Commentary

Six Paths for the Future of Social Epidemiology

Sandro Galea* and Bruce G. Link

* Correspondence to Dr. Sandro Galea, Department of Epidemiology, Mailman School of Public Health, Columbia University, 722 W. 168th Street, Room 1508, New York, NY 10032-3727 (e-mail: sgalea@columbia.edu).

Initially submitted July 20, 2012; accepted for publication January 11, 2013.

Social epidemiology is now an accepted part of the academic intellectual landscape. However, in many ways, social epidemiology also runs the risk of losing the identity that distinguished it as a field during its emergence. In the present article, we scan the strengths of social epidemiology to imagine paths forward that will make the field distinct and useful to the understanding of population health in future. We suggest 6 paths to such a future, each emerging from promising research trends in the field in which social epidemiologists can, and should, lead in coming years. Each of these paths contributes to the formation of distinct capacities that social epidemiologists can claim and use to elaborate or fill in gaps in the already strong history of social epidemiology. They present an opportunity for the field to build on its strengths and move forward while leading in new and critical areas in population health.

epidemiology; methods; population health; theory

Abbreviation: SES, socioeconomic status.

Editor’s note: Invited commentaries on this article appear on pages 850, 852, and 858, and the authors’ response appears on page 864.

Some years ago, one of us was in conversation with a physician colleague when he was asked what he did in epidemiology. When he answered that he considered himself a social epidemiologist, the colleague replied, “But, isn’t all epidemiology social?”

Social epidemiology is now an accepted part of the intellectual landscape in the United States and is experiencing a prominence it did not previously enjoy. As evidence of this broad change, consider that all of the leading epidemiology conferences in the United States have sections dedicated to social epidemiology. In some of them, the number of submissions that fall under the label of “social epidemiology” surpasses even those old epidemiology warhorses: chronic disease and infectious disease epidemiology. In our own large Department of Epidemiology, social epidemiology competes evenly with chronic disease and infectious disease epidemiology for incoming student interest.

This was not always the case. Forty years ago, there was no institutionalized subdiscipline of social epidemiology in the United States. Certainly, there were practitioners of what we would now call social epidemiology, but they linked themselves to social medicine or medical sociology instead of seeking to secure a recognized foothold within the discipline. However, beginning in the 1980s, a small group started to define themselves as social epidemiologists (1) and to press for recognition in departments of epidemiology, often to fairly hostile reactions from colleagues in the discipline. One of us was often told for many years that our department had reached its quota on social epidemiologists because he was already there; that is, one social epidemiologist was already enough. A request to initiate a course in social epidemiology was denied because we already had a course in psychiatric epidemiology that dealt with social issues.

This started to change in the 1990s. The 1990s was a period of high turbulence in epidemiology in general, with a series of influential articles that characterized what we might call the “epidemiology wars” (2, 3). These papers suggested that the purpose of epidemiology was to understand causes at all levels, from individual exposures to societal influences (4).
They offered a blueprint, a raison d’être for the field of social epidemiology, suggesting a multilevel framework within which to think about causation and making it acceptable for social epidemiologists to make their central focus the study of how social factors, such as social ties, poverty, and racial segregation, might shape the health of populations. Key theoretical developments, such as the establishment of the concept of fundamental causes (5, 6) and webs of causation (7) rounded out the picture to position the field at the end of the decade for what would become an empiric explosion building on the roadmap that had been charted over the preceding 30 years. The 2000s brought the rapid introduction of multilevel modeling in the field (8). Multilevel models were not new; they had been used in many other social sciences for at least 2 decades, often with different names (principally random-effects models), but they brought to epidemiology a ready methodological approach to handle thorny issues of clustering around levels of analyses. Multilevel models offered epidemiologists a way to continue using the dominant tools in their field with suitable but relatively straightforward adaptation to the emerging search for the social factors that “caused” population health.

This brings us to the present, when social epidemiology holds appeal for our students, has contributed to a growing awareness of the centrality of social drivers of population health in many health department agendas, and is a well-accepted subdisciplinary home for epidemiologists in the leading universities in the country.

However, and perhaps with some irony, as social epidemiology has achieved a position of primacy and found its place among the epidemiologic pantheon, it has also encountered a distinct danger—losing the identity that distinguished it as a field during its emergence. Simply put, its success is making trouble for itself, placing it in far more danger than at any time in its relatively brief history.

