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CHPAC-BOSC Workgroup

Review of the Research Translation of the
EPA/NIEHS Children's Research Centers:
Accomplishments and Opportunities for the Future

Findings Document, July 2007



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CHPAC-BOSC Workgroup
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I. Introduction

Background

The National Institute of Environmental Health Sciences (NIEHS) and the U.S. Environmental Protection Agency (EPA) share the common objective of fostering research that will ultimately reduce the extent of adverse human health effects occurring as a consequence of exposure to hazardous environmental agents. The agencies recognize that these health impacts can be particularly detrimental for children due to pronounced differences in nature and extent of environmental exposure as well as in functional development when compared to adults. A Federal Executive Order of April 21, 1997, "Protection of Children from Environmental Health Risks and Safety Risks," charged agencies to consider special environmental risks to children in their activities. Accordingly, in 1998 NIEHS and EPA created the extramural Centers for Children's Environmental Health and Disease Prevention Research which conduct multidisciplinary basic and applied research in combination with community-based research projects on environmental threats to children's health and translate those research findings to public policy, community needs, and information for the health care community and for the general public.

The long-range goals of the Children's Research Centers Program are to:

- (1) Stimulate new and expand existing research on the role of environment in the etiology of disease/dysfunction among children,
- (2) Develop novel effective intervention and prevention strategies, and
- (3) Promote translation of basic research findings into applied intervention and prevention methods, thereby enhancing awareness among children, their families, and health care practitioners regarding detection, treatment, and capacity to identify and address environmental threats and prevention opportunities.

To date, fourteen Children's Centers have been competitively awarded to investigate mechanisms of action, exposure pathways and health effects of environmental stressors in partnership with concerned citizens, community groups, health advocacy organizations and in some cases, official state health and environmental policy makers. With hundreds of publications in diverse, recognized journals the Children's Centers continue to advance the leading edges of clinical, field and laboratory-based research pertaining to environmentally-related diseases such as asthma, autism, ADHD and other adverse neurobehavioral outcomes.

Purpose and Workgroup Charge

EPA's Office of Research and Development (ORD) in partnership with the Office of Children's Health Protection and Environmental Education (OCHPEE) sought to identify the approaches for translating the research results of the Children's Centers which have been most effective at impacting public decision making processes at the local, state and federal levels. It is also important to identify further opportunities to translate findings directly to policy makers and health care practitioners. In April 2007, the EPA assembled an external workgroup (the "Workgroup") composed of members from two Agency advisory boards—the Children's Health Protection Advisory Committee (CHPAC) and the Board of Scientific Counselors (BOSC). This review was neither intended to evaluate the quality of science generated by the Children's Research Centers, nor to outline specific future research areas. Rather this Workgroup was charged with assessing the Children's Research Centers Program's ability to translate the science findings in a manner useful to public decision making. In accepting this charge the Workgroup focused on the following questions to guide their review:

- How have the basic science, exposure, epidemiology or intervention research findings contributed to changes in public policy, clinical practice and behaviors?
- Where applicable, have the Community Outreach and Translation Cores facilitated the flow of knowledge between, university scientists, community partners, health care practitioners and government agencies?
- How has community participation impacted the translation of scientific findings for broad policy change?
- What opportunities might there be for EPA Program Offices, Regions and state governments in incorporating new knowledge in childhood exposures and health effects into risk management and health prevention strategies?
- What minimal changes in the Center design might significantly accelerate the flow of scientific discovery to children's health protection?

The review was conducted in two phases. First, a case study template was developed by the Workgroup and forwarded to Children's Center investigators, soliciting their participation and agreement to develop up to two case studies demonstrating translation around specific scientific findings. (see Appendix A). A total of 16 case studies were received and reviewed from nine principal investigators (see Appendix B for list of participants). Secondly a facilitated two-hour conversation was held with Center PIs (see Appendices C and D for conversation format and list of participating Center/Pis). A glossary of key terms is provided in Appendix E.

In developing this findings document, the workgroup decided to collapse the answers to the aforementioned guiding questions into the following three themes:

- A) Policy Impacts of Children's Center's Research,**
- B) Impact of the Children's Center's Outreach on Communities, the Public, and Health Professionals, and**
- C) Community-based Participatory Research Strategies.**

Each section provides examples of Children's Center translation and/or CBPR approaches, barriers and challenges faced by the investigators or their community partners and lessons learned gleaned from the case studies. The Workgroup's findings as outlined in this document are respectfully submitted to the full CHPAC for their consideration.

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II. Policy Impacts of Center's Research

The Centers have been an invaluable resource in carrying out research on environmental impacts on children's health. The unique combination of basic research and human community-based studies has the potential to significantly improve risk assessment and risk management processes. The Centers' research has in many cases informed policy at the local, state, and/or federal level. In some cases this has resulted in local ordinances or local practices changing to reduce exposure and risk to children from environmental chemicals. In other cases the work has revealed information useful to agency risk assessors in a variety of ways, such as new exposure assessment methodologies, or new health outcomes not previously measured in children. The results of the research have been brought to the attention of policy makers in a variety of ways, including by direct interaction of agency scientists with the Centers but more often by interactions at the local level with communities, NGOs, local politicians and other stakeholders.

A. Informing Risk Assessment Policy and Practice

Center research has provided scientific information that has informed or has the potential to inform both risk assessment methods and risk management policy. For example, observational studies of children have provided parallel information on health effects of specific substances that have been noted in animals. This scientific information strengthens animal-based risk assessment and can reduce uncertainty about potential effects in human children which can only be estimated based on animal studies. Typical risk assessments usually utilize animal toxicological data and extrapolate to humans. Uncertainties in extrapolating from animals to humans are difficult to quantify. When risk assessment is based on observational studies in children, and in particular when study hypotheses are based on concerns generated by animal toxicology results, the uncertainty in the assessment of risks is lessened because of the reduced reliance on extrapolation from animal studies.

Children present unique challenges in terms of size, physiology and behavior for exposure assessment measurements. Center research has resulted in the development of new exposure assessment methods specifically to measure children's exposures, such as has occurred in the University of Washington (UW) Center research on take-home exposures. Data from this research can be used in risk assessments on specific chemicals to characterize risk, and in risk management to determine effectiveness of intervention strategies (as was done at the UW, UC Berkeley, and Columbia Centers). These methods can be reapplied more broadly and are an important step forward in the area of children's exposure assessment. We were provided with numerous examples of Center research that developed novel methods of exposure assessment (both measurement and analysis of data) that have the capacity to impact risk assessment in the future. For example, community participants proposed that a particular exposure pathway be studied which would have been overlooked by the researchers; this pathway turned out to be an important take-home pathway resulting in exposure to children.

Finally, Center research is providing new and refined methods for dose-response assessment. Some of the Centers have also provided new methodology for risk characterization. The UW Center is focusing on risk assessment methods development and thus will have the opportunity to

inform new risk assessment framework and methods. For example, UW has developed a technical report for EPA on a Physiologically-Based Pharmacokinetic model to look at neurodevelopmental toxicants that provides guidance for the type of data needed for such a risk assessment model. Further, their Risk Characterization Core has developed models and frameworks for improved understanding of mechanisms of toxicity to feed into Biologically – Based Dose-Response models. Their Center research and others have also characterized gene-environment interactions which informs risk assessment policy in terms of the variability in response in the human population.

