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Rescuing RCR Education

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Abstract

Responsible conduct of research (RCR) education requirements, resources, and research have proliferated over the past 20 years, but evidence and experience highlight shortcomings in many domains: goals, audience, content, teaching tools, use of the Internet for instruction, instructors, allocation of responsibility for education, education requirements, and sources of funding. Revised approaches and suggested roles and responsibilities are proposed to meet these challenges. The unifying theme for these recommendations is to shift the focus from RCR education to RCR culture building.

INTRODUCTION

The state of RCR education in the United States offers mixed news. The past 20 years have resulted in an impressive proliferation of resources and research (summarized in Kalichman, submitted). However RCR education is characterized by numerous signs of dysfunction. A high percentage of principal investigators appear to not know who, if anyone, provides the RCR instruction they committed to as part of their funded National Institutes of Health (NIH) training applications (Kalichman and Plemmons, 2007). The goals reported by RCR instructors are diverse, and not always compatible with clear understanding of pedagogy and learning objectives (Kalichman and Plemmons, 2007). Measures of putative effectiveness of RCR education have shown modest (Powell et al., 2007; Antes et al., 2010), no (Kalichman and Friedman, 1992; Drake et al., 2005), or even counterproductive outcomes (Eastwood et al., 1996; Heitman et al., 2001; Anderson et al., 2007). In practice, research institutions tend to participate in a “race to the bottom,” seeking the least costly, rather than most useful, approach to meet federal requirements; despite NIH guidelines explicitly arguing against reliance solely on online tutorials for RCR education, a high percentage of institutions continue to choose this option to meet the newer National Science Foundation (NSF) RCR requirement; anecdotally, many students who have taken previous RCR courses across the country report experiences that were not memorable, and sometimes counterproductive; and in the absence of departments or programs in research ethics, RCR teachers tend to be recruited ad hoc from diverse places and departments, often serving only as volunteer labor or in soft money faculty positions (Kalichman, unpublished observations). Despite increasing requirements and expectations for RCR education, the enterprise remains largely an unfunded mandate. The above concerns, and others, are a basis for arguing that RCR education is in need of rescue.

Given what has been learned over the past two decades, it is fair to ask how efforts might be best focused in the coming years. This commentary is intended as a personal perspective on what is needed for an RCR education enterprise that has fallen short of its promise. Ten recommendations are offered below as remedies to the perceived deficits. Each recommendation specifies not only what should be done, but who should take responsibility for carrying out the recommended action. While some of these recommendations overlap, all are considered to be independent (i.e., no recommendation need take precedence over another).

GOALS

Recommendation 1: RCR instructors, institutions, and regulating agencies should clearly articulate that the primary goal of RCR education is to foster a research culture in which conversations about responsible conduct of research are expected and acceptable

At least implicitly, the goals most commonly pursued through RCR education are to comply with federal requirements, to decrease research misconduct, or to increase ethical decision making skills. In principle, each of these is reasonable, but in practice they are all poor choices as the primary purpose of RCR education. Instead, it is recommended that the focus should be to promote conversations among researchers about the ethical dimensions of research conduct, increase awareness of resources for information as needed, and foster positive attitudes about promoting RCR.

Rationale for Recommendation

The presumption that responsible conduct of research (RCR) should be taught implies that there is some goal or goals that it is hoped will be achieved. Are there in fact common goals that might motivate institutions, mentors, and trainees? Why do we teach RCR? A reasonable starting place to identify goals might be the NIH (2009) and NSF (2009) requirements for RCR education, both of which appear to be based on the assumptions that RCR is important and education can facilitate RCR. However actual learning objectives or goals are not explicitly listed. Implicitly, the goal is simply to meet the NIH and NSF requirements. Clearly, if this were the only goal to be met by RCR education, it would be minimal at best and cynical at worst.

Two other goals frequently assumed or articulated for RCR education are more credible: decreased research misconduct and improved ethical decision-making skills. Both are desirable, but neither is suitable as a primary goal for RCR education (Kalichman, 2011): (1) telling adults that they need to be taught to not lie, cheat, or steal or how to make ethical decisions is a hard case to make; (2) no evidence exists that RCR education decreases research misconduct and the impact of RCR education on ethical decision making is modest (Antes et al., 2010); and (3) it seems unlikely that a limited educational experience will repair an adult's character or correct their willingness to lie, cheat, or steal.

