will provide you the best feedback on whether you have been sufficiently clear so that a reviewer with no knowledge of air transport can understand what you plan to do in the project.

Finally, arrange the list in the approximate order you will be doing the tasks. Place tasks that require more time or others' input higher on the list whenever possible. Next to each item, estimate the time required to accomplish the task. Now start at the bottom of the list and move backward from the due date to establish deadlines for yourself. If you find you have run out of time before the application deadline, you need to reconsider the funding agency you have selected or to postpone your application until the following cycle. Table 1 includes a sample deadline list for just a few of the items involved in preparing a grant application. A 6-month time frame is not unusual when grant writing is not your full-time occupation!

Once the application is completed, the author must ensure the entire grant is received by the funding agency in the appropriate format and within the required time frame. A final copy must be typed either on the application form or other appropriate paper as specified. Most agencies allow computer-generated text rather than a typed application.

Because grant applications often are reviewed by several people, the agency may request several copies of the application. The author must follow the instructions for the appropriate number of copies and include them with the proposal. The funding agency usually does not have the funds or the time to copy the proposal for each assigned reviewer. Consequently, applications without sufficient copies may be discarded or returned to the author.

Because the application must arrive by the deadline, the author will want to select an appropriate method for delivery of the grant. The author should request a return receipt from the post office or other delivery service so he or she can verify the application arrived by or was postmarked on the deadline. If the grant is not completed until just before the deadline, the author may need to use overnight delivery to ensure the application's timely arrival.

Grant Components

The format of a grant application varies across organizations. However, several basic components are part of most applications. Applicants must be certain they have obtained the required forms and have completed them correctly. Many organizations will discard an application that is not submitted on the correct form or does not adhere to all guidelines.

The researcher also must pay strict attention to the formality of the funding organization. Some organizations prefer a simple letter written in common, easily understood language because their reviewers are not researchers themselves. In contrast, other organizations—such as the federal government—require a highly structured application that adheres closely to the scientific method. Although reviewers for the federal government may not be experts in the area of transport, they will be expert researchers.

The application instructions should specify the content the funding agency re-

quires in the application, as well as items to be excluded. The grant components will be outlined, and information on format, such as length limitations, generally is provided. When guidelines on length are not given, the author should assume shorter is better. Although the author must provide enough information so the funding agency understands the proposal, the author also should be succinct. Reviewers' time is important; reviewing grants is usually a service on their part. If your application is overly long, the reviewer may become irritated, and this irritation may influence the reviewer's perception of the application.

The first component of most grant applications is a short abstract outlining the proposed research. After the abstract, the author will need to provide several sections that expand the ideas outlined in the abstract. Most grant applications request that additional sections address specific aims of the research (purpose), a summary of the relevant literature or other background material necessary to understand the proposal, a complete methods section, and a more in-depth discussion of the work's significance.

The methods section will vary in degree of detail requested. Unless otherwise indicated, the author should discuss the subjects, research design, instruments, research procedures, a time line for the research, and a plan for data analysis. Most grant applications also request a budget that outlines how the researcher plans to spend the money received. In most cases, the budget will be requested in a tabular form with sections provided for personnel, travel, supplies, equipment, and other resources. The author also may be required to justify each item within the budget.

Applications for funding from the federal government, as well as other agencies, often request additional information. A section on protecting human subjects frequently is required, as is information on how minorities and women will be included within the sample. Some federal grants also require information on previous related studies that the investigator has conducted.

In the following sections, each component of a grant will be discussed in further depth.

Abstract

The abstract is an essential component of the grant, not an afterthought, and may have several purposes. First, the abstract may be used by the individual receiving the grant to determine the appropriate reviewer(s) to which to assign the application. Second, if not all members of the review committee read each grant in its entirety, the abstract can be used by others to learn the basic intent of the project. Finally, the abstract may be used in press releases or other publications notifying the public of the grant funding.