B. Informing Future Risk Assessment Policy

Traditional risk assessment methodologies generally look at one health outcome or one chemical at a time. Research at the University of Southern California Center is evaluating a different approach to look at the burden of disease from air pollution. This may inform risk assessment methods for air pollution in the future. Currently, traditional site-specific risk assessment does not evaluate burden of disease from multiple air pollutants in a community. The USC approach pushes risk assessment further towards a cumulative impacts assessment, and brings in the concept of burden of disease from pollution at least from one media, in this case, air.

Another example of potential impacts on risk assessment policy comes from the University of California Davis Center. Their research has demonstrated a link between immunological abnormalities and autism which has implications for risk assessment of immunotoxicants and connections with neurodevelopment. Further research awaits application of this knowledge to risk assessment practices. To date (to our knowledge), risk assessment has not considered impacts of immunotoxicants on neurodevelopment, and USEPA risk assessors may be looking for more information on this connection in the future as a result of this Center work.

A cross-Center collaboration on pesticide susceptibility research characterized gene-environment interactions which may ultimately inform risk assessment policy in terms of the variability in response in the human population. Better definition of sensitive subpopulations will decrease the uncertainty in both interspecies and intraspecies extrapolation of data.

C. Informing Risk Management Policy

Because of the involvement of communities in Center research programs, many of the Centers have been able to make significant contributions to risk management policy in multiple domains. We believe that the Centers should be encouraged to continue to inform risk management policy where it makes sense to do so. We also believe that there is an opportunity, particularly through the use of advisory boards that include experts in risk policy, to expand the influence of the Centers so that their local successes can be applied more broadly. Several examples demonstrating the range of research results-based risk management approaches follow:

1. Local level, Non-Regulatory Outcome

In the UC Berkeley CHAMACOS study, the researchers evaluated exposures to farm worker's children via "take home" pathways noting that those whose parents had specific jobs in the field had measurably more exposure than others. The researchers worked with both the farm workers

and their families, and the growers to measurably reduce take home exposures via such measures as wearing appropriate protective clothing, washing work clothes separately, and hand washing practices. Interestingly, the “policy” impacts in this case were the worker protection practices in the field devised in cooperation with the workers, growers, and researchers evaluating the intervention ideas, and not via a regulatory agency mechanism.

2. Local level, Regulatory Outcome

A direct example of Center research informing local agency policy comes from the Columbia Center and the Mt. Sinai Center cross-collaboration in the area of exposures of inner city children to pesticides used for rodent and roach control. Measurements of pre-natal exposure to pesticides and a number of health outcomes in children in the Mothers and Newborns Study provided direct human evidence of neurodevelopmental effects of organophosphate pesticides. Intervention strategies designed to decrease the use of more toxic pesticides and increase the use of Integrated Pest Management to control vermin resulted in decreased exposures and decreased health effects in infants. The information generated by this research was used to educate New York City Housing Authority and the City Council which resulted in changes in practice of controlling pests in housing under their authority and local ordinances decreasing the use of toxic pesticides. The Columbia Center also provided scientific information on the impacts of children’s exposure to airborne PAHs which led to converting NYC’s bus fleets to cleaner diesel.

3. State and Federal level Outcomes

i. **Air Pollution Regulation and Legislation:**

State and federal policy has also been influenced by Center research on the effects of air pollution on children’s health, including studies evaluating respiratory health outcome of regional pollution and in association with proximity to local sources (traffic and port activities). The research findings of the USC Center were cited in both the California and Federal documents supporting lowering the state and/or federal standards for particulate matter, ozone, and nitrogen oxides. In addition, the USC Center research component which involved local communities, public interest advocates, and business leaders has resulted in planned reductions in particulate matter emissions from the Ports of Los Angeles and Long Beach, and influenced the planning for expanded port activities to include emissions mitigations. Further, U.S. Senators from California and elsewhere have now recognized the importance of air pollution at seaports and have introduced a bill to address air pollution from ships.

ii. **Culturally-Appropriate Fish Consumption Advisory**

Work conducted at the University of Illinois Center on Hmong immigrants exposure to PCBs and methyl Hg due to fish consumption resulted in a collaborative effort with the Wisconsin Department of Natural Resources to develop a culturally and literacy appropriate advisory that has now been used by the Minnesota and Wisconsin Department of Health in their outreach efforts to these communities.

iii. Biomonitoring and Pesticide Use

Information on prenatal exposure to organophosphate (OP) pesticides from the Columbia and Mt. Sinai Centers, coupled with the animal research demonstrating neurodevelopmental effects of chlorpyrifos, supports the EPA's decision to ban the use of chlorpyrifos and diazinon in residential settings where children's exposure potential is high. Likewise, data on exposure of rural children to azinphos-methyl, a highly toxic pesticide, via take home pathways that was developed by the University of Washington Center contributed to EPA's decision to phase out azinphos-methyl.

In each of these examples, the Centers worked very closely with community partners, hiring and training members of the community to educate and recruit participants and/or gather data for the Centers, reaching out to communities to understand the array of environmental health problems facing the individual communities, and learning what is important to those communities. Some Centers used a Community Advisory Board to guide the interactions with the community and overcome barriers to the research. The community advisory boards were important components of the research, whether the investigators used classical community-based participatory research to study a specific geographic community or whether they studied members of a "virtual community" defined by a diagnosis of a specific disorder (e.g., autism).

Work of the autism Centers (UCD and UMDNJ) may also bear fruit in the future in terms of policies directed at prevention of autism, a disorder on the rise.

D. Barriers and Challenges

The Centers each identified a number of barriers to informing policy makers. These include lack of relationships with policy makers, difficulties or gaps in statutory authority to address pollution, and lack of partnerships with organizations that lack (but should have) health and environmental impacts as a core concern.

Some of the Centers have more opportunity than others to work with local or state agencies. For example, in California the UC Davis center has the advantage of having California EPA scientists who work at the University in developmental toxicology willing and able to work with them, and thus provide a natural connection to the Agency. Further and more important in this case is the connection made with the California agency dealing with Developmental Services who determine eligibility for state services for autistic children, and who became partners with UCD sitting on their advisory group. The University of California campuses in southern California have long standing and strong air pollution research Centers. In addition, the Southern California Center had a translation core that is already well-networked with not only agency scientists but local and state politicians. This is due in part to the longstanding relationship between the University of California scientists and regulatory agency scientists around the state, particularly as regards air pollution research and moving research results into policy quickly. (California first set air pollution standards before the EPA existed.) This or a similar situation may not exist for many of other Centers making it more difficult to inform policy at the state level. Indeed, one has to have interested policymakers before being able to inform them with science.

Additional challenges to Center research informing policy changes include loopholes or gaps in statutory authority. In the case of the work at the Los Angeles Ports, the state agencies have no authority over locomotive or ship emissions. Yet these are major sources of air pollution in Southern California and elsewhere. Hence creative approaches to involve stakeholders such as the major shipping lines and the major railroad operators have been used to address emissions reductions. Further, urban planners, architects, transportation planners, planning commissions, and so on, representing organizations whose policies and practices impact children's environmental health in a number of ways have been involved as stakeholders in the Los Angeles air pollution emissions studies. Their policies impact where schools and houses are built with respect to freeways and industrial sources of air pollution, what pest control measures are used in communities, and how the communities' built environment impacts health. These organizations are far removed in many cases from academic health researchers and do not typically consider public health issues in their planning and decision-making. Thus, pulling in these groups is a real challenge for the Centers to inform important policies that impact children's health.

