(In)commensurable: Transnationalism, Ethnicity, and the Politics of Difference in Chinese Chronic Disease Science

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(In)commensurable: Transnationalism, Ethnicity, and the Politics of Difference in Chinese Chronic Disease Research

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(In)commensurable: Transnationalism, Ethnicity, and the Politics of Difference in Chinese Chronic Disease Science

Abstract

This dissertation explores the representation of medical difference in Chinese chronic disease science. Drawing on 18 months of ethnographic fieldwork with a group of chronic disease epidemiologists and their aging research subjects in Hong Kong, SAR and Guangzhou, PRC, respectively, it seeks to understand the dynamics and repercussions of an apparent paradox: Despite renewed appreciation of the plasticity and contextual embeddedness of forms of life and courses of disease in epidemiological science, these researchers continue largely to discount in their work local historical, social, and political forces as sources of pathogenesis that become differentially embodied by Guangzhouese and are reflected in unique patterns of chronic disease susceptibility, morbidity, and mortality. Rather than focusing on a single explanatory cause, and resisting claims of overdetermination, the dissertation instead frames the paradox as a contingent outcome of many structured macrolevel processes and micropolitical practices that historically have converged on the research group. By highlighting the contingency of these dynamics and pointing to parallel, if somewhat marginal, developments in the field that facilitate study of the contributions local social forms make to differential disease risk and outcomes, the dissertation ultimately aims to demonstrate the potential exists to build on practices and trends within chronic disease epidemiology in order to generate less reductionistic and more prosocial representations of medical difference in Chinese public health.

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For Georgia and her sisters

> “Thinking, no doubt, plays an enormous role in every scientific enterprise, but it is the role of a means to an end; the end is determined by a decision about what is worthwhile knowing, and this decision cannot be scientific”
>
> --Hannah Arendt, *The Life of the Mind*

Chapter 1: Introduction

I. Statement of the Problem

In 1998, Jiang Chaoqing took a fateful vacation with his old school buddy, Lam Tai-Hing. Jiang, a physician and epidemiologist, was at the time head of the Occupational Disease Prevention and Treatment Center at People's No. 12 Hospital in Guangzhou, China and, in the words of one colleague, "a well-connected guy who could make things happen." Lam was a physician and medical sociologist whose non-communicable disease (NCD) research and policy activism had recently started to garner international recognition that set his career on a steep upward trajectory. That year, he received an award from the WHO in recognition of his work advocating for tobacco-free societies; soon, he would be named to a chaired professorship of community medicine at the prestigious University of Hong Kong. The friends shared a common interest in researching the social, behavioral, and biological determinants of NCDs in China and, one night during their trip, got to talking about the possibility of setting up a large-scale study to do just that. As a prominent researcher and head of a major hospital in Guangzhou, Jiang had the professional credibility and *guanxi*, or networked relationships, needed to convince local authorities to support such a project in the city. And, given that Guangzhou was fast-modernizing metropolis with a rapidly aging population of just under 10 million persons, officially, he had access to a vast number of potential chronic disease research subjects. Lam, on the other hand, had the research pedigree and global institutional connections they would need to garner logistical, technological, and fiscal support from colleagues around the world who had experience designing and implementing such studies.

Jiang and Lam's timing was fortuitous, as planning for the project dovetailed with geopolitical, economic, and technological changes that bolstered the value and feasibility of such large-scale studies of chronic disease. The global neoliberal order that emerged in the closing decades of the 20th century had had a transformative impact on basic health science education and research, allowing scientists and resources to move across national borders with unprecedented-- if not absolute-- ease, laying as they went the global institutional circuitry needed for transnational research collaborations to proliferate. Advances in computing technology were poised to remake the design and capacity of such studies, enabling the collection, storage, and analysis of health data in numbers, at speeds, and with a degree of statistical power unthinkable just a decade earlier. And emerging genomic sequencing technologies had opened a promising new molecular space for mapping disease risks facing human populations. At the time of Jiang and Lam's vacation, both nation-states and international research consortiums were preparing to invest heavily in genetic biobanking projects as important sites of future-making, through which the health interests of specific groups—nationally or geo-ethnically defined—could be secured. In this regard, Chinese leaders were no exception. Like many countries undergoing rapid socio-economic change, China was facing what epidemiologists referred to as a double burden of disease (Li et al. 2012). Infectious diseases had not yet receded and already evidence of a looming chronic disease epidemic was threatening the country's population, with dire implications for the domestic economy. Incorporating vanguard techno-science into the state's response could serve multiple securitization priorities.

Over the next five years, with these winds at their backs, Lam and Jiang worked feverishly to establish the Guangzhou Biobank Cohort Study (GBCS), which would be touted, somewhat misleadingly, in domestic media reports as the first genetic biobanking project in mainland China (Yan 2004; Sung 2009). Though personal connections made over the course of their careers, and the connections of those connections, they were able to recruit technical and fiscal support, as well as institutional collaborators, overseas. Another school friend of Lam, physician and epidemiologist KK Cheng, enlisted his home institution in the United Kingdom, The University of Birmingham, to join the University of Hong Kong and People's No. 12 Hospital in Guangzhou as primary institutional hosts and financial backers of the project. Guangzhou-based branches of the Ministries of Health and of Science and Technology contributed to additional funding, a reflection of the region's and nation's enthusiasm for undertaking advanced bioscience projects as part of a broader biopolitical and geopolitical agenda organized around achieving domestic security and wellbeing, in part, by positioning the country's domestic science and technology sectors as major contributors to cosmopolitan bioscience. The Clinical Trails Unit at Oxford University, lent their expertise gleaned from administering the United Kingdom's national biobank project, in the form of technical support. By 2002, principal investigators were enlisting the first of their 30,000 research subjects from a local elderly welfare organization in Guangzhou. By 2006, the had published their first paper under the Guangzhou Biobank Cohort Study. They were up and running.

I arrived at The University of Hong Kong's (HKU's) Department of Epidemiology in the summer of 2014 to work with a group of GBCS affiliates in the department's Non-communicable Disease Research. I was drawn to the project out of curiosity about how novel forms of bioscience, specifically genomics, was affecting the practice of population-based chronic disease research in China. More specifically, I wondered how such forms were affecting the conceptualization of medical difference and risk in relation to the country's efforts to respond to its chronic disease crisis. Fourteen years into the new millennium, an enormous amount of evidence from both the life and social sciences suggested that this novel field of practice and its related technologies and knowledge frameworks had profoundly transformed the way life-scientists, clinicians, government health officials, and even ordinary people thought about and experienced embodied medical difference in relation to disease prevention and treatment, risk, care, medical ethics, and even identity and self-worth. This culminated in what the philosopher Nicholas Rose argues is a wholesale reorganization of medical perception, resulting in the "molecularization of styles of biomedical thought, judgment, and intervention" (Rose 2007).

I wondered what sort of transformations this molecularization had wrought in China and how it was shaping epidemiological research agendas, the ways in which chronic disease risk, morbidity, morality were being problematized and mapped, and the broader public health initiatives such for which such research furnished a much-needed evidence base. These questions seemed especially pressing in light of the dramatic de-skilling China's public health sector underwent in the closing decade of Mao's rule and the systems subsequent years languishing under privatization, which resulted in a serious lack of, among other things, the local epidemiological evidence base needed to tackle the country's public health crisis. As Chinese health officials have scrambled to generate this base, and with the knowledge that chronic disease morbidity and mortality patterns differed across groups because their risk factors and determinants are ineluctably biosocial, and hence contingent upon local social forms, I was curious how this shift toward molecularization in biomedical science would be reconciled with—or displace—public health science of the local and social forces driving China's chronic disease epidemic. At stake was whether molecularization would push GBCS research away from attending to the local social and contingent forces shaping Chinese medical difference, with respect to chronic disease risk, morbidity, and mortality—an outcome that would be particularly problematic for public health science due to its applied nature. Indeed, the philosopher Alex Broadbent has observed that epidemiology is unique among the basic human life sciences because it developed for the express purpose generating actionable interventions for specific populations rather than a coherent body of abstract, theorized knowledge—a bias toward the particularistic and preferential that was at once epistemic and ethical. Molecularization, on the other hand, abstracting and decontextualizing, could easily subvert this objective.

As luck would have it, the vagaries of fieldwork logistics intervened, and I found myself working not with a group of genetic epidemiologists, but instead life course epidemiologists. Led by Dr. Christine Bedford, a professor of biostatistics and epidemiology at HKU's school of public health with a joint appointment at a university in the U.S., where she spent most of her time, the Non-communicable Disease Research Cluster included seven graduate students, all from mainland China, two post-docs, both from Hong Kong, and two associate professors, also from Hong Kong. They were united under Dr. Bedford in their commitment to a lifecourse approach to epidemiology, which, unlike a classic behavioral approach to conceptualizing chronic disease risk and etiology—with a focus that is heavily on lifestyle factors—seeks to uncover the sociogenic and environmental causes of chronic disease risk, morbidity, and mortality across the individual's life and even across generations. This was very different from the genetic approach I was hoping to examine. As it turned out, the genetic part of the Genetic Biobank Cohort Study had gone bust for reasons I explain in Chapter 2.

My positioning in Dr. Bedford's group turned out to be of extraordinary benefit, helping me to reframe and refine questions more suited to understanding the core stakes of the project. It brought to my attention the fact that genomic technologies, knowledge frameworks, and practices had ramified unevenly across the life science disciplines. It impressed upon me the importance of understanding the contributions that both the location of GBCS within a transnational research space and the micropolitics that emerged within that space as a result of the professional, personal, political, and disciplinary forces that converged on it and shaped practices within it made to the premises and aims governing representations of medical difference in the GBCS research that came out of Dr. Bedford's group. It prompted me to think about how ordinary Chinese came to be envisioned as desirable research subjects by the foreign scientific institutions that participated in GBCS, and how the different regimes of epistemic, political, ethical, and economic valuation diverse stakeholders brought to the transnational collaboration contributed to the way in which GBCS participants were configured as valuable bearers of medically salient difference. It gave me new appreciation for the diversity of conceptual and methodological approaches available to chronic disease epidemiologists, as well as the uncertainty that emerged from that lack of consensus. I came to recognize that, in conditions of uncertainty, representational and methodological choices, as well as research objectives, are deeply inflected by moral reasoning, itself a product of the unique situatedness of researchers within a transitional field of practice and the socio-structural forces that shape that local. And I gained a deep appreciation of the extent to which different forms of value associated with scientific knowledge—epistemic, political, ethical—are coproduced.

Most significantly, however, it drew my attention to moments in researchers' knowledge production processes—be it developing a line of inquiry, designing and operationalizing a new study, deciding on what data to collect and how, or in the presentation of a new project to colleagues-- when latent tensions resulting from points of incommensurability between the diverse technological, epistemic, politico-institutional, and ethical rationalities that govern epidemiological science and the nature of its object—life-- erupted into the everyday sociomaterial practice. It was in these moments, I found, that I could begin to understand how it is that social determinants of poor health and other forms of medical difference continue to be deprioritized in postgenomic epidemiological science, despite ample evidence and a growing embrace within the bioscience community of the irreducibly biosocial nature of disease. And the insight I gained by attending to the tension, uncertainty, and resolution they engendered afforded a degree of granularity rarely enabled by explanations of biological reductionism that refer back to sweeping epistemic and fiscal hegemonies like molecularization or biocapital. By shifting out of these admittedly powerful analytic frameworks into one that emphasized differences that cannot be rendered commensurate, I was able to resist the sort of fatalism that often inheres in the former. Instead, I saw in these moments when, for example, the stubbornly normative and relational nature of life and disease, confounded attempts to standardize that variability away, or produced doubt in the researchers who sought to do so, the possibility for intervention that might contribute to a more holistic and humane practice of epidemiology. And that, ultimately, is what defines the stakes of this dissertation research—finding the points of fluidity and openness in contemporary representational practices, such that they may be reoriented more accurately toward the health needs of local research populations in the future.

II. Argument

The normalization of transnational collaborations over the past 30 years and more recent impact of molecularized styles of thought, along with genomics-adjacent technologies, on cosmopolitan epidemiological research practices in China have brought many benefits to domestic public health science. However, these forces have also perpetuated enduring biases toward biological reductionism and the erasure of social contingency from representations of medical difference. However, an ethnographic vantage on representational practices engaged in by Guangzhou

Biobank Cohort Study investigators suggests that problematic forms of reductionism are neither wholly attributable to these forces and their related economic and institutional incentives nor a forgone conclusion. Indeed, developments in the field of genomics over the past 15 years have, in fact, resonated with longstanding intradisciplinary critiques insisting on the importance of attending to local social determinants, even if novel genomic technologies and methodologies perpetuate molecularized and abstracted forms of reductionism. A shift toward ecological conceptions of human biology, the emergence in the last 20 years of subdisciplines such as epigenetics and social epidemiology, and growing demands for interdisciplinary approaches to human life science, all highlight new opportunities for moving away from reductionism toward something closer to the ontological understanding of human difference presented in Margaret Lock's theory of "local biologies." In Dr. Bedford's cluster, the extent to which these developments were incorporated into her groups' research strategies, practices, and aims, hinged powerfully on the local moral worlds inhabited by the researchers, where political, economic, and professional forces associated with their positioning within overlapping fields of practice and sovereignty often conspired to dissuade them from doing so despite the desire being there. This ethnographic account of the decision-making processes that lead to the perpetuation of reductionism thus offers insight both into the assignation of responsibility for ongoing reductionism and strategies for effectively building on growing momentum in the field to address and overcome such reductionism.

