

Why Critical Epidemiology?: Daring Ethical Science in an Unhealthy Civilization



Critical Epidemiology and the People's Health

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Chapter:

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Planetary Life Hanging by a Thread: Acceleration of an Unjust and Injurious System

The exponential growth of a discriminatory, rapacious, and oligopolistic market economy in the 21st century is nurtured and reproduced by an unhealthy civilization and its predominant modes of living.

Neoliberal economics, with its absolute belief in the uniquely efficient role of competition in productive optimization and of the market as the optimal distributor and unassailable mechanism of progress, was imposed beginning in the late 1980s. Disregarding a fair distribution of wealth, and dismantling social controls over corporations and the regulatory role of the state over large companies, this aggressive greediness implied the terminal divorce of capitalism from democracy.

Why Critical Epidemiology?: Daring Ethical Science in an Unhealthy Civilization

At that time, Fukuyama (1989) convinced many people, in the name of neoliberalism, that through capitalism modern civilization had reached the highest peak of development and brought about the end of socio-economic history. However, in the face of the recent global social upheaval and wave of protests, and studies that consistently dismiss Fukuyama's radically biased appraisal, it has been demonstrated that the real symbol of the 21st century is no longer the acceptance of the eternal presence of this highly rapacious economic system but, rather, a growing rejection of extreme inequity and the threat of disappearance (Garcés, 2019).

It is necessary to recognize that some important contradictory nuances have surfaced that add new complexities to the problem. Events such as the recent political upheaval in Brazil and Bolivia and the Ecuadorian and Chilean protests offer new ingredients for our analysis. The growth of social awareness is not monolithic and uniform. The "successful" reforms of progressive governments and even the proclaimed "successes" of right wing neoliberal administrations both point not only to objective institutional and social supposed transformations but also to subjective, cultural, and everyday commonsense structures (Arístegui, 2019). Coming from utterly different social formations, these represent opposing trends that yield vital clues for a deeper understanding of the people's ideology in our contemporary inequitable world.

Denouncing inequality by force of facts has ceased to be a matter for progressive leaders and conscientious investigators and has become the public assertion of conscious grassroots citizens. Beyond the efforts that the powerful have made to hide this growing injustice, the truth is that the people have finally seen what was in plain sight but was not seen due to the game of seductions and backstage bonanzas that had been used to sell them the promise of endless consumerism. And by looking with their own eyes at the reliable materiality of an exponential growth of inequality, whose lethal rhythm is only matched by the astonishing speed of an obscene accumulation of wealth, they are realizing that private capital is "devouring our future" (Piketty, 2015). That significantly reduces collective health improvement opportunities to zero.

The uncontained escalation of multinational corporations is only paralleled by the expanding reduction of spaces for wellness and life. The demolition of social, health, and environmental rights has become a blind pursuit and the principal strategy of big business expansion. This trend is not only present and severely affecting vast numbers of vulnerable communities in the Global South but also impacts many subaltern collectivities of the affluent North.

Present capital accumulation benefits only a minuscule entrepreneurial group. It revolves around the convergence of productivist uses of the technology of the fourth industrial revolution (Ribeiro, 2016); the unfair and fraudulent dispossession of strategic resources in their most varied forms (Harvey, 2003); and even the opportunistic exploitation of

Why Critical Epidemiology?: Daring Ethical Science in an Unhealthy Civilization

conditions of extreme despair, shock, and social anxiety (Klein, 2007). New and aggressive dimensions of technology, hypermedia, and cyberspace also make possible the frenetic expansion of the postmodern consumerist civilization.

The system's striking traditional disparities have widened: The rich to poor income ratio, a universal indicator of inequity, has reached a spine-chilling 1:99% (Open Markets Institute, 2018); research attests to the desperate global migration of the most vulnerable poor, in contrast to the territorial stability of the rich [United Nations (UN), 2017a]; and reports show that small economies are paying a high price, and there is a worldwide violation of the rights of nature due to mega-mining (EJAtlas, 2017) and agribusiness (Cotula, Anseeuw, & Baldinelli, 2019). An unprecedented number of scientific alarm signals related to climate warming populate books and articles, while powerful leaders give resonance to the cynical discourse of climate deniers. In addition, universal violation and commodification of our private lives are made invisible by the expansion of noncritical customers of the networks (Alvaredo, Chancel, Piketty, Saez, & Zucman, 2018; Fry & Taylor, 2018).

The persistent argument of big business is to equate the extreme profit search with progress and the common good. But the saying, "The road to hell is paved with good intentions" has now acquired colossal importance. The prognosticated global trends of economic inequality cast even bigger shadows over the future distribution of wealth. In the view of well-informed analysts, the expanding gap [recapitalization (r) > growth (g): private capital rent > income, production] that existed throughout the 20th century is becoming even greater in the 21st century. According to long trend data, this will be most destabilizing, as the relationship $r > g$ implies that in each new cycle, recapitalization of the past assets is faster than the rate of growth of production and wages.

We witness the historic progress of planetary technology and yet, at the same time, the decomposition of real conditions for social reproduction has reached its greatest level (Arizmendi, 2007). This unabashed recognition of the resounding failure of a civilization in a time of amazing technological potentialities is not only the foremost paradox of the 21st century but also, with regard to health, the principal menace we must face to protect and promote health and natural life.

But to support this finding, it must be understood that the material mechanisms of this unbounded destructiveness and extremely inequitable and unhealthy world system are far from self-sustaining. They are clearly supported in a set of political, cultural, and communicative mechanisms to discipline collectivities and alienate them from their strategic needs. Two types of mechanisms uphold such alienation: renewed cultural hegemony and digitally based cyber subsumption of collective behavior.

Why Critical Epidemiology?: Daring Ethical Science in an Unhealthy Civilization

The previously submerged and now evident “philosophical war,” intended to weaken intercultural relations and install racial/cultural supremacy, is on the run, as has been brilliantly explained by Enrique Dussel, one of Latin America’s most lucid contemporary thinkers (Arístegui, 2019). Taking as an example Bolivia’s and Brazil’s recent political ideological swings, he outlined how a conservative and fundamentalist version of ultra-conservative religious ideology has operated during the past few decades as an instrument of fundamentalist indoctrination. Its aim has been to adapt poor people, through their common sense and profound subjectivity, to the role of functional consumers and defenders of the neoliberal mode of living. The concept of a “new Christ,” an “inverse Christianity,” not of the poor but of the wealthy, has proliferated through patient grassroots brainwashing. It is a reverse Christianity that disregards or demonizes the ideas of native indigenous peoples and poor communities, seeking to impose the individualist ethos of private wealth building and pragmatic personal success, as modern, superior forms that surpass a supposedly backward communitarianism. This philosophical reversal begins as a means to discredit the sociopolitical ideas of solidarity, equity, and fairness found in Andean or Mezzo American indigenous communities, and it goes on to dismantle a set of ideas and values that make up the powerful heuristic and taxonomies that underlie their sophisticated ecosophical system that protects Nature and places collective rights over individual business.

As explained later, cyber subsumption of collective behavior is impelled and expanded by means of global digital platforms.

Our reflections on social, health, and environmental rights, our contemporary epidemiological notions, can therefore only acquire consistency if we construct them on the body of knowledge and historical experience that criticizes this accelerated entrepreneurial profit building sustained by extremist socially visible or invisible cultural-communicative mechanisms. In order to be imposed, justified, and tolerated, this insatiable accumulation of private wealth with its profit scheme needs to function by means of a combination of force, mass seduction, and a false truth replication apparatus and the violation of all ethical codes, social pacts, and environment agreements. These processes are producing unforeseen massive blows to wellness, collective health conditions, and the environment.

Capital Acceleration 4.0 and Neo-extractivism: Apocalypses or Alert for Transformative Action



To advance its economic apparatus and apply its anthropocentric philosophy, corporations have positioned *extractivism*¹ as the material support of economic expansion (Acosta, 2013). This represents an essential component of an economic system that has endangered the present and future life on Earth due to its extravagant energetic matrix,

Why Critical Epidemiology?: Daring Ethical Science in an Unhealthy Civilization

its wasteful logic, its destructive applications of technology, and its multiplication of inequitable relations.

In the past, extractivism was mainly concentrated on aggressive mechanisms for global control of exportable nonrenewable goods production (i.e., metal mining and oil and agricultural products). Capital accumulation demands highly specialized and continuous large-scale production processes. And in the case of the enormous territories of agricultural extractivism, it involves control over vast territories, water and seeds, and, more recently, genetic resources and artificial biology. For many years, land grabbing was the principal mechanism for installing profitable low-cost production processes through immense, monotonous one-crop landscapes. It became the key path to territorial control. The history of neocolonialism shows that it is based on land grabbing. In the case of Liberia, for example, the arrival of the Firestone Rubber Company at the beginning of the 20th century initiated the violent transition from a family-based agrarian economy to an entrepreneurial export economy. The company took possession of approximately half a million hectares for 99 years, at 6 cents for every 0.40 hectares. The story of how 20,000 indigenous people living in this area were forced to work on the Firestone plantations is painful evidence of the negative effects of agro-industrial greed (Hancock, 2017). Large companies have been striving to take possession of immense and ever-growing territories, either by global land purchase transactions (Nolte, Chamberlain, & Giger, 2016) or by leasing (Hahn, 2012). Throughout the world, this type of extreme rapacity has changed little in recent times.

In geographical terms, land use maps of the region show the decrease of biosphere reserves, the expansion of oil exploration blocks and mega-mining concessions in protected areas, as well as the impacts on agricultural areas resulting from the implantation of agro-industrial and mining enclaves.

From that insensitive, shortsighted, and opportunistic perspective, biodiverse multiple crop territories are viewed as economically inefficient. According to that paradoxical reasoning, “what is important for a sustainable planet is an obstacle to efficient extraction” and “biodiversity amounts to bad corporate business” (Bartra, 2006). The problem is that exponential growth of that type of agribusiness is an attack on all human rights. The problem is out of control, to the point that the UN Special Rapporteur on the right to food straightforwardly declared in relation to pesticide application (UN, 2017b)—one of the lethal elements—that

pesticides impose substantial costs on Governments and have catastrophic impacts on the environment, human health and society as a whole, implicating a number of human rights and putting certain groups at elevated risk of rights abuses. . . . Harm to the ecosystem presents a considerable challenge. This challenge has

Why Critical Epidemiology?: Daring Ethical Science in an Unhealthy Civilization

been exacerbated by a systematic denial, fuelled by the pesticide manufacturers and agro-industries. (p. 4)

The logic of mega-extraction is oriented toward whatever operations prove most profitable. In recent times, the decline of oil prices and the global recognition of environmental contamination caused by fossil fuels have placed great pressure on the current oil-based production and energy system. The current global mining extractivist boom likely owes its impetus to this crisis. Open-pit mining concessions are soaring, and countries are paying a high price for the global mineral boom, especially those of the Global South (Siegel, 2013). To accompany its global boom, mega-mining has also incorporated risky high-tech procedures (Vidal & Guest, 2015). The entrepreneurial argument is that “the internet of things, robotics and plasma are transforming mining into a safer and more productive industry” (Mining Technology, 2014).

However, in the past few years, extraction has expanded to encompass new productive technologies that accelerate capital accumulation, reduce production costs, and allow the production of an entirely new set of high-demand commodities. To do so, capitalism’s fourth industrial revolution has led to an explosive convergence of new technologies. An array of applications in robotics, nanotechnology, biotechnology, big data operations, hypermedia, and artificial intelligence constitute a powerful industrial arsenal (Ribeiro, 2016).

In addition to the better known applications of nano-technology, genetic engineering, and informatics in fields such as medicine and agriculture, the newer and less studied operation of digital global platforms, which extract people’s data and turn mega personal databases into extremely lucrative merchandise, is a new flourishing type of extractivism (Subirats, 2019). Such is the importance of cyber production that in the world’s largest economy, two firms own 97% of the market share of search engines: Alphabet (91%) and Microsoft (6%) (Open Markets Institute, 2018). As in the rest of the world, in Latin America huge corporate digital platforms extract the personal data of millions of computer and smartphone users (e.g., Facebook, Instagram, and Twitter), or data are obtained through the instantaneous connection of millions of consumers by service providers that operate through apps (e.g., Uber Eats, Seamless, and Door Dash). For instance, shared mobility in Latin America is the second fastest growing mobile market: In 2018, revenue generated by ride-hailing apps in the region was \$518 million, and it is expected to increase to more than \$1 billion by 2023. Uber entered the Latin American car-share market in 2013 and, according to its records, currently has more than 36 million active users (Phillips, 2018).

If we put aside for a moment the circumstantial individual practical benefits of those platforms and enquire about the massive negative socio-epidemiological implications of their current wide-scale operations, we come to understand the contradictory role of cybernetic processes in the social determination of our modes of living, the workplace, and our rights

Why Critical Epidemiology?: Daring Ethical Science in an Unhealthy Civilization

and health. In my keynote speech to the 9th Brazilian Congress of Epidemiology (held at the Federal University of Espírito Santo in 2014) published in the *Brazilian Journal of Epidemiology* (Breilh, 2015b), I stated,

The new digital technological revolution, about which some frightening prognoses are made for the next decades, could easily imply the advent of an era of radical subsumption of life processes. This will negatively affect not only our general way of living, thinking and planning, but also our deepest daily intimacy. This movement implies radical effects on health that we call cybernetic determination and subsumption. This novel process raises new questions on public health and prevention; but also requires a new reading of reality, a rethinking of human life and health, of its social determination, which implies the need for new categories and analysis and renewed challenges for critical epidemiology. (p. 945)

A range of health-related processes have emerged within the cyber domain in this new epoch. An illustrative problem is the unprecedented impact of cyber production on work, labor, and health rights. In the case of ride-hailing services such as Uber, Cabify, and others, the transnational firms control the performance and locations of their supposedly “self-employed” drivers through maximum monitoring algorithms. On the basis of their power to substitute drivers immediately and unilaterally, in most countries these virtual workers operate at their own risk, without contract or labor rights. Labor inequity is the rule given that the companies assign workers different salaries according to seasonal conditions. Asymmetries of power, biased access to information, and “hidden” unsafe working conditions are the governing rule. The companies’ gigantic digital platform algorithms allow them to connect providers and demanding citizens as an intermediary; the companies do not need to own the products that are sold, the instruments, or the vehicles. Nor are the employees under contract with the companies; they are “autonomous entrepreneurs,” but in reality they are not “self-employed” workers because they are tightly regulated in the intensely monitored and generally risky labor operations the companies control.

