

Epidemiology and public policies

Epidemiologia e políticas públicas

Abstract

The present essay deals with the relation between epidemiology and public policies, highlighting the epidemiology position in the public health field, analyzing the impact of public policies over epidemiological profile and contributions from epidemiology to the lay down, implementation and evaluation of public health policies. In the first title, the essay debates the links between the epidemiology and public health field, the social determinants and political action framework proposed by the WHO's Commission on Social Determinants of Health, and different approaches of health policies. In the second title the essay analyses the reduction of child stunting in Brazil as an example of public policies that impact epidemiological profile. The third title presents three strategic topics for the application of public health policies: reduction of social inequalities in health, health promotion and regulation of products and services that have impact over health. The fourth title discusses the possibilities and difficulties to combine the epidemiological knowledge in the lay down, implementation and evaluation of public policies and, finally, material examples of such relation between epidemiology and public policies are presented.

Keywords: Epidemiology. Public policies. Health policies. Social policies.

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Este ensaio trata das relações entre a epidemiologia e as políticas públicas, destacando inicialmente a posição da disciplina no campo da saúde coletiva, analisando os impactos de políticas públicas sobre o perfil epidemiológico e as contribuições da epidemiologia para a formulação, implementação e avaliação de políticas públicas de saúde. No primeiro tópico são discutidos os vínculos da disciplina com o campo da saúde coletiva, o modelo de determinantes sociais e de ação política formulados pela Comissão de Determinantes Sociais em Saúde da OMS, e diferentes enfoques de políticas de saúde. O segundo tópico analisa a redução da desnutrição infantil no Brasil como um exemplo de políticas públicas com impacto no perfil epidemiológico. No terceiro tópico são apresentados três temas estratégicos para a ação das políticas públicas em saúde: redução das desigualdades sociais em saúde, promoção da saúde e regulação sobre bens e serviços com impacto na saúde. O quarto tópico discute as possibilidades e dificuldades de incorporação dos conhecimentos epidemiológicos na formulação, implementação e avaliação de políticas públicas e, finalmente, são apresentados exemplos concretos dessa relação entre epidemiologia e políticas públicas.

Palavras-chave: Epidemiologia. Políticas públicas. Políticas de saúde. Políticas sociais.

The relationships between epidemiology and public policies are numerous. Meaningfully addressing such a broad topic requires focusing on certain aspects; otherwise, any analysis of these relationships would necessarily be general and provide a minimal contribution to the improvement of health practices.

With this initial limitation in mind, the present article is organized around three topics. Initially, the place of epidemiology in the field of public health as it relates to practice will be addressed and a model of social determinants and levels of performance will be presented, based on the study of the World Health Organization's Commission on Social Determinants of Health to inform public policies. Next, an example of how public policies can affect epidemiological profiles will be analyzed, even if this impact is not their primary or explicit focus. Finally, the use of epidemiology in developing, implementing, and assessing public health policies will be dealt with, highlighting two of the current commitments in the field of public health: reducing social inequalities in health care by acting on social determinants and promoting health, for which the regulatory functions of the state become important. There are several other uses for epidemiology, but they will not be the subjects of the current discussion.¹

The Relationships between Epidemiology and Public Policies

In Brazil and for several groups of researchers in different parts of the world, epidemiology has always been part of the public and collective health movement and has never developed as either a scientific discipline or as a field of practice separate from the field currently known as collective health. In Brazil, clinical epidemiology did not find adepts or practitioners, and

* Based on a talk presented at the VIII Brazilian Conference on Epidemiology of the Brazilian Association of Public Health (Associação Brasileira de Saúde Coletiva – ABRASCO), São Paulo, Brazil, 2011.

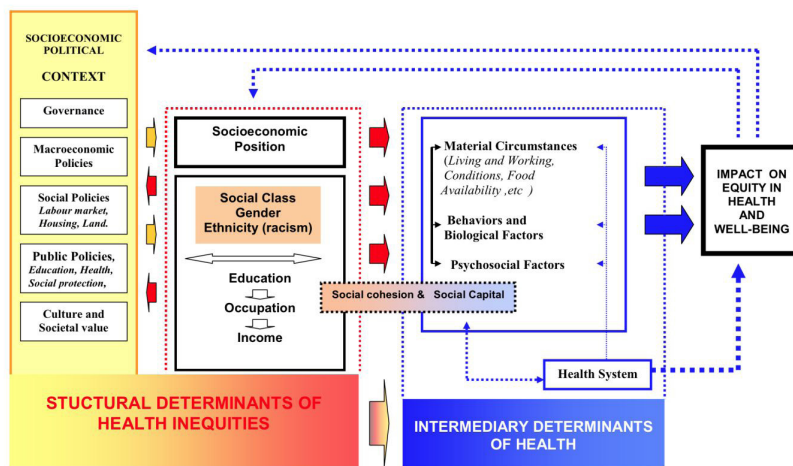
there has been much more support for a broader epidemiology.² This “grounded in reality” concept, as emphasized by Mauricio Barreto (2002), sets the direction of scientific inquiry, in which the emphasis is on solving problems as they are presented in practice.

