Guest Editorial

DATA SYSTEMS LINKING SOCIAL DETERMINANTS OF HEALTH WITH HEALTH OUTCOMES: ADVANCING PUBLIC GOODS TO SUPPORT RESEARCH AND EVIDENCE-BASED POLICY AND PROGRAMS

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Across many countries, describing and understanding what contributes to a more or less equitable distribution of population health, and turning that knowledge into action to reduce unfair differences, are attracting the interest of policy makers, health professionals, researchers, civil society, and media. However, valid data from different sectors, in the public domain, analyzed from different perspectives with appropriate methods, are needed. Important international and national efforts have helped tremendously in this evidence-based call for action.

A recent effort drawing on global evidence includes the World Health Organization (WHO) Commission on the Social Determinants of Health. The Commission's Final Report pointed out that the unequal distribution of health-damaging experiences and their persistence within and across countries is not at all a natural phenomenon.¹ Rather, structural determinants (such as poor social policies and programs, unfair economic arrangements, and bad politics) generate hierarchies of social position (such as gender or income inequalities). Depending upon the place in the social hierarchy that individuals and groups occupy, the combination of social stratification and the epidemiological environment determines exposure and vulnerability to health-enhancing or health-damaging conditions in daily life—e.g. where people are born, grow, live, work, and age.1

Health inequities flow from these patterns of social stratification—that is, from the systematically unequal distribution of power, prestige, and resources among groups in society. Health systems are also a social determinant of health, as these can either mitigate or amplify existing inequities, such as through progressive financing of health services or discriminatory practices when individuals seek care. Moreover, social determinants of health (SDH) interact with one another and with biological or genetic factors, shape individual behav-

iors, are accumulated during a lifetime, and are often transferred across multiple generations. The WHO Commission and a follow-up World Health Assembly resolution² set out a detailed agenda for global collaboration to reduce health inequities through action on SDH in three areas: (1) improve people's daily living conditions; (2) tackle the inequitable distribution of power, money, and resources; and (3) measure and understand the problem and evaluate action. Addressing SDH rests on evidence of the relationship between these determinants and health outcomes.

National and regional efforts have been crucial to engage a broad range of stakeholders, shape policy, and increase accountability. For example, Brazil, Chile, and the United Kingdom have organized recent national commissions including intensive stakeholder consultations to help guide policy, data analysis, and action on SDH. Under the leadership of the Spanish Presidency of the European Union (EU) in 2009, and with the involvement of WHO, in particular its Regional Office for Europe, an independent expert report³ and informal meeting of health ministers in the EU put the monitoring of SDH prominently on the political agenda. Subsequently, the European Parliament passed a resolution noting that as part of the process to make a more equitable distribution of health part of the EU's overall goals for social and economic development, the EU needs to improve the data and knowledge bases that support measuring, monitoring, evaluation, and reporting.4

In the United States, the Robert Wood Johnson Foundation (RWJF) set up an independent and non-partisan Commission to Build a Healthier America, with the goal of identifying interventions beyond the health system that can improve health and that are supported by a strong knowledge base.⁵ Recognizing that not everyone in the U.S. has the same opportunities to make healthy choices, the RWJF Final Report focused on identifying health-enhancing actions in the places where people spend the bulk of their time—homes and communities, schools, and workplaces—with key recommendations also outlining approaches toward greater accountability and collaboration across public, private, and not-for-profit sectors.⁶

Informed by public consultation, the U.S. Department of Health and Human Services around the same time was developing its fifth 10-year national health agenda to communicate a vision, strategy, and comprehensive set of national health objectives. The

first phase of this report advocated that health policy efforts need to be integrated with those related to education, housing, business, transportation, agriculture, and media, among others.⁷ Recently released, Healthy People 2020 includes SDH as a key topic: objectives are being developed that address the relationship between health status and a wide range of social determinants. To support the selection of indicators and underlying data required to track and monitor progress critical to Healthy People 2020, the Institute of Medicine identified 12 key topics and 24 leading indicators for assessment: social determinants is one of the key topics, and three leading indicators are proposed to monitor the proportion of the population experiencing a healthy social environment.8

Such national monitoring efforts are supplemented by more detailed analysis of existing data. An extensive literature review is beyond our mandate, yet worthwhile to note is a supplement to the Morbidity and Mortality Weekly Report that consolidates recent U.S. national data analysis on inequalities in mortality, morbidity, access to preventive and treatment health services, as well as social determinants of critical health problems.9 Truman and colleagues introduce the volume and outline a convincing narrative that (1) health inequalities and inequities are important indicators of community health and provide information for decision-making and evaluation of intervention implementation to reduce preventable morbidity and mortality; (2) data analyzed and interpreted on a wide range of topics provide compelling arguments for action; (3) actions include a mix of universally applied and targeted interventions; yet (4) there is insufficient evidence regarding the effectiveness of particular interventions in reducing specific inequalities among certain defined populations.9

Although this supplement of Public Health Reports extends innovations in analysis linking SDH with health outcomes, several challenges remain.