III. Theoretical Orientations

The interpolation of the knowledge frameworks, technologies, methodologies, aims, and ethical discourses of cosmopolitan sciences into local health projects carries with it transformative consequences that ramify, if unevenly, across biomedical, political, social and even legal domains (Rapp 1987; Strathern 1992; Rabinow 1999; Lock 2001; Beihl 2005) (Greenhalgh 2008; Taussig 2009; Lock and Nguyen 2010; Montoya 2011; Farmer et al. 2013)(Beihl and Petryna 2013; Tamarkin 2014)). In biomedical practice, in particular, their influence on how health problems are problematized, the kinds of evidence collected to render them legible, and the subsequent interventions made into them, is eminently consequential for both illness experiences and disease outcomes. However, such forms are not simply reproduced without difference in local context; rather, there is an interplay of influence between the two. As the knowledge frameworks, technologies, methodologies, and ethical discourses of cosmopolitan health science become localized within particular, concrete social fields, which are peopled by stakeholders with diverse biopolitical, epistemic, economic, institutional, and moral commitments, they are altered by the power dynamics that prevail in those fields, acquiring new, situated meanings, values, and ends. Scientific orders in other words, are "co-produced" with social fields of power (Jasanoff 2004) and "questions of epistemology are also questions of social order" (Latour 1993:15-16). This inevitable imbrication of knowledge production practices and social orders underscores what Cori Hayden aptly describes as "one of the most iconic arguments" to come out of the work of science study: namely, "that (scientific) knowledge does not simply represent (in the sense of depict) nature, but it also represents (in the political sense) the 'social interests' of the people who have become wrapped up in its production" (Hayden 2003: 21). In other words, there is always and everywhere a politics to scientific representation.

Interest in the biopolitical and biosocial effects of dynamic configurations of medical research and technologies with and within local social fields of power has intensified amongst anthropologists over the past three decades. Much of this interest has been organized around the rapid rise at the beginning of the 21st century of the omics sciences, a subset of the biological sciences. Harkening back to Michael Foucault's groundbreaking work on the deep sociologics of representation in natural and social sciences, *The Order of Things,* the philosopher Nicholas Rose argues that emergence of omics has led to a wholesale reorganization of medical perception (Rose 2006). In Rose's telling, the omics offer unprecedented access to the molecular bases and processes of life through techniques and technologies that allow them to be visualized and intervened in with a level of precision and sophistication unthinkable mere decades earlier. The resulting "molecularization of styles of biomedical thought, judgment, and intervention" has, in conjunction with the changes wrought by globalization, carried profound implications for how both life itself and human subject are valued and problematized as a target of clinical care, biopolitics, and bioeconomics (Rose 2006:11). As Paul Rabinow (1999) has argued in relation to his critique of the limits of conventional secular humanism as a universal framework for contemporary ethics, these novel configurations of biology, technoscience, and society, are producing new forms of life and hence require new ethical problematizations that are sensitive to the provisional nature of our understandings of their potential impacts and outcomes.

Accordingly, anthropologists have studied the impact this molecularization of life has had on subjectivity and self-valuation, biomedical research, reproduction, large-scale biopolitical projects, logics of belonging, and the trade in human biologicals, among others. Much of this work has focused on genetics, as anthropologists and bioethicists have voiced concerns that the geneticization of difference, disease susceptibility, and identity may lead to a "reinscription of race" (El-Haj 2007) or provide a "backdoor" to eugenic biopolitical projects (Duster 2004)). Others pointed to the growing emphasis on genetic components of disease susceptibility in biomedical explanations for interethnic and interracial variation observed in chronic disease morbidity and mortality patterns, noting that this emphasis perpetuated the de-prioritization of social and economic determinants of disease pattern variability in such groups (Fullwiley 2011; Montoya 2011). Still others drew attention to the growing popularity of bio-banking projects, probing the alignment of nation, people, and race the logic underwriting such projects assumed; the bioethical issues around privacy and consent they raised; and the potential for neocolonial valuation they brought to vulnerable groups of people under the bioethical formulations of human diversity protection and inclusion (Reardon 2004; Fortun 2008; Taussig 2009; Sleeboom-Faulkner 2009; Ong 2010). Finally, some explored the intersection of genetic testing and personalized medicine, focusing on how probabilistic knowledge afforded by estimations of genetic risk influence subjectivity and decision-making around intimate and high-stakes experiences concerning health and reproduction (Lock and Nguyen 2010; Lock 2013).

These scholars have produced incisive, timely reflections on the transformative potential new omics sciences carried for biomedical understandings of human biological variation in relation to race, identity, nationhood, and health equity. This project seeks to build on their work by expanding lines of inquiry in two directions. The first is motivated by the fact that much of this research is skewed towards a Western context, exploring agendas were that set by Western institutions and were informed by Euro-american history, bioethical frameworks, and sociological categories. More recently there has been a shift of interest towards East Asia. As East Asian nations become emerging leaders in biotech research, they formulate unique ethical and biopolitical valuations of such knowledge and technologies in relation to alternative histories, ways of reckoning identity and relatedness, national imaginaries, and governance prerogatives ((Kaur and Wahlberg 2014;.)Sleeboom-Faulkner, Ed. 2009; Ong 2016; Ong and

Chen, Eds. 2010; Song 2017)). This work is extremely informative but tends to focus on elites to the exclusion of ordinary Chinese. For this reason, in this dissertation, I seek to bridge ethnographic literatures on advanced bioscience and the health and wellbeing of ordinary Chinese through multi-sited ethnography that sets the practices associated with one form of advanced bioscience, genetic biobanking, alongside the health- and wellbeing-seeking experiences of the population of older Guangzhou residents from which the biobank subjects were recruited. In doing so, my aim is to better understand and, to the extent that I am able, give voice to, the health needs and experiences of those whose lives are inevitably affected by advanced bioscientific research but who live outside of the participatory democracies where the grassroots impact of such research has typically been examined.

The other is motivated by the tendency to treat genomics, as an ethnographic object, monolithically in this literature, which has resulted in the overrepresentation of genomic research projects to the exclusion of adjacent fields of science that are selectively interpolating technologies, methodologies, and knowledge frameworks from the field to shape health futures. This focus has been warranted both by the powerful and troubling legacy of 20th century genetic determinisms-- the political and medical atrocities carried out under their flag and the forms of structural violence they have been employed to justify, particularly against society's most marginal groups-- as well as the prominence genomics has been afforded in early 21st century scientific imaginaries and research agendas. What this focus tends to exclude, however, is the uneven impact of genomics across different fields of cosmopolitan human life science. While it is true, for example, that it has been extraordinarily generative in some areas—including, though not limited to, oncology research and human developmental biology—and abused as an explanatory mechanism in many others (see especially behavioral psychology)-- its impact on other subfields of human life science has been more complicated. Despite much enthusiasm for and investments in research concerning the genetic determinants of common forms of cardiovascular disease, obesity, type II diabetes, and other NCDs that constitute the major burden of morbidity and mortality across the globe, in fact genetics has done relatively little to offer new, explanatory insight into the source of variation in susceptibility to these ailments among individuals and groups of people. Instead, it has pushed etiological understandings of polygenic disease in new directions, upending conventional understandings of the deterministic relationship between gene expression and biomolecular outcomes, giving rise to a novel paradigm of the body in the form of systems biology, and encouraging a shift toward interdisciplinary forms of research.

In cosmopolitan NCD epidemiology, in particular-- which has undeniably seen heavy investments in population genetics research in the past 25 years-- one result of this unanticipated "dethroning" of the gene (Fox Keller 2000) has been to create epistemic space for novel approaches to understanding the relationship between environment and biomolecular processes, of which gene expression constitutes one contributing component. This can be seen most clearly in the twinned emergence of epigenetics and social epidemiology during the same time period. These developments underscore the need to be cautious in equating molecularization, in Rose's sense, with genomics, as well as to strive for specificity in understanding how omics knowledge and techniques are being interpolated into cosmopolitan forms of NCD research whose longstanding concerns about the role history, social context, culture, and material environment play in NCD disease etiology continue to have traction and gain new framings in relation to systems biology.

IV. Overview of the Research and Field Site

The Guangzhou Biobank Cohort Study (GBCS) is a longitudinal cohort study of 30,000 residents ages 50 and above recruited from the port city of Guangzhou. Established in 2006, the initial aim of the study was to track the emerging patterns of NCDs in this population across time in order to uncover associations between disease states and variable lifestyle, environmental, genetic, sociocultural, and biomolecular exposures. The project is a collaborative research venture between epidemiologists and public health workers at People's No. 12 Hospital in Guangzhou, the University of Hong Kong (HKU) in Hong Kong SAR, and Birmingham University in the UK. The initial study design was altered in 2008 to focus follow-up efforts on a cohort of 2,000 in response to funding shortfalls that arose after the University Oxford chose not to contribute financial support to the project owing to concerns about how Chinese laws restricting the transport of human biologicals outside of the country would affect the quality of information in the shared database that each institution would use to pursue specific research questions about the population. One consequence of this reduction in the cohort size was that it limited its value as a site of genetic research on NCDs.

My 18 months in the field were split between two sites. The first was a group of life course epidemiologists in Hong Kong who were the main conduit between People's No. 12 Hospital in Guangzhou, where information about the cohort was collected and tracked, and collaborators in Birmingham. This group, run by Dr. Christine Bedford, a British expat professor who split her time between teaching appointments at HKU and a university in New York City, sought primarily to understand how environmental and social exposures across the life course contributed to NCD risk and etiology in later life, particularly with respect to cardiovascular disease. They were the main group working with and publishing on biobank data in Hong Kong. My second fieldwork site comprised two community centers in *Liwan* district, Guangzhou, from whose membership the GBCS cohort was recruited. The time I spent there with community members gave me insight into the lived experience of NCD risk and morbidity in the GBCS cohort that simply could not be gleaned form information captured in the database maintained by Dr. Bedford's group.

My work with these GBCS stakeholders was motivated by the following set of questions: How and why were older Guangzhou residents deemed valuable as NCD research subjects at different times and by different stakeholders involved in GBCS? Who was empowered to make these value determinations, and what epistemic, ethical, biopolitical, and institutional commitments underwrote them? How were they materialized in the tools, technologies, questions, and research designs used to render legible and to measure health states in relation to specific environmental, social, lifestyle, and biological exposures?

V. Organization of the Dissertation

The body of the dissertation is divided into five chapters. **Chapter 2** demonstrates that a series of technological, economic, and political processes and events linked to globalization, including notably the opening of China's economy and professional sectors to foreign influence, led to the normalization transnational collaborations in Chinese chronic disease science. It argues that imputation of specific epistemic values to the older Guangzhou residents recruited for GBCS was influenced by the discrete interest and ends stakeholders, by dint of their differential positioning within the cosmopolitan field of NCD research, brought to the transnational collaboration. **Chapter 3** argues that those epistemic values became the basis for a set of claims concerning the geo-ethnic identity of the cohort. This identity, it shows, functioned as a technology of interest-alignment, configuring cohort members as bearers of specific forms of medical difference that seemingly rendered commensurate the diverse ends different stakeholders hoped to achieve through participation in the project. It concludes, however, that the rhetorical success of this geo-ethnic identity turned on a unique delineation of ways in which the cohort resembled and differed from other populations that ultimately erased local social determinants of poor health.

Chapter 4 examines the impact of molecularization and the advent of omics sciences on chronic disease epidemiology. It shows that while this impact has been significant, it has also been contradictory, interpolated into existent ontological, ethical, and methodological debates that demand practitioners' attention. It suggests that, in practice and under such conditions of uncertainty, the ontological and epistemic commitments of different camps in these debates inevitably refer value-based decision-making, underscoring the extent to which the epistemic is always grounded in the moral. It concludes by presenting ethnographic data surrounding representational decision-making in Dr. Bedford's research cluster that shows how moments of uncertainty in the group are resolved often by reference to political and institutional limitations, professional ethical commitments regarding what constitutes good science, and a kind of fatalism regarding the limits of scientific activism to encourage social interventions into poor health determinants. This process leads to a privileging of biological reductionism despite the group's commitment to an epidemiological framework that explicitly foregrounds the social as a source of differential disease risk, morbidity, and mortality.

The **final chapter** attempts to restore one aspect of the social context of the GBCS cohort that is systematically erased in GBCS research. Moving out of Dr. Bedford's cluster at HKU into the community centers where GBCS participants were recruited, it offers an ethnographic account of loneliness, an established risk factor for cardiovascular disease. By tracking the strategies GHHARE members have developed to cope with the felt risk of loneliness in everyday life and connecting that risk to the impact of local historical, political, and social developments in the city on familial, intergenerational, and community structures, this chapter demonstrates two things. First, it underscores the importance of experiential understandings of the local forms that social risk factors take to effectively diagnosing them and developing appropriate public health interventions. Second, building on calls from some epidemiologists for increased interdisciplinarity in the field, it offers insight into the important contributions that the incorporation of representational techniques designed to capture local, qualitative forms of disease risk and determinants can make to generating a care-oriented, ethical practice of transnational epidemiology.

Chapter 2: Transnationalism and the Idealization of Chinese Research Subjects

I. Introduction

In a set of introductory papers published in the mid-to-late aughts in elite academic journals, whose readership comprised the global epidemiological research community, principal investigators of the Guangzhou Biobank Cohort Study (GBCS) identify biomedically salient geographic, historical, social, and biological characteristics of the experimental cohort enrolled in the study and envision ways in which those characteristics may contribute to advances in understanding and arresting non-communicable disease (NCD) morbidity and mortality. The cohort they describe consisted of 30,000 Guangzhou residents, ages 50 and older, recruited from the membership of a city-wide municipal organization for retirees. Some of the characteristics they identify underscore the universality of health risks and disease determinants recruits had experienced. Prominent among these is the residents' lifelong exposure to NCD-linked socioeconomic changes that historically transformed health profiles in high-income countries and, by the end of the 20th century, appeared to be spreading inexorably, if unevenly, across the rest of the world. Others, like shared cultural beliefs, behavioral norms, and presumed genetic similarity, set their experiences and exposures apart, to varying degrees, from those of human groups around the globe. In particular combination, the characteristics conjure a geo-ethnically distinct group of people, referred to in the papers as "Cantonese," "Chinese," or even, at times, "Asian," whose singular positioning in a matrix of common social and biological forces that act on health gave authors cause to speculate their bodies and lives would be a rich and multifaceted source of knowledge about NCD epidemiology.[1] That knowledge, the authors conclude, could

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[1] I affix "geo-" to the common and less cumbersome sociological term "ethnicity" in order to acknowledge the implicit importance of spatial proximity and scale to GBCS researchers' claims about the relative internal homogeneity of the cohort, as well as varying degrees of the group's external heterogeneity relative to other human groups. Shared physical and social environment play an important role in demarcating the set of exposures that

contribute to a stunning range of basic science and applied public health ends, further elucidating fundamental questions about the interplay of universal sociogenic and biomolecular pathways driving NCD etiology as well as revealing local risks and determinants specific to NCD patterns observed in Chinese and other Asian populations ((Jiang et al. 2006; Jiang et al. 2010).