Barreto emphasizes that as a basic component of the field of public health, epidemiology is responsible for generating knowledge, information, and technology that can be used in the development of policies for the promotion, prevention, and control of health problems.³ However, interventions in the real world are limited not only by the quantity and quality of the technical and scientific knowledge available but also by the political interests at stake, i.e., by the powers exercised by different actors present in the social arena at a given time.³ Therefore, the potential relationships between any scientific discipline and political action present numerous challenges, among which is the need to abandon the relatively comfortable position of a science capable of formulating questions in favor of one that is also capable of developing effective solutions.⁴

James Marks⁵, former director of the Centers for Disease Control and Prevention

(CDC), provides several interesting ideas on this theme in his 2009 Alexander Langmuir lecture. Marks states that public policies are the means by which society shapes what it wishes to be or become, i.e., that it is through public policies, whether governmental or derived from social movements, that a society establishes its goals, expresses its values, and advertises its priorities. Public health work always occurs in a political context, and divorced from this context, epidemiological knowledge is sterilized and prevented from contributing to a transformative practice of population health care.⁵

The articulation of epidemiological knowledge and public policies, whether in the health sector or not, requires a comprehensive model of the process of determining health and illness at a society-wide level, as well as the identification of the most promising approaches and potential interventions.⁶ The model developed by the World Health Organization (WHO) Commission on Social Determinants of Health allows the identification of the social determinants associated with social organization dimensions, highlighting the processes responsible for the production of social inequalities in health.⁷



Fonte/Source: WHO. Commission on Social Determinants of Health. A conceptual framework for action on the social determinants of health. Discussion paper. 2007.

Figure 1 - Social determinants of health inequities.

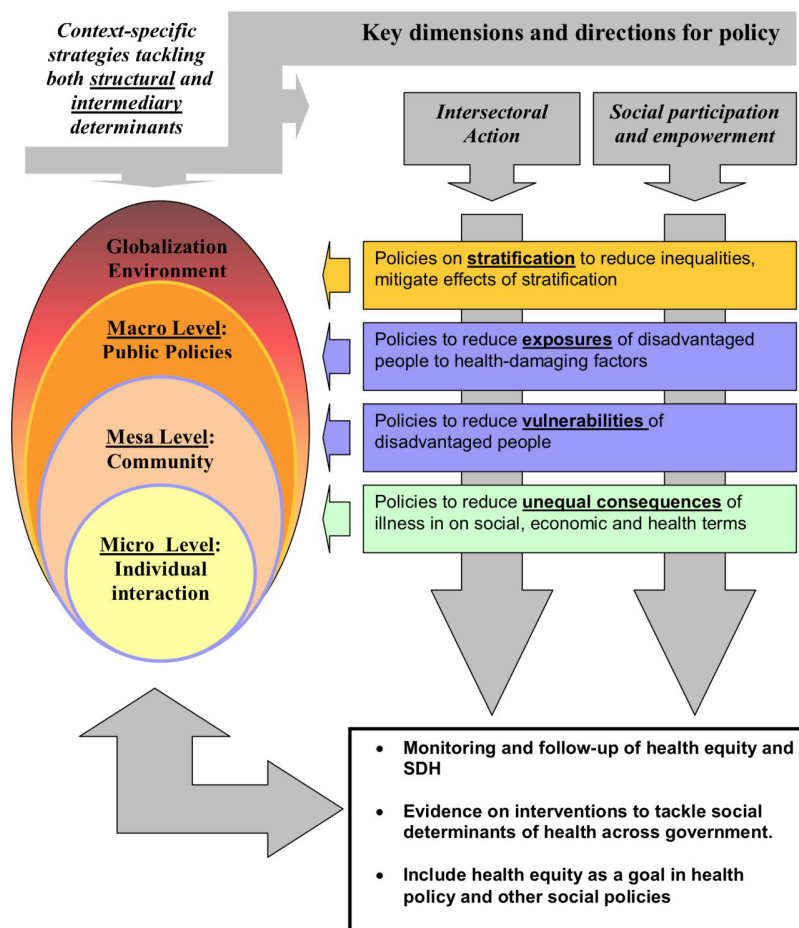
Figura 1 - Determinantes Sociais de inequidade em saúde.