Although the abstract may be the first part of the grant read, it may be the last section written. The abstract should summarize the entire grant with an emphasis on the work's problem, purpose, methods, and significance. The first statement in the abstract should lay out for the reader the problem to be addressed. Next the author should indicate what specific questions or hypotheses his or her work will address. A brief description of the methods should follow, including the planned analyses. The abstract should conclude with a strong statement of the proposed research's significance.

Purpose/Specific Aims

The specific aims section describes the overall purpose of the study. This section starts with a broad statement of the problem and moves toward the author's specific plans for solving it. The author usually provides a long-term goal for research, as well as the short-term goal this grant will address. This section is relatively short, one to two pages maximum, and should move from the general to the specific. Long-term goals should be discussed before short-term goals; goals should be discussed before questions and hypotheses.

Background/Literature Review

The background and review of literature section is meant to put the proposed research into perspective. The first purpose of the literature review is to provide information to the reviewer on previous related research. The literature reviewed should be directly relevant to the proposed research and should clearly demonstrate that this study is logically the next to be undertaken.

For example, early studies examining a given topic may have used descriptive methods to explore a phenomenon of interest. Surveys often are a first stage in investigating a given topic. A survey of the incidence of rapid sequence intubation (RSI) in air transport would provide data on how often this procedure is performed. A second study may use a nonexperimental design to look at outcomes from intubations with and without RSI. Finally a third study may use an experimental design and randomly assign patients to be intubated with or without RSI. Although the feasibility and ethics of random patient assignment to an RSI and non-RSI group is open for debate, the author hopes the reader can see how these three studies would build on one another. In the example provided, each study would use the knowledge of the previous study to strengthen its case. This connection between research studies helps the researcher build a strong argument for the need of the proposed project.

A second purpose of the literature review is to provide information (or background) on the instruments, methods, or analyses to be used in the study. If the investigators plan to use a unique approach, they should provide sufficient information not only to educate the reviewer but to provide sufficient evidence the approach selected is valid. The investigators may wish to review previous research that used similar techniques on a different topic.

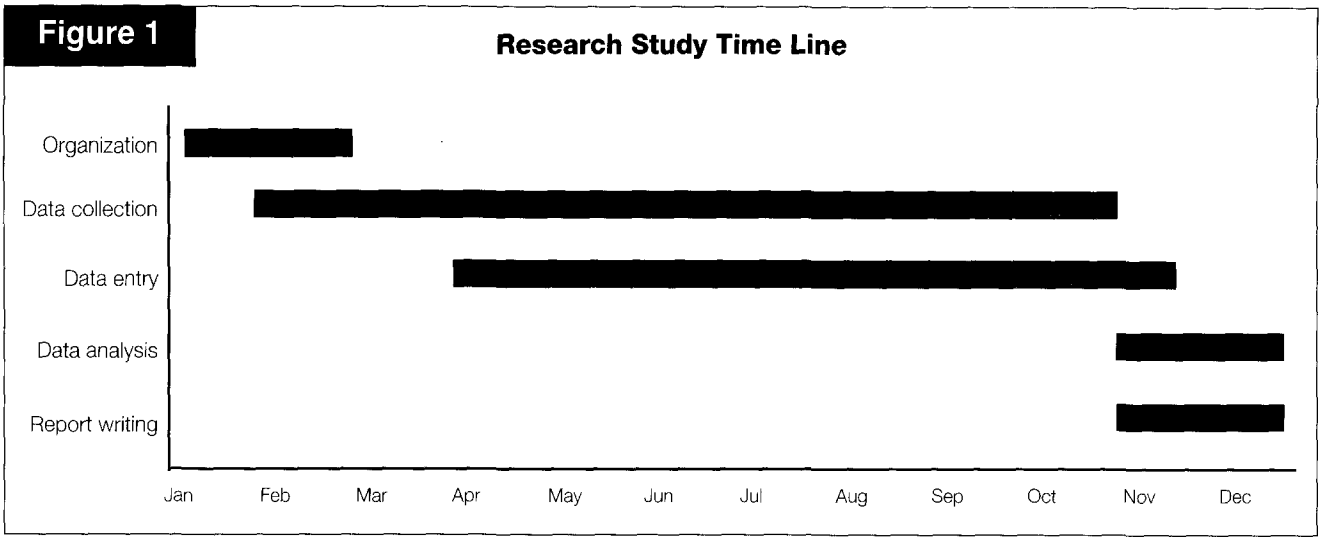
Methods

The methods section provides the details of the research plan. This section must flow from the specific aims, the research questions or hypotheses, and the background and literature review, and a direct connection must exist throughout. For example, the literature reviewed should support the methods chosen. The instruments discussed should match the variables in the hypotheses. Finally, the analysis should involve procedures and variables that relate to the hypotheses.