In the past few decades, a dark episode of health-related scientific fraud—that has immense public health consequences—occurred in the field of genetic engineering; this episode helps us understand the consequences of corporate pressure on science—pressure that endangers human and natural health. The plainly depicted and widely documented case of false evaluation and the consequent dismissal of the real risks of the genetic insertion of recombinant DNA (rDNA) in the *Escherichia coli* K12 bacteria triggered an alarm in the academic world about the dangerous effects of so-called *molecular politics*. Three closed-door national meetings held to evaluate the safety of genetically modified organisms (GMOs) (Bethesda, MD, in 1976; Falmouth, MA, in 1977; Ascot, UK, in 1978) and the Cohen report on the safety of rDNA (S. Wright, 1994) concealed important

Why Critical Epidemiology?: Daring Ethical Science in an Unhealthy Civilization

concerns and uncertainties about genetic modification that were circulating in the academic community, and it mistakenly concluded that there was enough consistent research on GMO safety (Druker, 2013).

In this emblematic case, a triple fraud has been suggested: (1) giving the impression that the insertion of a foreign gene into another organism was a natural process; (2) the generation of a belief that proteins codified by a foreign gene are adequately expressed; and (3) that this sort of experiment works well with all vegetable and animal genes, when in fact it only worked with non-inhibitory mitochondrial genes² (Druker, 2013). In the case of rDNA, not only were certain scientific procedures inadvertently altered behind closed doors, with the support of a public agency, but also essential genetic regulation mechanisms were intentionally altered.

The fact that in plants the genetic obstacles are even more complex, and gene insertion faces stronger physiologic defenses, encouraged different ways to penetrate plants' organic barriers and promote their genetic expression. The following are milestones in the development of genetically modified food: bacterial insertion of *Agrobacterium tumefaciens* that was able to misinform the plant in order to express its own genes (Latham, Wilson, & Steinbrecher, 2006; Reese, 2006, pp. 46–47); the development of promoters of genetic expression (e.g., 35s promoter), and particle bombardment or bio-ballistics that penetrates corn cells with foreign DNA (Kneen, 1999, p. 26). The search for valuable corn and soy crops in which to employ genetic enhancement was intense.

During this quest for improved productivity, unpredictable and uncontrolled results were amply documented in specialized literature. It demonstrates a flagrant sophism with regard to the boundless benefits of business-applied high tech. Along the way, scientific and legal rejection of the argument that genetic engineering innocuously replicates natural processes has proved that the “venture to genetically engineer our food has subverted science, corrupted governance and systematically deceived the public” (Druker, 2013, p. 60).

The panacea of technological manipulation of nature is applied for purposes of profit without sufficient experimental testing, in a manner that impedes both the application of the precautionary principle (Breilh, 2018a) and the democratic surveillance of its potential or actual risks. The same applies to climate engineering by means of the injection of aerosols in the stratosphere; the brightening of oceanic clouds to increase rainfall in agricultural territories (Straffon, 2018); or neuronal networks, machine learning, deep learning, as well as artificial biology, which are being developed by corporate researchers and “philosophers.” Contracted groups build algorithms for entrepreneurial applications of artificial intelligence in a diversity of disciplinary fields, such as economics and biology (Rodriguez-Beltrán, 2018). Automated decision-making systems embody socially determined political, ethnic, gender, and other preconceptions, which are contained on the huge data sets that

Why Critical Epidemiology?: Daring Ethical Science in an Unhealthy Civilization

serve for their “training.” This *algorithm bias* encompasses immense threats with respect to technological objectivity and neutrality (Naughton, 2019) and is becoming the accelerator of 21st-century racism and social exclusion. System 2 reasoning permits going beyond cognition linked to very concrete situations to understanding underlying structures at a very deep level. Giant database handling, at speeds that surpass human capabilities, has allowed for the placement of artificial simulation of natural neuronal and biological fluxes in artificial people and animals that can greatly exceed the cognitive and physical powers that nature has provided: “artificial creatures that—in suitable contexts—appear to be persons or animals” (Bringsjord & Govindarajulu, 2018).

The development of artificial life beyond the current natural reality, with its clear potential to change and challenge what we have recognized as human and natural life up to now, has resulted in some epistemologists, philosophers, ethicists, and anthropologists coining terms such as “posthumanism.” This represents a recent movement that can be viewed from different perspectives: criticizing classical humanism, condemning the anthropocentric perspective that commoditizes natural processes, or proposing to go beyond the protection of humans and recognize the need to defend all living beings against exponentially accelerated transformative processes. An extreme, desperate, outlook proposes the need to confront a so-called human demise in a terminal era of a supposed “end of humanity,” in which artificial creatures take over operations and decision-making in crucial areas of our cities, mines, and agro-industries (Ferrando, 2013). New technologies in the control of big business are inevitably leading humanity to a regressive revolution. Their marvelous potentialities are kidnapped and submitted to the logic of domination and profit.

The groundbreaking potential of artificial intelligence is also leading the system to what has been called the philosophical revolution of artificial life and intelligence. The dubious discourse of technologically based *singularity* forms part of the intellectual climate that is created around artificial intelligence. Singularity relates to the new immortal state that would be reached when artificial intelligence surpasses human intelligence. Mainly signifying the new capitalist nirvana of artificially designed people, technological convergence would make this possible, where nano- and biotechnologies are the hardware of the new artificial life, and informatics and cognitive technologies are its software (Cordeiro, 2019). Even discarding the veracity of these suppositions, the debate about a final “singularity” designed by the philosophers of big companies now forms part of the 21st-century episteme. Human standards for similarity based on a controlled pattern of traits would form part of an entrepreneurial utopia. It would aim to demolish the utopian democratic construction of a world of diversity. The current and future dispute over the control of technology will determine the fate of humanity and wellness.

Why Critical Epidemiology?: Daring Ethical Science in an Unhealthy Civilization

We must also be aware of what artificial life and intelligence, in the wrong hands, can do in the present not only to physical health and environmental conditions but also to the philosophical and material foundations of society. The distribution of high-tech research resources is intensely inequitable and is destined to expand already pronounced social and cultural gaps.

Finally, it is important not to lose sight of an apparent contradiction that has become a 21st-century paradox: an unleashed market monopoly combined with pre-capitalist agricultural relations to complete the extraction scheme. Big business' control of land, technology, and cheap labor has become even more profitable and competitive through unfair social and market relations and powerful lobbying. High-tech-based inequity combines with historic pre-capitalist overtly rapacious labor exploitation. Millions of "independent" small producers are submitted to disadvantageous production and market relations and policies or are invited to join the scheme as associated low-cost providers of certain subcomponents. Under these opportunistic mechanisms, the lower production costs of large high-tech estates entail prejudicial competition with small family farmers and present the additional benefit of differential rent for agribusiness (Bartra, 2008).

The resultant corollary of this vitiated structure that favors an unsustainable, plundering, and harmful agricultural system on the planet is that more than 1.5 billion peasant families and indigenous farmers, who together with 410 million gatherers in forests, jungles, and savannahs generate between 70% and 80% of the world's food (Rosset & Altieri, 2019), are forced to operate in extremely disadvantageous conditions. Rapacious businessmen, their political partners, and scientific henchmen such as climate deniers seem to underestimate that sooner or later all this irrationality will strike back and the historical pendulum will swing, as is demonstrated by the massive youth mobilizations in Europe and the people's anti-neoliberal protests in Chile and Ecuador.

The resounding voice of the International Peasants Movement (Via Campesina), a global movement that comprises more than 182 organizations in 81 countries with 200 million affiliates, is speaking for all of us when it denounces this "acceleration to disaster." The only viable and effective way to build a global movement for a clean and just food system and to put in place consistent health prevention and promotion strategies is to build a hands-on international platform to fully support the organizations and small family and cooperative medium-scale units that apply agro ecological, healthy, and sustainable farming (International Peasants Movement, 2008).

Cities also make up part of this troubled planet. The ecosystem and epidemiological setbacks are also urban. Here, we not only refer to deteriorating indexes of pollutants such as airborne particles that contribute to causing cancers and lung and heart disease, and also cause adverse effects on fetal development and foster poor lung and brain

Why Critical Epidemiology?: Daring Ethical Science in an Unhealthy Civilization

development in children. These are deteriorating, of course, not only in peripheral Third World cities but also in cities such as London, where ultra-fine particles resulting from vehicle emissions, domestic heating, and industrial pollution have reached extremely high levels—more than double the World Health Organization (WHO) standard of 10 µg.³ We must pay closer attention to what has been called “savage urbanism,” which constitutes the quintessence of urban capital acceleration in the *neoliberal city*. The poisonous cocktail of this process is the wholesale privatization of services, the construction of a real estate bubble for income extraction, the uncontrolled absorption of the poor expelled from the countryside by growing slums, and the expansion of dangerous neighborhoods (Barreda, 2008). Opportunistic gentrification and segregation of urban facilities and services according to postal code is constantly denounced by peoples’ organizations as a potent sign of regressive urban legislation.

Municipal spatiality, distribution, mobility, and landscapes are determined by an accelerated, unconsult, disorderly, and unhealthy logic that has generated the urban face of the global crisis. Cities’ development is implemented in order to benefit business enclaves and to segregate the extremely luxurious and overserviced habitats of the rich; the well-provided settings of the middle class; the deficient, contaminated, and perilous municipal locations of worker neighborhoods; and the ever-growing chaotic, extremely insecure, and overcrowded slums of the subproletarian population. Latin American epidemiology has documented the significant epidemiological differentials that have appeared in neoliberal cities (Barata, Barreto, Almeida-Filho, & Veras, 1997; Behm, 1992; Breilh, Granda, Campaña, & Betancourt, 1983; Bronfman, 1992; C. García, 1986).

Mega processes have resulted in planetary life and health hanging by a thread, by damaging and distorting the construction of sustainable, sovereign, solidary, and safe societies; to make things worse, they have concomitantly favored and sometimes even triggered the aberrant expressions of terrorism and the narcotics business. For instance, the poisonous penetration of narcotics business ventures is devouring the institutional ethos of our societies. Operating by means of different platforms and corridors, they have achieved varying degrees of infiltration of the sociopolitical scenarios of the South and North, no matter the political model. Having the affluent North as the big buyer, narcotics businesses have operated at times from Colombia, at times from Russia, and now principally from Mexico, using different countries either as transportation corridors or as marketplaces. This has signified the establishment of narcotics production and trafficking territories and corridors, often in association with the morally decayed dissidents of guerrilla organizations that historically arose as liberation armies.

This historical shift of 21st-century civilization under the powerful umbrella of huge multinational corporations represents a global blow to the possibilities for collective and public health. It has shaken the

Why Critical Epidemiology?: Daring Ethical Science in an Unhealthy Civilization

philosophical and ethical foundations of the market society. This colossal setback of humanity challenges all of us working in the life sciences.

The Downfall of Common Good and Derailment of Institutional Ethos

The demanding, honorable, and benevolent practices of epidemiology in sanitary posts and in a diversity of public and private health, teaching, and research units throughout the world comprise a formidable and dignified dossier. However, as members of today's globalized societies, epidemiologists are, willingly or unwillingly, hostages to the civilization we have just profiled. They must carry on limited preventive and health promotion activities in communities and workplaces that form part of cities and regions that endure a new alienated logic of living, in which the historical essentials of formerly progressive unionism have been derailed, servile or limited functional forms of organization prevail for the moment, and the positive action of valuable activist fronts and organizations is systematically offset by the fear and conservatism of silent majorities. The alienating winners-losers philosophy that rewards irresponsible consumerist individualism and punishes concerned communitarianism is the rule of a suicidal game.

So we all strive for health in an era in which public governance cynically tolerates health inequity and absorbs decadent forms of individualism, colonialism, and sexism either at home or abroad. Our societies are forced to maneuver in the frantic rhythms of functional and fearful modes of living that operate in spaces designed to prop up the system and enhance functional living codes, while health professionals must deal with a tsunami of unhealthy, destructive processes that lessen the protective effects of their benevolent and supportive actions. The premonitory argument of Hannah Arendt (1968) that a never-ending accumulation of property must be based on a never-ending accumulation of power is clearly reasserted by the present exacerbation of the apparatus of political dominance.

It is now clearer than ever that the ethical-cultural dimension, the frenetic expansion of postmodern consumerist civilization, is reproducing and confirming the prophesy made by Pasolini in his "Corsair Writings," published in 1975, in which he denounces the coming of a new fascism that replaces violent methods with the self-imposed domination of consumerist ideology—a process that "is not humanistically rhetorical, but Americanly pragmatic. Its purpose is the reorganization and brutally totalitarian homologation of the world" (International Peasants Movement, 2008, p. 6). And as part of this global regression, a rapacious neocolonialism is expanding and intensifying.

For those of us who work for the protection and promotion of life, the major contradiction of the 21st century is that we live in a context of historically unprecedented technological potential and renewed cultural diversity—traits that constitute powerful and promising possibilities for

Why Critical Epidemiology?: Daring Ethical Science in an Unhealthy Civilization

the common good—while at the same time being subject to the material basis of a deadly economy and the philosophical basis of a global ethical setback.

Climate change is the tip of the iceberg of the environmental hecatomb that is submerging capitalist postmodern societies of the fourth industrial revolution in behaviors that are “incompatible with the configuration of the world of life itself” (Echeverría, 2015, p. 51). We are immersed in a new cannon of the organization of life, both practical and intellectual, which has three main characteristics: an unrestricted devotion to technical capability based on the cold use of reason, the secularization of the political sphere (political materialism) expressed as the preeminence of shortsighted economic policy, and the aforementioned centrality of individual desires (Echeverría, 2015).