This model has the advantage of graphically articulating various theories on social inequalities in health, including, in a rather large figure, the structural determinants and intermediary or mediating determinants of these inequalities, highlighting the economic, social, cultural, and political aspects involved in the processes of social production and reproduction. The model incorporates the different dimensions of social structure and stratification in addition to the health system itself.

In the same WHO document, the authors present a model for public policies, defining different approaches and levels of action aimed at modifying the social determinants

and reducing inequalities: policies aimed at modifying social stratification by acting on the macro social scale; policies for reducing vulnerability and decreasing exposure to risk through actions at an intermediate scale; and policies to reduce harmful consequences through actions on a micro social scale, i.e., directly in the health sector, can be identified.

In addition to the determination model and a model to distinguish different modalities of public policies with potential application for reducing social inequalities, it is important to consider the different approaches that have informed the development of health policies because these



Fonte/Source: WHO. Commission on Social Determinants of Health. A conceptual framework for action on the social determinants of health. Discussion paper. 2007.

Figure 2 - A framework of action for addressing social determinants of health inequalities.

Figura 2 - Modelo para ação no enfrentamento dos determinantes sociais das desigualdades em saúde.

approaches ultimately determine the design of intervention proposals and have an effect on the results.

Frolich and Potvin⁸ identified three different approaches to population-based interventions in health: the risk approach, the population approach, and the vulnerability-based approach. The risk approach was formalized in 1974 in the Lalonde Report and it is based on the idea that interventions should be focused on population groups at greater risk of disease or death. Thus, the risk approach enables a more rational use of normally scarce resources, which increases the cost-benefit ratio given that only those with a high probability of having a certain problem would be subject to interventions.⁸

This approach is the object of numerous criticisms, mainly because interventions are aimed at individual behavior modification, which leads to blaming the victim, a low ability to change the distribution of exposures, a small effect on the population dimension, and a low level of effectiveness, given that groups with greater exposure can rarely benefit from the interventions.⁸

Rose's population approach is based on the premise that most cases occur among individuals with an average level of exposure and that mass intervention, preferably independent of individual decisions, always results in greater effectiveness because by reaching everyone indiscriminately, mass intervention necessarily reaches those at greater risk.⁹

Criticisms of the population approach highlight the usually high costs of achieving coverage capable of changing the distribution of problems in the population versus the number of cases effectively avoided and the possibility of maintaining social inequalities because, for instance, the most vulnerable groups might not benefit due to limited access to the intervention.⁹

Given these limitations, some authors propose using the vulnerability-based approach as a complement to mass strategies precisely to avoid maintaining or deepening social inequalities. Vulnerable groups are

defined based on shared characteristics that constitute social disadvantages throughout their lives and a higher concentration of risk situations.⁸

Therefore, each public policy may employ different approaches, using particular strategies and different modalities depending on the social organization dimension they intend to change and focusing on the modification of specific social determinants.

The relationship between epidemiology and public policies can be analyzed from both sides of the equation: on one side, how and to what extent social policies influence the epidemiological profile and, on the other side, how epidemiology can participate in the development, implementation, and assessment of public policies.

The Impact of Public Policies on Epidemiological Profile

One of the main concerns regarding the effect of social determinants on public health is the promotion of inter-sectoral policies that are concerned with both the impacts on health and reduction of social inequalities. This concern is often promoted by the slogan "Health in all policies."

Achieving this purpose, however, is not easy. Still, there are examples of public policies that produce results that positively affect epidemiological profiles, even though they were not developed with this in mind, precisely because they are able to modify some of the key social determinants involved in specific or nonspecific health problems.

The reduction of child malnutrition in Brazil over the last 15 years and the reduction in the unequal distribution of malnutrition among social strata can serve as an example of the impact of public policies on the epidemiological profile of the population, even if the effects on health were not at the center of the formulation of these policies.

A study conducted by Monteiro et al.¹⁰ analyzed data from four national surveys

between 1974 and 2007 and showed a significant reduction in malnutrition in Brazilian children under five years of age. In 1974-75, the prevalence was 37.1% (CI: 34.6-39.6) with a prevalence ratio between the first and fifth income quintiles equal to 4.9, indicating a 5-fold increase in the risk of malnutrition among poor children. The last survey, conducted in 2006-2007, found a prevalence of 7.1% (CI: 5.7-8.5) and a prevalence ratio of 2.6. Although the inequality between income strata persists, the difference has decreased by half, and the overall prevalence was reduced by more than 80% during the period.

Approximately 2/3 of the reduction in the prevalence of malnutrition between

1996 and 2006-2007 can be explained by four factors, all of which are subjects of public policies implemented during this period: increased maternal education, the increased purchasing power of families, the expansion of maternal and child care coverage, and increased water supply and sanitation.