Lessons Learned

It was clear that those Centers that had the most success to inform policy were those that worked from the ground up (grass roots), as well as the top down, to provide information on health impacts of environmental exposures to chemicals to local communities and stakeholders, who in turn worked with advocacy groups and local politicians to effect changes in risk management and practices and other policy vehicles (e.g., ordinances and statutes). Those Centers that were most active in utilizing community members as research partners seemed better able to inform local policy makers, likely due to keeping sustained interest of the community and focusing their energies appropriately on answering important scientific questions related to their community health concerns that in turn informed policy. As noted below, appropriate education of community partners is key to successful translation of Center research findings.

- Columbia Center researchers note that involvement of key community partners and appropriate education of these community members, regular and consistent communication between the scientists and local Community-Based Organizations (CBOs), and education of local communities such that they can advocate for themselves is key to affecting change in local policy.
- USC Center investigators note that involvement of and education of grass roots public interest advocates in Southern California, coupled with partnering with less traditionally health oriented organizations like labor and planners, was very effective in getting the attention of local policy makers. In addition, direct interaction of the researchers at the Center with regulators resulted in a "top-down" flow of information to move towards solutions.
- The CHAMACOS investigators note that partners in the community can bring scientific information to the attention of local and state elected officials to affect change. Further interventions need to occur at different levels to change policy and work practices that reduce children's take home exposures. The dissemination of knowledge has lead to improved public health in their community.

- Mt. Sinai Center’s estimate of the health and economic consequences of prenatal exposure to methyl mercury played a role in evaluating the EPA’s recent rule on mercury from coal-fired power plants. Although the output of any model can be debated, there model addressed the economic costs of pollution in a way that was not previously stressed.

Workgroup Observations

Workgroup members offered the following observations, based on the case study data:

- The process of translating research findings into policy is labor-intensive.
- Centers’ efforts were most successful where state agencies were actively involved (in one case, participating in the research).
- Effective outreach and translation requires “people skills.”
- In working with community-based organizations, it is important to strike a balance between academics and public interest advocates, and maintain an overall commitment to objectivity.
- It is more difficult to make policy impacts in arenas where the science is still fairly new (i.e. autism).
- The amount of community involvement that is most helpful may vary depending on the extent to which the scientific information base has been developed.
- There are important variables affecting the Centers’ ability to impact policy over which they have no control (e.g., political will).
- One of the benefits of including policy makers on an advisory board is that they can help identify the kinds of data that would be most helpful in impacting policy.
- Health departments and environmental agencies vary in their response to change – sometimes outreach in those arenas is difficult.
- It is hard work to develop and maintain partnerships. Overcoming cultural barriers, scientific versus lay person understanding, and general trust issues requires effort.
- Some Centers described actual policy changes that occurred as a result (at least in part) of their research, while others only described the potential for their research to cause policy change.
- Scientists may not see it as being in their purview to build relationships with agencies, nor ethical for their personnel to advocate for particular policy outcomes.
- Specific risk management methods were adopted as a result of Center scientists participating on key policy panels and committees, speaking to legislators, providing expert testimony, etc. This shows the importance of taking research results to venues where they can be applied.
- Some Centers have just arrived at the stage of being ready to share data with policy makers, though they have not yet taken those next steps.
- Some Centers undertook a tremendous amount of outreach to stakeholders (i.e., labor, public interest advocates, legislators, industry, etc.). They were thoughtful about who was invited to attend and / or speak at meetings. A “grassroots-up” approach seemed to be quite effective in getting the attention of policy makers as well as advocacy groups.
- It is good to harvest lessons learned so Centers can learn from each other with respect to the translation process.

- The Centers that described no actual translation of research results into policy could benefit from more information about the range of ways this can be done.

The Workgroup thought it was effective for Center scientists to take the initiative to conduct outreach to policy makers, not as public interest advocates but as experts who can provide objective information to be used in decision-making. We also note that service by Center staff on government advisory panels is a means to effective research translation. The Centers could share their expertise in effective research translation, and Center staff could learn more about the practical applications to which their research results are put.

The workgroup made observations about characteristics that would support maximum effectiveness in translating research results into policy including:

- Active, meaningful use of an advisory board, from the earliest stages of a project.
- Involving State and Federal agency staff in projects from the initial stages of the project (e.g., as members of such advisory boards, for ad hoc consultations, etc.).
- Partnering with community-based organizations in research design, implementation, and dissemination of the results.
- Researchers or program directors communicating their research results proactively to decision-makers.
- Partnerships with public interest advocates, the community, industry, and local decision-makers at every stage of the project.
- Make stakeholder partnerships a requirement for Center grants.
- Develop a cross-Center mentoring process (i.e., fund the pioneers from the most seasoned and successful Centers to provide technical assistance to other interested Centers).
- Cultivating relationships between state and federal agencies and academic institutions to welcome and encourage scientists to share their research results with decision-makers

III. Impact of Center Outreach on Communities, the Public, and Health Professionals

The impact of Center outreach was reviewed for three target groups: Communities, the public and health professionals. Impact can be addressed in terms of the involvement of these groups in the program development, implementation, and translation of research results into a) intervention and prevention activities, b) their increased awareness and understanding of environmental hazards and the environmental etiologies of disease, and c) how the involvement of these target groups modified the Centers’ research aims, methods, and outcomes.

Many of the areas of impact and opportunity addressed in this section are the same for communities, the public and health professions. What often differed were the types of outreach, the levels of involvement/interest of target groups, and the resulting outcomes within each target group.

We present examples from various Centers which exemplify approaches, successes and constraints to outreach activities. We also provide the material in terms of two specific questions that address components of outreach: (1) In what ways have Center outreach efforts resulted in changes in clinical practice; and (2) What factors have made Center outreach efforts effective? Because outreach to communities requires different strategies than outreach conducted to health professionals, the Center outreach efforts for each of these populations is discussed separately below.

Overview of Center Outreach Activities

Community and public participation

Outreach to community and the public was highly variable, in part dependent upon whether a Community-Based Participatory Research component was required, and whether or not there were pre-existing relationships between community groups and investigators. Of the eleven Centers participating in this review, all have some level of outreach projects. As a component of the CBPR process, many Centers include community advisory groups and public participation of community members in the research process. Outreach included a variety of methods for disseminating findings and changing behaviors and policy through translational activities in which information was shared with communities, community groups or advocacy groups.

Community and public outreach activities included:

- Educational campaigns/programs;
- Presentations to schools, community-based organizations and advocacy group meetings;
- Seeking to bring to the table all constituencies including municipal agencies and organizations;
- Project newsletters, websites and/or fact sheets;
- Media interviews;
- Service projects;
- Training of lay health workers from the community to assist in research process;
- Development and dissemination of age, culture, language and group sensitive; printed and video information appropriate for each constituent group; and
- Briefings/presentations to elected officials and governmental employees

Health professions

Many of the Centers tended to take a rather narrow view of the definition of the term ‘health professional’. Most of the focus was on dissemination of information to physicians and particularly pediatricians or in some cases OB/GYNs. However, opportunities exist to engage the wider circle of health professionals including, but not limited to nurses, pharmacists, local/state health department professionals, clinics and other embedded community-based organizations (CBOs) aimed at providing medical/healthcare to underserved communities. These CBOs may in fact be even more important in improving community health. The wider context of health professionals may provide avenues for increasing the impact and translation of basic research to communities at risk. Several Centers involved “promotoras” or community health lay workers in the design and implementation of their research efforts. While each of the Centers mentioned presentations or Grand Rounds given to physicians or other health professionals, few of the Centers discussed active participation of health professions, with the

exception of community health workers, in the design and implementation of their research projects. However, several did mention that local members of the medical professions were members of their community advisory committees. In most instances, the Centers tended to view other health professionals as “end-users” of their research findings, rather than partners in design and implementation.