To understand this threat, we go back to the question posed by our physician colleague interlocutor. Is epidemiology not all social?

As far back as 2004, in an editorial that accompanied the redo of their groundbreaking 1993 article “Actual Causes of Death in the United States” (9), McGinnis and Foege noted that “… it is also important to better capture and apply evidence about the centrality of social circumstances to health status and outcomes. …” (10, p. 1264). Their point that social circumstances need to be understood even when thinking of the causes of death was well made; this point was recently quantified in an article that showed that, using comparable methods, the number of deaths attributable to some social (e.g., low educational level) causes are of the same magnitude as deaths attributable to physiologic (e.g., acute myocardial infarction) and behavioral (e.g., poor diet) causes (11).

Therefore, to a large degree, epidemiology is indeed “all social,” and it has been social epidemiology’s triumph that it has taught this to the discipline at large. It would be hard to find an epidemiologist today in any leading academic department who would claim that social factors are not in the causal chain of factors that lead to the production of health. Smoking of course causes lung cancer, but social networks influence smoking (12), as do advertising, social norms, and taxation rates (13–15). Obesity is not simply a matter of energy balance. It must be understood by taking into account food availability, the presence or absence of walkable neighborhoods, the price of vegetables, and social norms about body size. Epidemiologists have been at the leading edge of demonstrating all these observations (16, 17), and research that aims to understand these phenotypes (e.g., lung cancer, obesity) must contend with the social causes as, at the very least, complicating confounders, if not outright “causes of causes” in any definitive analysis.

This represents a dramatic shift in the field and one that well might obviate the need for social epidemiologists. What purpose does it serve to label ourselves social epidemiologists if everyone else is also tackling social causes from their subdisciplinary redoubts? Subdisciplinary labels in our field (i.e., cardiovascular epidemiology, respiratory epidemiology) are fundamentally reinforced by the funding mechanisms at institutions that reward just this approach (e.g., the National Heart, Lung, and Blood Institute). What space is there for social epidemiology as a distinct specialty if cardiovascular, infectious, and pulmonary epidemiologists are themselves studying social causes?

We see our potential redundancy as a useful challenge to forge a stronger and deeper social epidemiology in the time ahead. We use the dramatic change in the stature of social epidemiology in the context of the United States as a springboard for imagining a future for social epidemiology in the time ahead. Situated in the present, we scan the strengths of social epidemiology to imagine paths forward that will make our subdiscipline distinct and useful to the understanding of population health. We suggest 6 paths to such a future, each emerging from promising research trends in the field, in which social epidemiologists can, and should, lead in coming years.

MACRO-LEVEL DETERMINANTS OF POPULATION HEALTH

The roots of social epidemiology lie not too far from early efforts to understand the development of pathology in the human body. Some of the earliest influential articles in the field were concerned with how social ties were associated with survival from cardiovascular disease (18). Subsequent evolution in the field moved us to neighborhoods and the exponential increase during the past decade of papers that were concerned with neighborhood characteristics (e.g., poverty, quality of the built environment) and how they shape population health (19). Despite some empiric work and some theoretical papers and books that have made this case, the body of work in the field that has explored how truly large-scale (macro-level) forces shape the health of populations remains disproportionately limited.

We suggest that there are 2 central reasons for this shortcoming. First, thinking and working at a macro scale are simply much harder than they are at a more micro level. A concern with the influence of urbanicity must, of necessity, involve samples that are heterogeneous across urban contexts and involve large samples that are collected across cities. Well-designed epidemiologic studies that tackle globalization, politics, and cultural influences on health are even harder to enact. Second,
these macro-level structures require an effort of conceptualization and measurement that typically stretches the epidemiologist’s toolkit (20). Epidemiologists are taught to exercise an abundance of caution when reducing complicated macro-level factors to dichotomous, or even scalar, variables in our analyses. It is a caution that we laud and one of the reasons why we are both epidemiologists. However, this means that our understanding of these large-scale forces remains limited and that epidemiology is simply not at the policy table, or at best is a junior partner, when taxation or efforts to reshape the urban environment are part of the national conversation. It also means that although we understand that these macro-level forces stand to effectively shift the curves of disease incidence, burden, and duration (21), we have little empiric data that can motivate nudging these forces in a salutary direction.