The increase in the purchasing power of families is mainly related to three aspects of economic policy: the resumption of Brazilian economic growth as a whole; the policy of real (above the inflation accumulated in the period) systematic increases in minimum wages; and income transfer programs, such as the Family Allowance (*Bolsa Família*) and the Continued Social

Survey	Prevalence (95% CI)	PR (Q1/Q5)
1974-1975	37.1 (34.6-39.6)	4.9
1989	19.9 (17.8-21.9)	7.7
1996	13.5 (12.1-14.8)	6.3
2006-2007	7.1 (5.7-8.5)	2.6

Source/Fonte: Adapted from Monteiro CA, Benicio MHA, Conde WL, Konno S, Lovadino AL, Barros AJD, Victora CG. Narrowing socioeconomic inequality in child stunting: the Brazilian experience, 1974-2007. Bull WHO 2010; 88:305-311 / *Adaptado de Monteiro CA, Benicio MHA, Conde WL, Konno S, Lovadino AL, Barros AJD, Victora CG, Narrowing socioeconomic inequality in child stunting: the Brazilian experience, 1974-2007, Bull WHO 2010; 88:305-311.*

Figure 3 - The prevalence of malnutrition in children under 5 years of age and the prevalence ratio (PR) between the first and fifth income quintiles in four national surveys on health and nutrition in Brazil.

Figura 3 - Prevalência de desnutrição em crianças menores de 5 anos e razão de prevalência entre o primeiro e o quinto quintil de renda em quatro inquéritos nacionais de saúde e nutrição, Brasil.

Indicator	1996		2006-207	
	Poor (Q1)	Rich (Q5)	Poor (Q1)	Rich (Q5)
Maternal education > 8 years	5.6	73.5	29.4	92.5
4 or more prenatal care appointments	37.5	93.7	80.0	97.7
Household with public water supply	39.9	80.9	65.3	89.2
Household with public sewage system	2.4	60.0	22.5	69.2
Order of birth < 5	69.5	98.4	91.3	99.7
Birth interval > 24 months	69.2	91.3	82.5	93.5
Use of birth control	51.1	79.6	93.9	93.7

Source/Fonte: Adapted from Monteiro CA, Benicio MHA, Conde WL, Konno S, Lovadino AL, Barros AJD, Victora CG. Narrowing socioeconomic inequality in child stunting: the Brazilian experience, 1974-2007. Bull WHO 2010; 88:305-311 / *Adaptado de Monteiro CA, Benicio MHA, Conde WL, Konno S, Lovadino AL, Barros AJD, Victora CG, Narrowing socioeconomic inequality in child stunting: the Brazilian experience, 1974-2007, Bull WHO 2010; 88:305-311.*

Figure 4 - Maternal education, prenatal care, water supply and sanitation, and indicators of reproductive health according to income quintiles, Brazil, 1996-2007.

Figura 4 - Escolaridade materna, assistência pré-natal, rede de água e esgoto, indicadores de saúde reprodutiva segundo quintis de renda, Brasil, 1996-2007.

Security Benefits (*Benefícios Previdenciários Continuados*) programs.

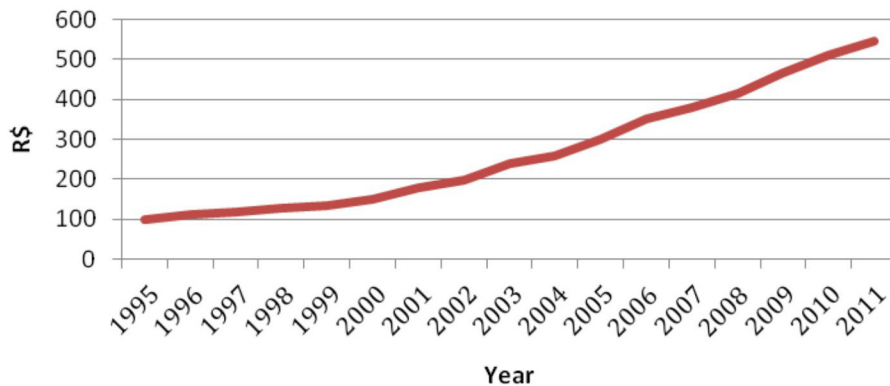
Figure 5 shows the curve for the evolution of the minimum wage since 1995. The values increased throughout the period, although the increase was accelerated after 2000. Then, after 2003, the values were consistently readjusted above the inflation recorded over the previous 12 months, which represented real gains and helped in the process of income redistribution.