If we analyze Echeverría’s (2015) philosophical assertion from an epidemiological perspective, we can expect very serious consequences for the fabrication of utopia and for the construction of healthy, sustainable, and caring societies. Taken together, the unbridled advance of a technologically accelerated material base of exploitation, the expansion of a radically individualistic, technocratic, and secularized civilization, the increasing dedication of social space for the benefit of major private interests, and the intensification of colonialism imply the defeat of the common good and the imposition of a new geography of inequity, exclusion, and death. This represents three negative trends.

First is a downfall of the sacred vision of the world and its natural spaces that has submerged nations in the profane and pragmatic trend of extractivist projects. We are experiencing and accepting the substitution of the accumulated social wisdom of First Nations and peasants with respect to Mother Nature by a shortsighted pragmatic reason that mathematizes nature and territories in order to use them for the extraction of private profit.

The expanded anthropogenic destruction of nature and human health is generally disguised by production mechanisms that are presented as correct, safe, and ecologically sensitive but that in practice take on a brutal form. The barbarian bonfire that agribusiness, landowners, and ignorant political leaders have ignited and promoted of late in the Amazon not only denotes extreme cynicism and scientific illiteracy but also constitutes painful, mind-boggling proof of the veracity of our argument that terrestrial life is hanging by a thin and fragile thread. In this case, the vital planetary metabolism of water, climate regulation, and oxygen production that is supported by 600 billion Amazon trees, the ecosophical communities and women who protect life, the animals, vegetation, and microscopic life that sustain natural cycles is currently being destroyed at an alarming rate by a handful of greedy companies and ill-informed landowners in the name of progress.

Why Critical Epidemiology?: Daring Ethical Science in an Unhealthy Civilization

In Lefebvrian terms (Lefebvre, 2007), we must admit that national and international territories are no longer a sphere for an all-encompassing social and natural reproduction but, rather, have become spaces of aggressive capital accumulation (Harvey, 2007) at the expense of all forms of life and ethical principles. The concrete geographical expression of this process is that rural and urban spaces are no longer places essentially dedicated to produce *use values* (food and other goods), under effective regulations and basic codes for social protection and rights. What we now have is an urban-rural fracture, in which unleashed productivist greed operates to produce commodities with a competitive *exchange value* in order to generate profit rather than producing goods with strategic use value for the reproduction of humans and all living beings (Echeverria, 2017).

Second is a decline in political spiritualism that degrades the value of politics as a tool for developing rights, solidarity links for effective social agency, and cultural means for the reproduction of identity. This moral and practical shift of politics at the hands of the powerful imposes the supremacy of private profit and interests. The political mission, for and from the territories, now ignores the ethical and the fight for territory as a space of emancipation and identity, rather assuming these as arenas of hegemony and the political technocratic control of private interests.

Third is a profound setback for the decolonized communitarian philosophy that originally characterized the human being, together with its remnants of collective sociability, with the consequent imposition of private interests on individually owned and colonized spaces. According to this logic, the construction of spaces based on the philosophy of the common good is discarded in order to impose geography of the productive, defensive, and classist enclosure of private ventures, and corresponding areas of extraction, commerce, and mobility.

Why Critical Epidemiology?: Daring Ethical Science in an Unhealthy Civilization

Nonetheless, the democratic, benevolent side of humanity fortunately keeps producing potent ideas with which to untangle and undo the disarray. Throughout the world, we find expressions of social wisdom and massive global mobilizations that denounce the dreadful wrongdoings of a decadent capitalist system. Gender, ethnic, human rights, youth, and environment-climate activists, artists for health, teachers and scientists, urban and rural workers, and millions of youthful scholars represent the moral reserve of this sick planet. The urgent need to redirect the powerful potential of knowledge, dignity, and wisdom motivates millions of health workers and many epidemiologists to fuel the torch of good living and meta-critical⁴ awareness on the planet, waiting for a profound change of our social system and its civilization.

Myths of “Progressive” Technocracy (Aberration of Health Governance): The “Sins of Expertness”



As explained previously, the rapid global shift to a high-tech-based economy that has taken place since the beginning of this century has modernized and accelerated the neoliberal scheme, with serious repercussions for the North-South geopolitical balance.

In recent decades, Latin America, as other regions of the Global South, has lived in hope of democratization and decolonization. Collective health advocates with different social and ideological perspectives cherished the appearance of new horizons for justice and wellness. In some countries, such as Chile and Colombia, the neoliberal model persisted throughout the past decades with macroeconomic indicators producing a false image of untrammelled progress. Chile is an emblematic example of the inconsistency of neoliberal hegemony and the inevitable contradiction between aggressive private capital accumulation and social wellness. On the other hand, the electoral success of so-called progressive governments in some countries triggered an era of social-democratic hopes. Within the capitalist framework, certain limited social advances were achieved: the implementation of minor redistributive processes; the relative reversion of the dominance of the neoliberal market over the public domain; and the emergence of UNASUR (the alternative Union of South American Nations) as a form of integration opposed to the geopolitical logic of asymmetrical, disadvantageous free trade agreements. In these countries, anti-establishment rhetoric came to the fore of political discourse, ushering in a climate of progressiveness and recovery of sovereignty and justice. Advances were undoubtedly made toward equitable territorial management and the creation of areas of affirmative action that favored communities and some minorities. But with the passage of time, willingly or not, potentially democratic undertakings dissolved into changes that preserved and even consolidated the established order.

The practices of extractivism intercepted the progression of rights advocacy and public services development, restraining them and disrupting the ethical standards of public servants. Oil extraction, mining,

Why Critical Epidemiology?: Daring Ethical Science in an Unhealthy Civilization

and agribusiness were presented as the golden rule for achieving progress and profitable governance in countries with an abundance of valuable natural resources. In order to conceal the inevitable social and environmental consequences, the notion of “good extractivism”⁵ had to be disseminated by the propaganda apparatus. The construction of hegemony in those muddy grounds implied a form of governance that reaffirmed and legitimized the model by distancing itself in the public’s memory from the openly neoliberal privatization policies of previous years. Switching from market-centered policies to a public investment state model focused on aggressive public infrastructure development and administrative modernization policies initially fostered hegemony. This clearly happened in fields of social interest such as education (school building), health (construction of medical care units), and transportation (road building), in which the public investment curve increased considerably. Second, fresh funds were provided to the populist distribution of social welfare bonuses, using these to build a clientele and political support network.

This demanded a judicial and institutional shift that would accommodate powerful international corporations and national big business within the logic of the state-centered model. Unfortunately, in some cases the persistent thirst for resources derailed the ethics of public administration and well-intentioned redistributive policies. The sky-high prices of key export commodities, and the corresponding plenitude of public funds in the hands of key decision-makers, created a breeding ground for straightforward corruption or, in some cases, the appropriation of public funds to finance the political apparatus.

History will inevitably confirm or deny the veracity and extent of the claims of corruption that proliferated around these governments. Nevertheless, it is a fact that bulky dossiers have been presented and accusations made; history will clarify if they were bogus political constructs or the genuine derailment of governments with initially democratic aspirations. Whatever the case, perverse mechanisms bled or drained the national treasury, leaving a residual crisis that is now being used to justify an exacerbation of the neoliberal cycle. The process we are describing consequently led to a “rescue,” designed to fix the misdeeds of an entire decade, with policies such as those promoted by the International Monetary Fund, whose typical methods leave devastating consequences—as we learned in the case of Greece—with measures placed on the shoulders of the poorest and provoking serious consequences for labor rights, services, and epidemiology (Inman & Smith, 2013).

From an integral social wellness perspective, one can understand that aside from some temporal improvements in income and living conditions, the driving force of extractivism induced dubious governance and a systematic distortion of social and public health development actions. It

Why Critical Epidemiology?: Daring Ethical Science in an Unhealthy Civilization

also endorsed the opportunistic and secular political philosophy we previously analyzed and assumed communities as clientele to be bought.

What we have now is the underlying contradictions of thriving neoliberal cities with fashionable neighborhoods and continuously growing slums, a rural environment with booming agribusiness and poor working-class communities, regions with an exponential increase in the automotive fleet used for private and business transport, and ever shrinking safe transportation for the poor. These, among other controversial realities of the neoliberal iceberg, confirm an unprecedented reproduction and amplification of social inequity and unhealthy modes of living in segregated, contaminated, insecure dwelling places.

Understanding this complex global regression is crucial to comprehend the multidimensional processes that determine collective epidemiological conditions. The social determination of wellness and health, the subsumption of the biological world in the social world (Breilh, 1977, 2003a), and, correspondingly, the specific forms of what has been defined as corporal and mental embodiments (Krieger, 2005, 2011) can only be understood when their analysis is inserted in a broader contextual determination.

In epidemiological terms, what we find in our countries as a result of this modality of social reproduction is an increase of two principal morbidity profiles: disorders that are more prevalent in subaltern non-entrepreneurial impoverished urban and rural populations (i.e., caloric protein malnutrition; diabetes; old, emergent, and reemerging transmissible diseases, including old and new forms of vector-borne diseases; and certain neoplasms such as of the uterine cervix) and those that are mostly prevalent in modernized industrial and consumerist enclaves (i.e., obesity; chemical precursor and radiation pulmonary neoplasms; leukemia; work overload and stress disorders; immunity disorders; addictions; and anorexia, bulimia, tanorexia, and multiple toxicity disorders) (Breilh, 2010).

Unfortunately, the just demands of affected communities and concerned citizens fall on the deaf ears of the facto illiterate powerful. We can profile this typical pattern with some illustrative examples. In North America, the devastating impacts of oil fracking (hydraulic fracturing) and the severe pollution of the water system in Flint, Michigan (Pauli, 2019), capture the role of big business denial confronted by victimized communities. In Asia, the case of privatization and total drainage and rupture of the natural cycle of aquifer recovery in an important region such as Plachimada (Kerala, India) can only be understood in the framework of unfair and fraudulent concessions to soft drink producers (Bijoy, 2018) that keep recycling their devastating production mechanisms in different locations. In South America is the equally emblematic and alarming expansion of gigantic genetically modified soy plantations in the Southern Cone countries (Melón & Zuberman, 2014), bravely contested in the case of Argentina by the women of the Ituzaingo

Why Critical Epidemiology?: Daring Ethical Science in an Unhealthy Civilization

Movement. The forest fires set in order to establish oil or agro industrial enclaves in Brazil (Escobar, 2019) or the struggle and repression of the Ecuadorian Amazonian communities protesting against oil concessions in one of the world's most biodiverse (supposedly protected) areas of the planet are other examples. All these cases exhibit the same logic of siege and final dispossession in favor of corporations that have operated in collusion with governments, even those of the self-denominated progressive variety.

The golden years of state-centered "progressivism," with its socially amicable narrative, large public investment, middle-class public employment, and aid for the extremely poor, came to an end when the market prices of commodities suffered a critical decline. The crisis revealed that the model had trapped countries in a perverse logic that was paradoxically turning their abundance into impoverishment and growing debt (Breilh & Tillería Muñoz, 2009). This type of technobureaucratic management not only left the power of the old ruling classes untouched, or even increased it, but also nurtured forms of accumulation of a new bourgeoisie based on the appropriation of public assets.

Overall and beyond the permanent rhetoric of responsible governance, the practice of extractivism has circumvented constitutional obligations and legal regulations, restraining the role of the state as the constitutional guarantor of human, social, cultural, health, and environmental rights. On the planning tables of diligent members of the powerful bureaucracy, community demands for the reinforcement of safeguards for protected territories and conservational constitutional rights are being overtly described as obstacles to "progress."

The experience of common people has made clear that the mythical discourse of "socially justified extractivism" was merely a set of instrumental statements with which to build political support. The media and many technical reports highlighted the growth of per capita public health investment (i.e., hospitals, health centers, and personnel) and the increases in budget funds that accrued to the sector, assuming at the same time that the modest decline of some basic mortality rates was a sign of successful performance of the populist model. Unfortunately, when one looks at the statistical panorama, it does not show consistent improvement, and in many cases it denotes deteriorating patterns (Breilh, 2018a). Sharpening the contradiction both in the North and in the South, "an increasingly transnational corporate health care industry . . . aggressively aims to exploit the gaps left open by underfunded or nonexistent public provision, furthering commodification and fragmentation" (Waitzkin et al., 2018, p. 239).

People have learned the lesson. Capital investment that benefits the medical industry apparatus does not generate consistent improvement of health indicators. Although the financing and modernizing of conventional public health care installations and the increase in professional resources have partially improved the old health care

Why Critical Epidemiology?: Daring Ethical Science in an Unhealthy Civilization

system, the potentially favorable impact of this policy has been counteracted by the low quality of such investments and the proliferation of unhealthy processes under conditions imposed by the destructive nature of the development model.

At the same time, the prevention and surveillance organisms are weak and ineffective and have become functional to the biomedical hegemonic system. Paradoxically, in years of higher per capita health investment, vaccination coverage in Ecuador declined by 25% between 2009 and 2017, and the country had the worst performance in Latin America (Aguilar, 2019). In fact, crucial protection coverage indicators tumbled, and the 116–120% coverage normally achieved before 2006 declined for all vaccines (Equipo Evaluador Internacional, 2017).

The “sins of expertness” are part of this paradoxical social and health system with its technocratic governance. The vertical foreign certification and evaluation systems that have been imposed on productive, educational, and services provision venues become normative straightjackets for universities, nongovernmental organizations, research units, etc. As a noted researcher declared, programs and projects are subject to arbitrary decisions because “reviewers face the unavoidable temptation to accept or reject new evidence and ideas, not on the basis of their scientific merit, but on the extent to which they agree or disagree with the public positions taken by experts on these matters” (Sackett, 2000, p. 1283). Biased rejection operates in conscious or unconscious manners against new or contesting ideas.

Correspondingly, we must raise our academic-informed voices to challenge the unfairness and destructiveness of our societies and their health establishment demanding a “paradigm shift . . . requiring changes in how we train, reward, promote, and fund the generation of health scientists who will be tasked with breaking out of their disciplinary silos to address this urgent constellation of health threats” (Myers, 2018, p. 2860; see also Dunk, Jones, Capon, & Anderson, 2019).