If decreased research misconduct and improved ethical decision making are not appropriate as primary goals for RCR education, and guidance is not provided by NIH and NSF, then it

is fair to ask what goals *are* pursued by RCR instructors. Not surprisingly, the stated goals of RCR instructors vary widely (Kalichman and Plemmons, 2007). It is unmistakable that the variety of goals, particularly for knowledge and skills, are wide-ranging, and all are largely creditworthy. However it is equally evident that not all can be covered, and that outcomes to date for specific courses or programs have been disappointing (Kalichman, submitted). Further, if researchers already have and/or are learning some RCR knowledge and skills (Heitman et al., 2007; Powell et al., 2007), then is the most important thing to do to provide them with more? Or, is it more important to arm them with a positive disposition toward RCR, with a sense that there are things they can do in the face of concerns, and with a belief that they are part of a culture that takes RCR seriously (Kalichman, 2007)? These attitudes are arguably more essential than any particular piece of knowledge or improvement in skills. In their absence, it would matter little if someone had perfect knowledge and skills. However in the presence of positive attitudes with respect to RCR, someone who might be lacking in knowledge or skills will be empowered to seek help, to find answers, to fill in the gaps.

Three components of proposed primary goals (conversations, knowledge, and attitudes) are summarized below.

Conversations—A primary goal should be to not only give trainees opportunities to talk with one another about research ethics, but to empower them to continue those conversations with peers, mentors, and their future trainees. Such conversations are rare (Swazey and Anderson, 1998; Brown and Kalichman, 1998). This is problematic given the argument that the “hidden curriculum” is a major factor in what trainees learn (Snyder, 1971; Whitbeck, 2001; Fryer-Edwards, 2002; Peiffer et al., 2008). It would be surprising if any quality of short-term course were sufficient to overcome the continuous influence on researchers of the environment in which they are socialized. If that environment does not foster conversations about research ethics, then the message is that it isn’t important. The success of efforts to promote those conversations can readily be measured by changes in self-reports of time spent discussing the ethical dimensions of the practice of science.

Knowledge—While few if any specific pieces of information can be defined as necessary for a successful RCR curriculum, there are some generic issues that should be known by everyone. In brief, trainees should be exposed to the reasons for and *existence* of rules, issues, options, and resources relevant to the responsible practice of their particular domain of research. Success could be measured by the ability to “identify places, people, and/or other resources to help in addressing ethical challenges to conduct of science” (Kalichman, accepted).

Attitudes—Knowledge or skills are insufficient if the individual doesn’t have the attitude that ethical decision making is an important part of the practice of science, and that part of their responsibility is lifelong learning about responsible conduct of research. Success in meeting this goal could be assessed through changes in self-reports of disposition toward research ethics (Kalichman, accepted).

AUDIENCE

Recommendation 2: RCR instructors, institutions, and regulating agencies should clearly identify the entire research community as the audience for RCR education

A common perception appears to be that it is sufficient to restrict RCR training to only those for whom it is specifically required. Instead, it is recommended that the focus should not be on individuals, but the research community.

Rationale for Recommendation

Restricting RCR education to a subset of researchers solely because of funding requirements unfortunately sends a clear message: RCR education is important only to the extent that it's required, not because it has intrinsic value. However, even if RCR education were not extended beyond those individuals mandated by federal requirements, a case can still be made that too much of current conversations about RCR education is misdirected. The focus appears to be on the risk that an individual researcher will commit research misconduct, on the possibility that the researcher lacks sufficient ethical decision-making skills, or that there are specific facts that he or she doesn't know. While all of these might be true, it is well understood in the transportation industry, for example, that when things go wrong it is a mistake to look for the one responsible individual (Strauch, 2004; Dekker, 2006). Instead, we are cautioned to look more broadly and ask what it is about the system, about the culture, that allowed problems to occur.

The point is not to relieve individuals of personal responsibility, but instead to create an environment in which it is hard to do the wrong thing and easy to do the right thing. This is precisely the point of RCR education, which is ideally designed to promote conversations and awareness about good practice of science: e.g., design experiments so as to minimize the risk of bias, keep good records, give credit where credit is due, and encourage collaborators to ask questions, discuss concerns, and share information. In short, the key is to promote the asking of questions and the conversations that will increase communication about responsible practice of science. Such conversations should involve the community, not select individuals.

CONTENT

Recommendation 3: RCR instructors, institutions, and regulating agencies should promote curricula that cover RCR topics, but without restricting which topics those should be

Content of RCR courses varies, but a common approach is to cover the nine specific topic areas now called for under NIH guidelines or to focus primarily on the rules and regulations. However, not all of the nine topics can be covered comprehensively, strict adherence to this list can be more than needed for some trainees and too limited for others, and RCR education is ideally about why and how rather than simply being told what the rules are. Instead, it is proposed that RCR educators should be encouraged to view lists of topics as menus, not recipes.

