

Farmworkers and Pesticides: Community-Based Research

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In this paper we summarize the results of a workshop conducted to disseminate information about community-based research on the environmental health risks of exposure of farmworkers to pesticides. Community-based research is an approach that is advocated for addressing issues of environmental justice such as exposure of farmworkers to pesticides. This workshop brought together scientists, community organization members, and agency representatives to review and discuss the research methods and organizational relationships that have been successful in conducting past community research so these principles can be applied to new situations. The objectives of this workshop were to a) be a forum in which those conducting community-based research with farmworkers could share what they had learned; b) delineate the successes and barriers across different projects to further develop models and methods for conducting community-based research; and c) determine future directions and needs of farmworker community-based research for environmental justice. **Key words:** agricultural health, community participation, environmental health, environmental justice, farmworkers, health disparities, migrant health, minority health, pesticides, translational research. *Environ Health Perspect* 108:787-792 (2000). [Online 13 July 2000]

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Pesticide exposure is a constant risk for farmworkers, as well as anyone else who works on a contemporary farm. Although pesticides are meant to assist humans through crop protection and enhanced production, they can pose a serious health threat to those who work most closely with them (1-4). Today more than 85% of the fruits and vegetables produced in the United States are hand harvested or cultivated by workers who are disenfranchised and often lack access to the knowledge needed to control their exposure to agricultural chemicals (5).

Accurate data about farmworker pesticide exposure on a national or comparative level are sparse (1,6). The commitment of the National Institute of Environmental Health Sciences to fund several individual projects and center programs focusing on farmworkers and pesticides is a response to a growing recognition of the need to better document and address the risks of farmworker pesticide exposure (3,7-9).

Community-based prevention research has been advanced as an effective and appropriate approach to develop, deliver, and evaluate interventions aimed at reducing disparities in health status among communities (10-13). In such an approach, community members and scientists form a partnership to identify and solve local problems. A community-based approach is particularly appropriate for addressing the environmental and occupational health problems of pesticide exposure among seasonal and migrant farmworkers because such groups often have unique values and practices that are best

understood with input from community members. As with other examples of environmental justice research (14,15), members of the farmworker community originally brought the environmental health hazards resulting from pesticide exposure within their communities to the attention of public health, regulatory, and research organizations; and farmworkers have demanded a role in resolving these hazards (16).

With community-based approaches gaining credibility, scientists and community members conducting community-based research need to evaluate the research methods and organizational relationships that have been successful in conducting past community-based research and apply these principles to new situations (17-20). The workshop "Farmworkers and Pesticides: Community-Based Research" at the 1999 American Public Health Association annual meeting brought together scientists, community-based organization members, and agency representatives currently involved in collaborative environmental health research on farmworker pesticide exposure to continue the development of common organizational frameworks and research methods to promote effective community-based prevention research. Most of the presenters are working on community-based research projects funded by the National Institute of Environmental Health Sciences (NIEHS) as part of its translational research program. This 1-day workshop was supported by a grant from the NIEHS.

This workshop had three objectives. The first was to serve as a forum in which those

conducting community-based research projects with farmworker communities aimed at reducing the environmental health risk of pesticide exposure would have the opportunity to share what they had learned with each other and with others seeking to develop similar projects. The second objective was to delineate the successes and barriers across the different projects to further develop models and methods for conducting community-based environmental health research. The final goal was to determine future directions and needs of community-based research for environmental justice, particularly regarding pesticide safety among farmworkers.

In this article we summarize the findings presented and discussed at the workshop. We first present a definition of community-based research and briefly review some of the difficulties in conducting this research. We then describe community participation models used in research on pesticide exposure among farmworkers. We review issues in research design and methods used in community-based projects. Approaches to the evaluation of community-based projects are then discussed. Finally, future directions and needs are presented for community-based research with farmworkers to reduce their exposure to environmental health risks.