Subjects

The subjects for the research should be discussed in detail. First, the type of subjects should be described. The discussion should clearly describe how subject selection relates to the research questions. Inclusion and exclusion criteria

Figure 1



need to be specified, and the link between the criteria and the research questions should be clear.

The number of subjects needed for the study should be discussed. Many times a power analysis is an appropriate method for determining sample size.[4] If a power analysis has been done, it should be summarized because it will allow the reviewers to determine whether the sample size is appropriate. A too-large sample may inappropriately increase the cost of the research, and a too-small sample may not answer the research question.

Finally, the author needs to discuss how he or she will obtain subjects for the research. This section needs to be in enough detail that the reviewers will be confident a sufficient number of subjects can be enrolled. Letters of agreement from agencies or groups of individuals may be included in an appendix to provide documentation of subject availability. For example, if you plan to evaluate a treatment protocol during transport, letters of agreement should be provided from each transport program that you expect to participate. A summary of the number of patients transported by each program during the past year and who would have met the inclusion criteria will help the reviewer determine if enough subjects will be available during the planned period of the study.

Design

The design section of the grant is very similar to the design section of an article reporting the research. The type of design should be discussed, as well as any issues relevant to selecting that particular design. An investigator must be particularly careful with this section if the design might be perceived as unusual or controversial. A discussion of the advantages and disadvantages of the chosen approach is appropriate and may be helpful in convincing the reviewer of the study's value.

Instruments

Instruments to be used in the study need to be discussed in detail (if allowed within the grant format). The researcher should not state an instrument will be developed unless this is a instrumentation grant. Instrument development should precede submission of the application, even for surveys and demographic data-collection forms. Copies of all instruments should be provided in an appendix unless specifically prohibited by the instructions.

The researcher should justify the instruments chosen. If an instrument has been used previously, psychometric data on instrument validity and reliability should be presented. If the instrument has not been used before, the methods for its development should be presented in enough detail to convince the reviewer the data obtained will be valuable and appropriate.

Procedures

The investigator should provide a detailed description (as space allows) of the exact methods to be used in the study. This description should include information on subjects, instruments, data-collection methods, and the timing of each event. For example, the investigator may say the subjects (e.g., patient family members) will be recruited by the flight crew at the time of transport during family briefing. Further information (signing a consent form, etc.) may be provided. The investigator then should describe how attempts will be made to contact the subjects at the receiving hospital, at what point data will be collected, and which data-collection forms will be used when. If the study involves a chart review, the grant should specify who will obtain the charts, as well as who will be responsible for actually reviewing the records.

If data are to be collected longitudinally, the investigator needs to make clear the exact order of data collection. For example, the investigator may state that initial data will be collected within 24 hours of hospital admission and that a follow-up phone call will be conducted by a flight nurse at 30 and 60 days postdischarge.

A time line is helpful for relaying the research plan to the reviewer. The time line addresses research activities on a macro level and often uses graphics to illustrate this information. For example, the time line in Figure 1 is from a study of intubation practices in air transport programs. The study occurred during a 12-month period. The first 2 months were used for organization, the second through tenth months included data collection, data entry was initiated in the fourth month and continued through the eleventh, and the last 2 months were reserved for data analysis and writing the report. The time line does not refer to individual subjects but rather addresses the major activities of the research team. Often many activities may be simultaneous. A time line is an excellent tool to

demonstrate this activity overlap. If each activity has a separate line, the anticipated start and stop times of each activity become clear.