Health professional outreach activities included:

- Presentations at local, state and national conferences, CME meetings and other venues;
- Grand Rounds presentations to medical faculty, residents, and practicing physicians (most of the focus on pediatrics and in some cases OB/GYNs);
- Training programs of residents and fellows, mostly in Pediatric Environmental Health Specialty Units (PEHSUs);
- Training for housing and health professionals, and childcare providers; and
- Presentations to health agencies and policy groups

Involvement of Target Groups in Program Development, Implementation and Translation: Center exemplars for impacting children’s health, clinical practice, and training

Community and public participation

The majority of Centers integrated a variety of community outreach activities into its research programs and included the community in the development, implementation and/or translation of findings from the program into public health measures. A couple of brief examples follow.

In partnership with Clinica de Salud del Valle Salinas, CHAMACOS developed an innovative, computer-based prenatal environmental health program to educate pregnant women about environmental health issues. The program is low-literacy and offered in Spanish and was developed with input from the targeted community.

Columbia Center’s *Healthy Home Healthy Child* (HHHC) community education campaign won the U.S. EPA’s Environmental Health Excellence Award in 2005 for effectively translating the results of their biomedical research into practical information for parents and other caretakers of young children about reducing environmental health hazards in the home. The campaign includes a series of bi-annual newsletters, community health fairs, and environmental health workshops for local leaders.

Health professions and clinics

The Centers were not required to set up evaluation efforts to determine if changes occurred in clinical practice due to the Centers’ efforts. Thus none of the Centers implemented evaluations to determine the impact of scientific advances on the practice of medicine, the treatment or referral of patients to health specialists with a focus on environmental/preventative medicine or mitigation/amelioration of environmental exposures, or changes in clinical practice that may have resulted from the Centers’ outreach, education, and training efforts.

It is generally held by the Workgroup that the lack of evaluation constituted a missed opportunity to assess the effectiveness of the messages conveyed, the resiliency of the message and the accuracy of the information retained by the professional. It is also generally acknowledged by

the Workgroup that these activities are time-consuming, expensive and may go beyond the purview and intent of the basic research Centers as presently configured and resourced.

There are a few exemplars however, that can be considered when determining the impact of Center outreach to health professionals. The Columbia Center, based on their research and the engagement of graduate students and faculty leadership, brought about the successful institutional policy change for using phthalate-free IV tubing in the hospital's NICU.

UC Davis partnered with the UCSF PESHU to present a Children's Environmental Health Toolkit for pediatric residents with a focus on anticipatory guidance for parents and risk reduction from environmental toxins.

A number of Centers involved residents and fellows while in their training programs; this may influence the way they practice when they ultimately complete their training and become practicing physicians, although evaluation mechanisms are needed to fully determine this impact.

What factors have made these outreach efforts effective?

Community and public participation

Common themes for effectiveness were using culturally, literacy, and linguistically sensitive materials, and employing or involving community members in the study activities. None of the Centers described any evaluation tools that they may have used to address the effectiveness of efforts.

Health professions

Clearly the enthusiasm of Center members for communication of their basic research findings to health professionals is reflected in the engagement of health professionals by some Centers. Centers that include physicians in leadership roles and that have established strong ties to academic medical Centers and medical schools appear to have the greatest opportunity for successful transmission of important concepts of exposure, susceptibility and pathologic outcome to new medical audiences. Identification of clinically-relevant health issues such as neurodevelopmental anomalies, pulmonary dysfunction and autism attract interest from clinicians and make them more likely to pay attention to the possibility that transient and persistent environmental contaminants may play an etiologic role or may exacerbate existing disease in susceptible populations. In addition, members of the Centers who have specific interest in medical education, clinical training of residents and fellows, and involvement of community health workers and clinics, brought their own leadership and connections to the outreach efforts.

Barriers and Challenges

Community and public participation

Programs effective in outreach efforts have leveraged the resources garnered by award of the Center by capitalizing on pre-existing relationships with community partners, developing new relationships and minimizing the potentially confounding factors of mistrust, inequalities in education, class, culture, etc.

Constraints reported were the different agendas and concerns of the communities and advocacy groups from those of the researchers. Some communities had difficulty trusting researchers, and class and cultural differences had to be acknowledged. Trust-building strategies reported by several of the Centers in the communities were impressive.

Developing relationships and maintaining them was reported to be difficult and time-consuming by a number of Centers.

An additional stumbling block was that some state agencies were not open to Center outreach either due to a lack of historical relationship between the academics and the agency, difference in culture, or because of concerns that Center findings may have fiscal impacts on agency responsibilities.

Finally, one of the Centers reported that they felt one of their major tasks was to educate community and advocacy groups so that good cross communication could take place. Agendas of advocacy groups are not always based on scientifically drawn conclusions rooted in a scientific approach, and more efforts are therefore required to bridge differences between groups and researchers.

Health professions

Programs reporting effective outreach to health professionals have leveraged the resources garnered by previous work of Center faculty and staff to capitalize on pre-existing relationships with community research partners, develop new relationships and take care to minimize the potentially confounding factors of mistrust, inequalities in education, class, culture, etc. Despite strong connections with community partners, unevenness in the outreach and response from health professionals and local and state environmental health-related agencies led to lost opportunities of translation of basic research into best practices and policy.

Several Centers mentioned that funding is a major obstacle to accomplishing outreach activities, particularly for health professionals. Increased financial resources and time are necessary to support dissemination and outreach activities.

Lessons learned

Community and public participation

A common theme across many of the Centers was that outreach work is labor intensive and takes time. At the same time most Centers felt that the community outreach was immensely rewarding and absolutely necessary for the success of the research. Community education is a necessary foundation for informing community action and changing policy. It is important to identify key persons in the community who are community leaders or individuals respected in the community. The community groups are an effective means of keeping in contact with participants, and there is a need to do assessments of the effectiveness of the outreach.

Health professions

It was felt by several of the Centers that the medical community is interested in translation of research to practice, and that a major focus needs to be educating physicians with evidence-based information in part to counter misinformation brought to physicians by peers, patients and/or parents and to provide evidence-based information to the parents. It is important to keep health professionals (not just physicians) informed especially if you want their involvement in the health activities associated with the study.

Highlights of lessons learned:

- Providing data and information to diverse groups required crafting materials culturally specific to the audiences being addressed.
- Hiring professionals to conduct translation activities (e.g., developing culturally appropriate reading materials) was reported by one of the Centers to improve the effectiveness of the communication to the target population.
- Several Centers found that participation of respected community members in developing the research agenda, conducting the study, and reporting results back to the community were a means of reducing suspicion about researchers from outside the community and developing trust.
- Outreach activities such as community health education programs were found to be useful for maintaining contact with study participants, community groups and advocates.