Figure 6 shows the curve of the Gini index for the same period. Values were stable until 1999 and there has been a decrease since 2000. This value is still relatively high, demonstrating the inequality of income distribution in Brazil. However, several initiatives of economic policy have contributed

to alleviating this situation, at least in part, in the last decade.

The Family Allowance program was created in 2004 by merging four income-transfer programs created after 2001. The program was greatly expanded after 2004 and is currently implemented in all Brazilian cities, reaching approximately 11 million families and benefiting 46 million people.¹¹

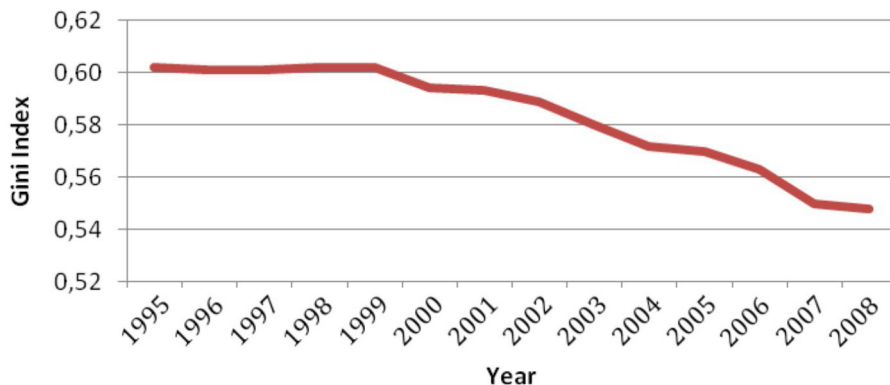
Santos et al.¹² assessed a number of the program impacts, emphasizing its contribution to the reduction of the Gini index, the increase in household expenditures on food, the reduction of the proportion of families experiencing food insecurity, the reduction in school dropout rates, and decreases in child labor. No significant differences were noted with regard to vaccination coverage,



Source/Fonte: Paraná Institute of Economic and Social Development / Instituto Paranaense de Desenvolvimento Econômico e Social - IPARDES

Figure 5 - The evolution of the minimum wage in Brazil, 1995-2011.

Figura 5 - Evolução do salário mínimo no Brasil, 1995-2011.



Source/Fonte: IPARDES

Figure 6 - The Evolution of the Gini Index, Brazil, 1995-2008.

Figura 6 - Evolução do Índice Gini, Brasil, 1995-2008.

most likely because the rates are usually high, even among the poorest families.

The main direct effect on health was the reduction in the risk of malnutrition in children of assisted families. These children were 26% more likely to present with age-appropriate height and weight.¹¹

The program was developed as part of a strategy for reducing hunger and poverty in the country and included among its indicators the monitoring of school attendance and the use of health services. However, the impact on child malnutrition was mainly the result of the increase in the purchasing power of families in situations of poverty.

Three Strategic Themes

Although epidemiology contributes to virtually all public health policies, three issues serve as public health commitments upon which all disciplines and knowledge in the field of public health should converge: the reduction of social inequalities in health, the promotion of health, and the state regulation of goods and services with health-related consequences.

The contribution of epidemiology to the control of diseases and health problems, in addition to the planning and organization of health services, remains important. However, because these roles of epidemiology constitute traditional tasks of the field, they will not be a subject of this reflection.

Pellegrini¹³ suggests that policies addressing social inequalities in health should be supported by three pillars: scientific knowledge to analyze the means of production of inequalities and to demonstrate the effectiveness of interventions aimed at modifying these processes, inter-sectoral coordination because the determinants are mostly outside the health sector, and broad social participation in the sense of involving the population in the search for solutions to their own problems.

However, Pellegrini himself notes the numerous difficulties in the development of policies for reducing social inequalities, highlighting the complexity of the social

processes involved in determining health and disease and the patterns of inequality present in different populations; the paucity of studies on the effectiveness of policies and the complexity of interventions that constitute a public policy; the scarce documentation of the effects and mechanisms of action of macro social policies, the mandatory adjustment of policies to needs, and local capacities and priorities; the low possibility of transferring experience among different populations; and the political interests of the various social actors.

Health promotion policies should also focus on the social determinants of the health-disease process. The transformation of situations that produce disease, as in the approach to reducing social inequalities, depends on the understanding of the processes involved with the different dimensions of social organization. Many of the initiatives of health promotion, especially those based exclusively on health education programs, show little effectiveness because the intervention is aimed at individuals, seeking to change behavior without changing the processes or conditions that contribute to those behaviors.

Removing the focus from the individual and seeking to understand the complexity of the associations among the different dimensions of social life is essential for the development, implementation, and assessment of health-promotion policies.

Barreto³ also emphasizes the need to develop alternatives for promotion and prevention that have a high potential for population impact and that are technically feasible, effective for one or more health problems, socially and individually acceptable, and politically feasible.