Models for Community-Based Research with Farmworkers

Israel and colleagues (10,11) reviewed the growing literature on community-based participatory research, particularly regarding occupational health and safety (21). They define community-based research in public health as a partnership approach to research that equitably involves community members, organizational representatives, and researchers in all aspects of the research process to enhance understanding of a given phenomenon and integrate the knowledge gained with action to improve the health and well-being

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of community members (11). Although several scholars and activists have discussed the value of community-based research, there is a growing recognition that collaboration between scientists and community members poses several distinct challenges. For example, Cornwall and Jewkes (18) discussed several problems of community-based research, including residents being skeptical of the value of the research, being uninterested in it, or feeling that it lacks local relevance. Community members may lack motivation, time, or resources to participate, or they may simply not value participation. Finally, even within small, geographically bounded communities, there are differences in values, sentiments, and needs; and these change over time, so that there are competing definitions of what it means to "represent" a community. Israel et al. (11) examined three categories of challenges associated with conducting community-based research: issues related to developing and maintaining research partnerships, methodological issues, and broader social, political, economic, institutional, and cultural issues. Arcury et al. (17) extended the discussion of community-based research problems to those that result from working with inaccessible or elusive populations such as farmworkers. Farmworker communities are often not locality based because farmworkers are very mobile. There are communication difficulties because farmworkers often do not speak English; in fact, the first language for many farmworkers is an indigenous language other than Spanish. Farmworkers often do not have telephones or mailing addresses. There are transportation difficulties, as many farmworkers do not own cars. Often, farmworkers are not represented by or do not belong to community-based organizations. Therefore, presenting models of successful collaborations with farmworkers is important for continuing and expanding research with farmworker communities.

Arcury et al. (17) described a multidomain, multimethod model for farmworker community-based research (Reducing Farmworkers' Exposures to Agricultural Chemicals; grant R21 ES08739). They argued for a model that recognizes the wide variability in the ability of different community members to be involved in research, community-driven or otherwise. Community members can be engaged in the research process at different levels or domains of involvement. These range from consultation (the least amount of participation), in which community members are kept informed about the research, through planning, in which community members help make decisions about what should be done and how it should be done, to implementation, in which community members are actual members of

the staff conducting the research. The modes for involvement in each domain are potentially unlimited and can be unique to each community-based project. For example, in-depth interviews and community presentations can be used to consult with the community, while members of a community-based organization can collaborate in planning and implementing the research process.

Another model for involving farmworkers in community-based research is to work through an established organization (Reducing Pesticide Exposure in Minority Families; grant R21 ES08707; L. McCauley, Oregon Health Sciences University). This may include community-based farmworker organizations (i.e., whose boards are composed largely of farmworkers) or farmworker advocacy groups that have a history of providing services to migrant farmworker populations. These organizations need not be focused solely on the topic specific to the research project, but the research program should not be contradictory to the functions of the organization. For example, research on child pesticide exposure is different from but compatible with an organization that provides services to families through migrant Head Start programs. This model illustrates how participatory research programs can maximize their effectiveness by building partnerships with groups that hold the community's trust and who already include community participation in the delivery of services. In turn, the researcher-community partnership allows the community-based agency to develop the capacity to obtain reliable and valid data that will be used to advocate for the population and improve the quality of service for an underserved community.

In some communities, there may be no community-based or advocacy organizations that have the trust of the various constituencies involved. Other procedures must then be used to mobilize community members around the issue under study. One model for doing this is based on recruiting representatives from a wide range of constituencies. For research on pesticide issues, these constituencies are likely to include farmworkers, growers, grower groups, representatives from the department of agriculture, labor and industry representatives, the health department, health care workers in private and public clinics, representatives from farmworker unions, and representatives from other groups that have an interest in pesticides. In-depth interviews and focus groups with members of each constituency can produce an understanding of the barriers and bridges that are important for the diverse groups to work together. Such a qualitative analysis can help build an organizational structure that supports widespread community participation.

An application of such a community mobilization process took place in Washington State (Center for Child Environmental Health Risk Research, grant P01 ES09604; B. Thompson, Fred Hutchinson Cancer Research Center, study director for the Community Intervention Study: Reducing Take-Home Pesticide Exposure in Children of Farmworkers in Yakima Valley, Washington). After conducting 28 interviews and holding 3 focus groups, a number of themes common to all constituents emerged. A community planning group suggested that a formal community advisory group be established to address the pesticide issue. The planning group recommended that every constituency be represented on the board, that people holding moderate positions should be selected as opposed to people holding extreme views, that the emphasis of the project be the risks for children, that intervention activities emphasize what farmworkers could do to protect themselves and their children, and that attempts not be made to try to eliminate pesticides from the farming system. Based on these recommendations and the assistance of the planning group, a community advisory board consisting of 18 members was formed. The board represents all of the constituencies and has adopted a nurturing rather than a blaming approach. The experience to date demonstrates the importance of understanding all key groups to identify common concerns that can bring a group together. Through such a process, potentially adversarial groups can work together.