Summary of Workgroup Observations

Primary goals of the EPA in establishment of these Centers are the facile translation and transmission of high quality basic science to inform policy and enhance environmental health. The following observations are offered for consideration as a means of achieving these aims, given the need for preservation of the best science in a ‘fixed budget environment’:

Community Involvement

- EPA leadership could institutionalize outreach and implement incentives for regional outposts to engage in substantive interaction with basic research Centers.
- Successful outreach efforts require recruitment of people from the community as members of the research team and getting buy-in from key people in the community at the onset of the project.
- Centers are enthusiastic about engaging external stakeholders (working from pre-existing relationships, or building new ones if they do not already exist).
- Centers can build new relationships through service projects offered to community residents.
- Developing relationships and maintaining them is challenging and time-consuming. Communities often have difficulty trusting researchers; class and cultural differences exist. Constant vigilance is needed in order to maintain successful outreach and community partnerships.
- Experts should be used, when needed, to help with outreach challenges (e.g., developing low literacy educational materials).
- Uneven outreach among Centers reflected different capabilities, interests, philosophies, institutional settings, and arrangements.

Translation/Training for Health Professionals

- Most health profession outreach focused on physicians. However, there are other health professionals that need to be included in outreach since in many communities, the nurse practitioner or lay health outreach worker is the primary contact with the community and patient.
- Rigorous outreach, education and training of health professionals at all levels needs to be considered.
- A comprehensive outreach evaluation component was not explicitly required in this Center grant program. Therefore, while all of the Centers had some aspect of outreach to health professionals, many did not demonstrate change in knowledge, attitudes and behaviors of the health professionals they reached. In one instance a Center was able to demonstrate a change in clinical practice however, this was not the norm.

The working group has concluded that it would be best if EPA continued to require a set of baseline activities (like the ones listed above) and consider the following:

- Require nominally-funded Centers to engage in translation activities to the extent that their budget permits should remain as a requirement of award.
- Offer supplemental funding to support a rigorous evaluation component that will enable the assessment of impact on the communities, and track input into policy or changes in public health prevention practices.
- Offer supplemental funding for the evaluation of health professional outreach to assess both changes in knowledge, attitudes and behaviors of health professionals and changes in clinical practice.
- Provide incentives for Centers to link with the Pediatric Environmental Health Specialty Unit (PEHSU) in their region so as to strengthen the health professions and clinical practice components, and consider providing supplemental funding to support partnerships between the Centers and the PEHSUs.
- Consider additional financial support to Centers that have developed innovative strategies to enhance community engagement and outreach, rewarding those Centers that are “pioneers” in the field of conducting and disseminating research through the use of community partnerships and can offer technical assistance to other interested Centers in how to more effectively conduct and disseminate research through the use of community partnerships.

IV. Role of Community-Based Participatory Research (CBPR) Strategies in Research Translation

Community partnerships are an important part of the Centers for Children’s Environmental Health and Disease Prevention research. Complex issues that impact children’s health and its relationship to the environment require greater community involvement in determining research priorities and interventions. These complex issues include conducting detailed exposure, intervention and epidemiological research in at-risk or highly susceptible populations, often with environmental justice concerns making access to these populations difficult.

US EPA ARCHIVE DOCUMENT

In 1994, the first children's environmental health conference was held to explore the benefits of using community-based participatory approaches to children's environmental health research and in 2000 a conference hosted by the NIEHS entitled, Successful models of community-based participatory research reported on successful models of CBPR (O'Fallon, Tyson, & Dearth). This conference report listed key principles of CBPR including the following:

- Recognizes community as a unit of identity
- Builds on strengths and resources within the community
- Facilitates collaborative, equitable involvement of all partners in all phases of the research
- Integrates knowledge and intervention for mutual benefit of all partners
- Promotes a co-learning and empowering process that attends to social inequalities
- Involves a cyclical and iterative process
- Addresses health from both positive and ecological perspectives
- Disseminates findings and knowledge gained to all partners
- Involves a long-term commitment by all partners (O'Fallon, Tyson, & Dearth, 2000).

This conference report underscored the importance of using CBPR strategies to improve the translation of research findings into policy and practice with the ultimate aim of reducing children's exposure to environmental toxins and to reduce health disparities.

In keeping with this report directive, and in response to specific requirements set forth in some, but not all RFAs, Children's Centers routinely apply CBPR to understand and prevent children's exposure to environmental hazards and reduce health disparities. To further accomplish this directive, EPA and NIEHS required all Children's Centers funded after 2003 to include a Community Outreach and Translation Core (COTC) which works in collaboration with the investigators, other Cores in each Center and a community advisory board to translate scientific findings into information for the public, policymakers and health professionals.

Despite the numerous challenges and barriers in conducting CBPR, there were many success stories presented by the Centers in developing, conducting and translating findings using CBPR principles.

Exemplars: CBPR Key Principles Application and Impact

The majority of Centers were able to successfully incorporate CBPR strategies into at least one research project. By virtue of the definition of CBPR, a variety of challenges and barriers needed to be overcome and specific strategies instituted to adhere to the principles of community engagement in the research process. Selected key principles as outlined by O'Fallon et al (2000) will be used to highlight the application and impact of CBPR strategies in Center research.

Builds on strengths and resources within the community

CBPR seeks to support or expand social structures and social processes that contribute to the ability of community members to work together to improve health (O'Fallon et al, 2000)

Establishment of coalitions with a variety of existing community partners promoted the translation of findings into behavior and policy change in several Centers. For example,

Columbia's collaboration with New York City's Housing Authority and Department of Health and Mental Hygiene and the NYC Department of health on a low-toxicity pesticide intervention in public housing produced results showing safe & effective methods for controlling prevalent pests in public housing without the use of highly toxic pesticides. The Center also collaborates with local advocacy groups to build the capacity of communities so residents can organize and take effective action toward improving the environmental health status of their neighborhoods. Columbia reported that these community partnerships contributed to the success of the intervention and evaluation.

Integrates knowledge and intervention for mutual benefit of all partners

CBPR seeks to build a broad body of knowledge related to health and well-being while also integrating that knowledge with intervention efforts that address the concerns of communities involved (O'Fallon et al, 2000)

Columbia's Center has expanded its ongoing *Healthy Home Healthy Child Campaign* (HHHC) to regularly inform cohort study participants of research findings, educate medical residents about children's environmental health, and empower community members to become active in organized initiatives to improve the environmental health of neighborhoods. As community residents become more aware of the adverse effects of environmental contaminants on their children's health, and informed of the progress that community action is making to improve conditions, they may be more likely to take an interest in participating in activities necessary for policy change.

In some cases, extreme measures were taken to effectively teach immigrant populations how to reduce risks from environmental exposures. The University of Illinois reported on the importance of integrating cultural anthropology into epidemiological research in their work with the Hmong population. The report underscored the importance of understanding the cultural background and beliefs of the community, and designing and conducting the research in a way that respects those beliefs and customs in order to be successful in the translation process. In addition, their lessons learned discussed the importance of hiring and training long-standing local community members to do the recruiting, interviewing and testing. This strategy was utilized in a number of Centers and although the extra training that was involved to bring these individuals up to speed was time consuming, results were well worth the effort and turned out to be critical to the success of the project. Another example of empowering communities was in the USC Center, where residents were trained to assess their own neighborhood's environment of air quality and health risks through use of trained Neighborhood Assessment Teams (A-Teams).