Rationale for Recommendation

One way to define RCR goals, consistent with earlier Public Health Service (PHS) requirements (PHS, 2000), and particularly with the most recent version of NIH Guidelines (2009), is by what topics should be covered. In practice, content actually covered in RCR courses varies widely (Mastroianni and Kahn, 1999; Kalichman and Plemmons, 2007; DuBois et al., 2010). Importantly, graduate students, and more likely postdocs, tend to already know more than half of the facts tested for before taking an RCR course (Heitman et al., 2007; Powell et al., 2007). While it is reasonable to expect that teaching any one “missing” piece of knowledge is an achievable goal, the number of possible RCR “facts” is vast, which is probably one reason improvements in knowledge tend to be modest (Funk et al., 2007; Powell et al., 2007; Schmalig and Blume, 2009). Further, even if the possible topics were restricted to the nine listed under current NIH guidelines (2009), it isn’t clear which of innumerable “facts” or issues should be addressed for any one of the topics; nor do all researchers need the same level of information on all topics (e.g., a researcher who does not work with animals does not need to know as much about animal regulations as someone who does).

Another common perspective is that the primary purpose of RCR education should be to teach the rules (e.g., federal regulations, institutional policies, professional codes of conduct) that must be followed. Unfortunately, this approach too is flawed. Most of what might be covered in RCR education is not reducible to a handful of rules or easy answers. Only a few possible topics (i.e., animal and human subjects, conflicts of interest, some aspects of data management) are readily put into such a simple box. And arguably these important rules and regulations are, and should be, taught by the offices responsible for oversight of those areas. Alternatively, RCR education should address *why* we have regulations rather than teaching the regulations themselves. It should be complementary, not duplicative to, what is covered by institutional offices responsible for complying with federal, state and institutional regulations and policies.

While it is self-evident that there are things that a responsible researcher should know, and would want to know, it isn’t clear that a single curriculum can be defined that is suitable for most or all researchers. There are important things to be learned, but those will and should vary among institutions, research disciplines, and individuals. We should worry less about being comprehensive and instead aim to cover *any* selection of the many possible illustrative issues that might fall under the heading of RCR.

TEACHING TOOLS

Recommendation 4: Teachers of RCR should make use of a variety of tools, not just case studies, for the purpose of emphasizing discussion, engagement, and critical thinking

A frequent refrain in discussion about how to teach RCR is to use case studies. However the point is not to use case studies (a pedagogical tool), it is to implement approaches that promote active learning, engagement, and discussion. Instead of advocating for case

studies, the focus should be on using any of a wide variety of tools, including case studies, to foster that discussion and reflection.

Rationale for Recommendation

One of the most frequent recommendations for teaching research ethics is that it is best to use case studies (Macrina and Munro, 1995; Stern and Elliott, 1997; Pimple, 2007). There is good reason for this argument. Evidence on pedagogy and adult learning emphasizes the value of learning by doing (Hill, 2000; Bransford et al., 2000, p. 12). Active learning, such as is possible when engaged in discussion about a case, is seen as a way to not only learn about RCR but to model and practice addressing of challenging issues. However, while cases studies are a valuable tool for teaching research ethics, it appears that the goal (engagement and discussion) has been confused with the method (case studies). There are many ways to stimulate discussion on important RCR issues, and most of them aren't case studies *per se*. Conversely, there are many ways case studies could be used simply as cautionary tales rather than as opportunities for active learning.

There are many other approaches that would help to enliven a curriculum, and clearly not all are case studies. At this point, a lack of curricular resources and pedagogical tools is no longer an issue (Steneck, 2013; Kalichman, submitted). The existing resources may need better curation to make them more widely accessible, but several existing websites already do that well enough (e.g., Resources for Research Ethics Education, <http://research-ethics.net>, and EthicsCORE, <http://nationaleticscenter.org>). Some of these many tools might still be considered "cases" with only a slight stretching of the definition of case: e.g., video vignettes, movies, biographies of scientists, historical fiction, role play scenarios, etc. (Plemmons and Kalichman, 2008). However many others are clearly not cases. For example: a lecture structured entirely around the asking of students questions to encourage them to generate the content; assigning two or more groups to take different perspectives in a debate; requiring students to generate questions that will be asked of a faculty panel about responsible conduct of research; challenging the class to develop data management or authorship guidelines for a group, department, or institution; or having students complete and analyze the results of a survey about research ethics issues. All of these options are known and previously used, but are too often overlooked in blind adherence to the goal of using case studies. The focus on teaching tools should be student engagement, not on a particular tool.

