DEPARTMENT OF EDUCATION

National Institute on Disability and Rehabilitation Research; Notice of Final Funding Priorities for Fiscal Years 1998–1999 for Certain Centers

SUMMARY: The Secretary announces funding priorities for three Rehabilitation Research and Training Centers (RRTCs) and four Rehabilitation Engineering Research Centers (RERCs) under the National Institute on Disability and Rehabilitation Research (NIDRR) for fiscal years 1998–1999. The Secretary takes this action to focus research attention on areas of national need. These priorities are intended to improve rehabilitation services and outcomes for individuals with disabilities.

EFFECTIVE DATE: This priority takes effect on July 13, 1998.

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Individuals with disabilities may obtain this document in an alternate format (e.g., Braille, large print, audiotape, or computer diskette) on request to the contact person listed in the preceding paragraph.

SUPPLEMENTARY INFORMATION: This notice contains final priorities under the Disability and Rehabilitation Research Projects and Centers Program for three RRTCs related to: aging with a disability, arthritis rehabilitation, and stroke rehabilitation. The notice also contains final priorities for four RERCs related to: prosthetics and orthotics, wheeled mobility, technology transfer, and telerehabilitation.

These final priorities support the National Education Goal that calls for every adult American to possess the skills necessary to compete in a global economy.

The authority for the Secretary to establish research priorities by reserving funds to support particular research activities is contained in sections 202(g) and 204 of the Rehabilitation Act of 1973, as amended (29 U.S.C. 761a(g) and 762).

Note: This notice of final priorities does *not* solicit applications. A notice inviting applications is published in this issue of the **Federal Register**.

Analysis of Comments and Changes

On March 3, 1998, the Secretary published a notice of proposed priorities in the **Federal Register** (62 FR 10428–10437). The Department of Education received forty-five letters commenting on the notice of proposed priority by the deadline date. Technical and other minor changes—and suggested changes the Secretary is not legally authorized to make under statutory authority—are not addressed.

Rehabilitation Research and Training Centers—General

Comment: One commenter suggested that NIDRR should do more than encourage all Centers to involve individuals with disabilities as recipients of research training and clinical training. A second commenter suggested that RRTCs should be required to hire individuals with disabilities.

Discussion: Involvement of individuals with disabilities is one of the general requirements that apply to all RRTCs. All RRTCs must ''involve individuals with disabilities and, if appropriate, their representatives, in planning and implementing its research, training, and dissemination activities, and in evaluating the Center.'' Applications for RRTCs are evaluated, in part, on the extent to which the applicant encourages individuals with disabilities to apply for employment.

Changes: None.

Comment: NIDRR received a comment in response to the proposed priority on Arthritis Rehabilitation that suggested that NIDRR require the RRTC to collaborate with arthritis-related organizations as well as other RRTCs.

Discussion: This comment prompted a general review of all of the collaboration and coordination requirements contained in the proposed RRTC and RERC priorities to determine their appropriateness and consistency. That review revealed some inconsistency in language requiring clarification.

Changes: The RRTC priorities have been revised to clarify that having met the stated collaboration or coordination requirements, each RRTC has the authority to collaborate or coordinate with other entities carrying out related activities.

Comment: NIDRR received comments in a preceding FY 98 RERC competition that suggested that the requirements for conducting a state-of-the-science conference and publishing a final report should be more flexible.

Discussion: As a result of this comment, NIDRR revised the general state-of-the-science conference and final report requirement in the preceding priority. The following reason was provided for this change: ''Information from the state-of-the-science conference will be used, in conjunction with NIDRR's programs reviews and other inputs in the determination of future research issues and as part of NIDRR's Government Performance Results Act database. The budget planning process requires this information to be available during the fourth year of a five year grant. As long as the report is available in the fourth year of the grant, grantees should have as much flexibility as possible in regard to the scheduling of the state-of-the-science conference.''

Changes: To be consistent with the state-of-the-science conference requirement used in the previous priority, it has been revised in the RRTC and RERC priorities to allow grantees total discretion in scheduling the conference.

Priority 1: Aging With a Disability

Comment: Research and training on aging with a disability should be interdisciplinary.

Discussion: An applicant could propose to carry out the RRTC's research and training activities using an interdisciplinary model. The peer review process will evaluate the merits of the proposal. However, NIDRR has no basis to determine that all applicants should be prohibited from proposing other models.

Changes: None.

Comment: The priority should include health promotion and wellness programs in the second activity on reducing aging's impact on health status.

Discussion: An applicant could propose to include health promotion and wellness programs in the second activity of the priority. The peer review process will evaluate the merits of the proposal. However, NIDRR has no basis to determine that all applicants should be required to include health promotion and wellness programs in their efforts to address reducing aging's impact on health status.

Changes: None.

Comment: The fourth activity on psychosocial adjustment should be expanded to include community integration in order to address broader community resource issues such as access to health care and employment.

Discussion: NIDRR agrees that expanding the scope of the fourth activity to include community integration will enable the RRTC to address a wider range of important issues. It will also provide applicants with more discretion to propose activities that address a wider range of issues related to psychosocial adjustment.

Changes: Community integration has been added to the fourth activity of the priority.

Priority 2: Arthritis Rehabilitation

Comment: The RRTC should study managed care in order to enable persons with expertise in arthritis to contribute to this burgeoning field of interest.

Discussion: The impact of managed care on the provision of services to persons with arthritis is an important area. However, it is not feasible, considering the complexity of the topic, for the RRTC to address managed care in addition to the current requirements in the priority.

Changes: None.

Priority 3: Stroke Rehabilitation

Comment: The RRTC should address reducing the incidence and impact of coexisting and secondary conditions on stroke survivors. These conditions are not only common in all age groups of stroke survivors, but also have a significant impact on the course, care, and outcome of stroke rehabilitation efforts.

Discussion: NIDRR agrees that including coexisting and secondary conditions within the activities of the RRTC constitutes a more comprehensive approach to stroke rehabilitation.

Changes: The first activity has been revised to include coexisting and secondary conditions.

Rehabilitation Engineering and Research Centers—General

Comment: The priorities should be broadened to include a field-initiated activity for grants smaller in scope.

Discussion: NIDRR's field-initiated projects competition is held annually. Therefore, including a field-initiated activity within an RERC priority is unnecessary.

Changes: None.

Priority 4: Prosthetics and Orthotics (P and O)

Comment: The RERC should be required to address the human-technology interface.

Discussion: The second activity requires the RERC to address selecting and fitting prosthetic and orthotic devices. The human-technology interface is a required step in this process. Therefore, an additional requirement addressing human-technology interface is unnecessary.

Changes: None.

Priority 5: Wheeled Mobility

Comment: Three commenters suggested broadening the priority to address new technologies in the area of wheeled mobility. One commenter specifically suggested requiring the RRTC to investigate advanced electric powered wheelchair controls and develop new wheelchair technology to increase performance and accessibility while reducing cost and preventing secondary disability.

Discussion: NIDRR agrees that research on new technologies in the area of wheeled mobility is needed. NIDRR believes that applicants should have as much discretion as possible in this emerging area. Under the revised priority (see below) an applicant could propose to investigate advanced electric powered wheelchair controls or develop new wheelchair technology to increase performance and accessibility while reducing cost and preventing secondary disability. The peer review process will evaluate the merits of these proposals. NIDRR also has no basis to determine that all applicants should be required to investigate advanced electric powered wheelchair controls or develop new wheelchair technology to increase performance and accessibility while reducing cost and preventing secondary disability.

Changes: The priority has been revised to require the RRTC to develop and evaluate new technologies in the area of wheeled mobility.

Comment: Thirteen commenters expressed concern about the need for continued research activities related to wheelchair transportation safety issues.

Discussion: NIDRR agrees with the commenters that issues remain to be addressed in regard to wheelchair transportation safety. An applicant could propose to include wheelchair transportation safety issues in the activity to develop and evaluate new technologies in the area of wheeled mobility. The peer review process will evaluate the merits of the proposal. However, NIDRR has no basis to determine that all applicants should be required to carry out research on wheelchair transportation safety issues.

Changes: None.

Comment: The fifth activity should be expanded to include voluntary performance standards for wheelchairs, and the sixth activity should be expanded to include outcome measurement tools or quantifying seating and mobility interventions.

Discussion: Expanding the fifth and sixth activities as suggested by the commenter is not necessary because an applicant could propose the commenter's suggestions under the new requirement to develop and evaluate new technologies in the area of wheeled mobility.

Changes: None.

Comment: Researchers have recently demonstrated wheelchair control systems that augment human motion control. Given the relevance of this area of research and the success of state-of-the-art prototypes, it is recommended that the commercialization of augmented wheelchair control systems be a requirement of this priority.

Discussion: The RERC can carry out research on augmented wheelchair control systems, however, commercialization of augmented wheelchair control systems is outside the scope and purpose of the RERC.

Changes: None.

Comment: It may be unclear to applicants why it is important to integrate external devices with wheelchairs. The priority could be improved by adding the word ''control'' to the second activity.

Discussion: The background section elaborates on the importance of control systems for external devices. NIDRR agrees that including ''control'' in the second activity will clarify the purpose of the second activity.

Changes: The second activity has been revised to include control of external devices.

Comment: A fundamental need before outcome measures can be developed for wheelchair seating is to develop the standardized measures and terminology that will define and allow communication about the quantification of the wheelchair seated posture. The sixth activity regarding the development and evaluation of outcome measurement tools should be revised to include standardized measures and terminology of seated posture.