Involves a cyclical and iterative process

CBPR involves a cyclical, iterative process that includes partnership development and maintenance, community assessment, problem definition, development of research methodology, data collection and analysis, interpretation of data, determination of intervention and policy implications, dissemination of results, intervening as appropriate, and establishment of mechanisms for sustainability (O'Fallon et al., 2000)

The ability to build capacity for translating findings into practice is exemplified at the University of Washington where the Center structure (versus individual investigator grants) has strengthened the scientific design of the studies as a result of community and stakeholder interactions. For example, on the suggestion of their Community Advisory Board (CAB), they added assessment of pesticide levels in vehicle dust to the occupational take-home exposure pathways study design. This additional data proved to be instrumental in linking the agricultural occupational take home exposure patterns through correlations with both house dust and children's urinary pesticide metabolites. In addition, the interest of the CAB in warehouse workers and their exposures resulted in the design in years 6-10 of the warehouse worker study. This type of interaction and input is unique to large center funding mechanisms. For these reasons, this has been a wonderful opportunity to impact the whole continuum of children's health issues and to make a difference.

Based on information gathered from a community needs assessment, community discussions, and focus groups, CHAMACOS partners decided to develop and validate sustainable community-based interventions aimed at primary prevention of environmental exposures to reducing pesticide residues brought into the home from the field and on worker's clothing and skin before returning home from work. Analyses indicated that significant improvements in risk reduction activities, such as the removal of worker's shoes before entering the home and washing work clothing separately from family clothing resulted from Center interventions.

The important role of the Community Outreach and Translation Core (COTC) was also consistently described in Centers where translation of findings was successful in changing human behavior and policy. At the USC Center, when Center scientists and the COTC became aware of port growth and related pollution problems, they began efforts to integrate the CEHC research findings on air pollution's adverse health impacts into the transportation planning and decision making processes.

Disseminates findings and knowledge gained to all partners

CBPR seeks to disseminate findings and knowledge gained to all partners involved, in language that is understandable and respectful. The ongoing feedback of data and use of results to inform interventions are integral to this approach. This principle is also concerned with the researchers consulting with participants prior to submission of any materials for publications and co-authorship where appropriate (O' Fallon et al., 2000).

Center PIs consistently reported that the development of coalitions to conduct and disseminate research findings ensured that these research results are delivered to these communities in ways that are meaningful and useful in improving daily environmental health at home and in the larger community. An extension of the range of dissemination was observed in the University of Michigan's Community Action Against Asthma (CAAA) project, who reported that community partners made national and international presentations at numerous scientific meetings and co-authored publications on methods and processes in conducting CBPR.

Barriers and Challenges

Reported barriers and challenges are consistent with the CBPR literature. These include:

- Initiation and maintenance of community-university partnerships
- Institutional commitment and recognition and value of academic institutions
- Training for researchers, providers, and community
- Evaluation of sites, individually and across sites

Lessons learned

- It is clear that Centers using CBPR strategies were successful in translation of findings into practice and policy. Successful community-based participatory research partnerships require significant time to develop trust and nurturing of relationships. Involvement of the COTC can help to nurture the relationships between Center investigators and community partners. The importance of developing trust within the communities was a major theme throughout all successful case studies. Although challenging and often time consuming, the development of trust was achieved through a variety of strategies, including a) hiring and training lay workers who are respected within their respective communities, b) conducting service projects before research studies are started, c) developing educational materials that are culturally appropriate, d) communicating regularly through community meetings and newsletters, and e) empowering communities to participate in the research process from the beginning.
- One critical issue that needs to be overcome through CBPR is the dichotomy that exists between the inherent needs of the communities that are disproportionately exposed to environmental pollutants (pesticides and air pollutants) and the research interests of public health professionals and scientists. Researchers and community members are not always on the same page and enter the research project with competing agendas.
- CBPR and resultant interventions can occur at several levels. Efforts to change individual behaviors as well as changes in policy and work practices are needed so the burden of protecting families and children is not placed solely on individuals. These efforts take time. However, the dissemination of knowledge and understanding gained through multiple efforts can lead to concrete changes that improve public and environmental health in the most affected communities.
- Centers that were successful in translating research findings into the community and practice settings instituted community advisory committees at the onset of the research project and included a wide range of stakeholders.
- It is essential that universities support CBPR because the pace of publication is at odds with the expected tenure-track trajectory and often is undervalued. In addition, there is a learning effect for the researchers related to CBPR capacity, specifically improved skills with translation activities as the study progressed.

Summary of Workgroup Observations

A CBPR approach can be used successfully in exposure assessment and behavioral intervention research projects without sacrificing the rigor of traditional research designs. Center PIs were consistent in their support for the benefits of using CBPR strategies to enhance the translation of study findings. These include:

- Enhanced data quality and quantity, relevance of collected data, and information dissemination
- Extends research and intervention beyond a specific project, and moves beyond categorical approaches
- Improved research definition and direction, clearer understanding of research questions, and improved identification of ethical dilemmas
- Enhanced translation of research into policy
- Knowledge that benefits the community's health, education and economics bringing additional resources and services to a community (e.g., training)
- Projects that in some cases build infrastructure and sustainability
- Increased trust of community residents for funding agencies

Based on their review of the case study data, Workgroup members identified the following points they would like to make with respect to how to use CBPR to further the goal of translating research results:

- Community participation and outreach must be maintained and be a required component of the research portfolio for Centers
- CBPR can help overcome cultural challenges to conducting scientific research, and enable scientific research in culturally diverse or unique communities.
- Build on pre-existing relationships where possible; if not, build them (e.g., through service projects)
- Use experts when needed (e.g., cultural anthropologists, health literacy)
- Incorporating community concerns into research; even problem solving when issues are outside of actual research project (case management)
- Take the time to build and sustain community relationships which will enhance the translation of research to improve public health
- Establishing trust is essential with community, policymakers, industry partners, and other stakeholders
- May need to create a community where none exists (e.g., non- “connected” service agencies; virtual communities of interested parents of children with specific diagnosed disorders)
- Research generated must be relevant to policymakers

V. Implications for the Future

The unique value of the Centers program includes a range of opportunities for the translation of research findings into practice and policy that are otherwise much more difficult to achieve through the efforts of individual researchers alone. Following are a number of specific attributes of a Centers-based approach to children's health research that make this approach even more valuable for public decision-making efforts.

Opportunity for Integration: The case studies demonstrated that integration occurs on a number of dimensions, including integration of basic science with real community concerns and environmental problems, and integration of research and outreach. Effective translation resulted from the a) utilization of the "cores," which make a major difference in terms of scientists' abilities to maintain cohorts, develop community trust, and to quickly move into areas of new research as additional issues arise and the b) utilization of a CBPR approach.

Sustained Period of Time: The Center approach allows one to accomplish objectives over a sustained period of time, which is needed for translation success.

Ability to Foster Trust: Centers are able to build effective relationships and lasting partnerships between researchers, decision-makers, industry partners, and communities, and demonstrate an ethic of giving back to the community through outreach programs, in addition to conducting basic research.

Multi-disciplinary Teamwork Enhances Research: The Centers have also served as resources to the community, as well as to academia and industry partners, affording a way for multi-disciplinary teams to work effectively together on children's environmental health problems.

Training of Future Health Professionals: The program offers opportunities to the next generation of healthcare professionals who are interested in conducting community-based participatory research with a focus on translating findings into practice (students doing thesis work in Centers, minority students doing research, graduate students becoming integrated into the community, etc.).