INSTRUCTION FORMAT

Recommendation 5: RCR instructors, institutions, and regulating agencies should promote the use of training formats that are defined by discussion, engagement, and critical thinking

Online tutorials are all too frequently seen as sufficient for RCR education, despite the fact that RCR educators would typically argue that such tutorials should only be supplemental, not the primary form of instruction. By definition, online tutorials lack the means to engage trainees in articulating and hearing different views and understandings of RCR. In short, they lack the opportunity for active engagement. Instead, it is proposed

that RCR education, whether in person or online, should be defined by formats that require interaction of two or more individuals around issues that highlight the nuance and ambiguities of ethical challenges raised in the conduct of science.

Rationale for Recommendation

A persistent hope is that RCR, or research ethics, can be sufficiently taught by solely using an online tool. From the perspective of students, mentors, and institutions, this is a quick, easily documented approach to getting everyone “trained” (Sieber and Bird, 2005). Once created, the cost is negligible compared to an in-person course or workshop. And to the extent that RCR is only about a handful of specific rules and regulations, this makes good sense. However, that’s clearly not the case.

RCR education is an opportunity to identify and face the diversity of answers found within the research community for key questions such as how to keep good records, how credit should be allocated, and fulfilling responsibilities as a scientist to the community in which we live. These items don’t lend themselves to black and white answers nor multiple choice questions such as are necessary for online tutorials (e.g., Braunschweiger and Goodman, 2007), which don’t involve student engagement with others. Instead, the complexity of RCR issues is more appropriately addressed with pedagogical tools defined by active learning, engagement, and discussion. This requires conversations, ideally in person, but also via electronic tools (appropriate web-based courses, e-mail, discussion boards, blogs, etc.). Online tutorials (in the absence of those conversations) can be an adjunct, or even a first step, but they should certainly not be the primary approach to RCR education.

INSTRUCTORS

Recommendation 6: Institutions and regulating agencies should promote programs and approaches to ensure that RCR instructors are motivated and prepared to provide quality RCR instruction

The current approach to RCR education merely calls for providing instruction, without consideration for the quality of the instruction or the motivation of the teacher. While it is certainly the case that many instructors are highly capable and motivated, the risk is high that programs will be defined by the view that it is sufficient to simply “teach RCR.” Instead, it is proposed that RCR instructors have at least nominal training in train-the-trainer programs, or that other means be developed to verify the quality of the instructional program.

Rationale for Recommendation

Several studies have assessed RCR education nationally (e.g., Anderson et al., 2007; Antes et al., 2010), but one factor largely untested is the possible differential quality of instruction. Are RCR courses generally of high quality? Two studies of student self-reports about the benefits of participation in an RCR course highlight promising evidence for quality of programs. In the first study, students from 11 different courses at 10 different institutions nationally were asked for their perspectives on the courses they had just completed

(Plemmons et al., 2006). These results rank as one of the clearest most robust outcomes for RCR courses to date, with well over half of the students agreeing with statements that the course had increased their “discussions about research ethics outside of the classroom” (58%), time spent “thinking about research ethics outside of the classroom” (56%), and depth of “thinking about research ethics outside of the classroom” (71%). In a subsequent study of students who had completed an RCR course at the Mayo Clinic, McGee et al. (2008) similarly found substantial evidence that student perspectives and perceptions of their behavior had changed for the better.

These two studies support the potential for an RCR course to have a substantial impact on attitudes and perceptions. However, the self selection bias involved in both studies can't be discounted. In the first study (Plemmons et al., 2006), course instructors were recruited to participate through an e-mail list for the Responsible Conduct of Research Education Consortium and an Office of Research Integrity listserv. It is likely that the instructors most likely to be subscribed to such lists were those most dedicated to promoting RCR education. And those who volunteered to include their courses would have been even further selected to be those confident enough of their teaching to include their students in such a study. One measure of this self selection is the duration of contact hours for these courses. Excluding the one online course, contact hours averaged nearly 19 hours, with 2 at over 30 hours, and none with fewer than 10 hours. The course at the Mayo Clinic (McGee et al., 2008) was nominally over 18 hours. These course durations are to be contrasted with the new NIH guidelines calling for a minimum of 8 hours.

While these two studies demonstrate that RCR courses *can* have substantial impact on students, the question is whether that is typical of RCR courses. In the absence of other data, the character of typical courses can at least be hinted at through anecdotal experience (Kalichman, unpublished observations). Students in UC San Diego courses are now routinely asked in the first class meeting about their prior experiences with RCR courses. A decade ago, almost no one had previously taken such a course. However in the last few years, in part because of the expanded NIH RCR guidelines (NIH, 2009), many trainees report having taken an RCR course or the equivalent at other institutions. Their reports are not encouraging. While a few describe positive impressions, most view their course experiences at best as “check off the box.”