Discussion: An applicant could propose to develop and evaluate standardized measures and terminology of seated posture under the sixth activity of the priority. The peer review process will evaluate the merits of this proposal. However, NIDRR has no basis to determine that all applicants should be required to develop and evaluate standardized measures and terminology of seated posture.

Changes: None.

Comment: The RERC should be required to investigate injury risk and assess technologies and strategies that will enhance wheelchair safety.

Discussion: An applicant could propose to investigate injury risk and assess technologies and strategies that will enhance wheelchair safety under the new requirement to develop and evaluate new technologies in the area of wheeled mobility. The peer review process will evaluate the merits of the proposal. However, NIDRR has no basis to determine that all applicants should be required to investigate injury risk and assess technologies and strategies that will enhance wheelchair safety.

Changes: None.

Priority 6: Technology Transfer

Comment: The background section should be expanded to discuss technology commercialization and technology utilization.

Discussion: Commercialization and technology utilization are key components of technology transfer. Commercialization and technology utilization are referred to in a variety of ways throughout the background section.

Changes: None.

Comment: The words ''technology transfer'' should be added to the third and fourth activities in order to clarify that the RERC is expected to address the continuum of technology transfer activities.

Discussion: The third and fourth activities address specific development, evaluation, design, and dissemination tasks. It is not necessary to include the words ''technology transfer'' in order to understand these requirements or ensure that the continuum of technology transfer activities will be pursued by applicants.

Changes: None.

Comment: The RERC should be required to carry out demonstration activities. Technology transfer needs to be demonstrated using assistive technology products that are consumer and market responsive.

Discussion: As reflected in the priority and the selection criteria that will be used to evaluate applications, the RERC is required to carry out research, development, training, dissemination, utilization, and technical assistance activities. Having met the requirements to complete these activities, an applicant could propose to carry out related demonstration activities. However, NIDRR has no basis to determine that all applicants should be required to carry out demonstration activities.

Changes: None.

Proposed Priority 7: Telerehabilitation

Comment: Four commenters feel the priority should be broadened to include the development of strategies and techniques necessary to provide and monitor vocational rehabilitation services.

Discussion: The priority purposefully refers to ''rehabilitation services'' in general in order to be applicable to all types of rehabilitation services. Therefore, the RERC is expected to address vocational rehabilitation services as well as other rehabilitation services.

Changes: None.

Comment: The four activities do not contain the words ''research,'' ''engineering,'' or ''science'' and could be misinterpreted as simply calling for demonstrations of existing technologies without significantly advancing the state-of-the-art. The wording of the priority should be modified to strengthen the commitment to scientific and engineering investigation.

Discussion: NIDRR agrees that the priority should be revised in order to reinforce the RERC's commitment to scientific and engineering investigation.

Changes: An investigation requirement has been added to the second and third activities.

Comment: A new activity should be added to require the RERC to serve as the national focal point for telerehabilitation and virtual reality related to individuals with disabilities and to maintain links with the much larger international and national telemedicine and virtual reality communities.

Discussion: RERCs are national in scope and expected to take a leadership position within the field. The RERC is also expected to communicate and coordinate with other entities carrying out related research and development activities. Unless the RERC could not achieve its purposes without a requirement to coordinate or collaborate with specific entities, NIDRR provides applicants with the discretion to propose the partners for coordination and collaboration activities.

Changes: None.

Comment: Two commenters indicated that, too often, patients in rural areas who experience communication disorders are unable to obtain state-of-the-art speech and language therapy in geographically accessible centers. These commenters suggested that scope of this RERC should be expanded to include the rehabilitation of individuals with communication disorders in rural settings.

Discussion: Unless noted otherwise in a priority, any NIDRR-funded project or center must address the needs of all persons with disabilities, including those with communication disorders.

Changes: None.

Comment: Two commenters indicated that the background statement mentions ''spinal cord injury, stroke, and traumatic brain injury'' as examples of disabling conditions to which telerehabilitation techniques might usefully be applied. To avoid ambiguity and an unnecessarily narrow mandate, the background statement should be broadened to include a broad range of disabilities.

Discussion: The fact that background statement mentions ''spinal cord injury, stroke, and traumatic brain injury'' as examples of disabling conditions to which telerehabilitation techniques might usefully be applied, is not intended to suggest that the RERC limit its activities to these conditions. This RERC is expected to address the rehabilitation needs of all persons with disabilities.

Changes: None.

Comment: Five commenters indicated the priority focuses too narrowly on individuals who lack easy access to outpatient rehabilitation care due to geographic remoteness. The commenters pointed out that many people in metropolitan areas have geographical access problems due, in part, from a lack of accessible transportation. The commenters suggest that the first activity be broadened to include all consumers of rehabilitation services who encounter barriers to receiving continued care through conventional means.

Discussion: The communication systems that the RERC will identify and evaluate to connect comprehensive rehabilitation facilities with therapists, individuals, and family members living in remote areas will be applicable to all consumers of rehabilitation and settings, including metropolitan areas.

Changes: None.

Comment: Two commenters feel the last sentence of the third paragraph in the background statement appears to limit monitoring capabilities to only video and audio technologies. The commenters suggested that the sentence should be broadened to include a variety of promising sensor technologies.

Discussion: The RERC will include sensor technologies in its activities, and these technologies are referenced in the second paragraph of the background statement.

Changes: None.

Comment: The word ''diagnostic'' in the second activity is too limiting and should be replaced with either ''assessment'' or ''evaluation.''

Discussion: NIDRR agrees that ''assessment'' is a more appropriate term.

Changes: The second activity has been revised by substituting the word ''assessment'' for ''diagnostic.''

Comment: The second activity should be expanded beyond rehabilitation to include post-rehabilitation health services.

Discussion: Having met all the requirements of the priority, an applicant could propose to include post-rehabilitation health services within the scope of its activities. The peer review process will evaluate the merits of the proposal. However, NIDRR has no basis

to determine that all applicants should be required to include post-rehabilitation health services within the scope of the RERC's activities.

Changes: None.

Comment: Managed care will have a major impact on the extent to which telerehabilitation will be used once these technologies are developed. Therefore, this RERC should be required to coordinate its activities with the NIDRR funded RRTC on Managed Health Care for Individuals with Disabilities.

Discussion: An applicant could propose to coordinate with the RRTC on Managed Health Care. The peer review process will evaluate the merits of this proposal. However, it is not necessary for the RERC to coordinate with the RRTC on Managed Health Care in order to carry out its purposes.

Changes: None.

Comment: Three commenters suggested that the priority should identify relevant rehabilitation disciplines such as occupational therapy, physical therapy, speech pathology and nursing. A fourth commenter indicated that nurses are the most common caregivers in the home setting and suggested that nurses should be included in the first activity.

Discussion: NIDRR agrees that the use of the term ''therapists'' in the first activity may be interpreted narrowly. ''Providers of rehabilitation services'' is a broader category would clearly include nurses.

Changes: The first activity has been revised by substituting ''providers of rehabilitation services'' for ''therapists.''

Comment: In regard to the second and fourth activities, the RERC should provide a testbed environment to demonstrate concepts prior to investment, including simulating telecommunication links to test bandwidth performance and simulating new rehabilitation strategies and devices in virtual reality software. Specifically the RERC should: demonstrate the application of tools via pilot tests with regional rehabilitation service partners; demonstrate the application of technology to establish on-line rehabilitation services communities; and provide collaborative virtual reality capabilities establishing on-line communities via the Internet to provide job postings, rehabilitation news, tips and best practices, virtual reality 3D chat rooms, push technology features to reach remote users, and education and training simulations.

Discussion: All of the proposals contained in this comment are within the scope of the priority and could be proposed by an applicant to achieve the purposes of the second and fourth activity. The peer review process will evaluate the merits of the proposals. There is insufficient evidence to warrant requiring all applicants to carry out the activities suggested in the comment.

Changes: None.

Comment: Although telerehabilitation and virtual reality are new technologies, they have little in common. Virtual reality is a therapy, while telerehabilitation is a health care delivery and educational system. The fourth activity requiring the RERC to investigate the use of virtual reality should be deleted from this priority. Virtual reality deserves a separate priority.

Discussion: NIDRR disagrees that virtual reality is a therapy. NIDRR believes that it is an emerging technology with significant therapeutic potential. In light of substantial work that is being supported elsewhere in the public and private sector on virtual reality applications, NIDRR believes that authorizing this RERC to undertake one activity investigating the use of virtual reality in rehabilitation is a proper course of action.

Changes: None.

Comment: The RERC should be required to implement the concepts of universal design and universal access in all facets of their research.

Discussion: NIDRR supports the promotion of universal design and universal access through a variety of research, training, technical assistance, and information dissemination activities. An applicant could propose to carry out its activities consistent with concepts of universal design and access. The peer review process will evaluate the merits of this approach. However, NIDRR declines to require all applicants to implement these concepts because the RERC's purpose could be achieved without adherence to these concepts.

Changes: None.

Comment: The RERC should not only research strategies that employ remote technologies to deliver services, but also strategies to collect and analyze process and outcome data over time.

Discussion: NIDRR agrees with the commenter and points out that the RERC is required to develop and evaluate these strategies under the third activity in the priority. No further changes are necessary in the priority.

Changes: None.

Comment: Although some systems may already be in place to facilitate the delivery of telerehabilitation services, new technologies are emerging every day. The word ''develop'' should be included in the first activity.

Discussion: NIDRR agrees that the RERC should not only identify and evaluate, but also develop communications systems under the first activity in the priority.

Changes: The priority has been revised to require the RERC to develop communications systems under the first activity in the priority.

Comment: The priority does not mention the potential that telecommunication technology has in promoting organizational and multidisciplinary team collaboration. NIDRR should place an emphasis on evaluation of telecommunications technology in fostering collaboration.