Upon first reading these papers, this configuration of the cohort's distinct, shared geo-ethnic identity as a unique object of biomedical concern and epistemic value appears to require no justification or unpacking. It is undeniable, for example, that for the last 30 years, if not longer, older Guangzhouese have been situated at the vanguard of the country's sweeping socio-economic transformation, as well as its resulting transition toward urbanization, industrialization, and sedentarism, all of which are exposures that have been firmly linked through epidemiologic research to increased NCD burdens in societies throughout the world. Yet, despite these macroeconomic changes and their impact on lived environment, the intractability of uniquely Chinese cultural beliefs and practices concerning health and wellbeing is evident even through a cursory survey of the city's public spaces and institutions. Aging adults gather in parks to practice *taijiquan*, to play *majiang*, to care for their bodies and spirits through traditional forms of mental and physical exercise. Traditional Chinese Medicine (TCM) institutes and stores specializing in a mindboggling array of medicinal foodstuff appear frequently among the shophouses and buildings lining the winding sidewalks of ancient Haizhu and Liwan residential districts. Evidence of the material and practical elements of a persistent cultural paradigm of self-

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underwrite claims about the relations of resemblance and difference within and between a study population and other human groups in NCD epidemiology. In Chapter 3, I examine in great detail investigators' claims about the relations of resemblance and difference between the GBCS cohort and other human groups and the work they do to establish its epistemic value as a research population. Here, let it suffice to clarify that, as a result of the importance afforded to spatial proximity in their operationlization, the geo-ethnic terms described in this opening passage as being used in introductory GBCS papers, such as "Cantonese," "Chinese," and "Asian," bear a confused relation to members of these ethnic groups who may not be living in Guangdong, China, and Asia, respectively, and should not be assumed necessarily to encompass the them.

care suggests that unique behavioral and psychosocial exposures distinguish this research population from other human groups who share common macroeconomic NCD health determinants. Alternately, China's history of domestic migration policies and traditions, social and cultural resistance to foreign influence, and 30-year period of political and economic isolation bolsters assumptions made about the relative genetic similarity of the cohort. Such socioeconomic, cultural, and historical narratives—familiar to anyone with superficial knowledge of the country-- imbue authors' characterization of the cohort's identity and epistemic value with a quality of obviousness.

Upon further reflection, however, it becomes clear that significant elisions are required to make this characterization work. The socioeconomic changes sweeping across China, while universal in reach, have nevertheless distributed their health impacts unevenly, as is reflected in an emerging social order increasingly stratified by relative exposure to occupational hazards, environmental risks, fiscal precarity, and inadequate access to medical care. In this context, it merits asking how well a group of older Chinese with urban residency benefits, including health insurance coverage, pensions, and social welfare services, could model the health risks facing nearly 300,000,000 of their compatriots who, as members of the country's migrant labor population, have been relegated to the lowest stratum of this new order.[2] Likewise, framing the contemporary rise in China's NCD burden as paralleling that observed in high-income countries in the middle of the 19th century, with a focus on shared exposure to common socioeconomic forces, ignores the profound advances in medicine, industrial technologies, and environmental science that have occurred in the interim (Omran 2005). All of these developments have

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[2] Statistics available online at: https://clb.org.hk/content/migrant-workers-and-their-children

increased human ability to identify and intervene in sources of NCD risk, morbidity, and mortality, complicating attempts to draw essentializing conclusions about the health analogs of industrialization and socioeconomic development across different time periods. Similar concerns crop up regarding claims about the cultural and genetic identity of the cohort. Subjected to scrutiny, then, the narrative underpinnings of geo-ethnicity presented in these papers give way to messier realities, calling into question whether they can be translated unproblematically into pat correspondences between health risks and determinants and social categories of belonging.

If geo-ethnicity—the shared, biomedically salient characteristics and attendant epistemic values it encompasses—is not simply given in the natural order of things, then how can one account for the particularistic way in which it is configured for the GBCS cohort in these introductory papers? One approach, mined fruitfully by science studies scholars, is to recognize the irreducibly hybrid and contingent nature of scientific representations, shaped as they are both by material, technological, and methodological exigencies as well as the diverse epistemic, ethical, and institutional commitments and objectives of empowered stakeholders. By examining the "interest-work," to borrow Steve Woolgar's iconic phrase, constitutive of scientific representations, not only have these scholars offered critical insight into the knowledge generation process as a site of negotiation for competing agendas and prioritized ends, but, in tracing a politics of knowledge production in their work, they've also drawn attention to the necessary imbrication of epistemic, political, and moral orders in science ((Woolgar 1981)). Their efforts to understand the process determining what is represented in scientific bodies of knowledge invariably require reflecting on who is represented—that is, whose needs, commitments, and hoped-for ends (Hayden 2003: 20-22). It is for this reason feminist science studies pioneer Donna Haraway has insisted, in opposition to a traditional paradigm of objectivity that treated knowledge as value-neutral and limited critical inquiry to surrounding social practices, both the subjects and objects of science be examined, or “situated,” in relation to their local contexts: as politico-moral-epistemic objects, all scientific representations “exist for some worlds and not others” (Haraway 1997:37). From this perspective, unpacking scientific representations in order to understand the role they play in (re)producing specific political, economic, moral orders— sociomaterial worlds, in other words, that serve the interests of some over others-- is a key challenge for critical social studies of science.

Accordingly, in this chapter and the following, I treat the geo-ethnicity of GBCS enrollees presented in these introductory publications as one such politico-moral-epistemic object, seeking to account for it by asking the following: Whose investments and participation made GBCS possible? What was at stake for them in doing so, and in what broader professional, governmental, and economic orders did such stakes emerge? Finally, in what ways did the epistemic value attributed to the cohort by dint of its geo-ethnicity resonate with or otherwise advance those professional, political, and economic stakes? Following the insight that social and epistemic orders are co-produced, I argue in this chapter that such questions cannot be answered without first taking stock of the profound impact an emerging set of technological, economic, and geopolitical conditions associated with late 20th century globalization had on cosmopolitan epidemiology, a semi-autonomous field of bioscientific practice united by global standards for the conduct of evidence-based research and truth production, as well as a shared body of foundational knowledge (Falk Moore 1973). By the time GBCS co-founders Lam Tai-Hing and Jiang Chaoqiang undertook efforts realize the project, these conditions had engendered new possibilities and inducements for transnationalism in Chinese chronic disease science, as is evident in the contemporaneous proliferation of collaborative research projects between foreign elite and domestic scientific institutions. Such projects linked domestic health science more closely to the institutional dynamics, research agendas, and incentives at play within the broader field of cosmopolitan NCD epidemiology and, by doing so, introduced new, increasingly diverse ways of imagining and valuing Chinese as NCD research subjects in relation to the discrete health science, bioeconomic, and biopolitical objectives of foreign and domestic stakeholders. Mapping the normative ways of imagining and valuing Chinese research subjects that emerged within transnational collaborative projects that brought together foreign elite researchers, Chinese public health scientists and government officials, and ordinary citizens lays the groundwork necessary to account for the geo-ethnic configuration of the GBCS cohort, which I turn to in the following chapter.

This body of this chapter is divided into two sections. In the first, I examine the sweeping socioeconomic and technological changes associated with the processes of globalization that took root in the second half of the 20th century. Not only did these changes increase NCD health burdens in low- and middle- income countries across the world, but they also created conditions that would further incentivize NCD epidemiologists from institutions in high-income countries, such as the US, the UK, and Europe, to seek new ways to engage in collaborative research overseas. As a result, I conclude, NCD epidemiology emerged as a global field of practice, bringing low- and middle-income populations into a regime of biomedical valuation that prized their potential contributions to basic, or generalizable, NCD science, in contradistinction to the traditional localized and applied focus of this branch of epidemiology. Chinese, I show, were imagined to be an ideal experimental population within this global regime of valuation, even as researchers seeking transnational collaborations expressed concerns about the quality and transparency of Chinese health science. In the second section, I examine the origins of China’s burgeoning NCD crisis, which, by the time GBCS was being assembled in the late 1990s, had grown urgent, prompting Chinese life scientists and public health practitioners to redouble calls for an effective response. By contextualizing PRC leaders' support of efforts to respond to this crisis within broader technoscientifically-grounded geopolitical goals accompanying the country's re-entry into the global marketplace, as well as the impact of political campaigns and reform policies on the country's public health sector, I offer insight into why transnational research collaborations like GBCS would carry domestic appeal. Finally, I unpack the domestic risk discourse surrounding Chinese participation in transnational collaborative research, underscoring its focus on the potential for exploitation rather than on the 'fit' of generalized research goals, and the conceptual frameworks associated with them, with domestic health needs.

II. Transnationalism in Contemporary Health Science

In the summer of 2012 I had lunch with Lawrence Cohen, a well-known anthropologist of biomedicine and aging, at a cafeteria near his office at UC Berkeley. I had enrolled in a Mandarin language course at the school and relished the opportunity to discuss our overlapping interests while on campus. As we ate, I outlined rudimentary plans for a project on public health science and China's "aging society" problem. He listened thoughtfully as I trotted out three or four potential frames before setting down his fork and observing, "The interesting question here is why certain people, their bodies and lives, become desired research subjects." His wisdom, pithy and far-ranging, sits at the origin of concerns about the ethics of scientific representation that unfold throughout this dissertation. For if, to summarize a fundamental assertion of scholarship probing the relationship between epistemic and political dimensions of scientific representation, to be measured is to be made to count, then accounting sociologically for why and how certain forms of life come to be measured—and therefore, how they are made to count--is a necessary first step in generating insight into the ethical questions raised by that relationship. And that accounting, in turn, starts with an exploration of the particularistic desires of those empowered to make choices concerning whom and how to measure in research, as well as the processes that selectively endow them with such determinative powers. In other words, it begins by asking what commitments and objectives motivate those choices and how valuations of particular research subjects are shaped by them

Globalization and the Search for Ideal Research Populations

The many reasons why and how older Guangzhou residents were configured as valuable, and therefore desirable, chronic disease research subjects by the diverse actors who ultimately brought GBCS to fruition cannot be understood apart from the macro-forces of globalization that dominated the closing decades of the 20th century. These geopolitical, economic, and technological developments radically altered lifeways across the world and integrated far-flung institutions, polities, and societies into common networks of production and consumption. While the public health sciences have always included a global dimension (Anderson 2006; Farmer et al 2013), given configurations of bioscientific and geopolitical orders are both historically entwined and relationally constituted; that is to say, they are reproduced and remade together (Latour 1993; Petryna 2002). Thus, late 20th century globalization altered the practice of epidemiology, including the chronic disease subfield, in such a way as to normalize technologically sophisticated forms of transnational collaborative research between scientists from high-income and low- or middle-income countries (LMICs). These projects interpellated populations from the latter into new, universalizing regimes of epistemic, ethical, and economic valuation as research subjects. Important and, often, ethically troubling repercussions for representations of both their health states, as well as needs and interests in relation to public health knowledge and interventions, followed (Sunder Rajan 2006; Petryna 2009; Crane 2013; Greenhalgh 2016).[3]

The detailed causes, scope, and implications of globalization have elicited vigorous and ongoing debate from academics who study its socio-cultural effects at local, national, and transnational scales (Harvey 2005; Jameson and Miyoshi 1998; Appadurai 1996; Ong 1999; Comaroff and Comaroff 2001; Ferguson and Gupta 2002; Tsing 2005). Most, however, would be in broad agreement about the following basic propositions: By the late 1980s, the collapse of the Soviet bloc and the liberalization of the Chinese economy had heralded the emergence of a truly global capitalist market (Harvey 2005:1).[4] Propelled by critical advances in commercial transport (Levinson 2016) and communication technologies (Castells 2010) the penetration of global market forces into formerly isolated polities, or pockets of society therein, brought with it new assignations of meaning and value to the labor, resources, and needs of those living there. At the same time, this process of expansion was propagated by a neoliberal ideology and associated laissez-faire legal, trade, and political apparatuses that disarticulated people, ideas, and value

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[3] Sandra Harding locates an earlier iteration of these transnational collaborations to the US-led post-WWII develop model of exporting technologies and health sciences to resource-poor postcolonial nations in an effort to foster a democratic, capitalist world market (Harding 2015:7). She details the subsequent failure of this model, which by the early 90s had been by neoliberal models that replaced state-state relations with private-public partnerships between NGOs and multilateral organizations (Keshavjee 2014). This decoupling of academic and scientific enterprise from the state and aligning it with private industry is a key feature of the late 20th century global neoliberal order that shaped the form of transnational collaboration exemplified by GBCS, albeit indirectly. For a more direct example of this kind of transnational collaboration, see Greenhalgh 2016.

[4] To offer a sense of the magnitude of this integration of local economies into the global capitalist order, consider this: At the time Deng Xiaoping's liberalizing policies began to take root in the early 80s, Chinese citizens accounted for 20% of the global population (Harvey 2005:1). Hence, Deng's Opening and Reform policies (selectively) integrated 1/5th of people in this world into the global market over the course of a decade.

systems, albeit unevenly, from national economies and governments, and to put them into global circulation with unprecedented ease (Appadurai 1996).

Consequences for the proliferation of transnational collaborative research in epidemiology were manifold. Neoliberal trade policies and information and transportation technologies gave rise to a class of multinational corporations that found it was now cost-effective to off-shore manufacturing operations to LMICs. The resulting shift from agricultural to industrial macro-economies in these places accelerated the pace of urbanization, exposing once-rural populations to new occupational hazards and related disease risk factors traditionally associated with the health profiles of high-income country populations. Expanding consumer markets soon intensified and broadened these risk exposures, as Western fast food conglomerates and tobacco companies, among others, turned east and south in search of growth, exposing ever-larger swaths of people to the ill-effects of their products (Brandt 2009; Watson 1997).

As international health authorities gave voice to increasingly dire concerns about impending chronic disease burdens outside of long-term industrialized nations,[5] epidemiologists in those countries likewise turned their attention to the health effects of globalization abroad. Some viewed bringing their knowledge and technical expertise to bear on chronic disease burdens in LMICs as an ethical imperative, arguing compassionately that long-term industrialized economies were both the primary drivers and uncontested beneficiaries of a process that was disproportionately distributing its harms amongst the former (Pearce 2004; Barreto 2004). These epidemiologists called for “collaborative research, skills transfer, and ‘volunteerism’” as a corrective to the historically-determined resource and geopolitical power imbalances that left

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[5] Statistics available online at: http://www.who.int/chp/chronic_disease_report/media/Factsheet3.pdf

LMICs dually vulnerable to adverse health effects and under-equipped to respond to them via public health science (Pearce 2004: 1127).