There are several characteristics common to the different models that have been successful in establishing farmworker collaboration in pesticide exposure research. The first characteristic is time. Whether working with an organization that has invested the time in gaining community recognition, taking the time to exchange information with the community through meetings and forums, or devoting the time to interview a broad spectrum of stakeholders, community-based research requires investigators to take time to build relationships when projects are being planned, and it requires the continued investment of time to maintain these relationships throughout the project. A second characteristic is the involvement of multiple community segments and multiple stakeholder groups. This involvement allows the researcher to understand the different perspectives that usually exist within a single community. Each of the models developed a procedure for valuing indigenous or community knowledge. Learning from community members is not simply a means of showing respect for the community, but can show the researcher important variables or characteristics not

previously considered. A common method for learning from the community is the use of qualitative research methods. Standards for the systematic application of qualitative research methods are now widely available for the interested investigator (22,23).

Community-Based Research Methods with Farmworkers

Those who wish to conduct community-based research must think in terms of different designs, as well as adapting methods creatively within more standard designs. Standard epidemiological and survey designs may not be appropriate or successful in community-based research. It is important to be willing to modify research activities and data collection methods to make them culturally appropriate. As we have seen, designs that incorporate qualitative methods may be extremely important to the successful infusion of community participation. The researcher must also be prepared to explain the design and methods being used in a form that community members understand. Although critically important to scientific inquiry, random samples and power calculations for sample size may not be important to community members who want the project to collect data from a farmworker they know was poisoned with pesticides. Community members often want to be studied personally and individually. However, from a scientific viewpoint, this is not the only way, and sometimes it is not the best way, to conduct etiologic research. The challenge is achieving scientific rigor in a context in which community members are comfortable.

Community-based projects have found success with a variety of methods to collect information with farmworkers. The selection of a method depends on the characteristics of local farmworker communities, as well as on the type of information to be collected and the purpose for which the data will be used. Researchers using community-based designs must also be aware of special issues of informed consent and procedures for developing study instruments.

Two designs that researchers have found to be successful in conducting community-based farmworker pesticide research are based in social marketing and popular education. Social marketing is an approach that uses commercial marketing methods to design, implement, and evaluate programs that change behaviors in ways that benefit individuals in a target audience or society as a whole (24). The methods typically used in designing a social marketing strategy—focus group and in-depth interviews—are accessible to both scientists and community members, making a social marketing approach readily integrated in a community-based

project (25). For example, the Florida Together for Agricultural Safety project used social marketing to develop a behavioral change program to reduce pesticide exposure (A Community-Based Environmental Health Intervention, grant R21 ES08766; L.L. Clark, University of Florida). University and community partners collaboratively completed the tasks required to design this social marketing program (e.g., limited surveys, focus groups, and in-depth interviews). The university partners contributed technical expertise (activity design, training, and analytical capability); the community partners contributed cultural expertise (culturally appropriate data collection and context for interpreting results).

Popular education is a dialogical problem-solving process in which all partners ("student" and "teacher") share in a learning process characterized by equality and mutual respect (26). Although popular education is generally a method of community intervention aimed at improving health, this approach has been modified by the Farmworker Health and Safety Institute, Glassboro, New Jersey, as a community-based research design called the "Diagnóstico" or Diagnostic Evaluation (27). Collecting information through structured and in-depth interviews, as well as observation, the Diagnóstico allows the researchers, who are current or former farmworkers, to record employer compliance of the Worker Protection Standard, thereby documenting farmworkers' risk for pesticide exposure. The unit of analysis, however, is the site or farm rather than the individual farmworker. Therefore, multiple visits are made to each site. In building relationships over several visits, the researcher is able to look for changes or inconsistencies in the data collected from a site. In this way, the researcher can confront respondents when interview and other data are in conflict, and thus collect more accurate data.