Discussion: An applicant could propose to place an emphasis on telecommunications technology that fosters collaboration. The peer review process will evaluate the merits of this emphasis. However, NIDRR has no basis to determine that all applicants should be required to place an emphasis on telecommunications technology that promotes collaboration.

Changes: None.

Comment: Given that shorter lengths-of-stay are becoming common place throughout the rehabilitation community, the RERC should be required to explore techniques for extending rehabilitation programs in the home and other settings (e.g., day care centers, senior centers, independent living centers).

Discussion: An applicant could propose to explore techniques for providing rehabilitation services through telerehabilitation in a variety of settings, including day care centers, senior centers, and independent living centers. The peer review process will evaluate the merits of this proposal. However, NIDRR has no basis to determine that all applicants should be required to propose extending rehabilitation programs through telerehabilitation in a variety of settings, including day care centers, senior centers, and independent living centers.

Changes: None.

Comment: Virtual reality is a costly technology and activities related to virtual reality development and testing could engage a disproportionately high portion of the resources available for this RERC. A relatively modest project involving applications of virtual reality could easily account for all of the funds proposed to support this RERC. It would be disappointing to see a focus on such a high profile application deter development of lower cost technologies that may have more immediate and broader payoff.

Discussion: NIDRR recognizes that the emerging field of virtual reality could

easily overwhelm the resources of the RERC and has purposefully limited the fourth activity to research related to virtual reality rather than development.

Changes: None.

Comment: Care should be taken to ensure that technologies developed under this RERC can be used in settings without state-of-the-art hardware and software. Developing technology applications that take advantage of the existing communication infrastructure has the potential to put state-of-the-art rehabilitation services within reach of all people, regardless of the wealth of the community.

Discussion: NIDRR agrees that the RERC should develop technologies with the broadest application. The selection criteria used in the peer review process will address this issue by evaluating the impact of the proposed activities on the target population.

Changes: None.

Comment: The priority should be broadened to require the RERC to study policy issues (e.g., reimbursement issues and selection criteria) that will affect the implementation of telerehabilitation.

Discussion: NIDRR agrees that there are policy issues that will affect the implementation of telerehabilitation. An applicant could propose to integrate policy issues into the first, third, and fourth activities of the priority. The peer review process will evaluate the merits of the proposal. However, there is insufficient evidence to require that all applicants address policy issues related to the implementation of telerehabilitation.

Changes: None.

Comment: The third activity appears to focus on remote therapeutic interventions while the second activity focuses on evaluation tools. Is this interpretation correct?

Discussion: The commenter's interpretation is correct.

Changes: None.

Rehabilitation Research and Training Centers

The authority for RRTCs is contained in section 204(b)(2) of the Rehabilitation Act of 1973, as amended (29 U.S.C. 760–762). Under this program, the Secretary makes awards to public and private organizations, including institutions of higher education and Indian tribes or tribal organizations, for coordinated research and training activities. These entities must be of sufficient size, scope, and quality to effectively carry out the activities of the Center in an efficient manner consistent with appropriate State and Federal laws. They must demonstrate the ability to carry out the training activities either directly or through another entity that can provide that training.

The Secretary may make awards for up to 60 months through grants or cooperative agreements. The purpose of the awards is for planning and conducting research, training, demonstrations, and related activities leading to the development of methods, procedures, and devices that will benefit individuals with disabilities, especially those with the most severe disabilities.

Description of Rehabilitation Research and Training Centers

RRTCs are operated in collaboration with institutions of higher education or providers of rehabilitation services or other appropriate services. RRTCs serve as centers of national excellence and national or regional resources for providers and individuals with disabilities and the parents, family members, guardians, advocates or authorized representatives of these individuals.

RRTCs conduct coordinated, integrated, and advanced programs of research in rehabilitation targeted toward the production of new knowledge to improve rehabilitation methodology and service delivery systems, to alleviate or stabilize disabling conditions, and to promote maximum social and economic independence of individuals with disabilities.

RRTCs provide training, including graduate, pre-service, and in-service training, to assist individuals to more effectively provide rehabilitation services. They also provide training including graduate, pre-service, and in-service training, for rehabilitation research personnel.

RRTCs serve as informational and technical assistance resources to providers, individuals with disabilities, and the parents, family members, guardians, advocates, or authorized representatives of these individuals through conferences, workshops, public education programs, in-service training programs and similar activities.

RRTCs disseminate materials in alternate formats to ensure that they are accessible to individuals with a range of disabling conditions.

NIDRR encourages all Centers to involve individuals with disabilities and individuals from minority backgrounds as recipients of research training, as well as clinical training.

The Department is particularly interested in ensuring that the expenditure of public funds is justified by the execution of intended activities and the advancement of knowledge and, thus, has built this accountability into the selection criteria. Not later than three years after the establishment of any RRTC, NIDRR will conduct one or more reviews of the activities and achievements of the Center. In accordance with the provisions of 34 CFR 75.253(a), continued funding depends at all times on satisfactory performance and accomplishment.

General RRTC Requirements

The following requirements apply to these RRTCs pursuant to these absolute priorities unless noted otherwise. An applicant's proposal to fulfill these requirements will be assessed using applicable selection criteria in the peer review process.

The RRTC must provide: (1) applied research experience; (2) training on research methodology; and (3) training to persons with disabilities and their families, service providers, and other appropriate parties in accessible formats on knowledge gained from the Center's research activities.

The RRTC must develop and disseminate informational materials based on knowledge gained from the Center's research activities, and disseminate the materials to persons with disabilities, their representatives, service providers, and other interested parties.

The RRTC must involve individuals with disabilities and, if appropriate, their representatives, in planning and implementing its research, training, and dissemination activities, and in evaluating the Center.

The RRTC must conduct a state-of-the-science conference and publish a comprehensive report on the final outcomes of the conference. The report must be published in the fourth year of the grant.

Priorities

Under 34 CFR 75.105(c)(3), the Secretary gives an absolute preference to applications that meet the following priorities. The Secretary will fund under this competition only applications that meet one of these absolute priorities.

Priority 1: Aging with a Disability

Background

Advances in medical care, rehabilitation technology, and rehabilitative treatment have made aging a routine event for persons with a disability. The rapid increase in the number of people with a physical disability who are growing older has been well documented (McNeil, J., ''Americans With Disabilities,'' U.S. Bureau of the Census, *Statistical Brief,*

SB/94–1, 1994). Many persons aging with a disability face significant new challenges to their health, daily functioning, and independence. These challenges may come from onset of chronic conditions such as hypertension or from secondary conditions such as post-polio. For example, approximately 70 percent of people with polio experience some form of ''post-polio syndrome,'' a condition that impairs functioning (Halstead, L., ''Assessment Differential Diagnosis for Post-Polio Syndrome,'' *Orthopedics,* 14, pgs. 1209–1222, 1991).

The problems resulting from aging with a disability can be grouped into four areas: (1) Decline in health status due to onset of new chronic conditions or development of secondary conditions; (2) decline in functional abilities due to changed health status; (3) difficulty maintaining psychological well-being and life satisfaction; and (4) diminished capacity of family and community support networks to accommodate changes associated with aging with a disability.

Aging with a disability is a complex phenomenon, influenced by both normal and injury-related biological processes, by medical and rehabilitative developments, and by changing social, cultural and physical environments (De Vivo, M., et al., ''Causes of Death During the First 12 Years After Spinal Cord Injury,'' *Archives of Physical Medicine and Rehabilitation,* 74, pgs. 248–254, 1991). Although some progress has been made in systematically assessing the ''natural course'' of aging with a physical disability (Whiteneck, G., ''Learning from Empirical Investigations,'' *Perspectives on Aging with Spinal Cord Injury,* pgs. 23–27, 1992), this work is not complete.

Persons aging with a disability face significant health problems because of the onset of new conditions associated with the aging process itself and potentially complicated by the disability condition. Research suggests that chronic diseases such as cardiovascular illnesses and diabetes occur at earlier than expected ages and in substantially higher percentages among persons who acquired a disability in early life (Pope, A. and Flemming, C., *Disability in America: Toward a National Agenda for Prevention,* pg. 191, 1991). Significant bone loss (osteoporosis) is higher in people with complete spinal cord lesions than in age-matched controls (Garland, D., et al., ''Osteoporosis After Spinal Cord Injury,'' *Journal of Orthopedic Research,* 10, pgs. 371–378, 1992). Other age-related health problems may be impairment-specific secondary conditions such as hip dislocations in people with cerebral palsy or respiratory problems for persons with post-polio syndrome. One study found that 50 percent of people with a 40-year history of cerebral palsy had severe joint, back or neck pain (Murphy, K., ''Medical and Social Issues in Adults with Cerebral Palsy, The California Study,'' *Developmental Medicine and Child Neurology,* Vol. 37, pgs. 1075–1084, 1995).

Fatigue, loss of strength, increased pain, and other health-related changes associated with aging may affect function so that capacity to perform activities of daily living (ADL) (e.g., mobility, bathing, and transfers), is diminished. Fatigue and weakness may affect 60 to 70 percent of people with spinal cord injury (SCI) or post-polio (Gerhart, K., et al., ''Long-term Spinal Cord Injury: Functional Changes Over Time,'' *Archives of Physical Medicine and Rehabilitation,* 74, pgs. 1030–1035, 1993).