This global setback presents people, leaders, intellectuals, and scientists with new challenges. It constitutes a moral and organizational tour de force that places extreme pressure on the wisdom, creativity, organizational strength, and technical skills of all the people, both academic and social, as well as the gender, ethnic, and cultural organizations that are permanently mobilized throughout the world, inspired by the utopian principle that another world is possible.

What Makes Transformative Audacious Health and Life Sciences?



So far, we have profiled the historic reasons for the current need for critical, transformative, and ethically audacious health and life sciences. A much-needed global academic mobilization to defend endangered life and

Why Critical Epidemiology?: Daring Ethical Science in an Unhealthy Civilization

accompany the global movement to forward human multicultural knowledge to confront the menaces and develop real solutions.

Virchow's (1848) arguments that preserving health and preventing disease requires full and unlimited democracy and radical measures rather than mere palliatives is more relevant than ever. But one should add that radical (i.e., critical) measures require radical thinking and methodology. In many fields—and epidemiology is no exception—scientific reform is lagging behind the current material and spiritual challenges of an expectant humanity. The health field is profoundly penetrated by the Cartesian logic. Rigor and complex thinking have been reduced to sophistication of quantitative empirical reasoning.

There are two important aspects of critical thinking. Foucault relates it to the capacity to deconstruct and reinvent epistemological certainties; discern and unveil mechanisms of coercion of knowledge; question the politics of truth and question truth as it operates through power; and go beyond the limits that hinder one's subjecthood (Foucault, Lotringer, & Hochroth, 2007). These traits are fundamental to the work of all conscientious scholars. However, as previously explained, in revealing the mechanisms of coercion and interrogating the politics of truth, it is also important to understand the profound epistemological relation between scientific modeling; the dominant paradigms that mold it; and the hidden cultural rules (episteme), pressures, and obstacles exercised by the power structure of society.

When elucidating how "humans are made subjects" and the "modes of objectification that transform human beings into subjects," Foucault (1982) explained the incidence of power relations that dominant states have institutionalized as a convenient form of official science. It is a methodology that ends up supporting a way of ordering the world according to the prevailing conditions of acceptability. This is possible because the explanatory authority of science and the practical power of technology are powerful tools for mastery and social control. Whether for practical productive purposes or for ideological reasons, knowledge is basic to the construction of hegemony. And it is precisely at this point that the functional paradigm of official conventional epidemiology is revealed.

In these circumstances, one most serious epistemological problem that academic communities face is that although a growing number of researchers have voiced their disagreement with the interpretative limitations of positivism and its functional role, and despite the fact that logical *empiricism*⁶ has been questioned in important academic circles, it continues to exercise a heavy influence on scientific work in many places, especially in mainstream science (Boltvinik, 2005). In effect, empirical experience based on direct observation being the supposed inductive fundament of all knowledge and having reduced theorizing to inference on related empirical phenomena (Punch, 2016) converts science, as we discuss later, in a mere reflection of empirical tip-of-the-iceberg facts and relations, renouncing to the complex understanding of crucial processes

Why Critical Epidemiology?: Daring Ethical Science in an Unhealthy Civilization

of the real world that have a concrete existence but are not directly perceivable. To say that a research question has to be an empirical question amounts to saying that we would have to answer it only and fundamentally by means of direct, observable tangible facts, qualitative or quantitative, renouncing to empirical phenomena that do not appear as significant—according to the rules of Cartesian reductionism and probability—or to fundamental processes that need a qualitative interpretation. So the Cartesian positivist bubble has been a permanent epistemological obstacle for critical transformative life sciences.

Critical science constitutes a unique epistemological demand, but it also responds to a reaffirmation of ethics. This is because it requires criticizing data of social and epidemiological inequality and seriously questioning the epistemic or cultural conditions imposed on people, but also denouncing the integrated regressive determination of the material basis of society, with its cultural civilization basis. Critical thinking questions the dominant ideas, practices, and ethos of a particular scientific field.

Broadbent (2013) wrote a book with the suggestive title *Philosophy of Epidemiology*. According to Broadbent, the book answers the question, Why philosophy of epidemiology? When stating why epidemiology is philosophically interesting, Broadbent adduces the following interesting features of “this young science”: It focuses on causation; the nonconformity to standard philosophical images of science in experiment and theory; the relative domain insensitivity of its methods; the centrality of its population thinking; and its stakes are high.

Broadbent’s (2013) arguments are definitively sharp and useful. We cannot deal with them in-depth here, but some basic comments are mandatory. For reasons provided in Chapter 3, several changes strengthen and place the author’s arguments in place with critical science. First, it should not focus restrictively on causation but, rather, on health determination. Second and third, should read some like: epidemiology’s nonconformity with lineal Cartesian functional reductionism and the restrictive reductionist experimental logic applied in the social sciences and empiricist theory. Fourth, should not be explained as domain insensitivity but on the contrary, to a careful sensitivity to complex multi-domain objectivity. The fifth argument is agreeable but with the condition that the notion “population” would not refer to an inductive sum of individual observations but to a different essence of the collective phenomena. And the sixth feature is totally correct because epidemiology’s stakes are definitively high—as we pretended to demonstrate in chapter 3—but not only for epistemic and moral significance, but on transformative action significance of any science destined to protect and promote human and planetary life.

Serious and well-intentioned researchers operating from the linear Cartesian paradigm are subject to what we call “paradigm bias,” which

Why Critical Epidemiology?: Daring Ethical Science in an Unhealthy Civilization

precedes any epidemiological design. All studies of Cartesian facture, even if they use the best design and analysis tools, will be biased.

The Cartesian Bubble: Preliminary Panorama



The Cartesian conception of reality dominates the life sciences. The Cartesian paradigm states that in reality all phenomena are a convergence of parts, and the properties of those parts determine the behavior of the whole. Being the essential elements, those parts preexist and only their conjunction defines the nature and existence of the whole. This operation has been defined as *reduction*, and its methodological matrix is called reductionism (Levins & Lewontin, 1985).

Broadly speaking, the reductionist ontology of Cartesian science, profoundly embedded in functionalist public health and reductionist medicine, can be summarized by the following set of linked operations: *fragmenting* the world into parts or preeminent ontological units (i.e., empirical qualitatively and quantitatively isolated parts of reality); *reifying* those parts as static, fragmented, and individualized elements (i.e., factors, risk factors, and outcomes); associating those parts or ontological fragments by mere *external conjunction*; *separating* parts from their “contexts and evaluative relations” (i.e., disconnection, decontextualization, and separation); limiting the understanding of movement to the variations of those disconnected parts or *fragmented empirical variables*; and applying the results of those operations to *describe* them, their empirical external connections, and *calculate the probability* of phenomena without explaining their movement and social determination. Later, we discuss why mere lineal causal relations—monocausal or multicausal—are not in themselves a substitute for complex process analysis of the social determination of health. We also reveal its practical political consequences: replacing the encompassing holistic perspective of critical collective health sciences with a narrow focalizing view of functional public health; exchanging the transformative leitmotiv of critical health sciences with a functional scheme of cosmetic public health administrative techniques; substituting the radical perspective of class, gender, and ethnic inequity with a light skirmish for palliatives; and replacing the radical objectives of community-based health action with the technobureaucratic approach of governance (Table 2.1).

Table 2.1 Linear Reductionist and Complex Critical Health Definitions	
Functional Linear Thinking	Complex Critical Process Thinking
HEALTH AS OBJECT	

Why Critical Epidemiology?: Daring Ethical Science in an Unhealthy Civilization

Single plane (“peak of the iceberg”) phenomena linearly connected (i.e., reified decontextualized fragments)	Concatenated, multidimensional, and contradictory process movement
Static and fragmented risk factors (i.e., probabilistic entities) causing disease; factorial reality	Process that generates the complex multidimensional movement of collective health, with embodiments in particular class/gender/ethnic and individual conditions
THE SUBJECT OF HEALTH	
Lineal, one-plane vision	Explaining concatenated, contextualized complex multidimensional movement
One discipline biomedical vision	Thinking transdisciplinarily: not simple juxtaposition of knowledges and their complementarity but mutual transvaluation (<i>Oxford Encyclopedia</i>)
Monocultural vision, centered in positivist academic monism	Intercultural knowledge building and transevaluation
Conception of reality centered on logical empiricism and systems theory (structural functionalism)	Meta-critical dialectic thinking (i.e., integrating the different critical epistemologies to transform reality: criticism of accumulation, functionalist instrumental reason, and uncritical subjectivity)
THE CONCEPTION OF PRAXIS	
Focalized risk factors action, with their systematization based on empirical differences and probabilistic weight	Characterizing action as meta-critical counteractive movement, sensitive reasoning, multidimensional neohumanism; operation on contradictions of critical processes, based on a radical notion of inequity and the analysis of strategic interests of the common good

Why Critical Epidemiology?: Daring Ethical Science in an Unhealthy Civilization

The logic we have just described, reinforced by influential biomedical determinism, when applied within public administration produces the divorce of health indicators from their social and cultural contexts. When considered for administrative and planning purposes, epidemiologic reasoning operates under the premise that a discretionary inventory of health standard indices alone will suffice as an evaluatory tool for assessing the success of social policies. Some classical indicators of changes in morbidity and mortality rates, or the degree of health services coverage, are considered, in themselves, to be the gold standard for weighing the effectiveness of public policy and governance. Such evaluations are therefore often limited to the analysis of isolated programs and services provision and to classical epidemiological indicators. From this perspective, when a society goes from “bad rates” to “less bad rates,” the illusion of success is declared.

Qualitative research is also affected by Cartesian bias. It has been developed to account for numerical reductionism to complement the scientific method. It “relies on text and image data, has unique steps in data analysis, and draws on diverse designs” (Aspin, 1995, p. 21). Some methodologists recognize the following as its principal strengths: collecting data directly in the field; direct data collection by researchers who analyze documents, observe conduct, or interview informants; relying on multiple data sources; including important deductive moments to build patterns, categories, and themes; keeping a focus on meanings defined by participants; maintaining an emergent, constantly developing design; researcher reflexivity and self-consciousness; and a holistic account of the problem (Creswell, 2014). But it is also true that different theories have influenced the paradigm-driven development of qualitative research—that is, positivism, critical theory, constructivism, phenomenology, symbolic interactionism, and grounded theory (Punch, 2016). The latter has been most influential, and according to Creswell (2014) can be explained as follows: “The researcher derives a general, abstract theory of a process, action, or interaction grounded in the views of participants . . . using multiple stages of data collection and the refinement and interrelationship of categories of information” (p. 14). This form of qualitative inductivism also occurs in Cartesian reductionism.

In Chapter 3, we discuss how Cartesian empiricism as a strategic cog of hegemonic science not only imposes the positivist ontology or qualitative cultural relativism we have just summarized but also, most important, constrains the philosophical stance of the life and health sciences within an anthropocentric individualist functional framework.

Social Determination of Health: Overcoming the Illusions of Linear Causality



As we have repeatedly argued in previous sections, the cardinal challenge of critical theory/method is to overcome the lineal single-plane causality of conventional epidemiology by superseding the reductionist inductive

Why Critical Epidemiology?: Daring Ethical Science in an Unhealthy Civilization

chain we have explained and that is applied in the Cartesian *principle of correspondence* (Figure 2.1).

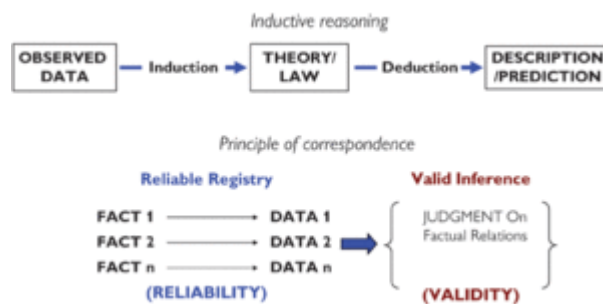


Figure 2.1

The principle of correspondence and empirical induction.

The knowledge illusion of linear reductionist tip-of-the-iceberg-type thinking resides in substituting the explanation of a complex multidimensional movement with mere description and prediction of partial variations and correlations. The knowledge illusion also resides in mistaking the sophistication of empirical descriptions—either qualitative or quantitative—for the understanding of complex movement that explains those empirical expressions. Instead of understanding the processes that explain epidemiological determination, it applies firsthand perceptions to *describe* factual variations and their empirical external connections and to *calculate the probability* of such phenomena. In other words, it describes variables and their external variations without explaining the complex social determination of health.

Complexity and Critical Science

When taking a scientific position on health as a complex dynamic process, we invariably need to put forward a consistent argument regarding *complexity*. Different perspectives converge to provide a critical outlook of this social feature. They all disprove the conceptual and methodological implications of the positivist linear single plane perspective. A crucial contemporary discussion about health as a complex process is fundamental in redefining the study object of epidemiology.

First, the idea that health is an object that takes its form within the inherent dynamic articulation of diverse types of phenomena, therefore demanding a *transdisciplinarity* approach, is one important element of complex thinking. As Morin (201) explains in his view of complexity,

We are at the same time biological, social, cultural, psychic and spiritual beings, it is evident that complexity is what attempts to conceive the articulation, identity, and difference of all these aspects. . . . In fact the aspiration of complexity tends towards

Why Critical Epidemiology?: Daring Ethical Science in an Unhealthy Civilization

multidimensional knowledge. (pp. 176–177; translated by the author).

From this perspective, one would clearly agree that critical epidemiology necessarily requires a complex transdisciplinary approach. This argument also leads to the broader notion of intercultural knowledge.

Second, in building a complex thinking approach to health, it is crucial to reexamine the different degrees of complexity that characterize processes pertaining to the various dimensions of reality that constitute health's *multidimensionality*. This characteristic involves understanding our social–epidemiological reality as a dynamic interrelated movement of three different domains: the general (G) domain of society (i.e., social reproduction and broader nature–society environmental metabolic relations); the typical particular (P) and collective *modes of living* of socially determined groups subject to social and specific metabolic relations (i.e., social class, gender, and ethnocultural power and metabolic relations) and the individual (I) domain of persons/families with their specific personal *styles of living*⁷ and corporal psychological embodiments (i.e., phenotypic, genotypic, psychological, and spiritual).