THREE CHALLENGES: ATTRIBUTION, DATASETS, AND ANALYSIS TOOLS

Despite much progress, attributing an improvement in the distribution of health in a particular context and population subgroup to a particular intervention addressing a social determinant of health remains difficult given the wide range of determinants of health, entry points, and analytical approaches. To move forward, we note that better theories, linked microdatasets, and improved analytical methods are needed to (1) describe and analyze pathways across a complex set of social determinants to health outcomes, and (2)

attribute causality to evaluate the impact of different policies or programs at local, national, or global levels, outside of the health system, on health outcomes.

First, better theories that can explain complex observations in light of daily life experiences are needed. Over the years, among others, Nancy Krieger has significantly advanced thinking in this area through the development of an ecosocial theory of disease distribution that integrates biological, social, and political processes and their implications for improving population health.¹⁰ More fundamental work along these lines, involving researchers across a greater number of disciplines and countries and a wider range of knowledge producers, can only help to further improve understanding of what can work to reduce unfair health disparities and guide policies and actions in a wide number of sectors. A detailed review is beyond the scope of our reflections, yet we agree that more attention needs to be devoted to identifying the correct etiologic period within a life-course perspective¹¹ and understanding the dynamic interplay between interventions and the social, economic, and environmental contexts in which interventions are delivered.¹²

Second, in most countries, information systems are not designed to generate, link, synthesize, or disseminate data and information in the public domain on SDH and health outcomes, especially by relevant categories of social position. Institutional mechanisms, technical norms, and appropriate incentives to share data are needed to enable linking existing micro-data from different sectors, ensuring public access for analysis, and improving new data collection systems. To contribute to the growing evidence base, linking and analysis of existing data should be considered a high priority across low-, middle-, and high-income countries as an efficient way to learn from data already collected. Most research linking SDH and health outcomes is based on national household surveys. Innovations are needed to extract information from vital statistics registration systems, surveillance systems, and serviceprovision data systems, across different sectors, that can be useful for decision-making at the local level.

One example is the Basket of Health Inequality Indicators developed and compiled by the London Health Observatory (LHO, one of a network of local health observatories across the United Kingdom).¹³ The LHO has implemented an operational approach that supports local analysis, policy formulation, and continuous monitoring and updating. It has negotiated access to individual and small-area disaggregated data from different sectors-including education, crime, environment, and health-that include a significant number of measures of SDH, of access to health

and other social services, and of health outcomes. It has linked these data together and provides analysis, program recommendations, and ongoing reporting relevant to different audiences at the local level, including municipal government, general practitioners, and other local social workers.

Third, existing analysis tools and training are not necessarily available to the people or areas of the world that would most benefit from adopting a social determinants approach to health. Addressing a conference on the WHO Commission on the Social Determinants of Health, participants agreed that a call for evidence-based policy is commendable, yet more information is needed to avoid the pitfalls of using potentially distorted statistics, as well as to learn about the best means of mobilizing reliable and testable figures.¹⁴ While collecting or making links to new data on SDH is important, there is a strong case for wider dissemination and greater utilization of existing tools for measuring and monitoring health outcomes with existing surveillance data on a number of topics, and for fostering critical interpretations. For example, the LHO also has a Health Inequalities Intervention Toolkit, which is designed to assist with analyzing interventions to reduce health inequalities. The LHO has already started to work with other observatories in other countries to support adaptation to local public health contexts across the United Kingdom and many other countries.

Used more widely, the World Bank's free ADePT tool¹⁵ uses survey micro-data as input to automatically produce standardized routine reports on many SDH such as poverty, education, social protection, and gender, which could reduce the time between data collection, processing, and communication to stakeholders. ADePT now has a module specifically for health that implements the methods for analyzing health equity, as detailed by O'Donnell and colleagues. ¹⁶ These methods include the calculation and decomposition analysis of summary measures of health inequality, benefit-incidence analysis, and health financing, among other domains. Importantly, ADePT's website also provides a number of training videos on how to use the tool in practice.

Another, more limited tool for facilitating routine reporting on health inequalities is the U.S. National Cancer Institute (NCI) Health Disparities Calculator (HD*Calc),¹⁷ which was created after a systematic review and empirical analysis of existing approaches to measuring health inequalities.^{18,19} NCI's tool is specifically designed to be integrated with cancer incidence, survival, and mortality data derived from its cancer surveillance system, but users may also upload their

own population and health data, and quickly generate multiple measures of health inequality, measures of uncertainty, and graphs.