We suggest therefore that social epidemiology stands to play an enormous role in pushing the field forward if we redefine “social” to extend to and focus on macro-level forces that, with few exceptions, other phenotype-oriented epidemiologists are not readily addressing. This extends to both investigating the conceptualization of which macro-level factors matter and understanding how and why they might matter. It has implications for both how we train our future social epidemiologists, discussed further below, and what is normative in the field. We may have to accept more uncertainty, more stochasticity in our observations as we move further away from the pathophysiological basis of disease. However, ultimately we would be tackling issues that are paramount to the production of population health and that are unlikely to be taken up by any other phenotype-oriented epidemiologists in the near future. It would also give the field the depth of expertise in handling and tackling these issues and, eventually, a voice in the policy discussions that are inevitably accompanying a rapidly changing world.

METHODOLOGICAL INNOVATION

Social epidemiology has presented some of the thorniest challenges with which epidemiologists have wrestled over the past couple of decades. The counterfactual paradigm (22, 23) has played a central role in clarifying causal thinking in epidemiology. However, the concerns of social epidemiology are all too often not readily handled within this paradigm. What does it mean to enter a parallel universe wherein everything is the same except for one’s race (24)? Clearly not much clarifies the “isolated” effect of race as a cause of population health. Similarly, directed acyclic graphs have brought much needed clarity about causal thinking in epidemiology and have rapidly gained acceptance in the field (25, 26). However, even the best-specified directed acyclic graphs do not fully capture the scope of social epidemiologists’ concerns. For one, the acyclicity of these graphs provided a challenge to many of the concerns of the social epidemiologist. For surely as social capital may influence violence, doesn’t violence also influence social capital?

This somewhat unhappy turn of events, nudging social epidemiology to the very limits of our epidemiologic armamentarium, may not have been an unalloyed negative. Rather, it has pushed social epidemiologists to be leaders in innovation in epidemiologic methods or, at the very least, prodded dyed-in-the-wool methodologists to innovate so that social epidemiologists may go about their work. We have already noted the rapid adoption of random-effects models coincident with our turn to questions about the role of neighborhood effects. More recently, social epidemiologists have led the way in pushing the field to engage with methods, such as systems dynamics methods, that have been used to good effect in other social and natural sciences but much less so in our discipline (27, 28). These methods remain limited, their use in its infancy, and we are not necessarily convinced that they will lead to widespread transformative use. However, they do represent a further effort in the field to push thinking forward, to expand the accepted toolkit, and to ask what can be done better and what we can do to achieve a stronger, more versatile set of methodological approaches.

We suggest that social epidemiologists, of necessity and hopefully by inclination, should lead the way in methodologic innovation in the field. What right do we have to claim such a role? Social epidemiology’s focus on long chains of causation, operating across social, psychological, and biologic systems, induces a new lens that its practitioners must adopt to engage the issues they wish to understand. The lens forces a novel perspective that needs to be used to identify new strategies for epidemiologic understanding. For example, understanding how cultural norms influence health behaviors, how the 2 interact reciprocally, and how jointly they shape the incidence of substance abuse takes us far from the 2 × 2 table (29, 30). We are not sure where this will push our methods, but with persistence, social epidemiology can lead in the development of both the novel approaches and the methods needed to tackle the central questions about how social circumstances shape the health of populations.

UNDERSTANDING MECHANISMS

Despite the broad acceptance of the roles of causes at multiple levels of influence in epidemiology, increasing disciplinary subspecialization has led to the separation of epidemiologists into camps framed by these same levels of influence, perhaps with social epidemiologists and molecular epidemiologists at the 2 poles. Although this may be due in part to the increasing specialization required of both species of epidemiologist, it has led social epidemiology further away from a concern with the mechanisms that underlie the link between social circumstances and the production of health.

In some of our earlier writing, we suggested that risk-factor mechanisms could not account for health disparities by socioeconomic status (SES) because SES dynamically shapes exposure to new risk and protective factors over time, recreating the SES–health association in different places and at different times (5). Focusing only on risk factor mechanisms and assuming that they would account for SES-related disparities served to distract us from a core focus on the foundational determinants of population health, the determinants that if manipulated can stand to shift the disease curve meaningfully for whole populations. That concern remains, but the discipline has changed. Many epidemiologists have now come to this view and have seen the need to incorporate social factors in any full assessment of disease risk (4, 31, 32). Therefore, we are today at a better point in the history of the field, one that
can embrace both the study of macro-level conditions and the study of why and how these forces may matter.