Regulatory activities are particularly subject to all types of economic, political, social, and cultural pressures because they are mainly exerted through legislative tools with broad ranges and implications for several sectors of social life. In a democratic system based on the respect for human rights, regulatory policies that usually include interventions that infringe upon or restrict

individual freedoms must necessarily be based on specific legislation that can ensure the context of the inviolability of rights and the implementation of state power.¹⁴

The role of epidemiology is important in both determining the nexus and causal mechanisms underlying the proposed intervention and assessing the impacts achieved. Technologies typical of epidemiological practices, such as surveillance and monitoring, can be useful in the implementation of these actions.

The Contribution of Epidemiology to the Development, Implementation, and Assessment of Public Health Policies

As noted by Souza and Contandriopoulos,¹⁵ “the idea that the use of scientific knowledge is a recommended practice for decision makers” is based on the assumption that policies formulated based on rational knowledge will be more effective and efficient. However, this is not an easily achievable task.

Different studies on the relationships between researchers and policy makers have identified numerous problems common to scientists: political naivete; little knowledge of the political process itself; unrealistic expectations of what the knowledge produced can achieve; mismatches between the time taken for knowledge production and the needs of practical action; formats used in the dissemination of scientific results that are not user friendly; and the lack of clearly defined practical implications, such as costs and expected impacts, among others.¹⁶

Moreover, from the researchers’ perspective, the use of their results seems more likely when the knowledge produced refers to unique risks that can be managed through simple interventions, when such use is desirable, when the evidence is observed as part of a larger puzzle in which each part can contribute to the overall picture, and when there is a close relationship between researchers and policy makers.¹⁷

However, there is a similarity between

the work cycles of policy makers and researchers, which can favor this type of close interaction. The cycle of scientific research can be simplified into four stages: the construction of a scientifically relevant problem, the formulation of a research project, the execution of a research study, and the evaluation and interpretation of the results.¹⁸

The work cycle of policymaking is similar, although with different parameters. In this case, the stages are the identification of socially relevant problems, policy formulation, implementation, and evaluation.¹⁸

Epidemiology can contribute to the stage of identifying socially relevant problems through the study of the distribution of health problems and their determinants in various social groups, providing technical information to support political decisions in both social movements and at the governmental level and contributing to other types of information to be considered in the decision-making process.

In the policymaking stage, the epidemiological knowledge of the mechanisms involved in the development of health problems and the effectiveness or efficiency of intervention tools in combination with information obtained from other sciences in the field of public health and other fields can help policy makers understand the complexity of the problem and its context, set goals, and select interventions.

In the implementation stage, epidemiology can contribute to follow-up through various technologies, such as epidemiological surveillance and monitoring.

Finally, in the evaluation process, epidemiological knowledge can be especially useful in the analysis of expected and achieved impacts. Santos and Victora¹⁹ draw attention to a series of events and stages that are interposed between the proposal of certain interventions or health policies and the evaluation of their effects or impacts on the population’s epidemiological profile. Clearly, for a change in the impact and epidemiological profile to occur, it is imperative that the implemented policy effect meaningful change. However, many

factors can be changed by processes unrelated to policy implementation, which can also modify the epidemiological profile and make it particularly difficult to assess performance.

Given these difficulties, the evaluation of public health policies can assume three distinct modalities: adequacy assessment, in which one seeks to demonstrate the achievement of certain goals and aims, assuming the effective action of the evaluated policy; plausibility assessment, in which attention is given to the demonstration that goals were achieved by the evaluated program or policy; and likelihood assessment, in which one seeks to estimate the statistical probability that the program or policy was actually effective.

Each of these steps presents particular challenges for the work and contribution of epidemiologists. Starting with the idea that “what gets measured gets performed,” the establishment of priorities for action usually involves the answer to four practical questions: Is there a problem? Do we know how to solve it? How much will it cost? Will the expected impact be achieved?²⁰

Traditionally, the contribution of epidemiology to answering the first question presents no major difficulty because there are conceptual and pragmatic tools to identify health problems relevant to different population groups and identify their distribution patterns, inequalities, temporal trends, magnitude, and other characteristics.

The epidemiological contribution to answering the second question, i.e., whether researchers know how to solve the problems identified, can be divided into two major areas: the knowledge of the processes of health and disease production and the evaluation of the effectiveness and efficiency of the intervention tools available. Although a large proportion of current epidemiological research is directed at the production of knowledge in both areas, and epidemiological methodology is also useful in both cases, much controversy remains on the soundness of the knowledge produced, given the

observational nature of epidemiological studies, and on the objectivity and neutrality in the evaluation processes of both risks and regulatory measures.