In addition to facing new physical challenges, some people aging with a disability also develop psychological conditions. In the general aging population, depression is often an unrecognized corollary of the aging process (Lebowitz, B., et al., ''Diagnosis and Treatment of Depression in Late Life,'' *Journal of the American Medical Association,* 278 (14), pgs. 1186–1190, 1997). At least one study has found that between 25 and 40 percent of persons aging with a disability show high distress, especially as expressed in symptoms of depression (Fuhrer, M., et al., ''The Relationship of Life Satisfaction to Impairment, Disability and Handicap Among Persons with Spinal Cord Injury Living in the Community,'' *Archives of Physical Medicine and Rehabilitation,* 73, pgs. 552–557, 1992). Treatment of depression for persons aging with a disability is difficult to obtain because of the failure of health professionals to recognize depression in persons aging with a disability (Krause, J. and Crewe, N., ''Chronological Age Time Since Injury and Time of Measurement: Effect on Adjustment After Spinal Cord Injury,'' *Archives of Physical Medicine and Rehabilitation,* 72, pgs. 91–100, 1991).

Families may experience new stresses because of age-related conditions acquired by their family members with disabilities. In addition, aging of family caregivers may affect their ability to continue caregiving roles, thus reducing the ability of a person aging with a disability to remain in the family setting. The importance of this issue is reinforced by the fact that family caregivers provide most of the personal assistance to persons with disabilities (Nosek, M., ''Life Satisfaction of People with Physical Disabilities: Relationship to Personal Assistance, Disability Status and Handicap,'' *Rehabilitation Psychology,* 40, pgs. 191–197, 1995). Helping families cope can include options like expanding respite care or training related to age-related changes.

The increase in the numbers of persons aging with a disability has increased the need for rehabilitation personnel trained in providing services to this population. Serving an aging population may also require new treatment and other service delivery models. Research on effective accommodations, including the use of assistive technology, for this aging population has been limited.

Priority 1

The Secretary will establish an RRTC on Aging with a Disability to promote the health, functional abilities, psychological well-being, and independence of persons aging with a disability. The RRTC shall:

(1) Investigate the natural course of aging with a disability;

(2) Identify, develop, and evaluate methods to reduce aging's impact on health status, including onset of new chronic conditions and secondary conditions associated with the primary disability;

(3) Identify, develop, and evaluate rehabilitation techniques, including the effective use of assistive technology, to maintain functional independence;

(4) Investigate and evaluate methods to improve community integration and psychosocial adjustment; and

(5) Conduct studies to identify the extent to which aging affects the ability of families to support persons aging with a disability in family and community settings and evaluate strategies that will enhance the ability of families to cope.

In carrying out these priorities, the RRTC must coordinate with aging with disability research and demonstration activities sponsored by the National Center on Medical Rehabilitation Research, the Department of Veterans Affairs, the Social Security Administration, the Health Care Financing Administration, and the RRTCs on Health Care for Individuals with Disabilities—Issues in Managed Health Care, Aging with Spinal Cord Injury, and Aging with Mental Retardation, the RERC on Assistive Technology for Older Persons with Disabilities, and other entities carrying out related research or training activities.

Priority 2: Arthritis Rehabilitation

Background

''Arthritis'' means joint inflammation and encompasses a large family of more than 100 so-called rheumatic diseases that can affect people of all ages. The prevalence of many of these diseases tends to increase with age and several occur predominantly in women; others are more common in men. These diseases can affect joints, muscles, tendons, ligaments, and the protective coverings of some internal organs. Onset is usually in middle age, and arthritis and musculoskeletal conditions typically present a cluster of chief complaints including, but not limited to, pain, muscle impairments, and joint impairments. Arthritis and musculoskeletal conditions typically result in functional limitations in ADL. While individuals with arthritis experience most of their limitations in physical functional activities, the concept of function has psychological and social dimensions as well (Guccione, A. A., ''Arthritis and the Process of Disablement,'' *Physical Therapy,* Vol. 74, No. 5, May, 1994). For the purpose of this priority, arthritis and musculoskeletal diseases must include, but are not limited to, rheumatoid arthritis (RA), osteoarthritis (OA), juvenile rheumatoid arthritis (JRA), osteoporosis, and fibromyalgia syndrome.

Physical activity may provide significant physical and mental health benefits for persons with arthritis and musculoskeletal diseases. In recognizing that regular physical activity can help control joint swelling and pain, the U.S. Surgeon General's 1996 Report on Physical Activity and Health, urges people with arthritis to exercise. The Center for Disease Control and Prevention has indicated that most persons with arthritis and other rheumatic conditions should engage in physical activity because exercise helps people with arthritis maintain normal muscle strength and joint function and reduces the risk of premature death, heart disease, diabetes, high blood pressure, colon cancer, depression, and anxiety (Krucoff, C., ''Taking Action Against Arthritis,'' *The Washington Post Health Section,* October 21, 1997). Maintenance of health and wellness is important when dealing with the problems of arthritis and musculoskeletal diseases. A number of factors, such as understanding and managing fatigue and conserving energy, developing relaxation techniques, participating in exercise programs, and learning about weight control and proper nutrition, aid in the goal of achieving a quality of life for individuals who cope with the various problems encountered.

Pain is a major concern for individuals with arthritis and musculoskeletal diseases. Pain can affect the ability to work or function independently in the home or community. The increased dependency encountered, the thoughts of progressive deformities, and feelings of frustration through loss of control often lead to psychosocial difficulties. Rehabilitation interventions can reduce pain, depression and improve functional abilities.

Musculoskeletal conditions are among the top-ranked conditions causing limitations in the ability to perform work and reported as causes of actual work loss. Estimates for prevalence of work disability, defined as ceasing to work, ranges from 51 percent to 59 percent. Clinical studies have indicated that when RA is in a severe form, this rate could be as high as 60 percent a decade after diagnosis (Felts, W. and Yelin, E., ''The Economic Impact of the Rheumatic Diseases in the United States,'' *Journal of Rheumatology,* 16, pgs. 867–884, 1989). Decreased work satisfaction has been reported by persons with RA; 59 percent are unable to maintain gainful employment. In addition, patients with RA are significantly more likely to have lost their job or to have retired early due to their illness, and are the most likely to have reduced their work hours or stopped working entirely due to their illness (Gabriel S. E., et al., ''Indirect and Nonmedical Costs Among People with RA and OA Compared with Nonarthritic Controls,'' *Journal of Rheumatology,* 24(1), pgs. 43–48, January, 1997). Reasonable job accommodations for people with arthritis and musculoskeletal diseases to manage fatigue, stress, job performance issues, allowances for medical treatments and individual-related modifications are areas for employers to consider.

More than 200,000 children in the U.S. are affected with some form of arthritis (Cassidy, J. T., et al., ''Juvenile Rheumatoid Arthritis,'' *Textbook of Pediatric Rheumatology,* pgs. 133–233, 1995). JRA is the most common childhood connective tissue disease (Chaney, J. and Peterson, L., *Journal of Pediatric Psychology,* Vol. 14, No. 3, 1989). JRA affects the physical, psychological and social development of children and adolescents. Assessing needs and developing strategies to aid in the promotion of improved medical, educational, psychosocial, and vocational services is essential with this population.

Priority 2

The Secretary will establish an RRTC on Arthritis Rehabilitation to improve the functional abilities and promote the independence of individuals with arthritis and musculoskeletal diseases. The RRTC shall:

(1) Identify, develop, and evaluate exercise and fitness programs;

(2) Identify, develop, and evaluate rehabilitation interventions to increase psychological well-being and reduce pain;

(3) Identify, develop, and evaluate job accommodations to maintain employment; and

(4) Identify, develop, and evaluate programs to maintain health and wellness.

In carrying out the purposes of the priority, the RRTC must:

- Address the needs of children and youth; and
- Coordinate with arthritis activities sponsored by the National Institute on Arthritis and Musculoskeletal and Skin Diseases, the National Center for Medical Rehabilitation Research, and other entities carrying out related research or training activities.

Priority 3: Stroke Rehabilitation

Background

In the U.S., there are approximately three million stroke survivors and 400,000 to 500,000 new or recurrent stroke cases annually (Gorelicj, P., ''Stroke Prevention,'' *Archives of Neurology,* 52(4), pgs. 347–355, 1995). Stroke survivors are the largest population in rehabilitation hospitals, and an estimated $30 billion is spent on stroke treatment each year (Alberts, M., et al., ''Hospital Charges for Stroke Patients,'' *Stroke,* 27 (10) pgs. 1825–1828, 1996). Previous NIDRR-funded stroke rehabilitation research has focused on prevention and treatment of secondary conditions of stroke; enhancing functional capacity following stroke; improving social and community functioning; and studying the natural history of impairment, disability, and quality of life after stroke.

Rehabilitation goals for stroke patients focus on maximizing physical and psychological function, teaching patients about prevention of recurrent stroke, and working with family members to facilitate integration of the person recovering from stroke back into family and community settings. Stroke patients potentially face a number of functional problems resulting from the paralysis, dysphagia, neurological, and other health-related sequelae of stroke.

Higher order cognitive deficits, such as incomprehension and short-term memory loss, have been shown to have a primary role in predicting rehabilitation length of stay, functional outcome and long-term care needs of stroke survivors. Early, comprehensive assessment of cognitive deficits has been shown to play a significant role in effecting better rehabilitation outcomes (Galski, T., et al., ''Predicting Length of Stay, Functional Outcome, and Aftercare in the Rehabilitation of Stroke Patients. The Dominant Role of Higher-Order Cognition,'' *Stroke*, 24 (12), pgs. 1794–1800, December, 1993).