The permanent evolution of those different domains is not essentially independent, as complex movement is not a simple sum of adjacent parts. There is dialectic interplay between the unifying trend of the reproduction of society as a whole and the diversifying movement generated due to the relative autonomy of parts that press to maintain their diversity. This determining interplay accounts for the *dialectic movement* of complex reality, in which the reproduction of *unity* is counteracted by the reproduction of *diversity*. In sociological terms, this involves the relation between collective and individual social reproduction, a movement that is crucial for understanding the genesis of health conditions. Juan Samaja (1997) appropriately described its integral nature by maintaining in his analysis the two contradictory trends: on the one hand, a creative process that arises from the particular domain—and even from the individuals—pushing to transform the general terms of reproduction and increase diversity and, on the other hand, a counteractive movement on the part of broader society to reproduce its general existence. This clarification was very important for the debate within social sciences and epidemiology because it gave a new sense of direction to the discussion about personal versus collective rule in society. We now better understand that both are permanently active as dynamic sources of social movement. Health correspondingly depends on the wider process of social determination; notwithstanding, the relative autonomy of individual action also accounts for important modifications.

This oppositional development of *unity (integration) versus diversity* of health as a whole and health as a particular and individual process also entails a double epistemological (interpretative)—methodological

Why Critical Epidemiology?: Daring Ethical Science in an Unhealthy Civilization

challenge: (1) to eliminate the false separations of Cartesian logic and (2) to correct the empiricist conception of multidimensionality.

One major challenge is to apply an epistemological paradigm that retains the cognitive dialectic of categories that positivist science has separated. In fact, positivist logic established a set of false separations that were utilized to subordinate scientific interpretations to its empiricist rules of objectivity (i.e., the notions of matter, motion, and number). This separation was first applied in astronomy and physics and later in physiology and biology (Irvine, Miles, & Evans, 1979, p. 66). Irvine et al. highlight some cases of uncoupling that distorted scientific thinking:

Subject	Object
Purpose	Mechanism
Value	Fact
Internal	External
Secondary	Primary (properties)
Thought	Extension
Mind	Body
Culture	Nature
Society	Science

The concepts in the first column were replaced by the concepts in the second column. This completely changed the interpretative essence of reality. The broader cognitive categories of the first column were reduced to the more descriptive and partial elements of the second column (Irvine et al., 1979, p. 66), and this reduction converted reality into a single-plane empirical world (Figure 2.2).

Why Critical Epidemiology?: Daring Ethical Science in an Unhealthy Civilization

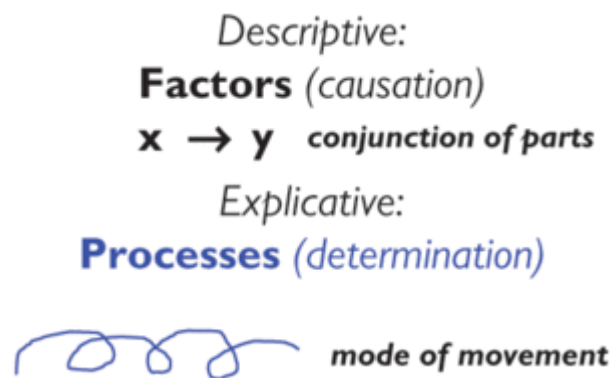


Figure 2.2

The two visions: factors that describe conjunctions versus processes that explain movement.

This type of cognition had important consequences for conventional epidemiological positivist methodology. From the specific concerns of critical epidemiology, we must recognize seven other conceptual substitutions appropriate to a linear functional description of health:

Collective	Individual
Processes	Factors
Subsumption	Conjunction
Determination	Causality (i.e., causes or determinants)
Embodiment	Causal pathogenicity
Explanation	Description, prediction
Inequity	Inequality, difference

The cognitive and logic implications of these substitutions are discussed in relation to the methodological breaks that we detail later. At this point, it is necessary to recognize that conventional public health and Cartesian epidemiological reasoning have applied many of those substitutions in order to subordinate their logic to the empiricist rules of objectivity: the individual (part) instead of the collective; causal risk factors instead of determining processes; linear conjunction instead of dialectic subsumption; causality instead of determination; causal pathogenicity instead of dialectic embodiment; empirical description and probabilistic prediction instead of explanation of complex determination; and

Why Critical Epidemiology?: Daring Ethical Science in an Unhealthy Civilization

phenomenal expressions such as inequality or difference instead of the underlying power relations of social inequity.

A second important undertaking is to recover the unity and interdependence that exists in multidimensional reality as a result of the ontological connection between processes that pertain to different dimensions. This is of paramount importance to health studies. It entails the task of restating the relations that define health and their manifold movement. Deciphering the essence and factual evidence of such connections between the general (G), particular (P), and individual (I) processes is precisely the main challenge of critical epidemiology, which is to grasp the essence of health as a socially determined multidimensional movement. This is what we aimed at when we incorporated the notion of social determination of health into our interpretative model in order to expand the empirical causal view, based on the firsthand, formal conjunction of “independent,” “dependent,” and “intervening” empirically defined variables—in other words, the notion of variables taken as fragmented expressions or segments, detached from their respective domains of reality and subject to mere external connection. Later, we discuss our methodology for assuming variables as nodal expressions of a broader movement and its critical processes.

The social determination of health process is complex not only because of its multidimensional nature but also because the dynamicity of its health conditioning process encompasses the contradictory movement of both concrete healthy, life-supportive, protecting subprocesses and concrete unhealthy, harmful, and destructive subprocesses. As explained previously, this multidimensional movement develops simultaneously and interdependently in all three dimensions (G/P/I); in all three domains, there are different contradictions between protective and destructive health processes.

As discussed previously, the social determination movement and its health-related aspects develop according to the broader structured characteristics and power relations of a defined social formation [i.e., social relations, modes of social reproduction (wealth production and accumulation), and metabolism with nature] and typical collective modes of living of socially determined groups subject to social relations (i.e., class position intertwined with gender and ethnic sociocultural relations)—all of which define their health equity status or potential—and, finally, in the individual (I) domain of persons/families with their specific personal styles of living and corporal psychological embodiments (i.e., phenotype, genotype, mind, and spiritual) (Figure 2.3).

Why Critical Epidemiology?: Daring Ethical Science in an Unhealthy Civilization

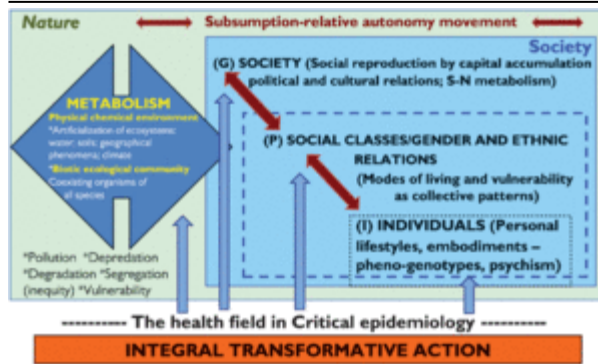


Figure 2.3

The social determination of health (complex—multidimensional movement) (Breilh, 1977, 2003a, 2015a). G, general; I, individual; P, particular.

Breilh, J. (2015a). Epidemiología crítica latinoamericana: Raíces, desarrollos recientes y ruptura metodológica. In *Tras las huellas de la determinación* (Memorias de Seminario Inter-universitario de determinación social de la salud; pp. 19–75). Bogotá, Columbia: Universidad Nacional de Colombia.

By this point, some readers may have asked themselves, What is so important about understanding and making clear the multidimensional unity and the contradictory protective–destructive nature of health? The straightforward answer is because it is indispensable to discover the essence of the health production and distribution process that epidemiology needs to reveal. And also because in order to comply with Virchow's (1848) ethical demand for radical measures and not palliatives—in order to get into real, consistent, and profound health promotion and prevention—we must reconnect what functionalist science disconnected and penetrate into the destructive nature of the economic system and its alienating civilization.

A personal experience I want to share with readers is relevant to the arguments presented in this section. I met Nancy Krieger for the first time in Quito, Ecuador, when she attended an international seminar in the 1980s that was organized to debate critical epidemiology and social *determination* of health. Researchers from 12 countries were convoked to share and discuss our challenges and contributions. Many years later, Krieger and I teamed up again on the same side of the international critical transformative epidemiological science debate. Two roundtables were held—one part of the World Conference on Social Determinants of Health, organized by WHO (Rio de Janeiro, 2011), and another in the 8th International Seminar on Public Health, planned by the National University of Colombia (Bogotá, 2013) to focus on “social determination of health” as theory for the 21st century. In both cases, our theoretical stances were complementary. Here, what is relevant to highlight is

Why Critical Epidemiology?: Daring Ethical Science in an Unhealthy Civilization

Krieger's important contribution in positioning the notion of *embodiment* (Krieger, 2005, 2013). From the perspective of my work, it entailed a perfect and necessary fit for my theory on social determination and my proposed substitution of conjunctive causality with determination by subsumption. Later, I expand this argument.

Social Determination: Social Reproduction, Metabolism, Subsumption/Embodiment, and Inequity

Determination is no doubt the cardinal category of critical epidemiology in relation to its understanding of the production and distribution of health, just as *causality* is the central notion of Cartesian linear empiricist epidemiology.

The philosophical fundaments of conventional linear causality can be traced back to the empiricist works of Locke and Berkeley and, most important, to David Hume's *Treatise of Human Nature* (1740/1967). In this influential work, the Scottish philosopher states the principles of association (i.e., resemblance, contiguity, and causation) that became the pillars of his Aristotelian conception of scientific knowledge as the revealing of causes and causal inference. Austin Bradford Hill (1965) developed his criteria for determining a causal association, whereas emblematic epidemiologists such as Brian McMahon (1975) with his "web of causation" and Kenneth Rothman and Timothy Greenland (1998) with their constellation of causes explicitly assume causal reasoning as the cardinal element of their important scientific work. Mainstream positivist health science consequently operates under the premise that causality constitutes what has been critically defined as the big organizing rationality of the Universe (Rorty, 1994).

The problem we face, leaving aside the valuable contributions and technical advancements of causal epidemiology, is that reductionism hinders the sophisticated potentialities of many of its own achievements. Causal reasoning entails a succession of reductions of Cartesian science, brilliantly explained by Bhaskar (1986), that operate along empirical lines. I have summarized this extremely important clarification as follows (Breilh, 2003a):

Once only empirical reality is included as patterns of events, excluding the other domains (that is, excluding the generative processes and the current non-empirical processes), it proceeds to incorporate from those patterns only those that are constant conjunctions (which means the empirical processes associated stably as variables), leaving out the constant non-associative movement patterns (i.e. the variables that did not yield significant correlations); finally, of those constant conjunctions establishes an "experiment," or better in the case of epidemiology, a "proxy" as a closed system. Thus the inductive empirical knowledge begins to close its logical cycle and establishes the causal conclusion:

Why Critical Epidemiology?: Daring Ethical Science in an Unhealthy Civilization

Demonstrated constant conjunction = causal law = knowledge

Hence also its practical logic follows:

Application = instrumental success = system functionality (p. 34)

Here, the core problem is reducing our complex world to demonstrated constant conjunctions detached from their profound determining connections through an experimental logic.

So in order to develop an alternative epidemiological rationale, while at the same time retaining the valid contributions and experience of the past, it was imperative to break the reductionist mold, proposing an interpretative substitute for causality. We needed a new paradigm that would give us back the vision of reality as movement, as ongoing processes and not stationary factors. A shift was required in order to reconnect the parts of that fragmented reality within a real integrative multidimensionality, to health's complexity in the contradiction of the protective and harmful processes and, as a consequence, to not only describe the empirical phenomena and make predictions but also explain the health process in an integral way. Only then could epidemiology be labeled a penetrating, transformative, and emancipating discipline.

Because the alternative theoretical framework needed to explain the production and distribution of health, we chose five categories as fundamental cognitive elements: determination, natural and social reproduction, society-nature metabolism, subsumption⁸, and inequity. These categories respectively explain: the movement; the overall articulating logic of that movement; the determining weight of the ecosystem; the social-biological relation; and the growing health gap that forms part of health's complexity in our societies. In other words, these provide a new vision that allows us to avoid the divisions and substitutions of the empiricist logic we are questioning. We now examine this challenge in more detail.

The dialectic explanation of movement and connection that causality does not allow requires overcoming causal notions. The transformation of reality that yields health consequences cannot reside solely in causal relations. We therefore had to work for a number of years in order to find a better system for explaining the complexity of the epidemiological movement. If reality moves not just by means of causal relations, we had to understand the alternative complete interpretative model that would allow us to explain health-generating processes. If epidemiological movement is not limited to quantitative variations (mechanism), if it is not reduced to an external causal production, and if variation is not reduced to a unique conjunction relationship, then we needed to develop a different approach that entailed answering a different question: How do we explain epidemiological movement as a complex determining phenomenon?

Why Critical Epidemiology?: Daring Ethical Science in an Unhealthy Civilization

In his valuable book *The Principle of Causality in Modern Science*, Mario Bunge (1972) argues that the facts which govern life are determined, not only caused. In searching for an alternative category that would encompass more than the notion of causality, he explored the category of *determination*. He found that it had three scientific meanings: (1) the property or attribute of things that have defined characteristics; (2) the necessary and unique connection between things, events, states, and qualities (causal, not generative or productive link); and (3) a mode of becoming—how a process becomes such and acquires its characteristics.

The third meaning, corresponding to the form (act or process) by which an object acquires its properties, precisely resolved our epistemological requirement. In this way, we came to understand that epidemiological processes not only have empirically defined characteristics, which can be observed and recorded as variables, but also acquire them in defined forms or processes that transcend causal links because they explain movement and generative power that go beyond causal conjunctions. The scope of epidemiological observation, then, is not limited to the phenomenon (i.e., single-plane “tip of the iceberg”) but must encompass the underlying determinant movements that generate the empirically observable elements. That is because epidemiological processes operate in a multidimensional social-natural context that determines their contents and scale. They extend their roots in all three dimensions (G/P/I) with their specific social relations, spaces, and territories. Those relations constitute the determining mold or material basis of social determination. At the same time, the political, cultural, and spiritual relations and conditions that make up a part of social reproduction intervene in the building and transformation of the social determination processes.