PROGRESS AND FUTURE DIRECTIONS

This special supplement of Public Health Reports offers contributions that clearly expand the knowledge base linking SDH and health outcomes, and provides examples of innovation in data and analysis approaches. One of the main rationales for this supplement was to push forward links between broader social determinants that are often difficult to measure (such as policies) and specific health outcomes. Collecting and standardizing measures of health and social policies across countries are considerable challenges, as the presence or absence of a given policy may make less difference than, for example, the extent of coverage, and similar policies may be implemented in vastly different ways.²⁰ One example of this type of policy analysis in this supplement is the article by Heymann and colleagues.²¹ Additionally, an unpublished manuscript by Westphal et al. describes an innovative approach to comparing municipalities in Brazil that have implemented integrated "social agendas" addressing a wide range of SDH with those municipalities that have not. Box 1, prepared especially for this supplement, provides further details on how the analysis was operationalized and offers suggestions for future analysis that consider complex interventions and impacts on health.

One common barrier to better integration between data systems and SDH is simply knowledge among data users and stakeholders of what may be done with existing data systems, as addressed in the article by Beltran and colleagues. 22 Another obstacle is that existing national health datasets that address different SDH have not kept up with the evolving needs of this cutting-edge area in public health. As a demonstration of what can be done, Muennig et al. prospectively link three decades of General Social Survey data to mortality data through 2008 via the National Death Index. Box 2, also prepared for this supplement, describes the core elements of this dataset and how it might help shape social epidemiology and other frontier areas of public health research.

Yet, perhaps the least explored territory is using data from other sectors. For example, Comer and colleagues lay out the challenges likely to be faced in linking patient-level electronic health records with information on potential community-level exposures.²³ Another interesting set of data emerging in the context of racial inequalities in health is the use of home mortgage loan data from the Home Mortgage

Box 1. How to Quantify the Effect of Local Social Development Agendas on the Living Conditions and Health of Brazilian Municipalities^a

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WHAT IS A SOCIAL AGENDA?

Reflecting local or regional efforts toward social development, "social agendas" are strategies that have been used in Brazil since the early 1990s in three major areas of activity: (1) sustainable development—reflecting Agenda 21 arising from the United Nations Conference on Environment and Development¹ (Earth Summit) held in Rio de Janeiro in 1992; (2) improving urban areas—reflecting Healthy Cities² policies and actions, developed with the World Health Organization and the Pan American Health Organization; and (3) involving all stakeholders, a national initiative of Sustainable Integrated Local Development³ efforts maintained by the federal government, from 1995 to 2002. Each of these efforts reflects social development initiatives, which act on a broad range of social determinants of health, most often at the local level. To advance evaluation methods in this area, a National Social Determinants of Health Commission⁴ was created in Brazil to gather further scientific evidence on what types of integrated actions improve health equity in the country.

HOW CAN QUANTIFICATION BE OPERATIONALIZED?

Quantitative methods are needed that can attribute a change in health to the implementation of social agendas and their effectiveness to improve health over time. Adopting the approach of O'Neill and Simard⁵ on Healthy Cities, the authors selected 105 municipalities, each of which had taken the initiative of constructing and implementing social agendas, across five large regions of the country; another 175 were selected as control municipalities. A longitudinal study was constructed to analyze the performance of the indicators in exposed and nonexposed municipalities, with the hypothesis that the existence of social agendas is a protective, or health-enhancing, factor. Given a wide range of policies and actions to improve social determinants, the study focused on the eight goals and related indicators of the Millennium Development Goals.⁶ Important areas for measuring improvements, for example, include reductions in poverty and hunger and in inequality between men and women as well as improvement in access to basic education and in sustainable environmental development. The impact of these improvements on better and more equitable health status of people living in the municipalities, including vulnerable groups, composed the operational framework. Primary and secondary data were collected to assess the relationship between the existence of social agendas in the municipalities and the change of population living conditions and health status indicators. The resulting dataset included 29 indicators for living conditions and health status from 280 municipalities from 1997 to 2006.⁷ As examples, four of the 29 indicators are as follows:

- Municipal revenue per capita from taxes and constitutional and legal transfers
- Male/female ratio among salaried workers
- Percentage of the population with piped water supply
- · Percentage of children younger than one year of age with protein/caloric undernourishment

Rather than any specific calendar year, the baseline for analysis of each municipality was defined as the year in which a social agenda was implemented, with follow-up assessments at three and six years.

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WHAT LEARNING CAN SUPPORT FUTURE ASSESSMENTS?