Specific Center Comments on Lessons Learned: Center PIs provided the Workgroup with solid examples of research projects that in a variety of ways have made a positive impact on children's health through changes in individual behavior, local/community programs and ordinances, state and/or policy initiatives. A discussion of the challenges and potential solutions to dissemination/translation of findings are summarized below and will need careful consideration for funding and implementing future research projects:

- Challenge: Trying to get science into policy → Solution: speaking at meetings, sitting on committees, educating people at the grassroots level. (If that is not done well, it is harder to influence policy.) Have strong involvement from agencies and strong partnerships with community groups and cross-disciplinary experts. Centers had a range of philosophies regarding interaction with policy-makers, from:

- Focus on science, but do not get too close to policy so you do not cross the line from scientist to advocate; to
- Proactively inform policy without advocating for a particular outcome.
- Challenge: Complicated environments; many stressors can impact a community member's ability to participate in a study and stay in the study, as well as the researchers' ability to share results with community members (e.g. poverty, violence, etc.) → Solution: recruited community members to work as field staff and recruiters. They got to know participants very well, which allowed the Centers to help them address some of the stressors.
- Challenge: Trust building within a community around cultural, social or economic roadblocks → Solution: CBPR -- involving community members in the study; working with anthropologists to understand and navigate cultural differences. One Center began interaction with the community with a public service activity to help build trust and recognition.
- Challenge: Lack of local infrastructure → Solution: Build on whatever infrastructure exists in the community; build new infrastructure where needed and possible.
- Challenge: Variations in organizational culture and expectations from EPA and NIEHS: → Workgroup members felt strongly that joint NIEHS and EPA funding for the Centers should be maintained, and that the two agencies should speak with one voice regarding expectations of the Centers.

VI. Conclusions

This Workgroup has identified approaches for translating the research results of the Children's Centers which have been most effective at impacting public decision making processes at the local, state, and federal levels. In addition, findings from the case studies reflect that the majority of Centers have been effective in the translation of research findings into applied intervention and prevention methods, thereby enhancing awareness and knowledge of environmental risks and risk reduction among children, their families, and health care practitioners.

A growing body of research has emerged about the need to conduct, environmental health research in partnership with communities. This review indicates that CBPR can empower community members to become active participants in the research process and enables university investigators to gain a more comprehensive understanding of environmental exposures and risks in local communities. Furthermore, CBPR permits research findings to be translated into actions and strategies to reduce children's exposures to environmental toxins and improve public health overall.

However, there is a need to build capacity across Centers, particularly in the area of outreach, to a broader definition of health professionals that also includes a strong evaluation component. This will help to ensure that future practitioners will disseminate needed information on risk reduction to children's parents and other caretakers.

The Workgroup has concluded that the Centers program represents an excellent investment and one that should continue in the future. Specifically, the Workgroup found that:

1. The Children’s Research Centers are extremely value-added and funding should continue to support a Centers-based approach to this work;
2. The use of CBPR strategies have substantially enhanced the effectiveness of research and need to be continued in future research programs;
3. The translation of research in ways that are geared for community-based organizations, health professionals, policy makers and the public-at-large are a cornerstone of public health research and should be expanded.

In addition, the Workgroup believes that the following expansions to the program would lead to an even greater societal impact: EPA should:

Broaden Representation on Advisory Boards	
	<ul style="list-style-type: none"> ○ Strongly encourage that community advisory boards be comprised of a diverse set of stakeholders, including federal and state agencies, whenever possible;
Improve and Document Risk Communication Strategies	
	<ul style="list-style-type: none"> ○ At the program’s annual Centers’ meetings, ensure sufficient time for Centers to reflect upon and learn from each other about lessons learned in risk communication, since this is a vital component of research translation. ○ Create incentives for Centers to evaluate the effectiveness of their risk communication techniques ○ Document lessons learned and contribute to the literature on risk communication principles, with the possibility for publication.
Support “Pioneers” to Train Others	
	<ul style="list-style-type: none"> ○ Fund “pioneers” at select Centers to mentor other Center staff in the area of CBPR, clinical translation , risk communication and policy change.
Link Centers with Other Outreach Tools	
	<ul style="list-style-type: none"> ○ Assist Centers in outreach efforts, such as connecting Centers to existing organizations and networks that have created effective outreach tools.
Offer Optional Supplemental Funding To:	
	<ul style="list-style-type: none"> ○ Support a rigorous evaluation component that will enable the assessment of impact on the communities, and track input into policy or changes in public health prevention practices; ○ Evaluate health professional outreach to assess both changes in knowledge, attitudes and behaviors of health professionals and changes in clinical practice; ○ Provide incentives for Centers to link with the Pediatric Environmental Health Specialty Unit (PEHSU) in their region so as to strengthen the health professions and clinical practice components.

Broaden Perceived Role of Scientists

- Identify ways to discuss with Center researchers about the evolving role of scientists in public health decision-making. The role of scientists is not just to bring science to the door of policymakers but is also to consider how data can be used by policymakers, community-based organizations, public interest advocates, and industry and to then proactively convey the science to them objectively in the context of relevant policy discussions.

APPENDIX A

CHPAC-BOSC Workgroup Review Template for the Children's Environmental Health Research Centers - Written Component

The Office of Research and Development in partnership with the Office of Children's Health Protection and Environmental Education is seeking to identify the approaches for translating the research results of the Children's Centers that have been most effective at impacting public decision-making processes at the local, state, and federal levels. This workgroup is charged with assessing the Children's Research Centers Program's ability to translate the science findings in a manner useful to public decision making as well as identify further opportunities to translate findings directly to policy makers and health care practitioners.

Directions: A "lessons learned" approach is utilized to frame the questions and responses, focusing on successes and challenges/barriers to initiating or sustaining public health measures.

For the purposes of this review, the CHPAC-BOSC workgroup seeks to collect information about research projects or "case studies" that reflect the impact on a variety of indicators that support public health including the following categories: a) State and/or federal regulatory initiatives, b) State and/or federal legislative initiatives, c) Changes in local ordinances, d) Outreach to communities and the public, and e) Outreach to healthcare professionals, community-based clinics, clinical providers, and/or a role in changes to clinical practice, and the f) Fostering of co-learning through community-based participatory research. These areas are described in more detail below.

We are requesting the development of two case studies from your Center. Both case studies should use the following six categories as a template for clearly explaining the lessons learned in translating scientific findings from a particular Center project or set of projects. Case studies reflecting all six domains are encouraged, though not required. Please use 12 point font, single spaced paragraphs. Please limit each case study to four pages (not including references).

Title of Project

Setting

Audience

Project objectives

1. State and/or federal regulatory initiatives

Describe new or emerging capabilities developed that may improve government's ability to conduct risk assessments, management or communication; or that might reduce uncertainties in existing risk assessment, management and communication approaches. In addition, discuss a) what research results from your Center might be ripe for impacting federal and state risk assessment processes and b) if your Center is currently involved with such translational efforts.

Include a description of lessons learned: successes, challenges/barriers and recommendations regarding what to do differently in the future.

2. Changes in policy: State and/or federal legislative initiatives

Describe policy change or the potential for policy change as a result of the research project at the state and/or federal level.

Include a description of lessons learned: successes, challenges/barriers and recommendations regarding what to do differently in the future.

3. Changes in policy: Local ordinances and not-for-profit institutions (e.g. primary care clinics)

CBPR fits well with “upstream” approaches to health promotion and disease prevention through its ability to mobilize community action. Although some approaches to environmental and policy changes require state or national legislative decisions, many other environmental enhancements can occur through micro-level policy change within the community or workplace. Describe how Center research has played a role in changes to local ordinances and/or the potential for change in policy.