A complex, fascinating dialectic defines and explains, through concrete forms of movement in each of the dimensions of reality, (1) how epidemiological processes become such and acquire their characteristics and (2) the observable embodiments of which empirical qualitative and quantitative phenomena form part. This finding became a major turning point in our work and opened doors to new challenges. Later, we further explain determination and illustrate this reasoning with a concrete example.

In its complexity, epidemiological movement encompasses natural organic and inorganic processes as well as social processes. But nonsocial and social processes are determined differently: The former basically operate under their own chemical or biological and instinctive conditionings (of course subsumed in social conditions), whereas social movement is determined by historical projects consciously defined by human collectives. This was explained this in a Pan American Health Organization/WHO publication as a dialectical subsumption relations system, among domains of different complexity (Breilh, 1994). This difference has been explained by Georg Lukács (2013) as a teleological⁹ problem. In his ontology, he differentiated the inorganic and organic domains from the social by considering the former as nonpurposeful,

Why Critical Epidemiology?: Daring Ethical Science in an Unhealthy Civilization

whereas the social domain would be teleological in the sense of conscious design of purpose.

Our previous argument and the understanding of the relation between the social and environmental-biological processes require a clear understanding of the difference between *natural reproduction* and social reproduction. Preconscious animal reproduction operates by making transformations in nature in order to produce elements that allow animals to obtain their means of survival (food, warmth, rest, play, etc.). They manage this movement in response to a natural instinct that operates as a determinant biological norm in the absence of conscious purposeful drive. This natural order functions without language, without representation of the “other,” and without conscious purposefulness. That is, animal processes in themselves lack historic determination. Animals need by instinct, they communicate with each other through signs, and their biological capacities can reach amazing levels of performance and allow for almost “perfect” instinct-driven solutions. Nonetheless, in the case of bees, for example, the difference between their perfectly built hives and the imperfect or even clumsy construction of a house by an unskilled human is the fact that the former was produced instinctively, without preconceived purpose, whereas the imperfect house was the purposeful product of a conscious project.

However, at this point we must emphasize the eco-epidemiological importance of the consequences of social production in the process of nature’s artificialization—that is, the social determination of ecosystem health. Although animal life functions according to the rules of instinct and a primitive psychic system, the fact that animals’ natural reproduction, life cycles, and breeding modes, as well as territorial habitats, are permanently transformed by the social-natural metabolism and subject to forms of artificialization carries with it the most destructive consequences. Influenced by critical epidemiology, a new zoonotic disease model has been developing as part of a different animal health paradigm (Acero, 2010). The quintessence of negative, massive transformation of animal life can be observed in the social-natural spaces of extractivism, either because extractive-derived hazards (agricultural pesticides, heavy metals from mining, etc.) kill many animals and in many cases affect their ecological role—for example, poisoning pollinizing bees that sustain vegetable reproduction—or because large-scale business concentrates immense numbers of animals in gigantic industrial breeding farms (poultry, swine, etc.). The profit-gearred design and operation of these farms is therefore permanently affecting the territorial health of large regions, destroying or severely affecting the rights of natural life beings, and dramatically increasing the contamination of regional soils and water systems. The Johns Hopkins University Pew Commission on Industrial Farm Animal Production (2008, p. 35) fully documented the devastating impacts of corporate animal farms in four primary areas: public health, the environment, animal welfare, and rural communities. It demonstrated how the shift from the innocuous family farm system to

Why Critical Epidemiology?: Daring Ethical Science in an Unhealthy Civilization

highly concentrated profit-oriented business systems is provoking an array of human, animal, and general ecosystem effects. The global implantation of high-tech, nature-unfriendly, insensible megafarms not only has expanded an increasingly unfair agricultural system but also has caused destructive embodiments in animals, inducing abnormalities in their physiology; causing uncontrolled damage through genetic modifications and reproductive organ anomalies; transforming their health by streamlining the process of raising animals for profit, including standardized feed for rapid weight gain and uniformity; and through genetic operations. All this artificialization is implemented for rapid profit and capital accumulation. These megafarms are also contributing to the increase in the pool of antibiotic-resistant bacteria due to the overuse of antibiotics; to air quality problems; to the contamination of rivers, streams, and coastal waters with concentrated animal waste; to animal welfare problems, mainly as a result of the extremely close quarters in which the animals are housed; and to significant shifts in the social structure and economy of many farming regions throughout the country. Here, we have a colossal embodiment of deleterious mechanisms within global and local ecosystems. This expanded concept of embodiment is defined later.

We launched our first version of a dialectical determination in the late 1970s (Breilh, 1977) through a systematic critique of McMahon's (1975) causal web theory and of the ecosystem model based on the Parsonian¹⁰ systems theory of the "natural history of disease" (Leavell & Clark, 1965). We shifted the logic of determination:

Causal *factors* or "determinants" that describe or predict, to
Generative *processes* that operate through intrinsic connections
between distinct domains that explain the forms of movement that
engender transformations.

Here, again, to comprehend health as movement, we had to embed its analysis in the transforming process of social reproduction. The challenge was to understand the material core and the domains of social transformations (see Figure 2.3). Doing so implied deciphering the dynamic development of modes of production and consumption, which take different social forms according to the strategic interests governing society. Notwithstanding the fact that the mode of social reproduction has changed throughout history, since the initiation of capitalist modernity it has taken the form of capital accumulation.¹¹ But social reproduction does not only encompass a material core but also simultaneously involves a conscious, historical, cultural creation process; it also entails certain power relations and forms of political organization and, most important, the metabolic relations of society with nature that we have outlined.

By means of all these integrated processes, capital accumulation has become the fundamental general matrix not only for reproducing the social, social-environmental, and human social-biological processes of our market societies but also of particular modes of living and ever-

Why Critical Epidemiology?: Daring Ethical Science in an Unhealthy Civilization

growing health inequity that subordinate social classes—traversed by gender and ethnocultural asymmetries/experience. Capital accumulation superimposes itself on the logic, trends, and hegemonic characteristics of all spaces and territories. It binds the historically unequal access to human and social rights to a power-based distribution of rent and income. By doing so, it conditions and puts limits on the degree of economic, political, and cultural power that conflicting social groups can acquire, as well as on the corresponding political disputes and alliances that characterize their relations. The capital accumulation matrix determines ecosystem relations in every sector of social space and the environmental contrasts that inequity generates in distinct territories and neighborhoods. All these congruent movements for guaranteeing the reproduction of capital do not operate separately; their movement is interdependent. What provides the overall congruency of the general social reproduction of accumulation is the process of subsumption, as we discuss later.

Geographical spaces and their ecosystems encompass concrete territorial forms of social reproduction. They are a product of the mode of social reproduction and its ways of transforming social space and nature, but concomitantly they actively contribute to its transformation. This *metabolism* of society and nature cuts across all dimensions of the process of the social determination of health and traverses all social-natural subsumption processes. Karl Marx first enounced the economical-political definition of a metabolic movement in his transcendental work on political economy (Marx, 1981). He referred to the processes between socially organized humans and nature where, through their own actions, they mediate, regulate and determine their metabolism with nature. By doing so, he linked his critical realist vision of both society and nature, thus providing a most potent explanation of critical ecology (Foster, 2000). In this abridged account, this dialectic concept surpasses *empirical ecology* theories—which have applied reductionist so-called ecosystem health paradigms—instead of explaining the social historical determination and territoriality of the relations between Nature and Society. At the same time, these relations make part of the healthy-unhealthy dynamics of such metabolism. Society-nature metabolism implies subprocesses of utilization, transformation, distribution, consumption, and excretion, which occur in all three dimensions (G/P/I), becoming a crucial element of social life and one crucial environmental embodiment of historical development. Unfortunately, society's dominant productive apparatus systematically provokes a large-scale inappropriate artificialization of nature's biocenosis (i.e., biotic or ecological communities; organisms of all species that coexist) and shapes its biotope (i.e., the physical and chemical setting and environmental conditions that operate as the vital space of flora and fauna), and it does so in ways that multiply unhealthy ecosystems.

As we have insisted, social reproduction operates in all three domains (G/P/I), but in each domain its movement involves different levels of

Why Critical Epidemiology?: Daring Ethical Science in an Unhealthy Civilization

complexity, ranging from the major influence of the general processes to the impact of less convoluted individual processes. In that complex reproductive movement, the weightier, more complex *general* domain processes subsume the *particular* less intricate processes and, at the same time, these subsume the lesser influence of the less convoluted *individual* processes. In Chapter 3, we touch again on the importance of *subsumption*, but for now we only state that it explains the inherent determining connection of processes pertaining to different domains of complexity of social reproduction, where the more intricate subsystem imposes its conditions on the movement of the least complex. The less complex individual biopsychological movement in people develops with its own psychological, physiological, and genetic natural reproduction rules, but their complete operation corresponds with and is influenced by the conditions of social reproduction. We now illustrate this crucial argument.

It is well known that autism, for instance, as with obesity and other pandemic problems, shows a rapid increase in global incidence and prevalence. Here again, different conflicting paradigms provide radically diverse epidemiological insights. The dominant vision unfortunately comes from an empiricist biomedical and conventional functional public health perspective. Fortunately, there is a growing awareness about the urgency of a paradigm shift in order to deal with 21st-century children's health from a critical social epidemiological perspective. For instance, groundbreaking approaches are focusing on the complex relations between neurodevelopmental disabilities, including autism, attention-deficit/hyperactivity disorder, and dyslexia, and other cognitive impairments that are more frequently diagnosed and related to wide systematic exposure to industrial chemicals that injure the developing brain (Grandjean & Landrigan, 2014). It is a cardinal problem for vulnerable communities upset by typical class-related vulnerabilities to neurobehavioral impacts of environmental toxicity. Early life exposures to neurotoxic chemicals affect children's developmental programming and functional maturation, provoking neurological degenerative changes. More than 5,000 children's products, such as clothing, toys, and shoes, have been recognized in certain regions as containing any of 66 chemicals of high risk to children, including toxic metals such as cadmium, mercury, cobalt, antimony, and molybdenum, and organic compounds such as methyl ethyl ketone and ethylene glycol, as well as phthalates (Uding & Schreder, 2015).

As mentioned previously, the powerful notion of embodiment, proposed by Krieger (2011) and used in the sense of giving a concrete perceptible form or body to a process, is integrated in our theoretical framework with the notion of subsumption. We can also expand this powerful category of Krieger's important interpretative tool of social-biological relation to other sorts of incarnations (metaphorically speaking) that are generated in different domains. Subsumption involves the conditioning of a less complex movement by a more complex one. For example, the movement of capital accumulation (general dimension G) subsumes that of

Why Critical Epidemiology?: Daring Ethical Science in an Unhealthy Civilization

particular modes of living (particular dimension P); at the same time, these subsume individual styles of living (individual dimension I), and this movement concomitantly conditions the phenotypic, genotypic, and psychological processes of an individual. Subsumption is not a unidirectional mechanical relationship but, rather, a dialectic movement that is counteracted due to the relative autonomy and generative potentiality of less complex processes. On the other hand, the transitive verb *embodying* means “to give a body to,” “to make concrete and perceptible,” and “to cause to become a body.”¹² As stated previously, we have extended the notion “to make concrete and perceptible” to the social or collective domain. This was indispensable not only because the human being experiences embodiments or incarnations of an epidemiologically generating process but also because, as we illustrate in the case of the social determination of vector-borne diseases in an agro-industrial territory, the movement produces social, geophysical-ecosystem, or collective human embodiments that we use methodologically to explain and situate certain specific variations (i.e., socially rather than probabilistically defined variables) and structure our different approach according to qualitative and quantitative research (Figure 2.4).

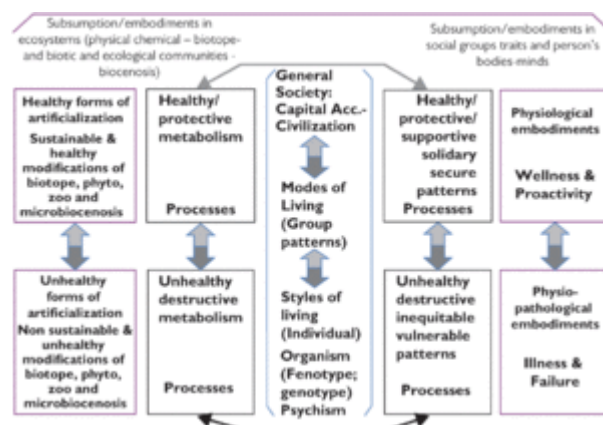


Figure 2.4
Domains of subsumption, embodiment, and artificialization.

Breilh, J. (1977). *Crítica a la interpretación ecológico funcionalista de la epidemiología: Un ensayo de desmitificación del proceso salud enfermedad*. Mexico City, Mexico: Universidad Autónoma Metropolitana de Xochimilco.

It is important to note that Cartesian lineal epidemiology, in consonance with its positivist rules of objectivity, assumes individual phenomena as the central reference, surrounded externally by so-called social variables or risk factors. The conceptual and methodological flaws of this viewpoint are discussed later, but for now it is necessary to bring the reader's attention to the ostensible extremely negative consequence of victim blaming, which results from separating individual conditions from their

Why Critical Epidemiology?: Daring Ethical Science in an Unhealthy Civilization

collective determining processes. As in the case of the obesity pandemic mentioned in the Introduction, when our scope of interpretation is reduced to the individual, we are surreptitiously converting a collective problem into one that is viewed as a personal lifestyle issue. By this conceptual transfiguration, we reduce our explanations to individual “causes” and apportion the entire blame for epidemiological occurrences to individuals and families. An important break with this Cartesian logic is the recovery of the ontological complexity and interdependence of collective and individual phenomena.