We suggest that although social epidemiologists need to keep their gaze fixed on the social, they simultaneously have an enormous amount to gain from exploring biologic mechanisms more deeply. This has substantial implications for how we conceive of the field and its practitioners. Although over the past few years there has been some exciting work published that jointly considers how social influences work together with genetic and molecular processes, this work is sparse (33, 34). Far more dominant is social epidemiologic work that constrains itself outside the skin, with an interest in social processes without much concern with why these processes may matter. Of the many reasons that social epidemiology might benefit from closer attention to mechanisms, we discuss 4.

First, whatever we presume the root causes to be, in the end, all disease is biologic; any full accounting must be cognizant of this fact. As a result, any brand of epidemiology (but especially social epidemiology) needs to carry the implications of the factors it studies to the pathophysiology processes that must be traversed for disease to occur. The more adept we are at showing how social factors influence biologic processes, the stronger is our case for the health relevance of the factors we study. Second, as social epidemiology has matured, so has the range of proposed explanations, that is, the proposed social drivers of disease outcomes. As one might reasonably expect, some of these explanations have collided to form explanations that compete for primacy in accounting for particular disease patterns. In many instances, these have taken the form of classic social selection versus social causation explanations (e.g., neighborhood, SES) (35, 36). Although many approaches are needed to resolve these debates, attending to mechanisms can provide useful information because the different explanations frequently imply different mechanisms. It follows that we can gather evidence about the plausibility of competing explanations by determining whether the mechanisms each implies are in fact found to exist upon empiric inquiry. Simply put, attending to mechanisms can help social epidemiologists sort out which of their plausible social determinants are the most compelling ones. Third, once a mechanistic pathway is discovered, the social, cultural, political, and economic context shapes the consequences of that discovery. Smoking is an obvious example. This signature epidemiologic discovery has had and continues to have an impact on population health through a powerful morass of social, cultural, economic, and political factors. More recently, discoveries concerning infectious disease led to the human papilloma virus vaccine that holds the possibility to powerfully shape cancer outcomes in the decades ahead. However, its impact on population health will be shaped by diffusion dynamics that are strongly influenced by culture, religion, and politics. Mechanisms, once discovered, become social, and social epidemiologists should closely attend to them for this reason as well. Fourth and finally, social epidemiology is in a unique position to push the population health sciences forward at the intersection of factors that matter inside and outside the skin. Doing so would represent perhaps the most radical of the prescriptions we suggest here for the field, but it might also represent the most promising direction, positioning social epidemiology at the heart of the larger epidemiologic concern with understanding how causes at multiple levels of influence jointly shape health and disease.

SOCIAL INTERVENTIONS

We shall not here retell the now well-worn arguments in epidemiology about the challenges of drawing inference from observational studies and about the potential role that interventional research plays in clarifying causal chains (37–39). That story has been written well elsewhere. Taken to the extreme, this suggests that only experimental approaches can illuminate our understanding of causes (40–42).

We find this approach unhelpful and think it is wrong. However, there is little question that there is much that we can learn from studying interventions and in particular social experiments, many of which will, of necessity, be natural experiments.

Social epidemiologists, particularly social epidemiologists concerned with large-scale social influences and circumstances, have little opportunity to experimentally manipulate the conditions in which they are interested. It seems unlikely that any social epidemiologist will be in a position to experimentally manipulate progressive taxation levels in different jurisdictions to understand whether the resultant narrowing in income inequality will also be associated with improved population health. It is not, however, unlikely that such an opportunity will present itself as a natural experiment, one that can well be studied to good effect. There are indeed some very elegant examples in the existing literature that have done just this: capitalized on natural experiments to understand how manipulating social circumstances does or does not shape the health of populations. Social epidemiologists will be interested in these natural experiments to the extent that they reveal whether and to what extent social factors matter for health outcomes. At the same time, social epidemiologists can occasionally be more broadly useful to the discipline because identifying and studying the consequences of such social experiments can sometimes provide critically important information for other areas of epidemiology. For example, the Nazi blockage created the Dutch famine that led to discoveries relevant to the associations between neural tube defects and schizophrenia (43). These examples readily convince us that this approach is promising and fruitful. What is perhaps surprising is how few such illustrations we can identify in the literature.