It should not be surprising if the quality of RCR education varies widely. Some institutions and some instructors take the responsibility very seriously, and others less so. It is not enough to simply expect that RCR should be taught, it is crucial to ensure that the instructors are supported so as to be prepared and motivated to foster discussion, engagement, and critical thinking. This support could take many different forms including, but not limited to: giving weight to RCR education roles in promotion decisions, providing financial support for salary and other programmatic costs, and conducting train-the-trainer programs to empower faculty to teach research ethics in the classroom, in the lab, or in a department.

RESPONSIBILITY

Recommendation 7: Instructors, research faculty, trainees, other researchers, and institutional administrators should all adopt roles and responsibilities in promoting RCR education

The current system of RCR instruction seems to largely cede all responsibility to those who volunteer or are asked to teach RCR. Doing so inappropriately separates RCR from the rest of the research enterprise. Instead, the institutional descriptions and implementations for RCR education programs should underline that promoting and advocating for RCR is a responsibility of everyone.

Rationale for Recommendation

The current allocation of responsibility for RCR education solely to RCR instructors misses the important roles of research mentors and the institutional environment. Attempts to promote conversations, knowledge, and attitudes of trainees through formal RCR education are inextricably dependent on what happens in the trainees' research environment (Anderson, 2000; Anderson et al., 2007; Mumford et al., 2007). At the very least, it is hoped that the institutional culture would be one in which mentors do not denigrate lessons learned through RCR education. However an even more positive approach would come from empowering mentors to proactively encourage RCR discussion.

Providing mentors with the tools and resources to introduce research ethics discussion into the context of the research environment has been the goal of some train-the-trainer programs (Kalichman and Plemmons, 2013). This is something which institutions could support at least for those faculty who are interested. Ideally, this would be a part of a larger institutional approach in which all members of the research community routinely have opportunities to address research ethics issues through not just courses, but also seminar series, workshops, individual seminars or lectures, and online materials. Importantly, such diversity would recognize that different individuals, research disciplines, and departments may appropriately need and want to take advantage of different approaches. While there is value in cross-institutional conversations and approaches, there is also value in avoiding the fallacy of "one size fits all."

In sum, rather than defining RCR education only as a responsibility for RCR instructors, a cultural focus would recognize roles for all participants. Research faculty should be prepared and interested to introduce research ethics issues into the context of their research settings. Trainees and all other members of research groups should be empowered to ask questions and seek counsel. Institutional administrators should not only speak publicly and positively about the importance of RCR education but back that up with institutional actions and funding.

REQUIREMENTS

Recommendation 8: Federal regulatory agencies should revise RCR education requirements to clearly articulate goals and expectations

Existing regulations provide either a prescriptive list of what an RCR education program should look like (NIH, 2009) or no guidance other than to provide an RCR education program (NSF, 2009). The result, not surprisingly, is a lack of grounding of programs in clear goals. Instead, it is proposed that regulations be changed to focus on what goals institutions are aiming to achieve, but allowing institutions, programs, and individuals to implement diverse approaches to meet those goals.

Rationale for Recommendation

There is a tension between federal regulators and the academic research community that was recognized as early as 2001 in an RCR Summit (Kalichman, 2006), and which has never been fully resolved. On the one hand, prior to the NIH requirements in the late 1980s, almost no institutions provided formal courses in research ethics. When requirements were imposed, institutions generally kept the focus only on those who were funded by NIH training awards rather than adopting the spirit of the NIH recommendation to "...incorporate instruction in the responsible conduct of research for all graduate students and postdoctorates in a training program or department, regardless of the source of support" (NIH, 1992). When requirements were temporarily broadened to require such education for all researchers (PHS, 2000), institutions around the country ramped up efforts, and those efforts were scaled down again once those requirements were withdrawn (NIH, 2001).

On the other hand, national regulations are invariably a very blunt tool, requiring a "one size fits all" approach that academic institutions rightly recognize as potentially counterproductive. Perhaps it is time for the NIH and NSF to re-visit existing requirements to clearly define intended and measurable outcomes (e.g., Recommendation 1) and to avoid the apparent prescriptive nature of lists of particular topics to be covered. One alternative is to broadly outline examples of programmatic approaches likely to be useful and those that are not (e.g., Recommendation 3). Part of the latter should encourage diverse approaches to RCR education and train-the-trainer efforts rather than a model defined by a single course.

FUNDING

Recommendation 9: Institutions and funding agencies should allocate at least 0.1% of research direct costs for the purpose of RCR education programs

RCR education requirements are widely perceived as needed, but are nonetheless implemented as an unfunded mandate. In the absence of secure funding, programs are ad hoc and of variable quality. Instead, it is proposed that no less than 0.1% of research direct costs be allocated to support RCR education.