Data Analysis

A clear and detailed description of the planned data analysis demonstrates to the reviewer your attention to detail and your understanding of the complete project. Often a researcher may say, "I will let a statistician analyze the data when data collection is complete." The problem with this approach is twofold. First, this statement indicates the researcher may not really know what he or she is doing and consequently may not truly understand the collected data. Having confidence in a researcher who cannot understand his or her own data may be difficult. In addition, the entire project, including the data analysis, should flow from the research questions; this connection should be clearly stated throughout the application. A researcher who does not develop an anticipated plan for data analysis appears either lazy or unable to understand the process, neither of which inspires confidence in a reviewer. Obtaining statistical consultation before you submit the application is a wise decision. This way you can use the statistician to help you write the data analysis section.

A second reason for planning your analysis early is a well-thought out plan for data analysis can save the researcher from mistakes. Often the researcher has not carefully thought out either the variables/instruments or the timing of measurements. When researchers begin data analysis, they may find they cannot actually answer their question with the data they have collected. This problem may necessitate dropping a research question or even discarding the entire effort. Working through the planned data analysis before submitting the grant should prevent this problem.

For example, a researcher may be interested in determining the effect of experience on intubation success rate. If the researcher does not collect data regarding experience, this question may need to be discarded. A more subtle problem may occur if the researcher collects the obvious data—years of experience—but then fails to note who did the intubation. Many transport records report that certain procedures were performed but not which team member did the procedure.[5] Problems such as this frequently can be avoided with a detailed plan for data analysis.

Significance

Many grant applications require a summary statement about the significance of the research. This section is crucial to a positive funding decision. In a paragraph or two, the researcher must make a case for the necessity of the research. Not only must the author convince the reviewer that the question is interesting but that the results will make a difference.

In addition, this section is where the researcher can make the case that his or her project is something this agency should fund rather than someone else. The author may find it helpful to quote the agency's mission statement and tie this statement to the project's goals. The author also may want to connect the current project to other projects the agency has funded.

Sometimes the significance of the project is the most difficult idea to relay to a naive reviewer. If the reviewer is not expected to understand the research area, the author must carefully lead the reviewer to the appropriate conclusion. In many cases, the conclusion will require explaining a series of steps. For example, a study of research priorities for air transport may not appear to have any direct consequences that will affect patient care. However, the investigator could demonstrate that determining priorities will help focus research efforts. The investigator could demonstrate the increased impact on patient care that a series of focused studies has versus a single study on a given topic. The value of the priority study is not in the priorities themselves but in what will result from focusing research efforts.

Budget

The budget section may come either at the beginning or the end of the application. The budget often is seen as the most important part of the grant. The budget section forms a contract of sorts that spells out how the money will be spent. The investigator is cautioned to determine how closely the funding agency will adhere to the budget description and to take this information into consideration when planning the budget. In most cases, the amount awarded is fixed, but sometimes individual budget items may be altered. Changes in the budget often occur as a result of the time between application and receipt of funds. The cost of equipment, supplies, and even personnel changes over time, but these changes must be anticipated to the best of the investigator's ability.

Funding agencies finance a variety of items. Some agencies are interested in computers; others refuse to fund them because they are considered the cost of doing business. Some agencies will fund the researcher's time, whereas others consider that cost the responsibility of the transport program because the researcher is already a full-time staff member. The author should be aware of budget limitations before starting the application.

The level of detail required within the budget varies across funding agencies. An agency may request just a total amount or may require the budget to be broken down by type of expense. Most agencies will ask for a breakdown by year because their own budgets are calculated on a yearly basis. If the project extends more than a year, the author must be sure to place the expenses in the appropriate year of the grant.

Personnel. Personnel can be accounted for in the budget using one of two methods or a combination. The first is on a salary basis. With this approach, researchers determine what percentage of their time they will be involved in the project. They multiply this percentage times their salary and request this amount. Percentages are usually rough estimates and, in most cases, vary across the span of the study. For example, during the initiation of the grant and again during the analysis and write-up, researchers may spend almost 10 hours a week on the study, but during data collection, they may spend only 7 hours a week. This time may average out to 8 hours a week (20%) for the period of the grant; this is the amount that should be requested. This first method usually is reserved for the principal and coinvestigators, as well as research assistants.