For most, however, the primary attraction was epistemic; as they saw it, the health effects of globalization in emerging market economies constituted a kind of natural experiment, in which socio-economic forces historically responsible for the biological, environmental, and lifestyle changes that produced high burdens of chronic disease observed in their native populations could be studied from the moment of origin, just as they began to transform the lives and health of those newly exposed to them (Ebrahim and Smith 2001). Though, by the early 21st century, the major socio-economic risk factors associated with such changes were considered to have been established, the detailed sociogenic pathways to epigenetic and metabolic changes ultimately responsible for the onset of such diseases remained unclear (Ferreira, Salis, and de Souza e Silva 2018). Hence, such populations offered an invaluable chance to study the beginning and progression of such pathologies across the life course, or even generations, from an epigenetic standpoint.[6] In other words, in the arena of basic science, NCD studies of LMIC populations presented the tantalizing possibility of developing deeper and more comprehensive models of the influence of environment on human developmental biology as well as the biomolecular pathways driving the etiology of complex chronic diseases. It also held forth opportunities to develop new biomarkers and therapeutic strategies that could be used to identify at-risk subpopulations, as well as to prevent and control NCD onset, early in a disease's etiological progression. Improved modeling, risk detection, and early intervention strategies would significantly reduce the economic, social, and human costs of NCD burden in high-income and LMIC countries alike.

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[6] Having access to "natural" experimental populations in which to observe, in real time, the biological impacts of lifestyle and environmental exposures associated with socioeconomic transition, was so important to epidemiologists because ethical, fiscal, and temporal considerations, among others, rendered deliberate, controlled experiments designed to study these impacts unfeasible, if not downright impossible.

The development of new, universal therapeutic targets and strategies could generate enormous revenues for traditional pharmaceutical companies as well as start-ups competing in the burgeoning biotech sector.

Crucially, this framing of the epistemic attraction of NCD research done using LMIC populations hinged on epidemiologic transition theory. This is the first-order premise, articulated by Abdel Omran in the early 1970s, that social and behavioral changes associated with urbanization, industrialization, and economic growth lead to the emergence of common polygenic diseases, such as adult onset diabetes, stroke, and cardiovascular disease, as the major sources of morbidity and mortality burden in a given population (Omran 2005); see also (Frederikson 1969; McKeown 1976)).[7] Omran's model, which posits an essentialized and staged evolutionary relationship between socioeconomic organization and population disease profile, culminating in advanced capitalist economies with high burdens of NCDs relative to other categories of disease, constituted a kind of Foucauldian table, within which it became possible to rationalize and codify relations of resemblance and difference between NCD research groups across the world (Foucault 1970). Cultural, temporal (rendered as non-coevality), and biological differences could be mapped onto a universalizing historical trajectory of capitalist development borrowed from modernization theory, allowing for the emergence of a global comparative framework for NCD research at a moment when a capitalist socioeconomic order was perceived actually to be global—read as all-encompassing-- in scope.

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[7] Polygenic diseases have multiple developmental pathways and their clinical manifestation varies among individuals and population groups ((Loscalzo, Kohane, and Barabasi 2007); Jiang et al 2006).

Establishing and validating such a comparative framework was essential to integrating diverse groups of people across the world into a shared regime of epistemic valuation for NCD research because, as the philosopher of science Alex Broadbent has noted, the field of epidemiology is built on a comparative methodology. At its simplest, this involves delineating two or more otherwise similar populations based on the presence or absence of a given exposure, in order to test for disease associations (Broadbent 2013: 21). The transposed universalisms of neoliberal economic globalization and epidemiologic transition theory constituted the assumed underlying homogeneity—or sameness-- upon which comparisons of the effects of other orders of difference—cultural, biological, temporal-- could be made between LMIC and high income-country populations. For this reason, they were indispensable to the transformation of NCD epidemiology into a global field of research as well as to the configuration of LMIC research subjects, including those in China, in to bearers of generalizable or universal knowledge about chronic disease in the eyes of foreign elite researchers.

Of course, to characterize biomedical knowledge as universal in import and meaning is not to assert that it is equally or maximally valuable to all humans. Rather, as the anthropologist Lawrence Cohen has admonished, the principles of commonality that authorize claims of universality in biomedical knowledge production often conceal an "underlying hegemony," which perpetuates specific interests linked to historically received material, fiscal, and institutional power dynamics that, in this case, have shaped the development of contemporary NCD epidemiology and are embedded in its associated body of knowledge (Anderson 2009:650). Indeed, it is possible to show that claims about universality in NCD research and the comparative framework that makes them possible nevertheless are partial. They are, in part, artefacts of prior determinations regarding whom or whose agenda knowledge produced should serve, a history crystallized both in the epistemic field that serves as the standard in relation to which new inquiries are developed as well as in the institutional networks and publication nodes that serve to stabilize findings into facts and to determine the scope of their circulation and influence (Latour 2005). In the final section of this chapter, I'll examine the partiality of interests embedded in epidemiologic transition theory in greater detail. In doing so, I'll show how the relations of similarity and difference it embeds and the particularistic deployment of temporal, cultural, and biological categories it facilitates erases other ways of figuring resemblance and difference that could lead to knowledge of NCD risk that may be of greater value to Chinese society, generally, or specific groups therein, than knowledge produced though the comparative framework described above.

Neoliberal Science and Genetic Biobanking in Chronic Disease Research

There are also more prosaic interests that drew NCD epidemiologists from high-income countries to research on LMIC populations. The search for cost-effective research settings, for example-- a byproduct of the neoliberalization of science in the US and European countries (Boggio, Ballabeni, and Hemenway 2016); Greenhalgh 2016)-- resulted in population-based health scientists turning to LMIC populations with increasing frequency in efforts to make an end run around the cumbersome and dilatory regulatory apparatuses governing human subjects research in their home countries (Crane 2013; Petryna 2009). Not only were such researchers able to take advantage of weakened state capacities in bioscience, which were the historical legacy of imperialist and postcolonial relations of domination, but they also benefitted from the unintended effects of under-resourced health care systems on the suitability of such LMIC populations for such large-scale comparative projects, where pharmaceutical naivety, or absence of routine, widespread use of drugs, reduced the likelihood that confounders would skew study results (Petryna 2009:21; Sung 2009).[8] The effects of this neoliberalization of US and European science on the designs, methods, goals, and ethical oversight of overseas research were most dramatic in the private sector, such as Susan Greenhalgh demonstrated forcefully in her exposition of Coco-Cola company's influential and selective funding of obesity science that stressed exercise over diet as a key preventative public health measure in China (2016). Basic life science researchers, including those involved in establishing GCBS, according to many of my interlocutors, may not have perceived the same immediate fiscal pressures to produce translational outcomes or otherwise abide the influence of corporate funders (Boggio et al 2016). Nevertheless, they were exposed, however indirectly, to the imperatives of the global bioeconomy, which relentlessly linked epistemic to economic valuations of biomedical knowledge (Sunder Rajan 2006).[9]

Perhaps the starkest example of the impact of this dual economic and epistemic valuation of biomedical knowledge on chronic disease research agendas could be seen in the emergence, in the late 1990s and early 2000s, of a global biotech sector alongside omics science, a class of fields whose reliance on computing technologies and de-territorialized epistemic objects resonated unmistakably with the material and conceptual infrastructure of the global economy (Sunder Rajan 2006).[10] From among the many transformations these developments precipitated

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[8] Of course, what constitutes a "drug" is a matter of perspective. The consumption of herbal supplements and other medicinal products associated with the practice of Traditional Chinese Medicine remains widespread amongst Chinese populations, and in particular older demographics (Farquhar and Zhang 2012). However, because they fall outside the purview of biomedicine, they generally aren't taken into consideration in deliberations over the naivety of a research subjects.

[9] See also Jeremy Greene's analysis of the US pharmaceutical market's impact on the search for risk factors, expanding definitions of disease states, and clinical reliance on pharmacological management in cardiovascular medicine in the post-WWII period for a compelling example of how bioeconomic dynamics shape basic chronic disease research (Greene 2007).

[10] Many aspects of the transformational impact omics, along with the commoditized forms of human biologicals they made possible, had on traditional fields of human life science lie outside the scope of this dissertation. To the

across traditional fields of human life science, here I want to highlight the impact that certain technologies and techniques associated with their rise—especially in the field of genomics-- had on the incentives motivating the participation of chronic disease researchers in transnational collaborations like GBCS, as well as on the conceptual and technological design of those projects. Beginning in the late 1970s and accelerating into the 1990s, the manufacture and refinement of commercial DNA sequencing machines, the development of amplification techniques, such as real time PCR and recombinant DNA, and the bricoleur-like improvisation of methods for increasing sequencing speed, such as "shotgunning", transformed human genetic materials, including whole genomes, into accessible, viable, and widespread experimental material (Heather and Chain 2016). This, alongside exponential increases in the power of affordable computing technologies applicable to biological research, known as bioinformatics, led to cost-effective and rapid methods of identifying potential associations between genetic variants, environmental risk factors, and disease outcomes in research cohorts.

Life scientists had long inferred from the power of family history to measure individual risk of common chronic diseases, such as type II diabetes and several forms of cardiovascular disease, a significant genetic contribution to their etiologies (Brunwald 1997: 1367-8). Unlike monogenic diseases, however, for which the presence or absence of a genotype would guarantee the development of an associated disease phenotype, most common chronic diseases were polygenic, meaning that their genesis depended on the presence and interaction of many distinct risk factors, including susceptibility alleles as well as environmental and non-genetic biological exposures

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extent that it is relevant, I discuss the history of omics sciences and their impact on chronic disease research in detail in Chapter 2. Here, my goal is to show how they affected the design, incentives, and technological infrastructure of transnational chronic disease research projects, particularly with respect to the deployment of a geo-ethnic taxonomy of difference in GBCS.

(Loscalzo et al 2007).[11] The new availability of human genomes as experimental material, in conjunction with advances in bioinformatics, enabled researchers to collect, digitize, store, and subject to sophisticated linear regression analyses vast troves of genetic, biological, lifestyle, environmental, and health exposure data from research subjects. From the perspective of chronic disease researchers, not only could this lead to new opportunities to monetize interventions based on genetic susceptibility, but it could also clarify the complex gene-gene and gene-environment interactions thought to drive common chronic disease progression. In other words, the omics and information revolutions undeniably imbued chronic disease research with new, promissory forms of epistemic and economic value.

The most immediate impact these changes had on chronic disease research could be seen in the proliferation of plans for genetic biobanking projects, first in high income countries like the US, the UK, and Iceland, then increasingly in LMICs, including several countries in Asia (see e.g. Fortun 2008 and Sleeboom-Faulkner 2009).[12] A genetic biobank, as Sleeboom-Faulkner summarizes nicely, is "essentially a database that stores patient and population samples, including tissue samples, serum, and genetics information, for the purpose of medical research" (2009: 5). Crucially, for polygenic disease research, these databases also store information on subjects' occupational, behavioral, environmental, socio-economic, and psychosocial exposures, allowing for the discovery of gene-environment interactions in pursuit of parsing their etiological pathways.[13] By recruiting a large patient population for study, storing extensive baseline genetic

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[11] As is examined in Chapter 2, subsequent developments in genomics revealed that the class Medelian model linking genotype casually to phenotype without intervening, independent factors, is incorrect for many monogenic diseases (see Loscalzo 2007: 2).

[12] Review scope of issues associated with biobanks in high-income and LMICs, respectively, surrounding identity, trust, nationalism vs internationalism, etc. Sleeboom-Faulkner has a good overview of this in 2009:6-7.

[13] Of course, the practice of biobanking, or storing of health data of a chosen patient population, in a database for analytical purposes, long predated both the omics and information technology revolutions that made genetic biobanking so popular at the turn of the 21st century. Indeed, as Lock and Nguyen note with respect to England, as early as the late 18th century, "…the systematic collection and storage, or 'banking,' of medical facts at a national

and other health information in these databases, and then tracking disease progression in that population over an extended period of time, researchers hoped to model those pathways for common chronic diseases. Indeed, this kind of database-backed longitudinal cohort study, as epidemiologists refer to such design, is the promise of big data in the postgenomic era.[14]

That said, as Margaret Lock and Vinh-Kim Nguyen note, such big data-driven longitudinal cohort studies are associated with an ideal-type study population, especially if one goal of such projects is to identify susceptibility alleles for chronic diseases, as the effects of such alleles on elevated disease risk tend to be small, and therefore difficult to detect. An ideal population would thus be very large, as the statistical power to detect small effects grows along with sample size. It would also be relatively genetically homogenous. Relative homogeneity would mean that allelic variations between individuals within the study population could be assumed to be relatively low, allowing disease-linked variations to be more easily detected. It would also mean that any stratification, or structured differences in allelic variation owing to non-random inheritance patterns, would be pervasive throughout the study population and therefore controlled for (Lock and Nguyen 2010: 355). According to a similar logic, relative historical, environmental, and cultural homogeneity within large study populations also make potential disease determinants—

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level had been proposed" (2010: 39). Similar governmental efforts to surveil systematically the health of national populations emerged in other European nation-states at this time and have been paradigmatically linked to the development of statistics as a mathematical tool for a variety of disciplines that sought to rationalize and lend control over probabilistic events (Gigerenzer, Swijtink, and Daston 1990); (Hacking 1990); the emergence of public health sciences (Coughlin, Beauchamp, and Weed 2009); and the ratification of "population" as a key mechanism of a new form of power, linked to the growing significance of national economies in 1800s, that Michael Foucault referred to as biopolitics (Foucault 2005). In other words, these two developments did not produce biobanking; rather, they represent a transmutation in its relation to new forms of technology, biology, and capital in the age of globalism.