Engaging community members in the research process is an important concern because community members often want to be involved in all aspects of a project. They do not want to be limited to project planning and oversight; they demand the shared ownership that includes being active partners in data collection, data analysis, and reporting research results (including coauthorship of papers). Involving community members must be accomplished in a manner that reflects their interest and investment in participation and ownership, while meeting the professional requirements of sound research technique and limited bias. For example, to conduct formative research using an in-depth interview design in a community-based project in North Carolina, community members collaborated in writing and pretesting the interview guide, recruiting respondents, conducting

interviews, and completing data analysis (Reducing Farmworkers' Exposures to Agricultural Chemicals, grant R21 ES08739; T.A. Arcury, Wake Forest University School of Medicine) (28). Community members received training in each aspect of the process at the time that aspect was being completed (e.g., interview training occurred before the interviews were conducted; training to code data was completed just before coding began). This method successfully incorporates farmworkers as researchers and respondents.

Although qualitative and case-study designs can be used to understand farmworker pesticide exposure, there are few epidemiologic studies of pesticide health effects in farmworkers. This results partly from the perception that the farmworker population is inaccessible for research. Collaboration with a farmworker community-based organization can help to overcome this inaccessibility. For example, researchers from the NIEHS collaborated with the Farmworkers Association of Florida (FWAF) to establish a sampling frame and recruit participants for an epidemiologic study of neurologic effects of pesticide exposure. With the collaboration of the FWAF, the researchers were able to access the membership roles of a farmworker community credit union as a sampling frame. FWAF members also helped to locate and recruit participants with a high response rate; in two locations, 90% and 94% of contacted workers were screened, and 79% and 85%, respectively, of screened workers participated.

An important but seldom discussed question in community-based research is the protection of human subjects. This becomes an important issue because community involvement is a process that can result in community-initiated research design that changes up to the moment data collection commences, but institutional review boards (IRB) require time to review defined research protocols. It becomes necessary for the researcher collaborating in a community-based project to instruct community members about the rights of individuals as study participants and to inform the IRB about the need for flexibility in the review of research protocols. This is also a juncture at which the researcher can educate the institution about the benefits of community-based projects (e.g., fulfillment of university mission of community service; involvement of minority groups in research; mentoring minority youth).

The key commonalities across the research designs and methods discussed at the workshop are flexibility and creativity. It is unlikely that textbook research applications will work well in community-based projects. Rather, researchers and community members must be flexible in conducting research so that the needs of the community

are met and the basic tenets of scientific integrity are maintained.

Most community-based projects focused on farmworker pesticide exposure have used qualitative methods. It is important that the systematic application of qualitative methods be maintained for their empirical validity (28). One of the strengths of qualitative research designs is that these methods are more amenable to modification in the course of the research process than are standard epidemiological or toxicological methods. However, innovation can improve the application of quantitative methods as well. In the epidemiological study of neurologic outcomes among Florida farmworkers, community-based organization resources (credit union membership lists and community members locating selected respondents) were engaged to accrue the sample. This facilitated the high response rate this study enjoyed.

The need to collect survey interview and epidemiological data in community-based research for quantification of farmworker pesticide exposure and ascertainment of the relationships of pesticide exposure to health are also important. These data are important for developing generalizable and measurable outcomes needed in health and environmental regulation and policy. There are many difficult problems that must be overcome in order to collect these quantitative data: sample design, trust and recruitment, and culturally appropriate and valid questions. These issues, as they pertain to regulation, should be the focus of future workshops. Community-based research on topics other than farmworker pesticide exposure can also be a source of successful models of community participation (29,30).

Another area important for addressing farmworker pesticide exposure that could challenge community-based research is the collection of biological data. How can community members be involved in collecting blood, urine, saliva, or other specimens? As discussed below, one of the major needs in research on the health effects of human exposure to pesticides is for simple, reliable, and affordable biomarker methods.