Endurance exercise is recognized as an important component of rehabilitation for stroke patient recovery of sensorimotor function. The ability of stroke patients to participate in exercise is compromised because they have lowered motor functional ability as a result of both reduced oxidative capacity and reduced availability of motor units. Traditional methods of measuring aerobic capacity are not appropriate for this population, nor are exercise training protocols that do not reflect stroke patient capacity for exercise (Potempa, K., et al., ''Benefits of Aerobic Exercise After Stroke,'' *Sports Medicine*, 21(5), pgs. 337–346, 1996).

Changes in personality, mood, and temperament can be confusing and distressing for stroke survivors and their caregivers. Depression can be a significant problem for both survivors and caregivers (Kumar, A., et al., ''Quantitative Anatomic Measures and Comorbid Medical Illness in Late-life Major Depression,'' *American Journal of Geriatrics Psychiatry*, 5(1), pgs. 15–25, 1997). Effective treatment of psychological and behavioral problems may require more standardized approaches that incorporate psychopharmacological, behavioral, and psychological interventions.

Although stroke is predominantly a phenomenon that strikes persons aged 65 and over, five percent occur in persons under age 45. Individuals in this age cohort are generally employed, have a longer life expectancy than older stroke patients, and generally have better underlying health status and incur less brain injury related to the stroke (Ferro, J. and Crespo, M., ''Prognosis After Transient Ischemic Attack and Ischemic Stroke in Young Adults,'' *Stroke*, (8), pgs. 1611–1616, August, 1994). Rehabilitation for younger patients may emphasize vocational options, sexuality, and social functioning (Roth, E., ''From the Editor,'' *Topics in Stroke Rehabilitation—The Young Stroke Survivor*, Vol. 1, pg. vi, Spring, 1994). In addition, complications such as drug use or pregnancy may complicate rehabilitation strategies (Meyer, J., et al., ''Etiology and Diagnosis of Stroke in the Young Adult,'' *Topics in Stroke Rehabilitation—The Young Stroke Survivor*, Vol. 1, pgs. 1–14, Spring, 1994).

Persons at the other end of the age spectrum, those over age 75 who comprise 41.8 percent of stroke rehabilitation patients (Personal communication with Samuel J. Markello, Ph.D. and Carl V. Granger, M.D., Director, National Rehabilitation Outcomes Database, maintained by the Uniform Data System for Medical Rehabilitation, University of Buffalo, January, 1998), are at risk for poor rehabilitation outcomes possibly because of the effects of frailty and co-morbid disease (Falconer, J., et al., ''Stroke Inpatient Rehabilitation: A Comparison Across Age Groups,'' *Journal of the American Geriatric Society*, 42(1), pgs. 39–44, January, 1994). In this population, presence of a healthy and caring spouse, bladder and bowel continence, and ability to feed oneself have predicted better outcomes (Reddy, M. and Reddy, V., ''After a Stroke: Strategies to Restore Function and Prevent Complications,'' *Geriatrics*, 52(9), pgs. 59–62, September, 1997).

Prevention of stroke recurrence is increasingly a goal of medical rehabilitation stroke treatment programs (Gorelick, P., ''Stroke Prevention,'' *Archives of Neurology*, 52(4), pgs. 347–355, April, 1995). Prevention methods include teaching individuals to monitor their blood pressure, raising awareness of the importance of nutrition and exercise, and educating family members about stroke.

Medical research shows promise for dramatically improving the diagnosis and treatment of stroke in acute care settings. New drug therapies may significantly limit the impact of the initial stroke. Better diagnostic tools, such as using magnetic resonance imaging (MRI) to determine stroke type, size, and location, will result in earlier diagnosis and treatment (Centofanti, M., ''Fighting Back Against Brain Attack,'' *Johns Hopkins Magazine*, pgs. 18–24, November, 1997). The consequences of improved initial stroke treatment for rehabilitation treatment and service delivery mechanisms are unknown.

Changes in financing and service delivery models of stroke rehabilitation have created different rehabilitation treatment setting options for stroke patients. Increasingly, stroke patients are receiving rehabilitation in post-acute service settings (e.g., nursing-home based rehabilitation programs). As a consequence of these changes, there are questions about the impact on outcomes of stroke patients. For instance, how does treatment intensity vary across settings; does treatment intensity affect outcomes across settings; do population characteristics differ across settings? Initial research indicates that outcomes may not differ dramatically when comparing acute to post-acute rehabilitation settings (Cramer A., et al., ''Outcomes and Costs After Hip Fracture and Stroke—A Comparison of Rehabilitation Settings,'' *JAMA*, Vol. 277, pgs. 396–404, 1997); however, knowledge about long-term outcomes of treatment in these different settings is still inconclusive.

Another development affecting stroke rehabilitation is implementation of practice guidelines. In 1996, the Agency for Health Care Policy and Research published stroke treatment guidelines (*Post-Stroke Rehabilitation: A Quick Reference Guide for Clinicians*, Pub. 95–0663, 1996). These guidelines aim to minimize variation in treatment across acute care and rehabilitation settings (Ringel, S. and Hughes, R., ''Evidence-based Medicine, Critical Pathways, Practice Guidelines, and Managed Care. Reflections on the Prevention and Care of Stroke,'' *Archives of Neurology*, 53(9), pgs. 867–871, 1996). The rate of adoption of these guidelines and their impact on rehabilitation service and outcomes is not yet known.

Priority 3

The Secretary will establish an RRTC for Stroke Rehabilitation to develop and evaluate rehabilitation approaches to improve stroke rehabilitation treatment for all patients. The RRTC shall:

(1) Identify, develop, and evaluate rehabilitation techniques to address coexisting and secondary conditions and improve outcomes for all stroke patients, giving specific emphasis to rehabilitation needs of older and younger patient groups and to methods that incorporate cognition in the treatment protocols;

(2) Develop and evaluate standard aerobic exercise protocols; and

(3) Identify and evaluate methods to identify and treat depression and other psychological problems associated with stroke;

(4) Determine the effectiveness of stroke prevention education provided in medical rehabilitation settings;

(5) Evaluate the impact of changes in diagnosis and medical treatment of stroke on rehabilitation needs;

(6) Evaluate long-range outcomes for stroke rehabilitation across different treatment settings;

(7) Evaluate the impact of stroke practice guidelines on delivery and outcomes of rehabilitation services.

In carrying out the purposes of the priority, the RRTC must:

- Collaborate with RRTCs on Health Care for Individuals with Disabilities—Issues in Managed Health Care, and Aging with a Disability; and
- Coordinate with stroke activities sponsored by the National Center for Medical Rehabilitation Research, the National Institute on Neurological Disorders and Stroke, and other entities carrying out related research or training activities.

Rehabilitation Engineering Research Centers

The authority for RERCs is contained in section 204(b)(3) of the Rehabilitation Act of 1973, as amended (29 U.S.C. 762(b)(3)). The Secretary may make awards for up to 60 months through grants or cooperative agreements to public and private agencies and organizations, including institutions of higher education, Indian tribes, and tribal organizations, to conduct research, demonstration, and training activities regarding rehabilitation technology in order to enhance opportunities for meeting the needs of, and addressing the barriers confronted by, individuals with disabilities in all aspects of their lives. An RERC must be operated by or in collaboration with an institution of higher education or a nonprofit organization.

Description of Rehabilitation Engineering Research Centers

RERCs carry out research or demonstration activities by:

(a) Developing and disseminating innovative methods of applying advanced technology, scientific achievement, and psychological and social knowledge to (1) solve rehabilitation problems and remove environmental barriers, and (2) study new or emerging technologies, products, or environments;

(b) Demonstrating and disseminating (1) innovative models for the delivery of cost-effective rehabilitation technology services to rural and urban areas, and (2) other scientific research to assist in meeting the employment and independent living needs of individuals with severe disabilities; or

(c) Facilitating service delivery systems change through (1) the development, evaluation, and dissemination of consumer-responsive and individual and family-centered innovative models for the delivery to both rural and urban areas of innovative cost-effective rehabilitation technology services, and (2) other scientific research to assist in meeting the employment and independent needs of individuals with severe disabilities.

Each RERC must provide training opportunities to individuals, including individuals with disabilities, to become researchers of rehabilitation technology and practitioners of rehabilitation technology in conjunction with institutions of higher education and nonprofit organizations.

The Department is particularly interested in ensuring that the expenditure of public funds is justified by the execution of intended activities and the advancement of knowledge and, thus, has built this accountability into the selection criteria. Not later than three years after the establishment of any RERC, NIDRR will conduct one or more reviews of the activities and achievements of the Center. In accordance with the provisions of 34 CFR 75.253(a), continued funding depends at all times on satisfactory performance and accomplishment.

General RERC Requirements

The following requirements apply to the RERCs pursuant to these absolute priorities unless noted otherwise. An applicant's proposal to fulfill these requirements will be assessed using applicable selection criteria in the peer review process.

The RERC must have the capability to design, build, and test prototype devices and assist in the transfer of successful solutions to relevant production and service delivery settings. The RERC must evaluate the efficacy and safety of its new products, instrumentation, or assistive devices.

The RERC must disseminate research results and other knowledge gained from the Center's research and development activities to persons with disabilities, their representatives, disability organizations, businesses, manufacturers, professional journals, service providers, and other interested parties.

The RERC must develop and carry out utilization activities to successfully transfer all new and improved technologies developed by the RERC to the marketplace.

The RERC must involve individuals with disabilities and, if appropriate, their representatives, in planning and implementing its research, development, training, and dissemination activities, and in evaluating the Center.

The RERC must conduct a state-of-the-science conference and publish a comprehensive report on the final outcomes of the conference. The report must be published in the fourth year of the grant.

Priorities

Under 34 CFR 75.105(c)(3), the Secretary gives an absolute preference to applications that meet the following priorities. The Secretary will fund under this competition only applications that meet one of these absolute priorities.