To complete our interpretative exercise, we had to discern the forms of movement that concur in complex epidemiological determination—both their forms and interrelations (Figure 2.5). We concluded that the determination process derives from and takes shape through certain forms of movement: (1) movement of contradiction, which determines the direction, expansion, and intensity of the movement of less complex processes with their conditions of subsumption and corresponding embodiments; (2) causal movement, which determines the forms of cause-effect efficient conjunctions; (3) feedback movement, which determines the capacity of adaptive-transformative system regulation; (4) probabilistic movement, which determines the random variation of regular systems under determined degrees of freedom; and (5) uncertain movement (“fuzzy”) in complex quality quantifier systems with high, formal, nonlinear complexity and chaotic movement of irregular system processes. These different forms of movement can be modeled and analyzed using different mathematical tools. Unlike linear Cartesian epidemiology, in critical epidemiology the process of data collection and analysis of each form of movement will be subjected to the dimensions of determination (G/P/I)—their dialectical relations of subsumption and relative autonomy. Specifically, this analysis uses variables but is not based on them; rather, it is based on critical processes that allow for the explanation of these modes of movement.

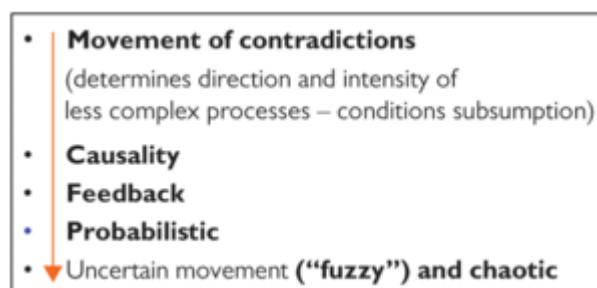


Figure 2.5
Components of the social determination movement (mode of becoming and acquiring characteristics).

Why Critical Epidemiology?: Daring Ethical Science in an Unhealthy Civilization

At this point, after discussing the flaws and implications of causal thinking in epidemiology, we need to call the attention of our readers to the crucial need to differentiate the category of social *determination* of health that we are putting forward as antithetical to causal philosophy from the notion of the social *determinants* of health that constitutes a cardinal concept of the dominant epidemiological and public health narratives and, unfortunately, of some expressions of conventional epidemiology that are considered progressive.

Social Determinants or Social Determination: Institutional Reformism or Radical Reform

The Commission on Social Determinants of Health was established by WHO in March 2005 “to support countries and global health partners in addressing the social factors leading to ill health and health inequities” (WHO, 2019). Within well-informed progressive academic scenarios of the South, at first glance this “new” commission’s title incited a feeling of hope. The announcement was made after three long decades of difficult creative battles on the part of Latin American researchers, and corresponding groundbreaking publications in Spanish and Portuguese. At this point, we thought voices of the South were starting to be taken into consideration; the important academic profiles of the commission’s members constituted a promissory signal.

Unfortunately, this was not the case, and with time we understood that, willingly or not, science from the Global South was not considered. What was at stake then, and even more now, was the real emancipatory essence of the new paradigm. The social determination paradigm is a commitment to a new public and collective health philosophy. Consequently, we have proclaimed in different international forums the importance of a democratic, mind-opening debate on the fundamentals of critical epidemiology as a tool for health policy and planning; it is an irreplaceable instrument to discern the best direction to take at the crossroads between health *reformism* and health *reform*. The former means changing some forms (i.e., “causes” or “factors”) so that the social substance is sustained, whereas reform means making changes that compete with the existing substance in order to open up the entire system to change (Echeverría, 1990). It entails forms of collective, transformative practice linked to the strategic interests of the affected communities and aware citizens, who need to change structural health inequity and correspondingly organize a new form of public health.

Thus, in order to carry out a thorough examination of the theoretical pillars and political guidelines of the “determinants” theory, our movement organized three scientific meetings, and the publication of their respective records, in Brazil (Passos Nogueira, 2010), Mexico (Eibenschutz, Tamez, & González, 2011), and Colombia (Morales & Eslava, 2015). Unfortunately, our collective, critical conclusion about the determinants theory was disenchanting. Aside from the good intentions underlying the social “determinants” of health paradigm—as defined by

Why Critical Epidemiology?: Daring Ethical Science in an Unhealthy Civilization

its principal members and mentors (Marmot & Wilkinson, 2006)—in practice it implied a relapse into linear empiricist causality and amounted to a refreshed functionalist health governance scheme. It is important to note that at the beginning of our work in the late 1970s, we proposed the epidemiological use of the concept *determination*. More than 30 years later, when the concept *determinants* was first used epidemiologically, we were not totally clear, as is now the case, about the vital nuances of this semantic difference. But with time, our efforts demonstrated the difference. What is now evident is that the neocausal paradigm of determinants had superimposed some of the original categories that Latin American authors had used and publicized widely, while inserting them in the same empiricist-functional mold (Table 2.2).

Table 2.2 Contrasting Paradigms: Social Determination and Social Determinants (Three Dimensions of Epistemological Description)

Epistemological Dimension	Social Determinants of Health	Social Determination of Health
Health as an object	Determinants as causes of a causal constellation (“causes of the causes”) Causes in a web of causal conjunction	Determination as a multidimensional movement; connection among dimensions of reality: general (G), particular (P), and individual (I) Processes articulated to the social relations of society
Health as a cognitive subject	Reformist institutional perspective Vision from policies and values for redistributive governance Technical critique from the public servants’/decision-makers’ perspective	Collective community-based perspective of reform from a social health system transformative struggle Critique of market civilizations Radical critical subject from the social transformation perspective Social empowered participation and the right of accountable public social alliance

Why Critical Epidemiology?: Daring Ethical Science in an Unhealthy Civilization

Health as praxis/ agency	Institutional policies and practice for redistributive governance, in the framework of system sustainability Agency against social factors (causes) that impede or limit redistributive governance	Social intercultural practice as historical movement, linked to strategic interests of subjugated class- gender-ethnic groups Struggle for radical transformation that encompasses inequitable social relations; unhealthy modes of living and alienating cultural patterns; unhealthy territories and metabolisms; empowerment of subjugated social, gender, and ethnic groups
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Based on Breilh, J. (2003a). *Epidemiología crítica ciencia emancipadora e interculturalidad*. Buenos Aires, Argentina: Lugar Editorial; and Breilh, J. (2015a). *Epidemiología crítica: Raíces, desarrollos recientes y ruptura metodológica*. In C. Morales & J. C. Eslava (Eds.), *Tras las huellas de la determinación* (pp. 19-75). Bogotá, Colombia: Universidad Nacional.

Looking at this matter objectively, it was surprising that beyond the good intentions of WHO in conforming regional subcommissions and integrating some scholars from the Global South, the consistent and by then pioneering amply circulated bibliography published by Latin American scientists was not even mentioned, let alone incorporated into the discussions about a new epidemiology. Many years before the commission was convened, we had worked, both conceptually and practically, to develop our social determination philosophy, construct a pioneering theory, renew methodology, and generate bold action programs. Latin American critical epidemiology had become a consistent facet of our continental movement of social medicine. By then, our bibliography was clearly familiar to progressive scholars of the North who published important reviews in high-impact English journals (Waitzkin, Iriart, Estrada, & Lamadrid, 2001). However, these advanced scientific contributions and proposals from the South were bluntly ignored by the proponents of new materials from the North, in their Eurocentric spirit.

Willingly or not, from our perspective, a form of epistemicide has taken place. However, for the benefit of a radical paradigm on health equality and environmental justice, we need to consolidate the emancipatory consequences that spring from this important 21st-century controversy

Why Critical Epidemiology?: Daring Ethical Science in an Unhealthy Civilization

between the Latin American paradigm and the functional logic of the “determinants” approach that operates in the linear fragmenting logic of causalism (i.e., “causes of the causes”), cherishing redistributive governance over “factors” as its leitmotiv. We need to bring this important discussion to academic and institutional scenarios if we want to overcome the conservative cosmetic functionalist strategy that has been enthroned among public servants and important university departments. The current global health crisis demands a new understanding and form of governance that decolonizes international scientific and technical cooperation and builds new democratic, respectful, and intercultural ties between the North and the South—a new form of governance that takes seriously the emancipating potential of the struggles of health workers and researchers throughout the world.

Wellness, Modes of Living, and Styles of Living

When defining wellness, conventional mainstream social sciences and philosophy resort to an empirical approach constructed through criteria designed to analyze so-called human development and quality of life. As a result, an interminable succession of empirical constructs have been developed to describe/predict a state of personal wellness as a set of decontextualized abstractions, stripped of their historical social-cultural relations.

The New Economics Foundation (NEF) has published a review titled *Well-Being Evidence for Policy* (Stoll, Michaelson, & Seaford, 2012). After presenting a summary of the “current literature on well-being and its determinants” structured by policy areas, NEF refers to what it considers the relative effects of different factors¹³ that influence personal well-being. The account recognizes that the literature sometimes suffers from a lack of clarity regarding the use of the term *well-being*, which is used interchangeably with personal subjective well-being, life satisfaction, and happiness. Taking sides with a Cartesian individualistic-subjective perspective, it assumes that the problem is basically one of personal satisfaction (i.e., individual psychological) that varies according to determinants (i.e., factors and causes). Here, we do not return to our methodological critique of this sort of fragmented, lineal one-plane reasoning; the example here simply illustrates how this approach, notwithstanding its formal sophistication, reduces the complexity of wellness to a constellation of fragments organized around individual well-being and focalized governance policy.

However, as is the case with health, wellness cannot be reduced to an individual phenomena, nor can it be reduced to personal psychosocial well-being associated with empirical fragments of a personal life history. It involves a complex set of interrelated processes of society, occurring in all three dimensions of its social reproduction (i.e., G/P/I). Wellness encompasses both basic indispensable material resources and the cultural spiritual conditions—tied to the aforementioned material conditions—needed to produce a collective and individual, sustainable

Why Critical Epidemiology?: Daring Ethical Science in an Unhealthy Civilization

and supportive, psychological and spiritual sense of well-being. Epidemiology as a sociobiological science therefore requires the understanding of complex systems. It needs to incorporate complex thinking in order to explain the actual material relations and contradictions between healthy, supportive, and protective processes, which are affected or contradicted by unhealthy, hazardous processes, in all three dimensions.

Viewing this challenge from the standpoint of critical epidemiology implies embedding the notion of wellness in a substantially different conceptual and social foundation. Most important, it needs to be inscribed in a whole new life philosophy and ethos. Restating wellness is consequently a road to reshaping the struggle for new, healthy, equitable modes of living and redefining the criteria for evaluating the advancement of collective health.

To transcend the predominant individual psychological connotation of wellness from a holistic epidemiological perspective, we need to go beyond individual well-being related to empirically defined satisfaction. Wellness in fact denotes the cultural-spiritual embodiment of a material healthy social reproduction. In this sense, it is an important component of health in the paradigm of critical epidemiology. Wellness therefore entails both a material embodiment of protective, supportive, empowering, safe, satisfactory, healthy modes and styles of living—that successfully overcome the contradictory elements of destructive, undermining, alienating, and unhealthy ones—and a subjective cultural and spiritual proactive embodiment that springs from satisfaction related to safe, rewarding, pleasurable, creative, collective and personal activities. From this perspective, wellness is the collective or personal expression of fruitful social reproduction that is embodied in interrelated forms. Objective processes related to what we have called the four S's of wellness/living—sustainability, sovereignty, solidarity, and security (integral biosecurity)—constitute an indispensable foundation (Table 2.3). Accordingly, beyond material wellness, it entails coherent forms of cultural-spiritual dimensions of human existence. Among other things, this involves a profound and respectful relationship with Nature and collective equitable relations with others.

Table 2.3 Principles of Good Living and Requisites for Wellness—the Four S's of Life

Dimensions	Description
Sustainability	Capacity for present and future reproduction of human and natural life (i.e., social subject and nature)

Why Critical Epidemiology?: Daring Ethical Science in an Unhealthy Civilization

Sovereignty	Autonomy in the conduction of a chosen social system and way of life Control of present indispensable resources and planning
Solidarity/ organicity	Equitable civilization Protective logic for the common good Organic popular organization around auto determined strategic interests Validity and feasibility of rights Solidary, psychological fraternity, and spiritual sense of well-being and togetherness Profound and respectful relation with Nature and collective equitable relations with the others
Security of life (human— ecosystem)	Healthy spaces and processes Protectors Healthy forms of embodiment

The sociohistorical development of wellness is a continuing process that is built, rebuilt, and perceived in social spaces where work, leisure, consumption, collective organization, and cultural emancipation take place in health-promoting territories. Societies of authentic wellness fight to sustain and multiply from an intercultural perspective the crucial components of living well through safe, rewarding, pleasurable, and creative collective and personal activities.

Having characterized our civilization as the antithesis of collective wellness, the horizon could be perceived as gloomy. Nonetheless, the growing awareness and global upheaval of the peoples do give rise to cautious optimism.

Latin American societies with a strong presence of indigenous cultures do provide some motives for optimism. A critical, academic, emancipatory paradigm related to society, life, and health can easily be harmonized with the philosophy and the principles of indigenous peoples' knowledge, their harmonious ecosensitive ways of relating to Mother Nature, and their community-based ethos that replaces competitiveness with sharing and mutual provision. This complementarity that I proposed in a previous essay (Breilh, 2003a) was effectively verified in meetings with native peoples' organizations held at Simon Bolívar Andean University (2007). In effect, during the preparatory intercultural process prior to the Constituent Assembly that would formulate a project for a new Ecuadorian constitution, the role of integral wellness (i.e., *buen vivir* or *Sumak Kawsay* in the indigenous Kichwa language) and the rights of nature were inscribed as key elements of the right to health. Consequently, there is a powerful, straightforward coherence between the assumed philosophical preeminence of human and cultural rights over

Why Critical Epidemiology?: Daring Ethical Science in an Unhealthy Civilization

business; the integral, heuristic, taxonomic, and ecosophical principles of the indigenous vision; and the conceptual ethical framework of critical epidemiology.