Boffetta et al.²¹ revived the controversy over the results of epidemiological studies when discussing false-positive results in cancer research. The authors attribute the existence of the numerous findings that are soon discredited and replaced by new findings to a tendency for “over-interpretation” and a lack of skepticism from researchers when faced with associations observed in studies conducted with small samples, a multiplicity of comparisons, no clearly formulated initial hypotheses, deficiencies in the adjustment of confounding variables, and missing or inconsistent dose-response relationships. According to the authors, premature conclusions can be avoided by cautious interpretations and great methodological care when conducting the study. Resorting to a greater critical sense and skepticism toward findings can help alleviate the problem.

Prominent members of the International Epidemiological Association²² defended the discipline, describing, among other things, the enormous contribution of epidemiological knowledge to the advances in public health. According to these members, one of the great advantages of epidemiology is that it is an applied science, i.e., it is based on real-world conditions. As one type of knowledge available for policy makers, the information produced will be subject to scrutiny and deliberation, which normally seeks to balance the consequences of both false-positive and false-negative results.²²

The controversy on the role of epidemiology is particularly important for extrapolating conceptual guidelines and developing clear implications for regulatory activity. In this sense, Blair et al. refer to the statement made by Sir Bradford Hill to support their point of view:

“in asking for very strong evidence I would, however, repeat emphatically that this does not imply crossing every ‘t’, and

swords with every critic, before we act. ... All scientific work is incomplete—whether it be observational or experimental. All scientific work is liable to be upset or modified by advancing knowledge. That does not confer upon us a freedom to ignore the knowledge we already have, or to postpone the action that it appears to demand at a given time” (p. 1812).²²

The second important aspect, particularly at the stage of formulating regulatory policies, concerns the procedures for evaluating the effects of certain risk factors on health, which are the object of the intended regulation. Many of the problems currently identified in the epidemiological profiles of populations are related to products produced by large corporations; therefore, confronting these problems involves numerous interests and mechanisms of explicit and implicit political pressure.

The methodologies available for assessing the effects of different products on health have been viewed as being capable of introducing greater rationality to the policymaking process. However, access to the internal documents of large corporations in the cigarette-manufacturing sector shows that the process may favor the interests of these actors against the objectives of health preservation.²³

According to Smith et al.,²³ the influence of corporations occurs through four mechanisms: cost-benefit analysis, where it is easier to predict the economic impact on the productive sector than the diffuse costs of potential benefits arising from the regulation; the information necessary to the regulatory process provided by the industries themselves; the monetization of benefits; and delaying maneuvers based on the questioning of available evidence.

As a consequence of political actions against large corporations, regulatory policies often cease to be based on the precautionary principle. Increasingly, the burden of proof lies on the regulatory agencies, and economic interests are usually imposed over social or environmental needs.²³

Tickner⁴, while analyzing the regulatory actions regarding the establishment of safety limits for chemical hazards, noted the inadequacy of the predominant focus of the regulatory agencies. Chemical products, such as other contaminants, are viewed as safe until their harmful effects on the environment and human health can be proven. In the process of establishing a causal nexus, industries work to increase uncertainty, questioning the available information and prolonging and delaying the deliberation process. From the perspective of public health and using the principle of precaution, it would be more productive to seek safe alternatives to the chemical products presenting plausible cause for concern. Over time, social mobilization can often be seen to be more effective and quicker in establishing restrictions than governmental policies.

Despite the abovementioned restrictions and difficulties, health policies are essential tools for action in public health, whether they are directed toward the promotion of healthy behaviors or toward the regulation of the production and marketing of unhealthy products, and epidemiological knowledge is an important component of the process.

Finally, at the stage of impact evaluation, and in addition to the usual indicators of impact analysis, epidemiology can contribute to the improvement and application of new methodologies, such as the development of scenarios that help the decision-making process by projecting the possible consequences of adopting different courses of action.

The ability to model complex scenarios has developed rapidly, providing increasingly reliable and valid projections. These models can be used to inform the political debate between alternatives, support community or governmental advocacy, and analyze the impacts of implementing programs or policies.²⁴

The construction of a scenario requires a large amount of data, in addition to the appropriate models for determining

health and disease processes and their interactions. The first step is to populate the model with current data and calibrate it to ensure consistent results. The second step is to create a reference scenario that projects the maintenance of current conditions in the absence of any intervention to serve as comparison. Finally, the third step is to generate several scenarios to inform the decision that can be easily communicated to managers, though with relevant content.²⁴ These scenarios may be used to assess the impacts of a program or policy by comparing the observed data with the expected data, i.e., those generated by the models.