Priority 4: Prosthetics and Orthotics

Background

Prosthetic limbs (also called artificial or replacement limbs) perform functions previously performed by lost or absent limbs or portions of limbs. Orthoses (also called braces or anatomical technology devices) are devices applied to limbs or other parts of the body that have either lost or impaired function to compensate for certain differences in anatomical shape or size, muscle weakness, or paralysis. Appropriately fitted prosthetic and orthotic (P and O) devices improve functional abilities for work and ADL.

The National Health Interview Survey of 1992 reported a prevalence in the United States of 102,000 individuals with upper extremity loss or absence, and 256,000 individuals with lower extremity loss or absence (LaPlante, M. and Carlson, D., ''Disability in the United States: Prevalence and Causes, 1992'' *Disability Statistics Report No. 7*, NIDRR, pg. 29, 1996). The majority of these individuals use or need prosthetic limbs. It is more difficult to estimate the prevalence of individuals who use or need orthotic devices because orthoses are used in a wide variety of disabilities, and unlike loss or absence of a limb, have not historically been a specific category in national surveys. However, the National Health Interview Survey on Assistive Devices (NHIS–AD) of 1990 reported that 3,514,000 individuals in the United States used anatomical technology devices, categorized as braces for either the leg, foot, arm, hand, neck, back or other (LaPlante, M. P., et al., ''Assistive Technology Devices and Home Accessibility Features: Prevalence, Payment, Need, and Trends,'' *Advance Data from Vital and Health Statistics*, National Center for Health Statistics, No. 217, pg. 6, 1992).

According to the Institute of Medicine, there is a lack of a complete and widely accepted base of scientific and engineering data to support the process of individuals obtaining the optimum device for their particular need. The lack of an effective scientific and theoretical foundation for human gait inhibits the engineering design of technology to aid ambulation. More

work is also needed in research and development directed to the problems of arm and hand replacement (*Enabling America: Assessing the Role of Rehabilitation Science and Engineering*, Institute of Medicine Report, pgs. 111–117, 1997).

The enormous diversity of P and O devices to address many different muscular, neuromuscular, and skeletal issues, adds to the complexity of this field and supports the need for quantitative documentation to improve the process by which individuals obtain the most appropriate P and O device for their need (Esquenazi, A. and Meier, R. H., ''Rehabilitation in Limb Deficiency. 4. Limb Amputation,'' *Archives of Physical Medicine and Rehabilitation*, Vol. 77, pgs. s18–s28, 1996). For example, there are approximately 100 commercially available prosthetic knees capable of being used in transfemoral prostheses (Michael, J. W., ''Prosthetic Knee Mechanisms,'' *Physical Medicine and Rehabilitation: State of the Art Reviews*, Vol. 8, pgs. 147–164, 1994), making it difficult to evaluate all possible options. The trend in health care toward evidence-based decision making will require the collection and analysis of data that may not have occurred in the past (Guyatt, G., et al., ''Evidence-Based Medicine: A New Approach to Teaching the Practice of Medicine,'' *JAMA*, Vol. 268, pgs. 2420–2425, 1992).

Evaluations will play a key role in shaping the services available in the future (Hailey, D. M., ''Orthoses and Prostheses,'' *International Journal of Technology Assessment in Health Care*, Vol. 11, pgs. 214–234, 1995). As more quantitative measurements are being made at the individual level with respect to device selection, there is a need to collect data on use of devices by individuals in a uniform format for archival reference and research purposes. A database that could be used to evaluate the outcomes of individuals using P and O devices does not exist. Such a database might include, but would not be limited to: technical specifications and details of the device; appropriate performance and outcome measures; relevant anthropometric measurements of the wearer; appropriate medical and demographic data, and payment information.

The increased attention to prosthetic technology in developing nations (Day, H. J. B., ''A Review of the Consensus Conference on Appropriate Prosthetic Technology in Developing Countries,'' *Prosthetics and Orthotics International*, Vol. 20, pgs. 15–23, 1996) along with the advanced state of science in many European nations, provides opportunity and impetus for the development of international standards in P and O. In addition, increased international exchanges of both information and technology, as a result of comparative work, are highly likely to be beneficial to both the United States and other countries.

Priority 4

The Secretary will establish an RERC on Prosthetics and Orthotics to strengthen and expand the scientific and engineering basis for the field, and develop new ways to use information technology that will ultimately result in delivery of improved service to individuals who can benefit from prosthetic and orthotic devices. The RERC shall:

(1) Increase the understanding of the scientific and engineering principles for human locomotion, reaching, prehension, and manipulation, and incorporate these principles into the design of P and O devices;

(2) Develop and evaluate a prototype computer-based system to select the most appropriate P and O device (or combination of devices), and fit the device to an individual;

(3) Develop a prototype database of individuals using P&O devices in collaboration with industry including, but not limited to, technical details of the device, appropriate performance and outcome measures, relevant anthropometric measurements of the wearer, appropriate medical and demographic data, and cost and payment information; and

(4) Maintain an international exchange of scientific information and participate in the development of international standards.

In carrying out these purposes, the RERC must coordinate on activities of mutual interest with the RERC on Land Mines and other entities carrying out related research or development activities.

Priority 5: Wheeled Mobility

Background

Approximately 1.4 million Americans use a wheelchair as their primary source of mobility (Kraus, L., et al., *Chartbook on Disability in the United States*, InfoUse, Berkeley, CA, 1996), including approximately 600,000 Americans who live in skilled nursing facilities and are over the age of 65 (Shaw, G. and Taylor, S. J., ''A Survey of Wheelchair Seating Problems of the Institutionalized Elderly,'' *Assistive Technology*, Vol. 3, RESNA Press, pgs. 5–10, 1991). The number of Americans who use wheelchairs nearly doubled between 1980 and 1990 while the general population increased by 13 percent during that same period (LaPlante, M. P., et al., ''Assistive Technology Devices and Home Accessibility Features: Prevalence, Payment, Need, and Trends,'' *Advance Data from Vital and Health Statistics*, No. 217, U.S. Department of Health and Human Services, September, 1992). The number of wheelchair users increases as a population ages (Ohlin, P., et al., ''Technology Assisting Disabled and the Older People in Europe,'' The Swedish Handicap Institute, Stockholm, 1995). As the American population continues to grow older, the number of individuals who will require the use of a wheelchair for mobility is expected to increase.

Wheelchairs and wheelchair seating systems have dramatically improved over the past decade due in part to advances in lightweight, high-strength materials, improved mechanical designs, and improved microprocessor control technologies, and more efficient drive train systems for powered chairs. There are virtually hundreds of options available to wheelchair users (e.g., frame sizes and designs, castors, hand rims, seat sizes, and seat backs). Selecting the appropriate options when either prescribing or purchasing a wheelchair or wheelchair seating system can be complicated and difficult for therapists and consumers.

Individuals who use powered wheelchairs often rely on external devices (e.g., ventilators, augmentative communication devices, and environmental control systems) for respiratory support or to help them function during the day. Improvements in electronic technologies have led to the development of sophisticated wheelchair controllers with built-in flexibility and adjustability. Typical controllers are based on microcomputers and allow for the adjustment of parameters (e.g., acceleration and deceleration control, speed control, and tremor dampening) to improve the user's ability to control the wheelchair safely (Cook, A. M. and Hussey, S. M., *Assistive Technologies: Principles and Practice*, pg. 549, 1995). These controllers are also capable of directly controlling external devices. Most external devices are made by companies other than wheelchair manufacturers. As a result, compatibility between external devices and powered wheelchairs is often problematic.

Wheelchairs and wheelchair seating systems combine to provide mobility, pressure relief, postural support, deformity management, and increased comfort, function and tolerance

(Hobson, D. A., ''Seating and Mobility for the Severely Disabled,'' *Rehabilitation Engineering,* pgs. 193–252, 1990). Most wheelchair users are candidates for seating and positioning interventions. Typical seating systems statically control an individual's posture by constraining the individual to a fixed position using modular or custom fit devices and systems such as foam wedges, hand shaped foams, ''foam-in-place,'' vacuum consolidation, and CAD–CAM (Cook, A. M. and Hussey, S. M., op. cit., pgs. 237–239). For individuals who have a high degree of muscle tone or spasticity, staying in a fixed position can be uncomfortable and cause pressure sores. An alternative to static seating is dynamic seating. A recent case study in this area of research looked at the benefits of a dynamic seating system for an adolescent with cerebral palsy with a high degree of extensor tone. This system allowed the individual to extend during spasms, then returned the individual to a functional seating posture upon relaxation resulting in a reduction of generalized tone and improved posture (Ault, H. K., et al., ''Design of a Dynamic Seating System for Clients with Extensor Spasms,'' *Proceedings of the RESNA 1997 Annual Conference,* pgs. 187–189, 1997).

Pressure relief is critical for individuals who have little or no sensation in weight bearing areas, such as persons with spinal cord injury and some elderly, or those who are unable to shift their weight to relieve pressure (Bergen, A., et al., *Positioning for Function: Wheelchairs and Other Assistive Technologies,* p. 4, 1990). Without proper pressure relief, individuals are prone to develop pressure sores (decubitus ulcers) that can result in tremendous costs for treatment and in time lost from work (Ditunno, J. F., Jr. and Formal, C. S., ''Chronic Spinal Cord Injury,'' *New England Journal of Medicine,* Vol. 330, pgs. 550–556, 1994). The incidence for pressure sores has remained fairly static (Stover, S. L., et al., *Spinal Cord Injury: Clinical Outcomes from the Model Systems,* pgs. 109–113, 1995). There are many factors that contribute to the development of pressure sores. External forces (i.e., tension, compression, and shear) applied to localized areas are the primary causes of pressure sores. Other factors affecting pressure sore development include, but are not limited to, stress, friction, body size, posture, nutrition, age, blood circulation, and the microclimate between one's body and the seating surface (Cook, A. M. and Hussey, S. M., op. cit., pgs. 282–285). Understanding the interactions between these factors is paramount to improving seating and positioning systems.