Rationale for Recommendation

The challenges noted above will be best met by a critical look at the goals for RCR education and by recruiting and supporting faculty who are interested and capable to promote understanding of research ethics. Unfortunately, there is no obvious structure to support those faculty in the current system. There are virtually no departments of research ethics. And the expectation, not inappropriately, is that this is an institutional responsibility;

therefore, the government provides few or no resources to reward and attract faculty to take the lead on research ethics instruction. In the context of this unfunded mandate, the RCR enterprise is largely based on volunteer labor or limited institutional support at best.

The result is to be expected. Because there is no minimal expectation of support for such programs, nor is there any measure of program effectiveness, all that is necessary is to provide an activity defined as “RCR education.” Institutions are free to find the least expensive options that meet the letter --without any need to consider the spirit or goals-- of the requirements. Assuming RCR education is important, this is not only inadequate, but arguably counterproductive (i.e., underlining a message that says RCR education is not valued). Perhaps it is time to shift the model to one in which the value of RCR education is recognized.

The current lack of dedicated support for RCR education can be contrasted with the plans that originally called for an allocation of 3% of federal genomic research budgets to address the Ethical, Legal, and Social Implications (ELSI) of human genetic research (Office of Technology Assessment, 1993). The level of ELSI funding was subsequently increased by legislative mandate to 5% of the extramural National Human Genome Research Institute (NHGRI) budget (Office of Technology Assessment, 1993).

Instead of 5%, or even 3%, it is worth considering what just 0.1% of support (as proposed previously: Kalichman, 2006) might do for RCR education of NIH-funded graduate students and postdoctoral fellows. Based on NIH guidelines (NIH, 2012), predoctoral fellows are to nominally receive \$42,200 per year for stipend, tuition and fees, and training related fees. Postdoctoral fellows, with 0 years of experience, are similarly slated to receive \$51,350 per year. Assume, conservatively, an average of \$45,000 per year per trainee. Current NIH guidelines (NIH, 2009) call for RCR training at least once each 4 years. Over a period of four years, direct costs for the average trainee would be \$180,000. At 0.1%, that’s \$180 per trainee. Using UC San Diego as an example, the goal has been to limit research ethics courses to no more than 20 students per class. At 14 hours, courses are longer than the NIH recommended minimum of 8 hours per course (NIH, 2009). Recent calculations of fully loaded costs (including faculty salary and benefits, staff support, supplies, equipment, etc.) came to just \$160 per student. That leaves a buffer of \$20.

Allocating sufficient funds for research ethics efforts may happen in some institutions, but unfortunately will only occur nationally if embodied in federal funding requirements. Federal agencies should engage institutions in providing the necessary support for RCR programs. This might occur by some combination of granting mechanisms to incorporate ethics education and training, providing supplemental funding through indirect costs, requirements that some percentage (e.g., 0.1%) of direct costs would be allocated to research ethics efforts, or some other mechanisms mutually agreeable to research institutions and federal agencies.

FRAMING

Recommendation 10: Institutions and regulating agencies should promote RCR culture building

The current model of RCR education is defined largely by an isolated RCR course, workshop, or other training experience. This approach misses the cultural context in which the instruction occurs, and emphasizes the training of individual students rather than promoting a positive institutional culture. Instead, it is proposed that the focus of RCR education efforts should be framed as the building of a positive RCR culture.

Rationale for Recommendation

If the focus should be the culture rather than the individual, then the framing of RCR education should be very different than it is currently constructed. The point is not to educate individuals as it is for other educational experiences. Instead, the point is to provide individuals with the opportunities and motivation to speak with one another about the ethical dimensions of the practice of research, to ask questions, and to be receptive to hearing questions from others. With this framing, there is no need to ask what to do about someone who “already had their training.” Instead, everyone is the audience, the community benefits from the participation of all – including the most experienced and knowledgeable. At the very least, this means that RCR courses should be for all trainees. At the most, it is hoped that the conversations made possible in RCR courses would include all researchers, including faculty and staff.

This is a fundamentally different approach to RCR education than the one we now have. Specifically, the focus is proposed not to be a select group, or on individuals *per se*, nor is it really education and training of those individuals. Instead, the intention is to promote a culture in which all of those involved in research engage in conversations about RCR.