The second method is to account for an individual's effort on an hourly basis. This approach often is used with consul-

tants and individuals assigned to a specific task, such as transcribing recorded interviews. In this approach the researcher determines how much time is required to complete the identified task, then multiplies this amount by the hourly or daily rate of the individual.

Researchers also must budget for the cost of benefits for all employed individuals unless their organization agrees to contribute the amount paid for benefits. Most institutions have a calculated percentage attributable for benefits. For example, staff nurses may be considered as having an additional 30% of their salary for benefits. This amount pays for vacation, sick leave, medical insurance, and taxes. Although the individual does not receive this money directly, the organization must budget for this expense when the individual is hired. The benefit percentage varies for part-time and full-time employees and with salary level.

When considering the number of personnel for the grant, the principal investigator (PI) needs to determine all activities to be performed and to assign each to a specific individual, even if that individual is unnamed yet. The procedure section and time line can serve as guides for this section of the budget. Activities often overlooked in conducting research include cleaning and maintaining equipment, entering and analyzing data, and transcribing taped interviews.

Travel. Many research studies require the researcher and/or research assistants to travel. At times the researcher must travel to the subject rather than the subject coming to the researcher. Although this is less common in air transport research, travel expenses are still a consideration. Most institutions have a standard rate for mileage, such as $0.25 per mile (depending on location). The investigator needs to estimate the number of miles to be traveled on study-related business and multiply this number by the mileage rate.

Larger grants also may pay for the PI to travel to conferences to maintain competence or to present research findings. For example, many federal grants allow the cost of one or more conferences per year to be included in the budget. The conference may be justified as a place where the investigator can meet with others with similar interests to consult and learn more about current research. Conference travel also may be included so the investigator can present the findings of the study.

Supplies, Equipment, and Miscellaneous Expenses. Most research efforts require a certain amount of consumable items. Common supplies include computer disks for storing data, paper for printing reports, and toner cartridges for printers. Occasionally the researcher will need equipment not already available at the workplace. For example, a researcher conducting in-depth interviews with patient family members may need a portable tape recorder to record the interview. The PI must ensure all needed equipment is available but that equipment requests are not frivolous. Relatively expensive equipment may be available for loan from the manufacturer or for rent from a local medical supply company. In general, the more expensive the equipment, the more reluctant a funding agency will be to purchase it for a short-term study.

Document duplication is a common expense included within a grant budget. Although the per page charge is small, the cost for copying can rise rapidly for a study with more than just a few subjects. When preparing the budget, be sure you have considered all forms that will need to be duplicated for each subject. The investigator should ensure monies are budgeted for copying the information letter, consent form (including a copy for the subject), data-collection forms, and any other documents used for each subject.

Other miscellaneous expenses to consider include postage, phone bills, fax charges, and similar nontangible items. The researcher should think through each step of the research process to be sure all expenses have been accounted for within the budget. Reviewing the budget for a similar project may help the researcher anticipate necessary expenses.

Budget Justification. The last section of the budget is the budget justification. Although some grants may not specifically ask for it, the justification is an essential component of many grants. This section must correlate well with the remainder of the grant.

A budget justification may include how the budget was determined, as well as the reason for each specific budget item. Determining the budget for some items requires the investigator to provide an estimate of the purchase price; cost calculation may be more complex for other items. For example, to calculate copying costs, the author may need to state, "Four data-collection forms are needed for each subject, 100 subjects will be recruited, and the cost of copying per page is $.05 (4 x 100 x $0.05 = $20)." This information can be included on either the budget page or within the budget justification.

Each budget item should be related to a particular activity in the research project. For example, the author may state that two reams of paper will be used for printing the data analysis and the final report. When a budgeted item is for personnel, the author must explain the individual's role in the project. A statement that the PI will manage the project generally is not sufficient to justify 50% of his or her salary. Consequently, an explanation, such as, "The PI will be responsible for soliciting all 100 family members, arranging a time to meet with the individuals, and personally conducting the interviews," reveals a level of detail that allows the reviewer to understand why 50% of the PI's time is required to complete the project.