Decisions made during seating evaluations are often subjective in nature and are based upon observational analyses and past experience of the therapists involved. There are over 300 commercially available cushions on the market (HyperABLEDATA, 1997), as well as a myriad of wheelchair options. Understanding these options and knowing when to use them is difficult for therapists and consumers. Voluntary performance standards for seating and clinical measurement devices would allow for objective comparison of products based upon standardized test results from each manufacturer.

A number of outcome measurement tools may be used to measure functional outcomes of individuals during the rehabilitation process. However, many of these tools do not consider assistive technology interventions, including seating and mobility, when rating an individual's overall performance. For example, in order to get a maximum score using the Functional Independence Measure, the individual cannot rely on assistive technology; thereby implying that a person cannot be totally functionally independent if he or she uses assistive technology devices (Scherer, M. J. and Galvin, J. C., ''An Outcomes Perspective of Quality Pathways to the Most Appropriate Technology,'' *Evaluating, Selecting, and Using Appropriate Assistive Technology,* pg. 21, 1996). A number of clinical measurement devices (e.g., pressure monitoring devices, and seating simulators) may be used in seating and mobility clinic environments, however, they do not systematically measure and record outcomes of wheelchair and seating interventions.

Priority 5

The Secretary will establish an RERC on Wheeled Mobility to improve the efficiency and selection of wheelchairs and wheelchair seating systems and investigate new seating system strategies including dynamic seating systems and pressure sore prevention. The RERC shall:

(1) Develop and evaluate strategies that can be used to aid therapists and consumers in making informed decisions when prescribing or purchasing new wheelchairs and wheelchair seating systems;

(2) Develop and evaluate strategies in collaboration with industry to promote the integration of external devices with powered wheelchairs and the control of these external devices, ensuring their compatibility and usability;

(3) Develop and evaluate new technologies in the area of wheeled mobility;

(4) Investigate the viability of dynamic seating systems;

(5) Investigate the factors that contribute to the development of pressure sores and develop and evaluate tools, devices and strategies to prevent them from occurring;

(6) Investigate the use of voluntary performance standards for wheelchair seating devices and clinical measurement devices and, if appropriate, develop in collaboration with industry strategies to facilitate the implementation of those standards; and

(7) Develop and evaluate outcome measurement tools for quantifying seating clinic intervention results.

In carrying out the purposes of the priority, the RERC must coordinate on activities of mutual interest with all the RRTCs addressing Spinal Cord Injury, the RRTC on Aging with a Disability, and other entities carrying out related research or development activities.

Priority 6: Technology Transfer

Background

Technology transfer is a means of capitalizing on and increasing the value of an initial investment in research of a particular technology through new applications. Technology transfer also involves moving conceptualizations and new inventions from a potential application into a working prototype and, ultimately, into a commercial product. There has been an increased interest in developing assistive technology in recent years. Basic research has yielded innovations developed with the disability population in mind and more generic applied research has resulted in new ways to transfer existing technologies initially developed for different purposes into assistive technology products. In addition, there are an increasing number of entrepreneurs and inventors developing devices specifically for persons with disabilities.

Approximately 13 million people with disabilities use assistive technology devices to assist them with major life activities (Kraus, L., et al., *Chartbook on Disability in the United States,* InfoUse, Berkeley, CA, 1996). Understanding the functional needs of persons with disabilities, translating those needs into technical solutions, identifying the markets and determining which technologies may be successfully transferred into usable assistive technology products is critical to the

technology transfer process (Spaepen, A. J., ''Technology Transfer and Service Delivery in Rehabilitation Technology,'' *Journal of Rehabilitation Sciences*, Vol. 4, pgs. 84–87, 1991). The assistive technology market is expected to grow dramatically over the next two decades as the American population ages and as the survival rate of accident victims continues to climb (Federal Laboratory Consortium, ''Federal Laboratory Technologies Enable the Disabled,'' *Technology Transfer Business*, Vol. 4, p. 11, 1997).

There are models of technology transfer that are routinely utilized by government, small businesses, nonprofit organizations, universities and industry (Rouse, D., ''Technology Identification and Partnership Development,'' Research Triangle Institute, 1997). These models assume a market that is identifiable and definable, somewhat homogeneous, visible, and well-financed. Transferring promising technologies and new inventions to the assistive technology arena presents unique challenges. Devices that either have the potential for use by persons with disabilities, or were invented for consumers with disabilities often are not successfully commercialized because of the limited number of potential users or the developer's inexperience and limited understanding of disabilities and the assistive technology marketplace (Gilden, D., ''Moving from Naive to Knowledgeable on the Road to Technology Transfer,'' *Technology and Disability*, Vol. 7, pgs. 115–125, 1997).

Frequently, inventions and prototypes of devices require considerable engineering, modification and redesign. The vast majority of assistive technology companies are very small and have limited access to knowledge, resources, markets, funds, skills and finance (Swanson, D., ''Determining the Government's Responsibilities in Technology,'' *Journal of Technology Transfer*, Vol. 20 (2), pgs. 3–4, 1995). Companies and entrepreneurs interested in transferring inventions and existing technologies into new products for persons with disabilities require technical assistance to make sound and profitable decisions and to do a better job of analyzing the viability of potential products.

Proper screening of devices is critical to the assistive technology transfer process and requires a feasibility study to be performed for each device prior to any significant investment of time and financial resources. Typical questions to ask include: Does the device already exist in some other form? Do consumers have alternate and satisfactory ways to perform the same function that would negate the need for another device? Would the required investment justify the development of the new device? Is the market too small? Are consumers interested in using the device? (Newroe, B. N. and Oskardottir, A. Y., ''Identification and Networking of Assistive Technology-Related Transfer Resources Through the Consumer Assistive Technology Network (CATN),'' *Technology and Disability*, Vol. 7, pgs. 31–45, 1997).

Assistive technology evaluation involves activities beyond the initial screening of new products and innovations. It is important to identify and include all other stakeholders in the evaluation process including, but not limited to, technology experts, engineers, developers, manufacturers, corporations, community organizations, providers and potential purchasers. In addition to evaluation studies, it is necessary to provide an estimate of the resources required and of the product's readiness for commercialization in order to attract a developer or manufacturer. Safety, reliability, cost, customer satisfaction and durability must also be measured (Sheredos, S., et al., ''The Department of Veterans Affairs Rehabilitation Research and Development Service's Technology Process,'' *Technology and Disability*, Vol. 7, pgs. 25–30, 1997).

Most assistive technology devices are considered orphan products (devices used by very small populations and having limited market appeal). In anticipation of a products' low volume and unproven market demand, potential manufacturers and suppliers must be offered a well researched device prospectus that will act as an incentive for production. Products incorporating the principles of universal design are developed with built-in flexibility so they are usable by all people, regardless of age and ability, at no additional cost (Mace, R., et al., ''Accessible Environments: Toward Universal Design,'' *Design Interventions: Toward Universal Design*, p. 156, 1991). The evaluation phase should include an assessment of whether a product may have universal application, thereby increasing its marketability.

Priority 6

The Secretary will establish an RERC on technology transfer to facilitate and improve the process of moving new, useful and better assistive technology inventions and applications of existing technologies from the prototype phase to the marketplace to benefit persons with disabilities. The RERC shall:

(1) Identify and evaluate models of technology transfer that are applicable to assistive technology;

(2) Identify the needs and provide technical assistance, including engineering design and support, to inventors, entrepreneurs, small companies, research laboratories, and industry and university labs to facilitate the transfer of assistive technology with particular emphasis on orphan products;

(3) Develop and implement methodologies to screen promising assistive technology and to evaluate the potential for commercialization, including an assessment of principles of universal design of prototypes developed by individual inventors, small businesses and public or private research laboratories for use by persons with disabilities; and

(4) Design and disseminate protocols for technical, user and market evaluations of promising inventions and new uses for existing technologies.

In carrying out the purposes of the priority, the RERC must:

Conduct activities in consultation with industry, public and private research facilities, small businesses, entrepreneurs, university-based research laboratories and consumers; and

Provide technical assistance and support to all RERC's on issues pertaining to technology evaluation and transfer.

Priority 7: Telerehabilitation

Background

One of the most notable changes in the nation's health care system is a dramatic downward shift in the average length of stay for patients admitted to rehabilitation hospitals. According to the National Spinal Cord Injury Statistical Center, the average length of stay for patients admitted into the Model SCI Care System dropped from 115 days in 1974 to 49 days in 1995 (''Spinal Cord Injury: Facts and Figures at a Glance,'' National Spinal Cord Injury Statistical Center, University of Alabama at Birmingham, August, 1997). Individuals living in rural areas may have less of an opportunity to continue their rehabilitation than do individuals living in urban settings due to a lack of rehabilitation outpatient centers in rural regions. Given that individuals are being discharged earlier in the rehabilitation process, there is tremendous need for new and innovative therapeutic devices and strategies that can be used to continue therapy for individuals living in remote settings who may not have access to outpatient therapy.