Evaluating the Effectiveness of Farmworker Community-Based Research

There are important ideological or political as well as scientific reasons for using a community-based approach for conducting research that addresses environmental justice issues such as farmworker pesticide exposure. However, we also need to evaluate community-based research to judge *a)* the degree to which community participation actually occurred, *b)* whether projects accomplished their objectives, and *c)* the degree to which

the science that was conducted with community participation achieved professional and disciplinary standards. The last point is extremely important because it demonstrates the acceptability of project results for public health policy, remediation, and the foundation for further research. A frequent drawback of community participation research is that the results are difficult to apply beyond the local level and are not easily integrated into "mainstream" scientific inquiry (31). This workshop demonstrated the need for community-based researchers in farmworker health to share research findings and to generate knowledge that is useful beyond the local confines of individual projects. Community-based research projects must ultimately result in scientifically valid and meaningful results in order for their conclusions to be accepted and acted upon by the larger public health, regulatory, and scientific communities.

Standard process and product evaluation criteria can be applied to community-based research. Each of the NIEHS-funded projects discussed at this workshop have a planned method of evaluation. Although health outcomes of specific community interventions need to be documented, community-based researchers can also add significantly to the field by documenting the structural and process indicators that impede or facilitate the implementation of community-based research. The process of community involvement needs to be documented, in part to substantiate the wide variety and usefulness of models currently used. All stakeholders need to be involved in the process. Particularly enlightening are the convergent or divergent views on the success of the project from both researchers and community members. In addition to traditional evaluation criteria, three other considerations must be addressed to evaluate the effectiveness of community-based research: community changes for the benefit of members and their health, meaningfully integrating the research process and findings into the community, and the sustainability or increased capacity of the community to engage in research or change after the research project is completed.

Beyond standard process and product evaluation, additional criteria can be applied for evaluating translational research. That is, how do both scientists and community members evaluate the conduct and outcome of such research from a personal or professional point of view? Given the time and effort needed to overcome barriers such as cultural differences and competing demands, what needs of each party must be met to make such a partnership worthwhile? For the conduct of research, community partners need for research issues to be community-generated and significant to the community.

They expect the community's knowledge and expertise to be respected and valued. In short, research should be conducted with the community, not on it. Scientists need research to be conducted using systematic procedures for sampling, measurement, and analysis; they, too, expect respect for their knowledge and expertise. For outcomes, communities are interested in legitimization of community concerns and capacity building in the community. Scientists need to arrive at results that can be defended to scientific peers. Both seek solving problems and establishment of an ongoing partnership. By attending to how communities' and scientists' needs in the research process are similar and different, it is possible to arrive at a partnership that is satisfying and mutually beneficial.

There are several indirect indicators for evaluating the different components of community-based research. Projects that are successful result in long-term changes in a community. For example, the Rural Health Research Program at the University of Mississippi has a continuous 28-year-relationship with communities in the Mississippi Delta. A further indicator of successful academic-community collaboration is the willingness of community organizations and community members to come to researchers with new problems and new project ideas. Community members' support for the researchers when they are exposed to political and legal pressure (an all too familiar occurrence when the research addresses issues of environmental and occupational justice) is a further indicator of successful community-based research. For example, in a recent case in North Carolina, community members were the first to call state legislators and other officials when their university researcher partner faced legal action from an industry group over his reporting results that could have a negative effect on industry regulations. A final indicator of a successful community-based research project occurs when community members are inspired to become politically active, to pursue a research career, or when they are able to use the results to further their public policy work in advocating for their community's rights.

Another indirect but widely accepted indicator for measuring the degree to which the science conducted in community-based research achieves professional and disciplinary standards is publication in refereed journals. Some of the projects using community-based approaches to investigate and intervene with farmworker exposure to pesticides are too new to have produced results that can be submitted for peer review. It can also be expected that true partnership of community members and researchers could prolong the time that it normally would take to achieve published results due to the multiple participants in the

writing of a manuscript. However, this process has begun, and several papers from these projects are published or are in press (28,32-37).

Conclusions and Future Directions

The objectives of this workshop included analyzing common features of successful community-based research to reduce farmworker pesticide exposure and determining the needs and directions for future community-based farmworker research. Commonalities for successful collaborations between farmworker community members and scientists involve models of organizational relationships, research design and methods, and tools for evaluating the products of these collaborations. In each of these areas, specific procedures were not selected as better than others; rather, general characteristics of successful approaches were delineated. There is no single successful organizational relationship between farmworker communities and research organizations. However, all successful relationships have common characteristics: the partners invest time, input is sought from all community stakeholders, and community and scientific knowledge is valued and shared. In this regard, the ideology or willingness that allows the voice of both parties to be heard may be the most important organizational requirement to develop and maintain a community-based research program that incorporates scientifically sound methods.