[14] I discuss the shift from genetic determinism to a postgenomic epistemology, as well as its impact on models of chronic disease risk and etiology, at great length in Chapter 2. Here, by way of a brief definition, "postgenomic" signifies a biological paradigm in which the gene is no longer viewed as a singular functional unit or code that unilaterally dictates phenotypic expression and inheritance. Rather, it is seen as a flexible part of a large, self-organizing living system whose phenotypic expressions result from interactions between coding and non-coding DNA sequences, transcription factors, methylation, other biomolecular regulatory processes, and environmental cues in feedback networks that transcend the body proper (Lock and Nguyen 2010; (Perbal 2015).

that is, differences within and between study populations that make a difference, in terms of disease risk-- more easily detected while, theoretically, controlling for a host of potential confounders and other sources of bias. Hence, bioinformatics and developments in omics sciences created new economic and epistemic incentives for the community of transnational epidemiologists to search for large populations about which claims of homogeneity—in terms of culture, history, genetics-- could reasonably be made. At the same time, it normalized genetic biobanks and big data-driven cohort studies as integral parts of the design of such studies, with important consequences for how Chinese research cohorts were imagined and assigned value by foreign elite scientists.

Chinese as a Model Experimental Population in the Global Epidemiological Imaginary

The technologies, epistemes, material and infrastructural transformations, and regimes of valuation associated with the forces of globalization, neoliberalism, omics sciences, and bioinformatics, described above, created new impetus for chronic disease epidemiologists to seek research populations in LMICs in the late 20th century. In the midst of such efforts, these researchers identified China as an early, idealized site in their burgeoning global scientific imaginary. Among other characteristics, epidemiologists were drawn to the country's vast population size; the recent, rapid, uneven pace of its socio-economic transition; and idiosyncratic understandings of longstanding social policies, such as the hukou system, that provided justification for assumptions made about the relative genetic and ethnic homogeneity of different groups within the country.

Breathless evaluations of the epistemic value of Chinese citizens as a kind of model population for chronic disease research abounded. In 1990, for example-- a mere 12 years after Deng Xiaoping's era-defining decision to re-open Chinese commerce and politics to the wider world—the prominent US journal Science ran "China: A Living Lab for Epidemiologists." In the article, elite chronic disease scientists from the US and UK involved in the renowned China Study, a collaborative, longitudinal comparative project between the US, UK, and China that examined the impact of dietary changes on cancer rates in areas at the vanguard of China's socio-economic development, described that experimental value in superlative terms (Moffat 1990). US National Medal of Science winner and nutritional epidemiologist Bruce Ames proclaimed China to be "the perfect place to do research," adducing to the uneven rate of epidemiologic transition in the country before concluding it afforded research opportunities that were "unique in the world" (Moffat 1990:53). Cornell epidemiologist T. Colin Campbell, a principal investigator on the China Study, echoed Ames' sentiment, highlighting the advantages of the recent, widespread appearance of "diseases of affluence" in these places to his work (Moffat 1990:53).[15] His fellow PI, Oxford-based epidemiologist Richard Peto, meanwhile, anticipated the development impetus identified by Neil Pearce as the ethical zeitgeist of early 21st century global epidemiology (2004:1127), noting of China-based research that it "also offer[ed] great potential for improving the health of one-fifth of the world population" (Moffat 1990:553). Neither the transnational relations described in the article nor the claims made about the epidemiological value of China's population were unusual for the time. Rather, the article exemplifies emerging norms governing the interests of global scientific elites involved in Chinese chronic disease science in relation to

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[15] "Diseases of affluence" is a holdover of disease mapping in the mid-20th century epidemiology imaginary and suggests common chronic diseases such as type II diabetes, cardiovascular disease, stroke, obesity, and certain cancers occur predominately within high-income countries. As I suggest in this chapter, one effect of globalization has been to challenge this map; in the following section, I'll explore how this paradigm, as well as the framing of challenges to it, has affected approaches to measuring and identifying chronic disease determinants in GBCS.

the particularistic epistemic and ethical configuration of Chinese citizens as ideal research subjects, as even a quick review of publications associated with the many transnational chronic disease studies that took root in China during the same period suggests.[16]

Importantly, the eagerness of elite epidemiologists from the US, UK, and Europe to assemble transnational chronic disease research projects in China was shared by both Chinese health scientists and political authorities at the highest levels. In fact, as Moffat's 1990 Science article makes clear, it was a Chinese epidemiologist, Chen Junshi, who first conceived of the China Study while on sabbatical at Cornell in 1980 (Moffat 1990). In a pattern repeated over and again in the origin stories of transnational health science projects in China, including GBCS, it was precisely this time Chen spent abroad, enabled by the increased mobility of Asian capital and credentialed professionals under the late 20th century neoliberal global order, that generated the network of overseas relationships needed to bring The China Study to fruition.[17] However, this increased presence of Chinese health scientists at academic institutions in high-income countries, and the deliberate cultivation of institutional networks along these same arcs, were not simply

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[16] See, for example, Cheng JS 1990; Wigley et al 1994; Campbell et al 1998; Liu BQ et al 1998; Chen Z et al 2005; China Health and Nutrition Study: http://www.cpc.unc.edu/projects/china; Yi Z et al 2009 for an overview of these studies.

[17] See also Root, M (2015). *China Project History Part 2: Serendipity of a Study*. Available at: https://nutritionstudies.org/china-project-history-part-2-serendipity-of-a-study. Interestingly, Root recalls that Chen and Campbell turned to Li Junyao, a cancer epidemiologist who, at Zhou Enlai's direction, had undertaken the first comprehensive study of cancer in China in the 1970s, for help developing *The China Study*. Li's work for Zhou Enlai afforded him the necessary *guanxi* to get such a project off the ground in China, and he just so happened to be on sabbatical at the NIH at the time Chen was at Cornell. This anecdote is interesting not only for demonstrating how integral the movement of academics across national borders was to creating the institutional affiliations and relationships needed for the late 20th century form of transnational epidemiology described in this chapter to emerge, but also because it illustrates a point about the representational politics of chronic disease research that Harvard School of Public Health professor Bill Hsiao once emphasized to me in an interview: quite often, in his extensive experience advocating for particular research agendas in the US and in China, it took personal experiences of powerful authorities to transform a particular disease in to a funding priority. In the US, prominent researchers lobbying congress for funding for a particular agenda will know exactly which members have been affected by a particular disease. In the case of China, epidemiological cancer research was virtually unheard of before Zhou himself developed lung cancer in the late 60s. That experience, in turn, led to Li's vast project, T*he Cancer Atlas*, as well as, indirectly, his tenure at the NIH in Maryland. And, as Matthew Kohrman notes, one sees a similar personal connection in the increase in funding for disability services under Deng Xiaoping, whose son was paralyzed during the Cultural Revolution (Kohrman 2005).

the inevitable outcome of increased market integration and the resultant marginalization of the nation-state in spheres of global commerce and adjacent semi-autonomous fields of professional practice like health research (Ong 1999).[18] Rather, they reflect the deep investment of Chinese authorities in harnessing the potential of transnational collaborative relationships to aid in the development of the knowledge, technology, human resources, and institutional infrastructure necessary to address a very real, looming national chronic disease crisis.

III. The Role of Transnationalism in Contemporary Chinese Chronic Disease Research

Cosmopolitan Technoscience and Risk Discourse in the Post-Mao Political Imaginary

In June of 2000, nearly ten years to the month after the publication of "China: A Living Lab for Epidemiologists," Science magazine ran an op-ed penned by Jiang Zemin, who was then president of the PRC. China was in the process of joining the World Trade Organization-- a significant milestone in the country's fraught 20-year project of political, intellectual, and economic re-integration into the capitalist global order-- and Jiang Zemin used the space to articulate his vision of Chinese participation in the cosmopolitan techno-sciences.[19] Addressed implicitly to the foreign scientific and political elites whose institutions exerted outsize influence over these sectors, his missive struck a tone that was at once reassuring and defiant. He wrote of China's "long history of science and civilization," traditions which, in the 19th and early 20th centuries, were subverted by a "decadent feudal system" as well as "the aggression of imperial powers, [who] plunged China into deep backwardness and humiliation in modern times" (Jiang

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[18] For more about semi-autonomous fields of practice, see: Falk Moore, S. 1978. "Law and Social Change: the semi-autonomous social field as an appropriate object of study." In *Law as Process: An Anthropological Approach*. London: Routledge.

2000: 2317). These traditions were restored only in the PRC era, when domestic scientists and engineers were once again at the forefront of solving "the numerous problems that once stunted [the country's] society" and had "succeeded in meeting the basic needs of 1.2 billion people" (2317). Their successes evinced the deep commitment PRC leadership had made to fostering the "favorable environment" required for techno-scientific research and innovation to flourish, thereby offering means with which to allay, if indirectly, concerns broadly shared by global scientific elites about whether the Jiang regime would embrace with sincerity the standards of professionalism, autonomy, transparency, and rule of law by which cosmopolitan techno-science was ostensibly governed (2137).

Jiang Zemin went on to suggest that this shared embrace of the principles necessary for rigorous scientific research and innovation provided the common ground needed not only for China to reap the benefits of participating in global scientific and technological markets, but also to engage in collaborative research with foreign scientific elites. Such international collaborations, Jiang implied, had over the last two decades become an important component of Chinese science, in part because, as a "developing country" with a "limited science budget," they offered Chinese scientists access to resources for and the chance to garner experiences working on projects that were outside of the scope of the government's immediate capacity to support on its own (2317).

This benefit, however, was not to be mistaken to suggest a relation of unilateral dependence; indeed, Jiang Zemin adduced, US-Chinese collaborations in many fields, including public health, had already "benefitted both countries," (2317). With its science and technology traditions having been restored under PRC guidance to the standard once decimated by imperialist aggression, China's collaborative positioning in cosmopolitan techno-science would reflect its transformed status from the humiliated and backward 'sick man of Asia' to an emerging global power. Chinese scientists, accordingly, should be acknowledged by global scientific and political elites as active and equal contributors to global techno-scientific progress, as they "increasingly shoulder[ed] [China's] share of responsibility in matters of international concern" and "join[ed] with… counterparts in other countries" to advance "humankind's common cause" (2317). Although "differences in social systems, economic models, cultural traditions, and levels of development" may complicate such collaborations, Jiang concluded, those threats could be contained by seeking out the "common interests" that fostered "international scientific exchange and collaboration," (2317). Such common interests undoubtedly existed if, as he asserted, "scientific breakthroughs form the foundation on which modern civilizations build… and promise a future replete with prosperity and intellectual enrichment worldwide," (2317).

Jiang Zemin's op-ed is revelatory of the deep governmental logic linking the Chinese state's efforts to respond to the looming chronic disease crisis to participation in transnational research collaborations beginning in the post-Mao era. At the core of this logic was a profound belief in the capacity of advanced cosmopolitan techno-sciences to deliver domestic prosperity, wellbeing, and stability, as well as to position China as a globally dominant political and economic power. This belief, animated and affectively charged by memories of China's techno-scientific domination by Western powers in the century before the establishment of the PRC, represented a unique strain of contemporary scientific positivism among prominent post-Mao Chinese political and intellectual leaders that the historian Hua Shiping traces to the May Fourth movement (Hua 1995). This movement, which dominated domestic Chinese politics in the 1920s, was deeply influenced by logical positivist attitudes then prevalent in Western scholarship. Subsequent experiences of the use of scientific knowledge and technologies to perpetrate war and other atrocities, intentional or not, challenged this positivism in the West and gave rise to competing discourses that focused on the potentially dystopic social and human impacts of techno-science. In the field of biomedicine, the role early 20th century eugenics science played in rationalizing the dehumanization and instrumentalization of marginalized or maligned groups, exemplified most starkly by Nazi-era human experimentation, precipitated a reckoning among European and American governments in the post-WWII era. This reckoning culminated in the Nuremberg Code, a set of universal medical research ethics that explicitly decoupled scientific progress from human benefit, well-being, and autonomy, subjugating the former to an independent set of ethical stipulations concerning the latter. However, as Nie, Guo, Seldon, and Kleinman have argued, East Asian countries were denied a similar collective reckoning to grapple with the legacy of Japanese biomedical atrocities in local theaters of war, including—prominently—China, leaving a profound lacuna in its place (Zhang 2011).

The absence of public reckoning with scientific positivism and the alternative genealogy informed by China's quasi-colonial history offer insight into the particularistic ethical configuration in post-Maoist political thought that has shaped domestic elites' views of potential risks and benefits associated with China's participation in cosmopolitan biomedical research. As anthropologist Aiwha Ong argues in her survey of emerging biotechnological sectors in Asia, while Euro-American bioethical discourses often problematize such research in terms of the negative consequences it may carry for individual autonomy and subjectivity, as well as the potential instrumentalization of life through increasing capitalization of human biologicals, Chinese political and scientific elites have tended not to identify the relations between governmental, economic, and social ends of such research, and the regimes of valuation into which they interpolate human health and bodies, as sources of such ethical risk (Ong and Chen, Eds. 2010; see also Wen-ching Sung 2009). Instead, she claims, the state-led development and capitalization of an advanced, globally distinguished biotechnological research sector are viewed as central both to securing domestic wellbeing and stability as well as to ensuring the state's geopolitical sovereignty; they form part of what Ong resonantly describes as the "scientifically driven imagination of [Chinese] modernity." (Ong and Chen, Eds. 2010: 21).[20] As a result, the risks associated with Chinese participation in cosmopolitan biomedical research are not normatively seen to inhere in the knowledge frameworks and technologies interpolated into its domestic health agenda- to what extent they will serve or subvert domestic health needs-- but rather the political and economic relations structuring that participation and the implications those relations carry for the PRC's autonomy and security. Hence, the enthusiasm for scientifically-driven development Jiang Zemin expressed in his 1990 op-ed was accompanied by a careful articulation of the terms of China's participation in global techno-scientific research and development—namely, as a sovereign equal. At stake was ensuring such relations would serve not to reproduce neocolonial forms of economic and technological domination but as critical means to advance state prerogatives regarding health, economic growth, political autonomy, and geopolitical security.

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[20] Evidence of this comes from the massive investments the state continues to make in the staff, space, stuff, and systems (Farmer 2014) required for a world-class domestic STEM sector: Between the 1980s and 2006, for example, nearly 200,000 foreign-trained Chinese scientists returned to the country, drawn by nationalist overtures, ample government funding, and a lax regulatory environment. That same year (2006), PRC leadership announced plans to invest $29.4 billion dollars yearly by 2010 to foster technoscientific research and development, with much of that funding going to emerging life science fields like genomics, nanotechnology, stem cell research, and GMOs (Beech 2006), sited in the gleaming high-tech science parks that have cropped up in major metropoles across the country, including Guangzhou (Ong 2010). This focus on emerging life science fields reflects the way in which technoscience figures strategically as a means to pursue the PRC's geopolitical goals of protecting state sovereignty and achieving global prominence. As science reporter Hannah Beech suggests, one reason such fields are targeted is, by dint of their novelty and the relatively onerous ethical regulations governing their development in Europe and the US, PRC authorities view them as ideal grounds on which to position Chinese science as a global leader (Beech 2006).