For more than 30 years, clinicians, researchers, and others have been

investigating the use of advanced telecommunications and information technologies to improve health care, resulting in the advent of telemedicine. Telemedicine has a variety of applications including patient care, education, research, administration and public health (*Telemedicine: A Guide to Assessing Telecommunications in Health Care*, Institute of Medicine Report, National Academy Press, p. 16, 1996). At least 10 States have established Medicaid payment mechanisms for medical services provided through telemedicine (U.S. Department of Commerce, ''Telemedicine Report to Congress,'' January 31, 1997). Technological advances in medicine, sensor technologies, telecommunications and information technologies provide unique opportunities for expanding upon the field of telemedicine to further develop the field of telerehabilitation. By using technology, telerehabilitation enables rehabilitation professionals to provide rehabilitation services to individuals when distance separates the participants (Temkin, A. J., et al., ''Telerehab: A Perspective of the Way Technology is Going to Change the Future of Patient Treatment,'' *REHAB Management*, p. 28, February/March, 1996). Telecommunication and information technologies used in telemedicine are modernizing medical rehabilitation services and are beginning to be used in other aspects of the rehabilitation process. For example, ongoing experiments to provide effective delivery of therapeutic counseling from the offices of professional psychologists to clients physically located elsewhere, using modified video-conferencing techniques, are under study by the American Psychological Association (Sleek, S., ''Providing Therapy from a Distance,'' *APA Monitor*, American Psychological Association, Vol. 28, No. 8, August, 1997).

Two very important aspects of comprehensive rehabilitation are education and training. Rehabilitation practitioners work closely with individuals and family members to enhance their functional abilities, assist them in adjusting to their disability (Haas, J., ''Ethical Issues in Rehabilitation Medicine,'' *Rehabilitation Medicine: Principles and Practice, Second Edition*, p. 34, 1993), and lessen the likelihood of secondary complications (Stover, S., et al., *Spinal Cord Injury: Clinical Outcomes from the Model Systems*, p. 322, 1995). Secondary complications from acute trauma, such as spinal cord injury, stroke, and traumatic brain injury, are a leading cause for re-hospitalization. One way of reducing the likelihood of contracting secondary complications is through education, training, and monitoring. This can be achieved using portable, low-cost communication devices capable of providing video and audio connection between comprehensive rehabilitation facilities and individuals living in rural communities. Those devices can enable individuals to communicate with rehabilitation professionals while at home or in remote clinical settings, and to continue with the educational and training components of the rehabilitation process. These devices also allow physicians and other clinicians to monitor the progress of these individuals and offer clinical diagnoses and interventions when appropriate.

Traditional therapeutic interventions include the use of heat, cold, light, friction, and pressure to facilitate healing and relieve pain in affected areas. Many of these therapy techniques require costly equipment and can be used only by trained therapists. Given that individuals are being discharged earlier in the rehabilitation process, there is tremendous need for new, innovative and cost-effective therapeutic devices and strategies that can be used to safely continue therapy for individuals living in remote settings who may not have access to comprehensive outpatient rehabilitation therapy.

Virtual reality is an interactive computer-based technology capable of simulating complex three-dimensional (3–D) environments. The number of virtual reality applications has risen dramatically over this past decade and includes flight simulators, 3–D medical imaging technologies, and entertainment systems (Hayward, T., *Adventures in Virtual Reality*, pgs. 41–48, 1993). The benefits of combining virtual reality with rehabilitation interventions are potentially extensive. Virtual reality technologies are being used to convert sign language into speech and to develop barrier-free designs for people with physical disabilities. Biosensors that provide qualitative and quantitative data about muscle activity, pressure and movements are also capable of being integrated into virtual reality systems for use in rehabilitation.

Priority 7

The Secretary will establish an RERC on telerehabilitation to identify and develop technologies capable of supporting rehabilitation services for individuals who do not have access to comprehensive outpatient rehabilitation services. The RERC shall:

(1) Identify, develop, and evaluate communication systems capable of connecting comprehensive rehabilitation facilities with providers of rehabilitation services, individuals and family members living in remote settings to provide ongoing rehabilitation education and training services;

(2) Develop, investigate, and evaluate monitoring and assessment tools that can be used in the provision of rehabilitation services through telerehabilitation;

(3) Develop, investigate, and evaluate strategies and devices to provide and monitor therapeutic interventions in remote settings; and

(4) Investigate the use of virtual reality in rehabilitation including, but not limited to, education, monitoring, diagnosing, and therapy.

In carrying out the purposes of the priority, the RERC must coordinate on activities of mutual interest with the RERCs on Telecommunications and Information Technologies Access, the RRTC on Rural Rehabilitation Services, and other entities carrying out related research or development activities.

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Note: The official version of this document is the document published in the **Federal Register**.

Applicable Program Regulations: 34 CFR Part 350.

Program Authority: 29 U.S.C. 760–762.

(Catalog of Federal Domestic Assistance Numbers 84.133B, Rehabilitation Research

and Training Centers, and 84.133E Rehabilitation Engineering Research Centers)

Dated: June 8, 1998.

Curtis L. Richards,

Acting Assistant Secretary for Special Education and Rehabilitative Services.

[FR Doc. 98–15697 Filed 6–11–98; 8:45 am]

BILLING CODE 4000–01–P

DEPARTMENT OF EDUCATION

[CFDA Nos.: 84.133B and 84.133E]

Office of Special Education and Rehabilitative Services, National Institute on Disability and Rehabilitation Research; Notice Inviting Applications for New Rehabilitation Research and Training Centers and New Rehabilitation Engineering Research Centers for Fiscal Year 1998

Note to Applicants: This notice is a complete application package. Together with the statute authorizing the programs and applicable regulations governing the programs, including the Education Department General Administrative Regulations (EDGAR), this notice contains information, application forms, and instructions needed to apply for a grant under these competitions.

These programs support the National Education Goal that calls for all Americans to possess the knowledge and skills necessary to compete in a global economy and exercise the rights and responsibilities of citizenship.

The estimated funding levels in this notice do not bind the Department of Education to make awards in any of these categories, or to any specific number of awards or funding levels, unless otherwise specified in statute.

Applicable Regulations: The Education Department General Administrative Regulations (EDGAR), 34 CFR Parts 74, 75, 77, 80, 81, 82, 85, and 86; and Disability and Rehabilitation Research Projects and Centers—34 CFR Part 350, particularly *Rehabilitation Research and Training Centers* in Subpart C and *Rehabilitation Engineering Research Centers* in Subpart D.

Program Title: Rehabilitation Research and Training Centers (RRTCs)

CFDA Number: 84.133B.

Purpose of Program: RRTCs conduct coordinated and advanced programs or research on disability and rehabilitation that will produce new knowledge that will improve rehabilitation methods and service delivery systems, alleviate or stabilize disabling conditions, and promote maximum social and economic independence for individuals with disabilities. RRTCs provide training to service providers at the pre-service, in-service training, undergraduate, and graduate levels, to improve the quality and effectiveness of rehabilitation services. They also provide advanced research training to individuals with disabilities and those from minority backgrounds engaged in research on disability and rehabilitation. RRTCs serve as national and regional technical assistance resources and provide training for service providers, individuals with disabilities and families and representatives, and rehabilitation researchers.

Eligible Applicants: Parties eligible to apply for grants under this program are States, public or private agencies, including for-profit agencies, public or private organizations, including for-profit organizations, institutions of higher education, and Indian tribes and tribal organizations.

APPLICATION NOTICE FOR FISCAL YEAR 1998 REHABILITATION RESEARCH AND TRAINING CENTERS, CFDA NO.84–133B

Funding priority	Deadline for transmittal of applications	Estimated number of awards	Maximum award amount (per year)*	Project period (months)
Aging with a Disability	8/12/98	1	$700,000	60
Arthritis Rehabilitation	8/12/98	1	800,000	60
Stroke Rehabilitation	8/12/98	1	800,000	60

* **Note:** The Secretary will reject without consideration or evaluation any application that proposes a project funding level that exceeds the stated maximum award amount per year (See 34 CFR 75.104(b)).

RRTC Selection Criteria: The Secretary uses the following selection criteria to evaluate applications under the RRTC program. (See § 350.54)

(a) *Importance of the problem* (9 points total).

(1) The Secretary considers the importance of the problem.

(2) In determining the importance of the problem, the Secretary considers the following factors:

(i) The extent to which the applicant clearly describes the need and target population (3 points).

(ii) The extent to which the proposed activities address a significant need of those who provide services to individuals with disabilities (3 points).

(iii) The extent to which the proposed project will have beneficial impact on the target population (3 points).

(b) *Responsiveness to an absolute or competitive priority* (4 points total).

(1) The Secretary considers the responsiveness of the application to the absolute or competitive priority published in the **Federal Register**.

(2) In determining the responsiveness of the application to the absolute or competitive priority, the Secretary considers the following factors:

(i) The extent to which the applicant addresses all requirements of the absolute or competitive priority (2 points).

(ii) The extent to which the applicant's proposed activities are likely to achieve the purposes of the absolute or competitive priority (2 points).

(c) *Design of research activities* (35 points total).

(1) The Secretary considers the extent to which the design of research activities is likely to be effective in accomplishing the objectives of the project.

(2) In determining the extent to which the design is likely to be effective in accomplishing the objectives of the project, the Secretary considers the following factors:

(i) The extent to which the research activities constitute a coherent, sustained approach to research in the field, including a substantial addition to the state-of-the-art (5 points).

(ii) The extent to which the methodology of each proposed research activity is meritorious, including consideration of the extent to which—

(A) The proposed design includes a comprehensive and informed review of the current literature, demonstrating knowledge of the state-of-the-art (5 points);

(B) Each research hypothesis is theoretically sound and based on current knowledge (5 points);