For the time period assessed, no significant effect of social agendas was quantified by the indicators monitored, as performance of 15 of the 29 indicators improved across municipalities. Although not statistically significant, better values of indicators included were found among municipalities with social agendas than among those without a social agenda. However, qualitative research in another part of the study did convincingly show that increased community participation made a difference to health. One lesson is that three years is probably an insufficient period to measure impact and significant change, given the pathways from improving social determinants to improving health status. Moreover, the Brazil study found that the number of municipalities with six years of implementation dropped considerably, which, in evaluation terms, reduces the opportunity for meaningful comparisons between exposed and nonexposed municipalities. Finally, the authors note that to measure improvements arising from a wide range of diffuse actions—in this case, implementation of social agendas—a range of mixed methods is required. This includes quantitative and qualitative methods as part of the same study design; the construction and use of compound measuring instruments, such as compound indexes, which can combine different dimensions; and, importantly, evaluations over a longer period of time (e.g., cohort studies), as actions on social determinants and improved health can taken much longer than three or even six years to assess.

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Disclosure Act (HMDA) that Mendez and colleagues²⁴ have analyzed in this supplement. HMDA data are one example of attempting to link two different data systems to leverage novel exposure data, in this case a measure of institutional discrimination that is notably difficult to measure in practice.²⁵

To move forward, we encourage researchers to debate and support collaborative efforts including consensus building on what types of measures to use for monitoring SDH and how to measure the magnitude of inequality in health outcomes. Based on existing global mandates such as those of WHO, other international or multilateral efforts should facilitate

national policies that encourage greater disaggregation of evidence within routine systems by social groups and increase the comprehensiveness of data collection from multiple sources ranging from censuses, vital statistics, and surveillance systems to household and other specialized surveys. Data collected from health services or programs could be particularly useful and are often underused. Possible actions include developing data modules or questions that can be integrated within existing data collection and surveillance approaches, and agreeing on minimum standards for vital statistics registration to include basic stratifiers of social position. In parallel, efforts should be made to lay the

Box 2. Excerpts from the General Social Survey-National Death Index: An Innovative New Dataset for the Social Sciences^a

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THE BASICS OF THE GENERAL SOCIAL SURVEY-NATIONAL DEATH INDEX

The General Social Survey (GSS)-National Death Index (NDI) offers one approach to construct a nationally representative sociomedical dataset linking psychosocial factors with mortality data. The GSS is a multiyear, cross-sectional survey that is rich in sociological variables. The authors prospectively linked the GSS to mortality data by cause of death between 1979 and 2008 via the NDI to form the GSS-NDI. Focusing on the 1978–2002 period (allowing for a lag time because very few deaths occur among subjects in the two- to fouryear period following the survey), more than 30,000 subjects are included in the GSS cohorts and as many as 9,271 deaths are available for some variables. More than 600 GSS variables have at least 1,000 deaths linked to them. The GSS sampled only English-speaking subjects aged ≥18 years in the noninstitutionalized population using a multistage probability sample. During the 1978–2002 period, GSS survey response rates ranged from 70% to 82%, and information on nonrespondents is available. Due to missing values over the years, it is critically important for researchers to report the number of subjects and deaths in their specific sample.

MATCHING

To generate a matching file for the NDI, it was necessary to electronically code paper records for the GSS. Entered values were manually cross-checked. The authors employed a modified version of the National Center for Health Statistics' probabilistic matching algorithm. Social Security numbers (SSNs), one important component of the match, were available for only 36% to 56% of the subjects, depending upon the survey year, and only after 1993. In previous studies, 83% to 92% of deceased individuals were correctly identified with similar information.² In the current case, internal checks revealed a high degree of consistency when records with known SSNs were matched to NDI records with and without the SSN included in the match record. Details of the probabilistic matching and flag schemes are available in the codebook accompanying the dataset.3

PUTTING GSS-NDI INTO THE PUBLIC DOMAIN

The GSS-NDI will be released to the general public in October 2011, and download instructions will be available in the codebook.3 The de-identified dataset has been granted approval from the Institutional Review Board at Columbia University in New York City. To ensure that subjects cannot be identified, only the year of the subject's birth and the de-identified primary sampling unit (rather than the subject's city or state of residence) will be available in the public release dataset.

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groundwork to improve linked data sources across different sectors and across time—e.g., with cohort data. Together, these efforts would yield tremendous value to better describe and link SDH and put together policy options that reflect better evidence of what works. Moreover, further dissemination of data and analysis tools in the public domain are urgently needed, including open data platforms, perhaps through data warehouses and cloud computing that can extend data analysis and re-analysis opportunities to more people and institutions around the world.

CONCLUSION

The knowledge gained from studies of SDH needs to be critically consolidated and widely shared through systematic reviews of evaluated interventions that might help to reduce inequalities in health. These reviews should, to the extent possible, incorporate local, national, and global evidence; describe carefully the context of interventions; and consider the advantages or disadvantages of targeted vs. universal programs. Integrating qualitative studies will certainly refine interpretation and applicability to different contexts, further support policy narratives to illustrate macro issues as well as specific case studies, and aid civil society and the media to communicate what can be done to address SDH and reduce inequalities.

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