This framing carried important repercussions for what Chinese political and scientific elites deemed to be at stake in transnational collaborative biomedical research. On one hand, such research constituted a necessary global venue for Chinese scientists both to hone and to perform their capacities and skill sets with respect to advanced bioscience. Not only would participation expand the state's limited budget for advanced bioscience by granting increased access to the resources, technologies, and knowledge bases of foreign elite researchers, but it would also create opportunities to ratify the view of Chinese science set forth in Jiang's op-ed by endowing its leading scientists with the institutional credentials, publishing bona fides, and professional connections that confer global symbolic prestige within their fields of practice. In other words, as one Chinese bioscientist I spoke to in the course of my research acknowledged of the transnational project in which he was involved, such work doubled as a form of soft diplomacy, a way to negotiate how and where Chinese science-- as a metonym for Chinese state-- would rank vis-a-vis the global powers with whom the PRC was cautiously re-establishing political and economic interchange. Indeed, evidence of the ongoing investment of PRC leadership in this science diplomacy and geopolitical securitization is found in the extraordinary fact that China was the only contributor among low- and middle-income countries to the Human Genome Project (Ong 2010). On the other hand, these relationships also carried the risk of enabling neocolonial forms of exploitation, should collaborative projects simply become a means for foreign elite scientists to extract the techno-scientific and bioeconomic value they coveted from the "uncanny surplus" of China's exemplary population in ways that undermined the state's bio-securitization and bioeconomic prerogatives (Ong 2010: 25).

One troubling effect of this construal of risk in terms of the geopolitical relations and performance of cosmopolitan science, rather than the local social and public health impacts of its epistemic, technological, and methodological contents, is reflected in the outside influence cosmopolitan scientific agendas has had on domestic public health policies in the decades since Opening and Reform was first implemented. Susan Greenhalgh shines a light on the devastation this logic of risk wrought for Chinese women, families, and the country's demographic structure in her stunning book Just One Child. She shows convincingly that Chinese authorities dismissed domestic social scientists' call for relatively lax growth regulations, embracing instead the notoriously stringent restrictions advocated for by a group of missile scientists armed with cutting-edge computer modeling skills and predictions influenced heavily by the Club of Rome and related Western scholarship (2008). In his study of disability and subjectivity in post-Mao China, Matthew Kohrman offers an equally compelling, if less dramatic, example, showing how WHO projections for national disability rates overdetermined epidemiological measurements of the domestic incidence of disability, as authorities focused on demonstrating competence to the international health community by producing the "right" statistics (2005).

More recently, Katherine Mason has demonstrated how global scrutiny following the 2003 SARs pandemic, which began in Guangdong province, influenced subsequent efforts rebuild China's public health system in such a way as to reflect the professionalization, technological savvy, and biomedical competence associated with elite science. She concludes that this emphasis on creating a system that would achieve global prestige was, for all its advances, deeply uneven, often failing to protect or meet the local needs of those subject to it (Mason 2016). Together, these cases show how the failure to problematize cosmopolitan techno-scientific forms in terms of their fitness to address local social and health needs has generated diverse forms of social suffering for different Chinese demographics. In the final section of this chapter, I will return to this work in order to elucidate how the knowledge frameworks, technologies, and design of

GBCS embed representations of Chinese that, through selective epidemiologic erasure, may likewise perpetuate and even generate new forms of social suffering.

State of China's Health Sector at the Outset of Its Chronic Disease Crisis

Given PRC leaders' emphasis, beginning in the late 1970s, on achieving state securitization and prosperity through the capacitation of domestic techno-science sectors, it may come as a surprise that, when it became apparent in the early 2000s that the country was facing a chronic disease epidemic of unprecedented proportions, Chinese public health and epidemiological science sectors were woefully ill-equipped to respond effectively. Indeed, this state of affairs belied the status of citizens' health as a signal biopolitical concern of the Maoist era. Investing in basic primary care access had been a signature feature of PRC rule under the Maoist regime. Beginning with his first mass public health campaign in 1952, Mao signaled that improving the health of ordinary Chinese would be a priority of the CCP (Mason 2016: 8). Subsequently, state-led efforts to improve public hygiene, expand vaccine coverage, eradicate parasitic and infectious diseases, and safeguard infant and maternal health, led to pronounced achievements in this regard. Infant mortality rates fell from 200 to 34 per 1,000 live births and the average lifespan nearly doubled, increasing from 34 to 68 years, between 1952 and 1982, while widespread immunization and vector control campaigns curbed malaria, schistosomiasis, and other common infectious diseases (Blumenthal and Hsiao 2005:1166).[21] A centerpiece of these efforts was the nationwide Cooperative Medical Scheme (CMS), a rural network of community health stations staffed by "barefoot doctors," or laypersons who had undergone basic training in

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[21] To offer a sense of how rapid this lifespan increase was, France's population underwent the same average increase over a 140-year span, from 1810 to 1950. Institute National D'Etudes Demographique, available online at: https://www.ined.fr/en/everything_about_population/graphs-maps/interpreted-graphs/life-expectancy-france/

primary care and public health medicine. Barefoot doctors extended primary health care to vast swaths of the rural population who could not access China's public hospitals and specialized facilities, which were far fewer in number and concentrated in urban areas, and acted as indispensable grassroots liaisons to its national public health and epidemic surveillance infrastructure (Blumenthal and Hsiao 2005: 1166; Mason 2016: 7-8). The result was a universal, if somewhat rudimentary, socialized health care sector that ultimately inspired signatories to the 1978 Declaration of Alma Ata, who argued for global access to primary care as a matter of social justice in response to the gross imbalances of health and health resources between high-income countries and LMICs (Li et al. 2017).[22]

By the time Deng Xiaoping's regime began to enact economic liberalization reforms in the early 1980s, the demographic profile of China's population had changed dramatically, drawing the interest of foreign researchers in the manner described above. A lower infant mortality rate, longer average lifespan, and years of pro-natal family planning policies under Mao led to dramatic population growth; between 1950 and 1980, the population increased by 433 million (Yi, Z. et al 2009:11). Meanwhile, cancers, strokes, and cardiovascular diseases were displacing infectious disease as the greatest source of morbidity and mortality (Blumenthal and Hsiao 2005: 1166). China was indeed undergoing an epidemiologic transition, and Deng's Opening and Reform policies, which precipitated the rapid urbanization of China and radically transformed the country's economic substrate, only hastened it. By the early 2000s, the need for chronic disease prevention, control, and care had grown urgent (Yang et al. 2008). In 2005, health researchers estimated that 80% of deaths and 70% of disability adjusted life years (DALYs) in

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[22] The full text of the Declaration of Alma Ata is available online at: http://www.who.int/publications/almaata_declaration_en.pdf

China were attributable to chronic diseases, with cardiovascular diseases and cancers identified as the leading contributors to both death and disease burden (Wang et al. 2005:1821). This burden was exacerbated by the newly visible after-effects of the One Child policy, which had created an extreme age imbalance in the population structure (Greenhalgh 2008). By 2000, the ratio of Chinese aged 65 and older—the period when chronic disease is most likely to become disabling—to those aged 15 to 64—mostly likely to be tasked with providing the human and economic resources necessary to care for older adults, was poised to decrease dramatically (Yi, Z. et al 2009: 11). Thus, developing a comprehensive and proactive public health response to identify population-level risk factor exposure and control chronic disease burden through early mitigation, prevention, and care was critical to compensating for these shortfalls.

By 2000, Chinese authorities had been aware of and taking steps to mitigate the health and economic impacts of the country's epidemiologic transition for several years, and collaboration with both foreign institutions and international organizations was an established strategy. In 1995, for example, the Ministry of Health established the Division for Non-Communicable Disease Control and Management, the first public health sub-branch of the PRC's sprawling bureaucracy to be devoted exclusively to the problem NCDs (Beaglehole et al. 2011). In 1997, it partnered with the World Bank to implement the "Disease Prevention Project," which used lifestyle risk factor surveys and education programs to prevent and control NCDs in seven pilot cities and one province.[23] Though the program showed initial promise in reducing the prevalence of smoking and mortality associated with cardiovascular disease, efforts to sustain and reproduce

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[23] The project's emphasis on prevention through educational campaigns targeting lifestyle changes was in keeping with contemporaneous WHO guidelines for prioritizing low-cost interventions low- and middle-income countries, ratified in a March 2000 Director-General report entitled "Global Strategy for the Prevention and Control of Non-Communicable Disease." Available online at: https://afro.who.int/sites/default/files/2017-06/NCD-Global_Strategy_for_the_Prevention_and_Control_of_NCD_2000.pdf.

these successes in other sites across the country were limited by funding shortages and systemic inadequacies in the public health system, which was designed around infectious diseases and had serious shortcomings in terms of its capacity to monitor and treat NCDs through basic research and primary care access (Wang et al 2005).

As Liming Lee and Jun Lv report, public health efforts to surveil and control chronic diseases remained scattershot into the early 2000s. Inadequate NCD funding to local branches of the newly established CDC system; the lack of centralized policy, comprehensive prevention and care guidelines, and professional societies to coordinate and govern a nationwide response; and a series of acute infectious disease outbreaks—including SARS, human *Streptococcus suis*, and Hand-foot-mouth disease— and natural disasters that drained resources and attention from the less spectacular threats posed by chronic disease, all contributed to weakening these efforts (Beaglehole and Bonita 2009). Indeed, as Katherine Mason has shown, a systemic bias in the CDC system toward infectious disease control only intensified in the years following the 2002 SARS outbreak in southern China (Mason 2016). As a result of these ongoing inadequacies, Li and Lv note, local prevention and care efforts tended to be dictated by existent health sector capacity, with a focus on universally proximal determinants of NCDs—low HDL, hypertension, obesity—in individuals rather than on the unique historical and social conditions driving the rise in NCD rates in China (Beaglehole and Bonita 2009:194).

State-led efforts to respond more effectively to the NCD crisis were complicated three things. One was the historical impact of the Cultural Revolution on health sector capacity. In line with that movement's ostensible aim to revolutionize Chinese society through the eradication of political and academic hierarchies, Mao oversaw "the most extreme experiment in radical de-professionalization of the medical profession ever conducted" (Henderson 1993:185). The prosocial impulse generative of the barefoot doctors and CMS-- to create universal access by training in basic primary care the laypersons who staffed rural health stations—had become grossly distorted by the end of the Cultural Revolution, resulting in the wholesale deskilling of the health sector. Indeed, the extremism of Mao's anti-intellectualist stance during this period, and its impact on the country's professional health sector, are captured in stinging commentary on the Ministry of Health (MOH) he promulgated at the outset of the movement in 1965. Renaming the MOH as "The Ministry of Urban Gentleman's Health" in an explicit critique of its perceived elitism, Mao complained of its administrators, "the more books one reads, the more stupid one becomes" (Dobson 1981:42). By all accounts, during the Cultural Revolution Mao achieved his aim to massively redistribute health care resources from the urban centers in which they were concentrated into the rural areas populated by 80% of Chinese (Dobson 1981). However, this success came at the steep cost of severely curtailing the development of specialized care in secondary and tertiary centers, research capacity, regulatory oversite, and other critical characteristics of robust heath systems that require professional training. This purging of the professional class, in combination with broader disruptions to the country's educational system during the decade-long campaign, decimated health science training for a generation of Chinese, which significantly slowed capacity-building efforts at the outset of Opening and Reform (Dobson 1981; (Kleinman 2007).

The second was a series of consequential economic policies implemented following Mao's death in the late 1970s. Opening and Reform leaders sought to jumpstart socioeconomic development through the Four Modernizations, an overarching agenda to transform the country's agricultural, industrial, science and technology, and defense sectors to rival those of high-income countries by the year 2000 (Dobson 1981: 42). For the MOH, this indicated a shift away from policies emphasizing universality and equity of access toward “medical and health care modernization”—that is, improving the quality of care through professionalization efforts, as well as technological upgrades to secondary and tertiary care facilities (Huang, Y. 2012: 54). However, as Huang Yanzhong notes, nearly from the outset this objective was undermined by efforts to decentralize and liberalize the Chinese economy, an “economics in command” approach that stipulated “social and political issues should be addressed from an economic perspective” (2012: 54). In practice, this meant that professionalization and modernization would occur within the context of radical health sector privatization, as successive PRC regimes promulgated directives to shift the burden of health care financing onto provincial and municipal governments, incentivized profitability in public and private clinics and hospitals, and made deep cuts to state subsidies for care.

A profoundly dysfunctional system emerged. Old urban-rural disparities reappeared and deepened. By the late 1980s, the CMS had collapsed for lack of funding, an effect of the cessation of state subsidies and household farming reform in rural areas. In response to the growing dereliction of village health stations and township health centers, rural residents began to seek better quality care in nearby urban hospitals, which only accelerated the redistribution of resources out of the countryside and primary care centers (Huang, Y. 2012: 56-58). A lack of consolidated regulatory oversight, owing to the fragmentation of the health system amongst private and state administrators, as well as pressure to sustain health facilities through profit-making enterprises, undermined quality of care and led to excessively wasteful spending, while MOH efforts to rationalize patient flow only compounded these issues (Huang, Y. 2012: 62). As privatization and profiteering sent medical costs skyrocketing, the number of people with access to subsidized care plummeted; by the late 90s, the 19% of the population with access to subsidized care through the Government and Labor Insurance Schemes accounted for 42.5 percent of the country's total annual medical spending, much of which was deemed unnecessary (Huang, Y. 2012). By 2003, an MOH Health Services Survey found that nearly 40% of the population avoided seeking biomedical care when sick owing to concerns about the economic impact it would have on them and their families (Huang, Y. 2012: 66).