The author is encouraged to include a short paragraph in the budget justification outlining the resources that will be either donated by his or her transport program or provided from some other source. This information will help the reviewer see that all resources necessary for the research will be available.

Although not technically a part of the budget justification, letters of agreement from all important personnel help document that the personnel budgeted will be available for the work. Unless specifically prohibited, the author should include a letter of agreement from all individuals listed as coinvestigators or consultants on the grant. Letters of agreement generally are not needed from secretarial support, research assistants, transcriptionists, etc.

Miscellaneous Grant Components

As mentioned previously, individual funding agencies may require additional information to accompany the grant application. Most organizations require a specific cover sheet, which usually includes generic information, such as in-

vestigator's name and address, the amount requested, the grant title, and time frame for the grant.

The federal government and most organizations request information on the protection of human subjects and may request that the study be approved by a local human subjects review board before submission of the application. Other organizations require this approval only when funds are released.

Grants submitted to the NIH require information on the inclusion of women and minorities within the sample. For many years researchers often limited their sample to men and/or Caucasians to simplify study design and data analysis. Consequently the federal government now requires all studies to include both women and minorities unless a strong reason is provided for not doing so. In the case of air transport research, this section usually contains a statement that all available subjects meeting the inclusion criteria will be included within the sample and that women and minorities will be encouraged to participate.

The investigator also may want to include statistics on the number of men, women, and minorities who were transported in the past year or are members of the transport team. These statistics will provide information on the potential number of women and minorities expected within the sample. Because some areas of the country have few minorities within the population, in all likelihood their samples will contain few minorities. The investigator needs to document that this limitation will be the result of the available population rather than research team bias.

An individual funding agency may or may not allow appendixes to the application. For example, letters of agreement to participate, consent forms, and data-collection forms often are included within an appendix. If the research project is a follow-up to a previous study, the author may wish to include the earlier work's report to support the current application.

In summary, the components of a grant application vary by agency. However, all applications must be clear and succinct. Each section of the application must be connected to the previous, and all major decisions related to design and methods must be defended. The reviewer must be able to follow the investigator's train of thought so a clear vision of the project to be undertaken is obtained.

Conclusion

This installment of the "Basics of Research" series has focused on obtaining research funding by writing a grant application. The details of the paper may make the process seem overwhelming. However, most of what must be done for a grant application also must be done as part of preparing for any research project. In many ways, writing a grant application is a valuable process in and of itself. The act of writing an application requires the researcher to clearly articulate his or her plans. Often when putting the proposal in writing, the researcher will realize part of the proposal is not feasible or is not optimal for answering the proposed questions. In fact, even if funding is not required, researchers should create at least a small proposal before initiating any research for the value of placing the plan in writing.

Keeping the value of the grant-writing process in mind is also helpful for dealing with feedback from reviewers. Because of the limited funds available, writing a successful application is difficult. Even the best researchers are not successful with 100% of their grant applications. In many cases, a grant application must be submitted two or three times before being funded.

However, feedback obtained from reviewers generally is helpful. Often the greatest point learned is that the author did not clearly express his or her thoughts. Revising the application provides an opportunity for the author to better articulate ideas and the rationale for those ideas. Many comments from reviewers are not the result of a bad plan, just a poorly explained one.

One final word of caution. Even if you do not obtain funding, do not necessarily attribute this to poor-quality work. As mentioned, grant funds are limited. Not everyone, even when qualified, can be funded. One consequence of limited funding is that agencies have many grants from which to choose. As a result, they often choose the grants that most closely match their interests. If your topic is not one currently viewed as important by the funding agency, your chances of being funded are poor regardless of how good the proposal is.

In summary, writing a grant application can be a complex but rewarding process. A strong application is one that clearly describes the research plan and adequately justifies all major design decisions. Allotting sufficient time for grant preparation and attending to details are essential to developing a successful grant application. The time spent preparing a strong application will increase the chances of obtaining a positive funding decision.

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