The dialectic of collective and individual life in concrete, social, and territorial spaces is fundamental to our critical approach. Different societal groups operate according to specifically structured living patterns for their social reproduction. In those configurations, there is a permanent opposition between healthy and unhealthy trends. So the broader social relations of society determine the life of groups, and these determine the individual styles of living¹⁴ of their members (Table 2.4). These specific particular modes of living concur either with typical patterns of exposure and vulnerability to harmful conditions or with characteristic capabilities for taking advantage of favorable processes and building protective immunity. In those specific contexts, individuals develop their possible personal-familiar styles of living that are finally embodied in corresponding phenotypic, genotypic, and psychological characteristics (Breilh, 1977, 2003a).

Table 2.4 Collective Modes of Living and Individual Styles of Living		
Characteristics	Modes of Living (Collective)	Styles of Living (Individual)
GENERAL		
Living patterns determined by class-gender-ethnic relations, structured conditions and spaces, and variations with time	Collective socially determined specific patterns of the group	Individual socially determined specific patterns of the person
Work	Space and typical conditions of the class at work: position in the productive structure; protective (healthy) and destructive (unhealthy) work patterns; exposure and vulnerability patterns	Personal labor itinerary, labor relations and protective and unhealthy socio-environmental conditions during the workday and its leisure periods

Why Critical Epidemiology?: Daring Ethical Science in an Unhealthy Civilization

Consumption	Spaces and typical consumption patterns conditions of the class: quality and access to consumer goods; type of income; constructions of necessity; access system to goods; protective and unhealthy patterns of consumption; food and consumer goods biosecurity	Personal protective and unhealthy patterns of consumption: in food; rest and leisure periods; home place; access and quality of vital goods, services and recreation-leisure
Organization and supports	Organizational spaces and conditions; collective, community, and family life supports and protections; political spaces and means (degrees of empowerment and resources in terms of public-social leadership, social control, and public and private accountability over class interests); union and objective capacity for the class and its empowerment	Personal capacity to organize actions in defense of health of the individual, immediate family, and at work; affective and material personal supports; formal or informal membership of class and community organizations
Cultural-spiritual means	Spaces for building sovereign culture and subjectivity; objective ability of the group to create and reproduce cultural values and identity (class, gender, and ethnicity “for themselves”) linked to their strategic interests; critical thinking and intercultural	Individual subjectivity profile and personal identity; personal conceptions and values; critical capacity and spirituality

Why Critical Epidemiology?: Daring Ethical Science in an Unhealthy Civilization

	development; emancipated and emancipating forms of spirituality	
Metabolic relations	Society-Nature metabolism spaces; quality, sustainability, and security of the group's ecological relationships	Personal metabolic itinerary and quality of individual ecological settings.

Bourdieu's (1998, p. 61) notion of *habitus*, which implies a "modus operandi," a conceptual stand that orients and organizes practical life, is only partially approximate to our understanding of modes of living. Our idea of modes of living not only encompasses an enduring cultural disposition that characterizes and contributes to molding the living patterns of a specific group but also fundamentally involves the material socio-economic basis of such cultural determination. The typical working and consumption patterns of the working class, for instance, not only depend on and develop according to their cultural and moral mold but also, among other things, are strongly determined by the material structure, timing, impositions, salary, and concrete material options of the working-class journey.

However, it is evident that the notion of the social determination of health that I described extensively for the first time in 1977 (Breilh, 1977, 1979) is the backbone of critical epidemiology. It subsequently appeared in several works by other authors belonging to Latin American social medicine and collective health movements. Together with the other categories that constitute a potent conceptual arsenal, since our work began in the 1970s, the social determination of health paradigm has been instrumental in promoting a theoretical, methodological, and practical break with the empirical-functionalist public health paradigm (Figure 2.6).

Why Critical Epidemiology?: Daring Ethical Science in an Unhealthy Civilization



Figure 2.6
Comparative elements of paradigm shift.

In the next section, we profile the fundamental logic and conceptual transformations that must be implemented.

Subsumption of Processes Instead of Conjunction of Factors

As discussed previously, in order to develop a new methodology, critical realism had to break with quantitative and qualitative reductionist empiricism. Five decades ago, in their critical reflections on modern teleological reason, the radical thinkers of the prolific Frankfurt School confronted its profound interpretative flaws. Habermas (1973) stated that “the social sciences that operate through the empirical analytical methods, define social reality as a system constituted by a functional connection of empirical regularities” (p. 222).

This breakup entailed a split with the interrelated static notions of causality and single-plane linearity through the conception of determination and complexity as the conditions of permanent movement. I do not deal here with the entire history of how linear epidemiology was challenged by various advocates of new Latin American epidemiological thought from the 1970s through the early 2000s—authors such as Laurell (1976, 1994), Samaja (1997), Donnangelo (2014), Almeida-Filho (Almeida-Filho, 2000; Almeida-Filho et al., 1992), Tambellini (1978), Menéndez (1998, 2008), Ayres (1997), Victora, Barros, and Vaughan (1992), and myself.

The maturity of our collective transdisciplinary international work allowed for the systematization of abundant contributions that instituted the critical standpoint. In my contribution to an international seminar in 2014, I announced a panoramic view of what I considered representative epidemiological paradigms (Breilh, 2015). Applying an analytic matrix, I classified the emblematic contributions that have influenced the development of critical Latin American epidemiology according to their ontological assumptions, epistemological transformative elements, and proposed practical (praxis) transformations. The idea was to understand the transformative performance of each school in conceptual,

Why Critical Epidemiology?: Daring Ethical Science in an Unhealthy Civilization

methodological, and ethical terms and their proximities or distances with respect to the causal empiricist schools. Here, we provide the reader with our final classification, which illustrates the diverse and enriching contributions originating in different social cultural and geographical settings (Figure 2.7).

Epidemiological Paradigm	Conceptual Sources	CRITICAL EPIDEMIOLOGIES							
		Traditional	Empirical	Causal	Critical	Reflexive	Praxis	Integrity	Reflexivity
Traditional	Biomedical Science, Public Health, Epidemiology	Traditional	Empirical	Causal	Critical	Reflexive	Praxis	Integrity	Reflexivity
Empirical	Biomedical Science, Public Health, Epidemiology	Traditional	Empirical	Causal	Critical	Reflexive	Praxis	Integrity	Reflexivity
Causal	Biomedical Science, Public Health, Epidemiology	Traditional	Empirical	Causal	Critical	Reflexive	Praxis	Integrity	Reflexivity
Critical	Biomedical Science, Public Health, Epidemiology	Traditional	Empirical	Causal	Critical	Reflexive	Praxis	Integrity	Reflexivity

Figure 2.7
Matrix for epistemological comparative analysis of epidemiological paradigms.

Breilh, J. (2013). *Proyecto de investigacion sobre la teoria de la determinacion social de la salud la critica de la noción del "buen vivir."* Quito, Ecuador: Fondo de Investigacion de la Universidad Andina Simon Bolivar.

Speaking about our contributions from the South to the refounding of contemporary critical epidemiology, we can say that they sprang from the academic and political process of the conflictive and demanding years from the late 1970s to the present. The broader outline of this progression has been widely documented and commented on (Duarte Nunes, 1986; Franco et al., 1991; Waitzkin et al., 2001), and I have also summarized it in "Latin American Critical Epidemiology," which forms part of the latest edition of *Epidemiology: Political Economy and Health* (Breilh, 2010).

Being the organizing temporal-spatial metaphor of empirical epidemiological inquiry, linearity implies accepting a single-plane order of conjunctions among phenomenon. Regarding disease generation, the conjunction¹⁵ of various decontextualized "risk factors" (individual, behavioral, cultural, social, and even structural) and their biological effect on individuals. The Cartesian logic circle is completed by assuming that those risk factors ultimately have biological effects in susceptible peoples' bodies and minds.

One potent methodological move was to switch the logic of factorial description and prediction to the scrutiny of generative determination by a process movement (differences shown in Figure 2.5). In such a

Why Critical Epidemiology?: Daring Ethical Science in an Unhealthy Civilization

multifaceted complex whole, a contradictory interplay develops between the tendency of the whole system to reproduce itself, conserving its defining characteristics, and the tendency of its parts to apply their relative autonomy to generate changes (Samaja, 1996).

As explained previously, this new approach entails switching from factors that describe conjunctions to processes that explain movement. The dialectic thrust of this movement implies the opposition of subsumption tendencies that subject particular groups to the broader logic of general social reproduction conditions, and singular individual living styles to the broader logic of their classes' mode of living. But, at the same time, the contrary relative autonomic movement of individuals in relation to their groups and of groups in relation to their society as a whole is the essential trait of the permanent transformation of epidemiological conditions.

In defining how to avoid that empiricist ontology and its epistemological failure of not introducing the logic of determination, one central methodological problem is how to replace linear external conjunction of factors with the inherent determination process by subsumption. As previously argued, subsumption¹⁶ entails the conditioning of a less complex movement by a more complex one. This is not a unidirectional mechanical relationship but, rather, a dialectic movement that is counteracted due to the relative autonomy and generative potentiality of less complex processes. But subsumption generates concrete forms or embodiments that form part of the process and exhibit concrete dynamic relations between them, as demonstrated in Chapter 3 with an illustrative case. We have included the idea of embodiment (i.e., metaphorical incarnation) to complete our epidemiological reasoning. Krieger proposed to explain how we “incorporate, biologically, in societal and ecological context, the material and social world in which we live” (Krieger, 2011, p. 214). We realized that it was undoubtedly an important interpretative tool to explain the social-biological determinant relation that we presupposed in our explanation of subsumption (Breilh, 1977). The notion of embodiment completed our reasoning, but we also realized that, in our opinion, it could be extrapolated to other sorts of “incarnations” (metaphorically speaking)—that is, concrete perceptible formal expressions of those processes that go beyond the individual human body and mind. These other forms derive from critical processes that are generated at different moments of the social determination of health movement, and they are not exclusively of a personal biologic corporal or psychological nature. So we are in no way discarding Krieger’s valuable contribution; on the contrary, we are applying its potent significance to other forms that necessarily participate when we assume the multidimensional complexity of the social determination process. This is because from our perspective, the notion of embodiment not only applies to the individuals “embodied in flesh.” Embodiment can also represent the concrete “incarnations” that can appear as typical collective human patterns; in natural and artificialized ecosystems; or in

Why Critical Epidemiology?: Daring Ethical Science in an Unhealthy Civilization

the form of institutional, cultural, and political stable dispositions that accompany the specific social movement being analyzed. So embodiments are also generated in the particular and general domains. To explain the crucial methodological implications of this finding, S includes a graphic representation.

Chapter 3 provides an illustrative case example related to the critical processes involved and the methodological breaks we have developed in the study of the social determination of vector-borne dengue in an agro-industrial territory. Then, accordingly, it explains the practical model shifts simplified for concrete effective action.

Notes:

1. "Extractivism is the process of extracting natural resources from the Earth to sell on the world market. It exists in an economy that depends primarily on the extraction or removal of natural resources that are considered valuable for exportation worldwide. Some examples of resources that are obtained through extraction include gold, diamonds, lumber and oil" (Acosta, 2013).
2. Because bacteria cannot adequately express the genes of higher animals due to the fact that it is not able to deal with introns, different types of enzymatic promoters, terminators, and codons, the genetic engineers removed the introns; they avoided codons and replaced them with others manageable by bacteria. Also, they did not include promoter and terminator sequences but instead put their synthetic gene under the control of a bacterial promoter and terminator. All this happened without sufficient knowledge or proof of unpredictable consequences (Druker, 2013).
3. According to Professor Annette Peters, Director of the Institute of Epidemiology at the Helmholtz Zentrum, Munich, interviewed by *The Guardian* on December 14, 2019 (https://www.theguardian.com/environment/2019/dec/14/uk-must-limit-killer-ultra-fine-air-pollutants?CMP=share_btn_link).
4. *Metacritic* is a notion that encompasses intercultural and transdisciplinary counter-hegemonic action that the author has developed as the essential guideline of emancipatory epidemiological action; it is further explained in Chapter 3.
5. In a manner that reminds us of the recent debates on fake political truth, the discourse of "good" extractivism that pays for social expenditures, that has become common during the past two decades, especially among these self-proclaimed "progressive" Latin American governments.

Why Critical Epidemiology?: Daring Ethical Science in an Unhealthy Civilization

6. "Empiricism is a philosophical term to describe the epistemological theory that regards experience as the foundation or source of knowledge" (Aspin, 1995).

7. Here, as we further explain later, it is very important to distinguish our notion of *styles of living* with the conventional English concept of "lifestyles." It is also important to differentiate it from our notion of collective *modes of living*.

8. *Subsumption* is a notion we applied in epidemiology that we connect to the category *embodiment* proposed by Nancy Krieger.

9. Teleological: exhibiting or relating to design or purpose (*Merriam-Webster Dictionary*: <https://www.merriam-webster.com/dictionary/teleological#other-words>).

10. Talcott Parson's "systems theory," the so-called *structural functionalism*, proclaimed reality as a system composed of a set of systems that permanently tend toward equilibrium, adaptation, and adjustment in order to attain certain functional roles (Parsons, 1991).

11. *Capital accumulation* at its core results from the surplus value that any production company generates by extracting from the productive cycle of workers additional value to that of the labor force measured by the same unit of time. If the labor force generates per day or per hour a value greater than the value of its salary for that period, surplus capital is generated. Nonetheless, there are other sources of cyclic accumulation involved that we explain in this chapter.

12. *Merriam-Webster Dictionary* (<https://www.merriam-webster.com/dictionary/embodiment>).

13. The proclaimed model involves an array of factors that include the economy (11 variables), social relationships and community (9 variables), health (5 variables), education and care (2 variables), the local environment (9 variables), and personal characteristics (6 variables).

14. The expression "styles of living" applied here to individual everyday itineraries is used with the intention of differentiating it from the commonly used notion of lifestyles, which in common English suggests a collective cultural trait.

15. *Conjunction* refers to external causal links; it is fully discussed later.

16. *Subsumption* is a general principle of existence that involves the conditioning of a less complex movement by a more complex one. It must be differentiated from the particular social historical Gramscian notion of *hegemony* that entails a form of social oppression and control of a dominant ruling sector that results from the system's seduction of subordinate social classes that accept and adhere to the system's logic.

Why Critical Epidemiology?: Daring Ethical Science in an Unhealthy Civilization