The problems wrought by privatization for clinical care ramified across the public health domain. The collapse of the CMS network and fragmentation of health facility administration among a variety of state and non-state actors significantly impeded the capacity and coordination needed to monitor and intervene in emerging health threats at local, regional, and national levels (Daemmrich 2012); Huang, Y 2012). Indeed, the lack of a nationwide primary health care network that could be deployed to track epidemiological information, along with a significant decrease in health care access by the hundreds of millions of Chinese priced out of the private market, led to a scarcity of data with which to generate an epidemiological map of NCD risk in the aging population, even as it increased the likelihood that those at risk for NCDs would experience acute symptoms and significant morbidity before receiving a diagnosis or treatment (Daemmrich 2012). Decentralization struck public health bureaus directly, too, as state subsidies for preventative health programs were discontinued in favor of a "pay-for-benefits" policy that required local branches to shoulder the costs of such programs, exacerbating emerging health disparities across the country, as those locales in greatest need of preventative programs were also least able to afford them (Huang, Y. 2012: 84). Indeed, as a measure of privatization, Blumenthal and Hsiao note that between 1990 and 2002, public funding as a percentage of public health revenue fell from 60 to 42% (2005: 1167). Predictably, local anti-epidemic stations turned to profit-generating clinical practices, such as sales of medicines, in order to compensate for the loss of subsidies, thereby deprioritizing preventive care and reproducing the same waste and access issues seen above.

This weakening of the public health system through privatization only compounded problems endemic to the grassroots approach Mao embraced. Heavily reliant on preventative mass mobilization campaigns, public health under Mao lacked an enduring, organized scientific and institutional infrastructure; hence, as privatization shifted priorities away from such campaigns, and once-controlled infectious diseases began to re-emerge even as new threats loomed, public health officials were hamstrung by a fundamental lack of the institutional substrate, human resources, and knowledge base required to map, monitor, and respond to epidemiological problems quickly, broadly, and in a sustainable fashion (Huang, Y. 2012). Katherine Mason notes in her study of the impact of SARS on public health practice in China that, once dismantled, the public health system languished into the early 2000s, when, as noted above, initial efforts to rebuild focused largely on infectious disease surveillance and control rather than NCD prevention and care (Mason 2016: 11).

The third obstacle concerned how Chinese leadership and public health administrators configured the nation's population as an object of biopolitical concern early in the reform era. In his careful and provocative scholarship on modern forms of power, Michel Foucault traces the emergence of "population" as a key concept of social science and policy-making to 18th century European nation-states, as the target of a new paradigm of governance, which he termed "biopolitics," that deployed statistical codification, institutionalized knowledge, and public policy to control basic life conditions-- birth, death, reproduction, morbidity, etc.-- in relation to broad political and economic aims of the state. Indebted to the discipline of natural history, this novel concept of "population" reconfigured individual subjects as "a global mass" or "man-as-species," in which "bodies [were] replaced by general biological processes" whose trends could be optimized through knowledge of and intervention into the "relations between the human race, or human beings insofar as they are species… and their environment, or the milieu in which they live" (Foucault 1997: 242-249). Foucault's argument is indispensable not only because it identifies and names a governance paradigm that pervades modern exercises of political power in relation to health policy, but also because it highlights the historical specificity with which forms of human life are conceptualized, problematized, and intervened in by state and para-state actors—including, prominently, those working within the health sciences.

As Susan Greenhalgh's work on the One Child Policy demonstrates, the historical configuration of the political problem of "population" in reform era China bore the imprint both of PRC authorities' anxieties and desires concerning cosmopolitan technoscience as well as their emphasis on economic growth as the lens through which competing social policies should be evaluated. In result, the prioritization of economic growth as a measure of development was mirrored in reform-era family planning directives that suggested a preoccupation with the problem of population growth. Even as the CMS languished, authorities were investing much political capital and resources in curtailing reproduction in response to a ballooning population, the urgency of which was amplified, as seen above, through dire projections from Western scholars of the political and economic costs of such growth to the Chinese state. State investment in population control policies, while simultaneously defunding health care, evinced a problematization of population health and wellbeing fixated overwhelmingly on quantity, rather than quality of life (Anagnost 2004); Greenhalgh and Winckler 2004; Greenhalgh 2008). It was not until the mid-2000s, as the human and economic costs of this framework became apparent in the population's grave demographic distortions and increasing inability to access health care, that PRC leadership rebalanced its approach to development by embracing a "people first" approach that would foster the health and wellbeing of Chinese, in line with what Arthur Kleinman describes in his forward to The Governance of Life in Chinese Moral Experience as a kind of humanizing shift in the prevailing state logic of governmentality exemplified in Greenhalgh's study (Zhang, Kleinman, and Tu, Eds. 2011).[24]

In this context, Chinese epidemiologists faced an intractably difficult situation as they sought to contribute to efforts to control the country's growing chronic disease burden at the beginning of the 21st century. Developing a comprehensive response to the crisis it posed—that is, one that went beyond piecemeal interventions into universally proximate determinants—would require "local scientific evidence," or detailed epidemiological data, to map the unique topography of that burden, to identify its major drivers, and to understand how those drivers converged on differently positioned subgroups to produce the patterns of risk, morbidity, and mortality that contoured that topography (Li et al. 2012: 210). As the basic scientists of public health, it was epidemiologists' duty to produce this local evidence. Yet the health sector writ large lacked the resources, infrastructure, and existent body of knowledge required to ramp up their efforts quickly—conditions, incidentally, that constituted part of the local topography of NCD risks, determinants, and distribution epidemiologists were tasked with mapping. On the other hand, collaboration with foreign elite researchers who had overseen similar projects elsewhere,

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[24] At the 17th National Congress of the Communist Party of China, this rebalanced approach was affirmed: "The scientific concept of development means putting people first and aiming at comprehensive, coordinated, and sustainable development. To put people first, we should take people's interests as the starting point and foothold of all our works, making continuous efforts to meet the various needs of the people, and to promote the overall development of the people" (World Bank 2011:vii).

facilitated by Chinese health workers who had studied abroad, offered access to expertise, technological support, and funding that might very well expedite their response. Such collaboration, under the right circumstances, would offer an expedient path to addressing an urgent problem of health science.

Conclusion

It is by re-situating GBCS principal investigators' characterization of their experimental cohort in early publications within the transnational context set forth above that one can begin to take stock of the complex representational politics giving shape to that characterization as well as the work it did in service of that politics. In order to solicit support for GBCS from collaborating academics and funding bodies in the UK, Chinese state and municipal-level authorities and health science organizations, their home institutions in Guangzhou and Hong Kong, and the cosmopolitan community of NCD epidemiologists who would ultimately confer merit on the project, co-founders Lam Tai-hing and Jiang Chaoqing would have to negotiate the diverse epistemic, political, and ethical commitments each stakeholder brought to the project in order to bring them into alignment. As described in the introduction, primary GBCS stakeholders included epidemiologists from the University of Birmingham, which was a connection facilitated by Dr. Kar Keung Cheng, a professor at the university's medical school whom Lam knew from his graduate training and who became the third co-founder of GBCS. With Cheng's support, Birmingham not only joined People's No. 12 Hospital, which Jiang ran in Guangzhou, and The University of Hong Kong, at whose public health school Lam held an endowed chair, as a primary institutional site of GBCS, but also ultimately matched the seed funding contributed to the project by Jiang and Lam's institutions. Additional primary stakeholders whose logistical support, funding, and, in some cases, permissions, were solicited for the project during its initial phase (1998-2003) were local Chinese government offices, including the Guangzhou Public Health and Science and Technology Bureaus; a semi-public social welfare organization for aging adults, called the Guangzhou Health and Happiness Association for Respectable Elders (GHAARE); and the Clinical Trials Service Unit at Oxford University, which had been instrumental in designing the UK Biobank, upon which GBCS was modeled. Only by producing interest-alignment between these different actors, however contingent, partial, and haphazard, could the institutional, technological, fiscal, and regulatory relationships necessary to realizing and sustaining the project be established (Latour 1993).

Success in achieving this alignment would turn on honoring the many ways in which such stakeholders, as well as the professional and governmental communities to which they were beholden, conceptualized and imputed worth to the cohort as a hoped-for source of valuable biomedical materials and information in relation to discrete ends. As set out above, these included: An ideal experimental population whose unique positioning within a matrix of common historical, environmental, behavioral, and biological health determinants may very well translate into critical advances in basic NCD science of universal applicability and import; a bearer of epistemic, economic, and ethical value that linked domestic public health needs to Chinese state geopolitical goals through a biosecuritization paradigm that emphasized Chinese representation—of the health states of research subjects *and* the work of life scientists-- in cosmopolitan technoscience as a means to meet both; and, finally, the object of an emerging biopolitical paradigm of care, which compelled Chinese health scientists and authorities to seek local evidence of NCD risks and determinants that would translate into applied public health interventions to ameliorate the economic, physiological, and social suffering caused by the country's burgeoning health crisis.

Bruno Latour, the provocative elder statesman of contemporary science and technology studies, once summarized the major contribution of the influential Edinburgh School's 'strong programme' to a critical sociology of science, stating: "Questions of epistemology are also questions of social order" (Latour 1993: 15-16).[25] The inverse is equally informative: the interest-work required to bring these commitments and hoped-for ends into alignment-- to foster the relations needed to assemble powerful stakeholders into networked alliances that would form the social infrastructure of the project-- necessarily broached the problem of its epistemic order. A key exigency of this representational problem was to demonstrate the project cohort's biomedical salience at multiple scales of epistemic valuation. That is, the biomedical representation of the cohort would have to incorporate characteristics with the potential to satisfy both the universalism of knowledge sought by foreign scientific elites concerning basic etiological pathways of NCDs, the advances in cutting-edge technoscience sought by governmental actors, including—as Katherine Mason has shown-- health officials seeking to modernize the country's public health system, as well as the particularism of knowledge about local chronic disease drivers needed to strengthen China's public health sector (2016). Doing so would entail making important, hierarchical determinations regarding how, specifically, the cohort both resembled and differed from different subpopulations to which it was compared. In the following chapter, I explore why and how the geo-ethnic identity of the cohort was configured as crucial, if problematic, index of this difference-in-sameness, functioning as a

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[25] This is not to ignore that Latour was deeply critical of the strong programme for reasons that were not, perhaps, in keeping with the best faith interpretation of its tenets (Bloor 1999).

technology of interest-alignment that enabled and sustained the assembly of the project's social infrastructure and imputed worth while simultaneously deferring critical reflection on the representational ethics of the project.

Before turning to that analysis, however, I want to address briefly one important concern about the stakeholders whose interests are considered. Notably absent from the list enumerated above are the research subjects themselves. What of the representational interests—that is, the felt risks and health needs—of those 30,000 older Guangzhouese whose lives and bodies constitute the material objects of political, epistemic, and ethical claims made about the cohort? How were the exigencies they faced and their hoped-for ends, with respect to chronic disease health, written into the science of GBCS? The answer to these questions powerfully reinforces the importance of efforts to re-socialize scientific representations and to elucidate the politics that constitutes them. To speak of knowledge production as an inherently political process is to situate it within fields of power —social, governmental, fiscal, professional—and to assert that the outcome reflects the inequalities that define those fields. Despite ostensibly being key stakeholders—both as the source of highly valued information and experimental materials and as the group whose health is most immediately at stake in GBCS research—the fact is that GBCS research subjects had very little input into the aspects of their lives, bodies, and health states that would be incorporated into the project database and the epidemiological knowledge sought from it. Indeed, their ability even to articulate preferences about these representational concerns was hindered by the fact that few participants understood the nature of the project. According to a 2009 survey of GBCS participants conducted by Zhang Xinqing, Professor of Bioethics as Peking Union Medical College, most interviewees believed that they were being offered free health exams every 5 years as part of their membership in GHHARE, the citywide elderly welfare association through which they were recruited, and did not recognize fundamental concepts associated with the project, such as “gene” and “biobank” (Zhang, XQ 2009). When I visited the organization’s *Liwan*-branch headquarters in 2013, GHHARE staffers affirmed Zhang’s findings in conversation with me.

The marginalization of research subjects’ interests is not uncommon in human life science, and the reductive approach of standard ethical frameworks used to safeguard them has been thoroughly problematized in both medical anthropology and bioethics literatures (Rabinow 1999; Sleebom-Faulkner, Ed. 2009). These shortcomings are particularly apparent with respect to the interests of LMIC populations, where structural violence; alternative cultural norms concerning consent, interpersonal responsibility, and belonging; and/ or the absence of grassroots activism around science, leave research subjects particularly vulnerable and at risk of marginalization or even exploitation (Petryna 2009; Sundar Rajan 2010; Crane 2013). Indeed, the very eagerness of GBCS participants to receive free medical exams hints at what category of needs might be important or urgent to them and casts into troubling relief the relatively little information GBCS researchers collected about potential NCD risks and determinants related to uneven health care access in Guangzhou, as discussed in greater detail below. More broadly, the apparent inability of the standard ethical frameworks used in cosmopolitan epidemiological research to protect subjects’ interests even in a narrowly construed sense—in this case, by adhering to the principle of informed consent—suggests just how urgently empirically-grounded, re-socializing studies of practices of representation in transnational research are needed. It is worth mentioning that informed consent procedures failed in GBCS despite the project being subject to regulatory oversight by institutional and municipal-level ethics boards in China, Hong Kong, and the UK. Ultimately, then, GBCS cohort members aren’t treated here and in the following chapter as important stakeholders whose interests shaped the geo-ethnic representations in question because, in practice, they weren’t—and they didn’t.

Chapter 3: Unpacking Geo-Ethnicity, or Biomedical Identity and Interest-Alignment in GBCS

I. Introduction

In the previous chapter, I sought to show that the normalization of transnationalism in Chinese chronic disease research turned on the production and stabilization of collaborative relationships between foreign elite scientists, Chinese public health scientists, and Chinese government officials. Each category of stakeholder, I suggested, brought with it distinct, if inevitably overlapping, ways of valuing Chinese research subjects that were informed by specific institutional and epistemic commitments and hoped-for ends for the project. The successful realization of these projects was thus dependent upon the careful negotiation of and appeal to those many commitments and objectives. Following Donna Haraway's argument that the working objects of science are politico-moral-epistemic hybrids that must be situated in social context in order to be rendered legible, I argued that those commitments and objectives lend insight into the unique epistemic values attributed to the GBCS research cohort by principal investigators (Haraway 1997). In this chapter, I extend this analysis by unpacking the representational claims made by principal investigators about the identity of the cohort as a working object of their research in early publications. Neither value neutral nor given in the natural order if things, I argue that this configuration of the cohort's identity as a research population becomes legible only when one recognizes the important rhetorical function it performed in aligning the objectives of key stakeholders in the UK, Hong Kong, and China.