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References

- Anderson M. Normative Orientations of University Faculty and Doctoral Students. *Science and Engineering Ethics*. 2000; 6:443–461. [PubMed: 11228769]
- Anderson MS, Horn AS, Risbey KR, Ronning EA, DeVries R, Martinson BC. What Do Mentoring and Training in the Responsible Conduct of Research Have To Do with Scientists’ Misbehavior? Findings from a National Survey of NIH-Funded Scientists. *Academic Medicine*. 2007; 82(9):853–860. [PubMed: 17726390]
- Antes AL, Wang X, Mumford MD, Brown RP, Connelly S, Devenport LD. Evaluating the effects that existing instruction on responsible conduct of research has on ethical decision making. *Academic Medicine*. 2010; 85(3):519–26. [PubMed: 20182131]
- Bransford, J.; Brown, AL.; Cocking, RR. *How People Learn: Brain, Mind, Experience, and School: Expanded Edition*. Washington, D.C: National Academies Press; 2000.
- Braunschweiger P, Goodman KW. The CITI Program: An International Online Resource for Education in Human Subjects Protection and the Responsible Conduct of Research. *Academic Medicine*. 2007; 82(9):861–864. [PubMed: 17726392]

- Brown S, Kalichman MW. Effects of training in the responsible conduct of research: A survey of graduate students in experimental sciences. *Science and Engineering Ethics*. 1998; 4(4):487–498. [PubMed: 11658057]
- Dekker, S. *The Field Guide to Understanding Human Error*. Burlington, VT: Ashgate Publishing Company; 2006.
- Drake M, Griffin P, Kirkman R, Swann J. Engineering Ethical Curricula: Assessment and Comparison of Two Approaches. *Journal of Engineering Education*. 2005; 94:223–231.
- DuBois JM, Schilling DA, Heitman E, Steneck NH, Kon AA. Instruction in the Responsible Conduct of Research: An Inventory of Programs and Materials within CTSA's. *Clinical and Translational Science*. 2010; 3(3):109–111. [PubMed: 20590680]
- Eastwood S, Derish P, Leash E, Ordway S. Ethical issues in biomedical research: Perceptions and practices of postdoctoral research fellows responding to a survey. *Science and Engineering Ethics*. 1996; 2:89–114. [PubMed: 11657788]
- Fryer-Edwards K. Addressing the Hidden Curriculum in Scientific Research. *American Journal of Bioethics*. 2002; 2(4):58–59.
- Funk CL, Barrett KA, Macrina FL. Authorship and publication practices: Evaluation of the effect of responsible conduct of research instruction to postdoctoral trainees. *Accountability in Research*. 2007; 14(4):269–305. [PubMed: 18246945]
- Heitman, E.; Salis, PJ.; Bulger, RE. Teaching Ethics in Biomedical Science: Effects on Moral Reasoning Skills. *Proceedings of the First ORI Research Conference on Research Integrity*; 2001. p. 195-202.
- Heitman E, Olsen CH, Anestidou L, Bulger RE. New graduate students' baseline knowledge of the responsible conduct of research. *Academic Medicine*. 2007; 82(9):838–45. [PubMed: 17726387]
- Hill, WF. *Learning Through Discussion*. Long Grove, IL: Waveland Press Inc; 2000.
- Kalichman M. Ethics and science: A 0.1% solution. *Issues in Science and Technology*. 2006 Fall;:34–36.
- Kalichman, M. Why do we teach research ethics?. *Proceedings from National Academy of Engineering Workshop on Practical Guidance on Science and Engineering Ethics Education*; 2013. forthcoming
- Kalichman M. A brief history of RCR education curricula and materials. n.d submitted.
- Kalichman, M.; Plemmons, D. Helping Faculty Teach Research Ethics to their Students. *Third World Conference on Research Integrity*; Hyatt Regency Hotel, Montreal. May 6, 2013; 2013.
- Kalichman MW. Responding to challenges in educating for the responsible conduct of research. *Academic Medicine*. 2007; 82(9):870–875. [PubMed: 17726394]
- Kalichman, MW. The Problem of Research Misconduct, Ethics CORE, National Professional and Research Ethics Portal. 2011. <http://nationalethicscenter.org/resources/220>
- Kalichman MW, Friedman PJ. A pilot study of biomedical trainees' perceptions concerning research ethics. *Academic Medicine*. 1992; 67:769–775. [PubMed: 1418260]
- Kalichman MW, Plemmons D. Reported Goals for Responsible Conduct of Research Courses. *Academic Medicine*. 2007; 82(9):846–851. [PubMed: 17726389]
- Macrina FL, Munro CL. Graduate teaching in principles of scientific integrity. *Academic Medicine*. 1993; 68(12):879–86. [PubMed: 8259956]
- Mastroianni AC, Kahn JP. Encouraging accountability in research: a pilot assessment of training efforts. *Accountability in Research*. 1999; 7(1):85–100. [PubMed: 11657564]
- McGee R, Almquist J, Keller JL, Jacobsen SJ. Teaching and learning responsible research conduct: Influences of prior experiences on acceptance of new ideas. *Accountability in Research*. 2008; 15:30–62. [PubMed: 18298028]
- Mumford MD, Connelly S, Brown RP, Murphy ST, Hill JH, Antes AL, Devenport LD. Environmental Influences on Ethical Decision Making: Climate and Environmental Predictors of Research Integrity. *Ethics and Behavior*. 2007; 17(4):337–366.
- NIH. Reminder and Update: Requirement for Instruction in the Responsible Conduct of Research in National Research Service Award Institutional Training Grants. *NIH Guide*. 1992; 21(43) <http://grants.nih.gov/grants/guide/notice-files/not92-236.html>.