Social structures change all the time. New laws and regulations are introduced with regularity. Urban renewal efforts are put in place. Cultural norms shift. These changes lend themselves to careful, systematic data gathering that can add insights not otherwise available through observational studies alone. Linking to some of the areas discussed here, the study of natural experiments embeds its own conceptual and methodological challenges, further suggesting the inevitability of the social epidemiologist’s engagement in these areas.

THE CENTRAL ROLE OF INTERGROUP DIFFERENCES AND INEQUALITY

The roots of social epidemiology a quarter century ago were indelibly shaped by a concern over black/white differences in some fundamental health outcomes in the United States (44). That many of these differences remain as they
were decades later well argues for the continued importance of health inequalities as a core motivation in the field. We argue that it is therefore the natural métier of social epidemiologists to maintain an abiding interest in intergroup differences in health, or as they are also called, health inequalities or health disparities. We have little hope that these differences will vanish any time soon. With some luck and concerted effort, we may narrow racial differences in health. However, evidence suggests that socioeconomic differences are, if anything, growing (45–47), not to mention international differences in health indicators (48, 49) that are appalling. This provides sufficient motivation for several lifetimes of work but can also be clarifying for social epidemiology as a foundational commitment to improving the underlying conditions that influence health so as to narrow differences between groups.

We realize that articulating a values-based commitment to intergroup equality in health for a scientific discipline may raise eyebrows. We suggest that what we are proposing is not particularly different than what is de facto the case in much of science already, but which is not as explicitly stated. Our questions are not unbiased. Much as we may like to think that we are asking questions that are informed only by prior dispassionate knowledge, our preconceptions inevitably frame our questions and, less felicitously, our answers. It is true that social epidemiology has always been more susceptible to this than have other areas in epidemiology. Many people are drawn to social epidemiology out of a concern for the social, a desire to understand and improve social conditions that may influence health. Few of us are neutral about social conditions in our nonprofessional lives. Our values around the importance of a market-orientation to our economy determine for whom we vote. To some degree, this sets social epidemiologists apart from, for example, occupational epidemiologists. Our sentiments about ceramics are likely less a part of our civilian engagement than are our sentiments about income inequality. This indeed raises the bar for social epidemiology as a discipline may raise eyebrows. We suggest that all future social epidemiologists will do little to advance any values we hold if we get our science wrong.

However, recognizing that social conditions may engage the epidemiologist does not suggest that social epidemiologists need to shed their concern about the very social conditions that motivated us in the beginning. Rather, we suggest that such efforts are futile and that social epidemiologists would do better to recognize our driving influences in this area and elevate them, as appropriate, to a motivating concern that shapes our work.

**THEORY AND THE HEALTH OF POPULATIONS**

Epidemiology has long flourished as a “black-box” discipline. We have applied our methods, with notable success, to isolate factors that co-vary with disease and aimed to intervene on these factors without a good grasp on why they might matter. The isolation of folic acid as a determinant of neural tube defects is a well-recognized case in point (50–52). It can be argued, however, that these cases are not normative. Rather, particularly as we expand the scope of epidemiology to take into account a broad range of factors, a black-box approach may lead us to the isolation of spurious associations or to a chase for associations where there are none.

As we see it, the only alternative to this conundrum is a deeper engagement for the field in theory, a richer grounding in an understanding of why particular factors may matter, and the confidence to articulate a priori hypotheses about what social conditions might matter, leading to testing through observational or experimental studies. This will require not only a deeper grounding in theory borrowed from other disciplines but also development of a theory of the production of population health that stands on its own. With a few notable exceptions, epidemiology remains quite poor in this regard.

We see this as both a critical area for the development of the field and a central opportunity for social epidemiology to help population health science transcend some of the individualistic thinking inherited from the medical sciences that at times holds back epidemiology as a whole. Population health science needs to be rooted in an understanding of the drivers of the health of populations. These drivers, the factors that shift the curve of disease incidence, severity, and duration are by definition outside the curve, exerting their influence on whole populations rather than on individuals. Similarly, our methods in the field are population-based methods, having little utility for individual diagnosis and prediction. However, conflation of population-based and individual-based inference is commonplace in biomedical research. We argue that a clearer articulation of the concepts that underlie social epidemiology and how that shapes our questions and our inference can further help clarify our concern with populations and with the social drivers thereof.