Include a description of lessons learned: successes, challenges/barriers and recommendations regarding what to do differently in the future.

4. Outreach to communities and the public

Describe outreach activities incorporated into the research project that promoted community and public participation, as well as characteristics of successful investigator-community partnerships.

Include a description of lessons learned: successes, challenges/barriers and recommendations regarding what to do differently in the future.

5. Outreach to health professionals

Describe how this Center research project incorporated outreach efforts to health professionals and community-based clinics to support the translation of findings into practice. Has this research project resulted in changes in clinical practice and if so, what is the evidence that your translational efforts have resulted in the intended outcomes?

Include a description of lessons learned: successes, challenges/barriers and recommendations regarding what to do differently in the future.

6. Community-Based Participatory Research (CBPR)

CBPR bridges the gap between knowledge produced through research and what is practiced in communities to improve health. Describe the role and value of community members in the research process and any co-learning that took place (keeping in mind that development of the capacity of individual researchers and research Centers to interact more collaboratively with the community should be described).

Include a description of lessons learned: successes, challenges/barriers and recommendations regarding what to do differently in the future.

APPENDIX B

List of Participating Principal Investigators and Children's Research Centers: One or More Case Studies Submitted

Patrick Breysse, Ph.D.

Johns Hopkins School of Public Health

Brenda Eskenazi, Ph.D.

University of California at Berkeley

Elaine Faustman, Ph.D.

University of Washington

Frank Gilliland, M.D., Ph.D.

University of Southern California

Barbara Israel, Dr. P.H.

University of Michigan

George Lambert, M.D.

University of Medicine and Dentistry of New Jersey

Frederica Perera, Ph.D.

Columbia University

Isaac Pessah, Ph.D.

University of California at Davis

Susan Schantz, Ph.D.

University of Illinois, Urbana-Champaign

Mary Wolff, Ph.D.

Mount Sinai School of Medicine

APPENDIX C

CHPAC-BOSC Workgroup Review Template for the Children's Environmental Health Research Centers - Conversation with Center PIs: Interview format

Representatives of ten Centers participated in a two-hour conference call with Workgroup members to expand upon their case study data (see Attachment B) and answer Workgroup member questions. Members chose to focus this discussion on two themes:

- What has worked well and not so well with regard to the translation/dissemination process; and
- What has this program allowed the Centers to do that they would not otherwise have been able to do.

To the extent that time allowed, Workgroup members had agreed in advance that they would be especially interested in eliciting Center insights on:

- Who Centers engaged with and why
 - Did they use advisory boards and when?
 - If so, how did they determine the composition?
 - Did they involve the community in designing the study? Shaping core values? Writing up results?
 - How did they develop trust within the community?
- What made Centers' risk communication effective? Was it evaluated?
- Were there constraints on effectiveness?
- Was there follow-up with communities (post CBPR)?

APPENDIX D

TWO-HOUR CONFERENCE CALL PARTICIPANTS

June 18, 2007

PIs working on air pollution, asthma, and disease prevention

Dr. Perera
Columbia University

Dr. Breyse
Johns Hopkins University

Dr. Gilliland & Andrea Hricko
University of Southern California

PIs working on autism, ADHD, and other neurobehavioral outcomes

Drs. Irva Hertz-Picciotto & Robin Hansen on behalf of **Dr. Pessah**
University of California at Davis

Dr. Lambert
University of Medicine and Dentistry of New Jersey

Dr. Schantz
University of Illinois, Urbana-Champaign

PIs working on growth and development and intervention research

Dr. Faustman
University of Washington

Drs. Maida Galvez and Barbara Brenner on behalf of **Dr. Wolff**
Mount Sinai School of Medicine

Dr. Eskenazi
University of California at Berkeley

Drs. Joe Brain and Robert Wright
Harvard University

APPENDIX E

GLOSSARY

ADHD: Attention Deficit Hyperactivity Disorder

Agency: Refers to the United States Environmental Protection Agency

BOSC: Board of Scientific Counselors, a federal advisory board for the Office of Research and Development

CBO: Community Based Organizations

CHPAC: Children's Health Protection Advisory Committee, a federal advisory board for the US Environmental Protection Agency

Children's Centers or Centers: Refers to the Centers for Children's Environmental Health and Disease Prevention Research

CHAMACOS: The Center for the Health Assessment of Mothers and Children of Salinas, a project of the University of California at Berkeley Center for Children's Environmental Health Research

Chlorpyrifos: A toxic substance commonly found in household pesticides.

Clinica de Salud del Valle Salinas: Health Clinic of the Salinas Valley, associated with the CHAMACOS program

CME: Continuing Medical Education

Community Advisory Committees: synonymous with *Community Advisory Board*.

CBPR: Community-Based Participatory Research

COTC: Community Outreach and Translation Core. Since 2003 a required component of the Children's Centers, which aims to develop, implement and evaluate strategies to translate and apply scientific findings into information for the public, policy makers, and clinical professionals to use to protect the health of children.

Columbia: Columbia Center for Children's Environmental Health. Site of the Healthy Homes Healthy Children (HHHC) program.

EPA: United States Environmental Protection Agency. Also referred to as EPA, *Agency* and *USEPA*

Healthy Home Healthy Children: A community-based program of the Columbia Center for Children's Environmental Health (see above)

Hmong: An ethnic Asian group emigrating from rural regions of Laos. Many immigrated to the United States in the mid 1970s.

Methyl mercury: A bioaccumulative environmental pollutant originating from sources such as burning fossil fuels.

Mt. Sinai: Mount Sinai Center for Children's Environmental Health and Disease Prevention Research

NGO: Non-Governmental Organizations

NICU: Neonatal Intensive Care Unit

NIEHS: National Institute of Environmental Health Sciences

OB/GYN: Obstetrician/ Gynecologist

OCHPEE: Office of Children's Health Protection and Environmental Education

OP: See *Organophosphate*.

ORD: Office of Research and Development, an intra- and extramural research arm of the Environmental Protection Agency

Organophosphate: A toxic substance commonly found in insecticides and herbicides.

PAH: Polycyclic aromatic Hydrocarbon. An airborne pollutant.

PCB: Polychlorinated Biphenyl. An organic pollutant.

Pesticide Metabolite: A biomarker serving as evidence of the metabolism of pesticides in the body.

PESHU: Pediatric Environmental Health Specialty Units. Funded by ATSDR and EPA, the PEHSUs form collaborations between pediatric clinics and occupational and environmental clinics to provide education and consultation for health professionals, public health professionals and others about children's environmental health

PI: Principle Investigator

RFA: Request for Applications.

UC Berkeley: University of California at Berkeley Center for Children's Environmental Health Research. Site of the CHAMACOS program.

UCD: University of California – Davis Center for Children's Environmental Health **UMDNJ:** University of Medicine and Dentistry of New Jersey Center for Childhood Neurotoxicity and Assessment

University of Southern California (USC): Children's Environmental Health Center at the University of Southern California

UCSF: University of California San Francisco

USEPA: United States Environmental Protection Agency. See also "EPA".

UW: University of Washington Center for Child Environmental Health Risks Research

Workgroup: external ad hoc committee composed of members from two EPA advisory committees, the Board of Scientific Counselors and the Children's Health Protection Advisory Committee.