Some Examples of the Role of Epidemiology in Public Policies for Health Promotion

Alcohol and tobacco consumption are currently two of the main consumed goods that pose a risk to human health. The examples that will be analyzed refer to policies focused on the control of exposure to these two substances in which the contribution of epidemiology was highlighted.

Alcohol

Motivated by the high number of fatal accidents involving drivers of transportation companies, the United States Congress passed a law in 1991 that made alcohol testing mandatory for transportation employees. The program included pre-employment testing, random testing after admission, testing in situations of reasonable suspicion of alcohol consumption, and post-accident testing. Drivers presenting alcohol levels above 0.04 g/dl in any of these tests would be immediately suspended. The law clearly generated much controversy, with strong opposition from the unions and entrepreneurs regarding the lack of evidence on the benefits for traffic safety.²⁵

The trend analysis of fatal accidents according to drivers of private or commercial transportation and blood alcohol level made between 1982 and 2006 (the period before

and after the law was approved) showed an 80% reduction in the number of drunk drivers from transportation companies who were involved in fatal crashes compared to a 41% reduction for the remaining drivers. The epidemiological analysis showed that approximately 23% of the reduction in overall fatal crashes and 48% of the reduction in accidents involving commercial drivers could be attributed to the mandatory testing policy.²⁵

Paschall et al.²⁶ developed an index to classify countries according to their policies for controlling alcohol consumption and analyzed its correlation with the prevalence of adolescents' alcohol consumption over the past 30 days, heavy or "binge" drinking, and the onset of alcohol consumption before 13 years of age.

The Alcohol Policy Index was constructed using information related to five domains: availability (e.g., age restriction for purchasing, hours of sale,), context (e.g., training of servers, public view on consumption), price, advertising (advertising restrictions), and control measures aimed at drinking and the driving of motor vehicles.²⁶

The study showed an inverse correlation ($r = -0.57$) between the index and per capita consumption in the 30 countries under assessment. Each 10-point increase in the index corresponded to a 1-liter reduction in consumption per capita. The prevalence of alcohol consumption among young people and the frequency of consumption over the past month were significantly associated with their country's Alcohol Policy Index.²⁶

In both examples presented above, epidemiological studies were important for problem identification, policy formulation, and the evaluation of the results.

Tobacco

Various strategies have been used to reduce tobacco consumption and the number of people that initiate the habit, restrict tobacco consumption of smokers, and encourage smokers to quit this habit.

Among these strategies are initiatives for establishing smoke-free areas in work environments and public spaces, educational campaigns in the media, increased unit pricing, restricted advertising, and warnings on the packages, among others.²⁷

The impact analyses of these initiatives suggest that approaches that are more comprehensive, i.e. those based on a combination of several strategies, appear to have greater effectiveness than isolated actions.²⁸

The California tobacco control program, for instance, includes media campaigns, school-based prevention, programs for the cessation of tobacco use in health services, community programs, the education of health professionals, advertising restrictions, smoke-free environment laws, and taxation. Levy et al.²⁸ developed a simulation model to analyze four components of this policy: taxation, smoke-free environment laws, media campaigns, and youth access restriction.

The model included data from 1988 and compared the prediction made for 2004 with the observed data. The reference model, which was built with the projection in the absence of interventions, indicated a 24% reduction in the number of smokers in 2004. In the presence of the policy, the model predicted a 41% reduction; the observed reduction was 49%. Most of the reduction (59%) could be attributed to taxation. An increase of US\$ 1.00 in the price produces a 5% reduction in the number of smokers. Media campaigns were responsible for 28% of the estimated reduction, and the

smoke-free environment law was responsible for 11%. The smallest impact was observed for the restriction of youth access to cigarettes (2%).²⁸

Final Considerations

This paper aimed to reflect on the role epidemiology plays in crafting public health policies or other social policies reaffirming the political and social commitment of this scientific discipline and recognizing the need to articulate epidemiological knowledge alongside other knowledge to improve public health and, consequently, quality of life.

By recalling Juan Samaja²⁹, one can find inspiration in the intellectual work of Milton Santos, highlighting the potential role of the knowledge produced to make the present “a less painful and more promising gift for real men” (p. 106).

After all, along with James Marks,⁵ one might ask oneself, “what do people really seek when they aspire to a healthier life?” Marks believes that what people really want is a satisfying and meaningful life in which they are able to do the things they value and enjoy what gives them pleasure.

Our task seems to be to reconcile this desire for a full, satisfactory, and pleasurable life with a maximum of health and a minimum of injustice. This task is quite a challenge, one that will require all of one's energy and ability combined with a strong political commitment.

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Recebido em: 25/11/11
Versão final apresentada em: 02/02/12
Aprovado em: 23/05/12