**IMPLICATIONS FOR THE NEXT GENERATION OF SOCIAL EPIDEMIOLOGISTS**

Our prescriptions for the field represent a tall order, one that is too tall, in fact, for any one social epidemiologist to embrace. Perhaps it is a sign of the maturity of the subdiscipline that it can move forward in so many directions, well beyond the scope of any one person’s research. The approach proposed here does have clear implications for both how we practice the field today and, perhaps more importantly, for how we train the next generation of social epidemiologists.

Aspiring to be forward-looking, we suggest 3 particular areas that bear careful consideration in the education of the next generation of social epidemiologists. First, we must train social epidemiologists to be comfortable across levels of influence. This does not mean that all social epidemiologists could or should move comfortably between studies of the role of the urban environment in shaping health and studies about how exogenous stressors induce epigenetic changes that can modify gene expression and hence physiologic processes. However, we suggest that all future social epidemiologists need to at least understand both the social conditions that are foundational and the causal links that result in the embodiment of health. So doing will lead us to ask better questions.
and focus on plausible answers. It also represents an opportunity to bring a measure of synthesis to the broader discipline of epidemiology that currently is pursuing all these strands, often resulting in diverging and poorly cohering patterns.

Second, we need a generation of social epidemiologists that is comfortable with and can push the limits of our disciplinary methods. This does not necessarily mean that social epidemiologists will or should become epidemiologic methodologists. However, it does mean that we need a generation that is not content with the constraints of our current methods and that is comfortable working with peers in biostatistics, mathematics, and computer science to find or develop better tools. We might suggest that this should be a feature of all future epidemiologists. Perhaps, but, relevant to this essay, it suggests that social epidemiologists need to be trained not simply to adapt methods but to critically understand and challenge methods. That is indeed a different orientation than our current training in the field, and it suggests a training that is in informed by propulsive questioning and that encourages emerging scholars not to settle for our current methods but rather to seek their own.

Third, it is incumbent upon us to embed the training of social epidemiologists in a deeper appreciation of theory (and inevitably history of that theory) than we currently do. Because the field has emerged rapidly over the past 2 decades, much social epidemiology is informed by theory, but that theory is at best grafted onto the field from other disciplines, sometimes fitting poorly. We aspire to a generation of social epidemiologists that asks why we are asking the questions we ask, to the end of asking very different questions and identifying better answers than the ones we have produced thus far.

CONCLUSION

We return to the question framed by our physician colleague. If epidemiology is all social, or perhaps more accurately, if all epidemiologists are concerned with social circumstances as at least part of the causal chain, how then does a social epidemiologist distinguish herself?

We suggest here that we do so through clarity of focus on understanding the macro-level factors that matter, how they affect biologic processes with the body, and the methods that help us articulate these answers. We think that well distinguishes social epidemiologists from other epidemiologists who are, correctly for their subdiscipline, concerned centrally with the interface between exposure and pathogenesis, focusing on specific disease processes. Although there are 6 paths identified, they all have much in common. Each of these paths contributes to the formation of distinct capacities that social epidemiologists can claim and use to elaborate or fill in the gaps in the already strong history of social epidemiology. They present then an opportunity for the field to build on its strengths and move forward while leading in new, critical areas in population health.

There is a danger in our prescriptions: In attempting to do all of this, social epidemiologists run the risk of dabbling, developing a limited understanding of social circumstances, biologic processes, theory, and methods. A vigilant field can avoid this pitfall. We can give our emerging scholars the foundations they need to then pursue any of the 6 paths we outline here. We suggest that doing so will lead to a generation of scholars and scholarship that can move social epidemiology in exciting and fruitful new directions.

ACKNOWLEDGMENTS

Author affiliation: Department of Epidemiology, Mailman School of Public Health, Columbia University, New York, New York (Sandro Galea, Bruce G. Link).

Dr. Galea is funded in part by National Institutes of Health grants MH 095718, MH 082729, MH 082598, and DA034244 and Department of Defense grant W81XWH-07-1-0409. Dr. Link is funded in part by National Institutes of Health grant HD 058515 and Robert Wood Johnson Foundation grants RWJF 67952, RWJF 69247, and RWJF 70281.

We thank Laura Sampson for her research assistance on the preparation of this manuscript.

Conflict of interest: none declared.

REFERENCES

704–711.


1485–1490.