Most of the projects discussed in this workshop used qualitative research methods. The use of these methods should not be seen as a requirement of community-based research. Rather, qualitative methods have three characteristics that make them extremely valuable in community-based research designs: the application of qualitative methods is flexible, they are excellent techniques for learning from the community, and their format of dialogue and conversation provides a familiar setting that encourages community participation. We advise those who wish to use qualitative methods that they must have the expertise for their appropriate application.

Qualitative research is not doing a single focus group. It is taking a systematic approach to the collection, analysis, and reporting of data that strives to understand the meanings that the members of a community have for phenomena. Like quantitative research, qualitative research is concerned with issues of sampling, data quality, and rigorous data analysis (22,23,38,39).

Other research methods have also been applied in community-based research. Like researchers who employ qualitative designs, those using quantitative methods must strive for the utmost representativeness of their

samples and use culturally appropriate tools with demonstrated reliability and validity. The most important characteristics for developing research designs and incorporating methods into community-based research are flexibility and creativity.

Workshop participants identified two major areas that need development for future community-based research on farmworker pesticide exposure. The first of these is conducting rigorous epidemiological and survey research that produces generalizable results. We cannot depend on case-study analyses to remediate the risks of pesticide exposure in this population and to influence environmental and occupational regulations. A few studies have used survey and epidemiological design, but more of this work is needed. Some of the obstacles in applying these survey designs include the difficulty in locating representative samples, problems of recruiting farmworkers who fear employer reprisal or investigation by the Immigration and Naturalization Service, and the lack of linguistically and culturally appropriate instruments for this diverse population. The second major need is for procedures to measure biological exposure to pesticides among farmworkers. The difficulties in doing this are discussed elsewhere (7). Both exposure assessment and methods of biological monitoring require that environmental scientists be active participants in these projects. Most of those participating in this workshop were health educators, epidemiologists, and community activists. They fully appreciate the difficulty in assessing pesticide exposure through questionnaire methods. Biomarker procedures that are simple, valid, and inexpensive will improve diagnosis of farmworker pesticide exposure and the ability to evaluate exposure reduction interventions.

Evaluation of community-based projects must consider criteria in addition to those normally applied. These criteria must reflect what benefits are left in the community as well as increasing scientific understanding. Community criteria include increased capacity and skills of community members and the continued relationship between community and research institution. Evaluation criteria among researchers include acceptance of study results by peers and the publication of findings.

Finally, the projects discussed in this workshop are each addressing behavioral change among farmworkers to reduce their pesticide exposure. Although individual behavior change is important, it must be accompanied by change in the work environment, as well as in pesticides, to reduce exposure risks among farmworkers.

There is tremendous potential to be derived from collaborative research with

farmworker communities. A major requirement for continued efforts for community-based health research is the availability of funding and the requirement by funding agencies that community-based efforts be used. There are strong indications that both of these requirements will be met. Under the direction of Kenneth Olden, the NIEHS has sponsored several translational research initiatives that require or strongly encourage community participation. These include "Environmental Justice: Partnerships for Communication," "Community-Based Prevention/Intervention Research," "Health Disparities: Linking Biological and Behavioral Mechanisms with Social and Physical Environments," "Centers for Children's Environmental Health and Disease Prevention Research," and "Environmental Health Science as an Integrative Context for Learning." The most recent Superfund Basic Research Program competition also included an option for community-based projects. Other institutes in NIH have started their own community-based research initiatives (e.g., National Cancer Institute), as have other agencies within the Public Health Service (e.g., Agency for Health Care Policy and Research, Centers for Disease Control and Prevention), and other federal agencies (e.g., Environmental Protection Agency).

In summary, a strong foundation has been laid for farmworker community-based research to reduce the risks of pesticide exposure. Aspects of this work have been found practicable in several situations. Those collaborating with farmworker communities must consider the features of community-based research common to other populations. Other significant areas need to be developed for the continued growth of these efforts. Communities and scientists are fortunate to be working at a time when there are several agencies in the federal government, as well as in the private sector, that understand the importance of community-based approaches to redressing environmental and other health disparities and who are willing to support these efforts financially as well as philosophically.

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