- NIH. Notice of suspension of “PHS Policy on Instruction in the Responsible Conduct of Research. February. 2001; 22:2001. NOTICE: OD-01-020. <http://grants.nih.gov/grants/guide/noticefiles/NOT-OD-01-020.html>.
- NIH. Update on the Requirement for Instruction in the Responsible Conduct of Research. 2009. Release Date: November 24, 2009 NOTICE: OD-10-019 <http://grants.nih.gov/grants/guide/noticefiles/NOT-OD-10-019.html>
- NIH. Ruth L. Kirschstein National Research Service Award (NRSA) Stipends, Tuition/Fees and Other Budgetary Levels Effective for Fiscal Year 2012. 2012. NOTICE: OD-12-033. <http://grants.nih.gov/grants/guide/notice-files/not-od-12-033.html>
- NSF. B. Responsible Conduct of Research. Proposal and Award Policies and Procedures Guide. Part II – Award and Administration Guidelines. 2009; IV-3 http://www.nsf.gov/pubs/policydocs/pappguide/nsf10_1/nsf10_1.pdf.
- Office of Technology Assessment. U.S. Congress, Office of Technology Assessment, Biomedical Ethics in U.S. Public Policy —Background Paper, OTA-BP-BBS-1O5. Washington, D.C: U.S. Government Printing Office; 1993 Jun. Box 2-A—Ethical, Legal, and Social Issues Programs, National Institutes of Health and U.S. Department of Energy; p. 8<http://www.princeton.edu/~ota/disk1/1993/9312/931201.PDF>
- Peiffer AM, Laurenti PJ, Hugenschmidt CE. Fostering a Culture of Responsible Lab Conduct. *Science*. 2008; 322:1186.
- PHS. PHS Policy on Instruction in the Responsible Conduct of Research (RCR). Announced: December. 2000; 5:2000. NOTICE: OD-01-007 <http://grants.nih.gov/grants/guide/notice-files/NOT-OD-01-007.html>.
- Pimple, KD. Using case studies in teaching research ethics. 2007. <http://poynter.indiana.edu/files/2113/4849/7612/kdp-cases.pdf>
- Plemmons, D.; Kalichman, M. Discussion Tools. Resources for Research Ethics Education. 2008. <http://research-ethics.net/discussion-tools/current-events>
- Plemmons DK, Brody SA, Kalichman MW. Student Perceptions of the Effectiveness of Education in the Responsible Conduct of Research. *Science and Engineering Ethics*. 2006; 12:571–582. [PubMed: 16909159]
- Powell S, Allison MA, Kalichman MW. Effectiveness of a Short-term Course in the Responsible Conduct of Research for Medical Students. *Science and Engineering Ethics*. 2007; 13(2):249–64. [PubMed: 17717736]
- Schmalig KB, Blume AW. Ethics instruction increases graduate students’ responsible conduct of research knowledge but not moral reasoning. *Accountability in Research*. 2009; 16(5):268–83. [PubMed: 19757232]
- Sieber J, Bird SJ. Web-Based Ethics Education in Science and Engineering. *Science and Engineering Ethics*. 2005; 11(3):323–511.
- Snyder, BR. *The Hidden Curriculum*. New York: Alfred A. Knopf; 1971.
- Steneck NH. Global research integrity training. *Science*. 2013; 340:552–553. [PubMed: 23641099]
- Stern, JE.; Elliott, D. *The Ethics of Scientific Research: A Guidebook for Course Development*. Hanover, NH: University Press of New England; 1997.
- Strauch, B. *Investigating Human Error: Incidents, Accidents, and Complex Systems*. Burlington, VT: Ashgate Publishing Ltd; 2004.
- Swazey, JP.; Anderson, MS. Mentors, Advisors, and Role Models in Graduate and Professional Education. In: Rubin, ER., editor. *Mission Management*. Washington, D.C: Association of Academic Health Centers; 1998.
- Whitbeck C. Group Mentoring to Foster the Responsible Conduct of Research. *Science and Engineering Ethics*. 2001; 7:541–558. [PubMed: 11697010]