This rhetorical function, I suggest, is evident in principal investigators' claims about the specificity and value of the GBCS cohort as a research population. The fluid geo-ethnic identity they described for the cohort, variably labelled "Cantonese," "Chinese," or, at times, "Asian," deployed flexible concepts of history, social geography, economic progress, culture, and genetics to establish a shifting taxonomy of resemblance and difference between the cohort and other populations that encompassed multiple scales of speculative epistemic valuation—local, translocal, global. With the freedom to stress alternately the relative universality or particularity of the potential knowledge to be gleaned from studying the cohort, principal investigators were able to appeal to GBCS stakeholders seeking to advance so-called "basic" NCD knowledge, the epistemic and economic value of which would potentially extend to populations across the globe. At the same time, they could also appeal to Chinese public health authorities' need for knowledge about health determinants unique to the country's domestic population, which could explain local patterns of NCD morbidity and mortality and identify effective interventions into the growing crisis. Despite the seeming commensurability of these different ends implied by the authors' characterization of the cohort, however, in fact there are good reasons to argue that GBCS cannot be a source of generalizable knowledge without eliding local questions, and vice versa. One outcome of the rhetorical function of this characterization, I conclude, was to defer critical ethical reflection on how these two ends should be balanced. Such reflection, I conclude, is urgently needed in transnational NCD epidemiology. Thus, by drawing attention to the interest-work this configuration of geo-ethnicity did to facilitate the realization of GBCS as a project of value both to domestic heath needs and global NCD interests, I aim both to offer insight into how ethnic difference was conceptualized and operationalized in the project as well as to open new space for critical ethical reflection on the representational problems posed by geo-ethnic categories as a taxonomy of difference for population-based comparative research chronic disease epidemiology.

This chapter draws primarily on early papers published by GBCS principal investigators in prominent international epidemiological journals. The ostensible purpose of these papers is to describe the biobanking project and to establish its objectives. Central to each is a detailed description of specific biomedically salient characteristics of the GBCS cohort in relation to the stated aims and prospective value of the research project. To support a close analytical reading of them, I draw from scholarship by medical anthropologists, Science and Technologies Studies scholars, and historians of medicine whose work examines and contextualizes normative practices of representing biological variation and medical difference in population-based comparative research. Accordingly, the body of the chapter is divided into three sections. In the first, I examine the normative methods and concepts NCD epidemiologists have developed in order to maximize the benefits of population-based comparative research and manage the challenges that human biological variation poses to the generalizability of knowledge resulting from research on specific groups to other human populations. Key to doing so is to standardize categories of difference across different groups. This process allows for the generalization of research outcomes despite systematic variation in biological and external disease determinants, but does so at the cost of erasing both meaningful sources of intragroup variation as well as forms of difference—often social and historical—that cannot be standardized though techniques of abstraction and quantification.

In the second section, I account for the configuration and use of geo-ethnic categories of identity as a standard taxonomy of medical difference in population-based comparative epidemiological research, tracing its roots to recent ethical concerns about the inclusion of underrepresented groups in biomedical research as well as to the resurgence of interest in genetic variation prompted by the development of genomic sequencing technologies at the turn of the millennium. Drawing on scholarship that has critically examined these developments, I highlight the potential for geo-ethnic categories of difference to fatally distort or erase salient sources of variation and medical risk that derive from local social, historical, and political context. In the final section of the chapter, I unpack the socio-cultural, temporal, and biological narratives of the GBCS cohort's geo-ethnic identity presented by principal investigators, showing how these standardized representations of difference enabled wide-ranging and, at times, contradictory claims about the universal and particularistic epistemic value of the cohort. At the same time, they elided medically salient forms of difference rooted in local political and social history that, if recognized, would have undermine the validity of the cohort as a working object of transnational comparative research. I conclude by asking what this erasure of local sources of risk and poor health in favor of the production of generalizable knowledge means—or ought to mean-- in terms of transnational collaborative researchers' accountability to serving the health interests of their Chinese research subjects.

II. Generalization and the Standardization of Difference in NCD Research

In this chapter, I have set out to show that the formative influence of diverse interests and objectives powerful GBCS stakeholders brought to the project could be traced in the geo-ethnic identity articulated for the cohort as research subjects and the relationship its component characteristics bore to discrete health ends, diverse beneficiaries, and potential biomedical markets that could imagined for the project. One way to frame a sociological understanding of this relationship, I want to suggest, is to think of those characteristics in terms of the relative particularism and universalism of the speculative epistemic values they imputed to the cohort, as the efficacy of cohort's geo-ethnicity to function as a technology of interest alignment in lay in its apparent capacity to accommodate at once a range of particularistic, or local, and global knowledge needs imagined by different stakeholders, which could, in turn, be converted into other forms of biopolitical, geopolitical, and bioeconomic value. Before offering a close reading of how the geo-ethnicity configured for the cohort resonated with stakeholder interests shaped within the transnational context set out in the foregoing, then, it is necessary briefly to take a closer look at the qualities of particularism and universalism in epidemiological knowledge production and how they relate to the representation of relations of resemblance and difference in biomedicine.

As a dimension of epistemic value in biomedicine, relative particularism or universalism indicates a scale of applicability for potential knowledge or therapies, delineated in relation to humanity, writ large, or specific subpopulations thereof. In epidemiological terms, this scope of relevance is referred to as the *generalizability* of a study— a concept that, in its narrowest sense, refers to the validity of extrapolating findings from a research cohort to human subpopulation(s) for which it said to stand. However, as epidemiologists Kenneth Rothman and Sander Greenland point out, as a common scientific concept it carries a second meaning—namely, how abstractable findings are into general scientific hypotheses or concepts (Rothman and Greenland 2005:5) [1] These two senses of generalizability, and the implications they carry for how epidemiologic research cohorts are designed, intersect with the problem of how to formulate and identify salient medical difference, operationalized as variation in the type and degree of exposure to disease determinants, in compelling and illustrative ways.

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[1] In practice, generalizability is a deeply contested topic for epidemiologists, broaching vagaries and disagreements about fundamental scientific and biomedical concepts like causality and the ontological underpinnings of human disease and biology. Chapter 4 of this dissertation offers a detailed discussion of these issues and their impact on the representational practices and goals of the GBCS researchers I worked with in Hong Kong. Here, I limit the discussion of generalizability to the narrow question of how medical difference comes to be operationalized in observational epidemiologic research designs.

The reason for this stems from the complex biosocial interactions that shape disease etiology and outcome; contextual differences in people's biologies, enculturated behaviors, socio-economic conditions, psychosocial statuses, lived environments and other forces shape the course of embodied pathologies as well as the effectiveness of therapies and interventions. In order to make abstractable inferences concerning the role any one of these factors might play in disease etiology, epidemiologists must find ways to identify and control for the influence of other biosocial determinants that interact with them. Otherwise, they risk producing results that are skewed by *confounding,* a form of statistical bias that, in its technical specificity, denotes the influence of an unmeasured factor—or exposure-- on a measured one, leading to researchers to overestimate or underestimate the independent effect of the measured variable on a disease outcome (Broadbent 2013: 117-118).[2] To control for these sources confounding, however, investigators designing a study are often faced with the challenge of making *a priori* assessments both about how properly to delineate human subpopulations based on shared biosocial contexts or medically salient exposures, as well as what forms of medical difference—as variations in type and degree of exposure—"make a difference," to borrow Gregory Bateson's oft-cited phrase, to the health outcomes of the research population at hand as well as to the concrete research goals they have articulated for that population (Bateson 1972:453).

The difficulty this presents is apparent in the fact that the randomized controlled trial (RCT), considered the gold standard of cohort design in evidence-based medicine, effectively makes an end-run around it; by relying on the random distribution of exposure variation across subjects,

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[2] Controlling for influence of biosocial interactions on the measure of discrete disease determinants is an exceptionally difficult task in the study of common NCDs, which, with few exceptions, are polygenic, meaning that multiple categories of exposure interact over long periods of time, creating complex feedback loops that shape (or arrest) etiological progression as they do. Multiple factors can produce the same pathogenic outcomes via diverse pathways; conversely, the influence of known disease determinants can be moderated by the presence of protective exposures.

they obviate the need to identify many potential sources of confounding.[3] However, while RCTs are appropriate for evaluating the efficacy of pharmacological and some other therapeutic interventions whose presence or absence in a particular research cohort is easily controlled by investigators, temporal, ethical, and fiscal constraints render them unfeasible for studying many major disease determinants and risk factors. As one prominent epidemiologist at the Harvard School of Public Health put it during a conversation with me, how could one randomly assign research subjects to a sex category, or genomic type, or socioeconomic class?

Those who wish to study less easily manipulated exposures must rely on observational methods, which exploit existent differences in exposures between subjects rather than introduce them. Basic observational cohort designs vary according to the goals of a study; if investigators wish to understand how exposures operate in a pre-defined target subpopulation, then they will seek to enlist are *representative* subjects; this might include ensuring proportional representation across a range of variable exposures, including age, sex, socio-economic status, occupation, ethno-racial categories, education levels, and so forth. As epidemiologists Rothman and Greenland note, this design is reliable for generating knowledge that can be extrapolated to the target subpopulation—generalizability in the first sense—but because it does not control for clustered variation in exposures within the cohort (say, systematic coupled variation between ethno-racial categories, socioeconomic status, education levels, and psychosocial determinants), it is not

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[3] As sociologist Steven Epstein notes, this is not always the case; for example, pharmaceutical companies have started engaging in "bridging studies" to supplement primary clinical trials to account for potential variation in pharmacologic effects and efficiencies in subpopulations sorted by sex and geo-ethnicity ((Epstein 2007:153)). And, as Lock and Kim note, even RCT results tend to translate poorly from clinical context to the lived world, where pharmaceutical efficacy can be undermined by socioeconomic, social support, and behavioral realities absent from the controlled and structured environment of the clinic (2010: 185-186). There's much to be said about the positioning of RCTs at the pinnacle of evidence-based medicine; however, because this dissertation focuses on an observational epidemiological study, that discussion falls largely outside of its scope.

particularly useful for generating abstractable knowledge—achieving generalizability in the second sense (2005:5-6).

To generate abstractable knowledge, a better option is to maximize similarities among subjects as a way to control for biosocial interactions and allow significant associations between target variable exposures and disease outcomes to be tested. This can be achieved by sorting otherwise similar subjects into two cohorts based on the known presence or absence of a target exposure or disease outcome, such as the famed study by Richard Doll and Austin Bradford Hill establishing an association between smoking and lung cancer (Broadbent 2013: 4). Or, it can be done through a prospective cohort study that strives to enlist subjects who share as many contextual exposures as possible, assuming that the relative internal homogeneity of the cohort will control the "noise" of confounding to allow the "signal" of meaningful exposure variations between groups of individuals who do and do not develop specific disease endpoints to come through.[4] GBCS employs this kind of prospective cohort design, buttressing claims about the relative biological, cultural, and social homogeneity of enrollees with a wealth of microdata about participants' lifestyle behaviors, occupation exposures, education levels, health history and baseline biological indices, and genomic profiles.

Regardless of the observational design selected, the stubborn fact remains that these methodological fixes cannot provide solutions to the intractable problem of having to make *a priori* assessments about how to define human populations as bearers of biomedically salient traits and to divvy them up according to a taxonomy of resemblance and difference. As Margaret

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[4] As noted in the first section of this chapter, Margaret Lock and Vihn-kim Nguyen identify this maximally homogeneous cohort design as a key technique for investigators seeking to identify allelic variants associated with elevated risk for specific NCDs.

Lock and Vihn-Kim Nguyen have observed, such assessments are built into the study apparatus itself; existing outside of that which can be tested, they carry an inherent risk of circularity (2010: 185). That risk is only amplified by the impossibility of accessing a fixed ontological order onto which to map them, a possibility foreclosed by the historicity and dynamism of biosocial interactions. What researchers are left with, most often, are social categories of belonging whose indexical values are always partial and context bound. Variations in interpopulation statistical averages used to demarcate group difference obscure similarities uniting individuals across those boundaries; categories encompass difference in one context but fail to do so when transported to another, as is observed in cerebrovascular stroke patterns that differ significantly from Caucasian populations in ethnic Japanese living in East Asia but not Hawaii (Jiang et al 2010). As a result, the configuration of categories used to transform research subjects into stable working objects of scientific study are almost always overdetermined by the methodological imperatives, institutional and disciplinary contexts, and concrete goals envisioned for those studies. [5]

This includes, crucially, who or, more accurately, what subpopulations are envisioned as potential beneficiaries of the study, which returns to the foreground the two senses of generalizability set out by the epidemiologists Rothman and Greenland. In practice, virtually all prospective cohort studies are neither strictly representative of a target subpopulation nor reductively homogeneous to the point of striving to vary simply by just one target exposure or

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[5] The most compelling example of the role that categorization schemas play in overdetermining sought-after forms of homogeneity comes from social studies of population genetics. As the sociologist Troy Duster notes, any two people within a ethno-racially defined subpopulation will embody greater genetic diversity than there is found between the average genomic profiles to two subpopulations. Likewise, one could use just about any taxonomy for categorizing subpopulations—Duster uses the example of the populations of NYC and LA—and find systemic genomic variations between those groups. The categories used, in other words, render visible the grounds for claiming that they accurately index relations of similarity and difference. Circularity haunts even the most material and quantifiable forms of biomedical difference (Duster 2001).

disease outcome, as is exemplified by the classic Doll and Bradford Hill study. Instead, like GBCS, they are designed with the goal of generating both forms of knowledge that are immediately transferrable to a pre-determined target subpopulation (e.g., Cantonese, with slippages to Chinese or Asian, in the case of GBCS), and those more readily abstractable into universal relevance. The key to doing so, as Steven Epstein notes, is by developing techniques that allow "“locally generated knowledge to travel comfortably across… boundaries” (2007:159). A primary means to do this is through the standardization of medical difference.

Standardization is a necessary practice for epidemiological research. Without formalizing exposures as research objects, it would be impossible to do the careful work of replication that is crucial to stabilizing scientific facts. Nor would it be possible to put new research into conversation with the discipline’s existent body of knowledge if one did not have standardized ways of operationalizing and measuring exposures across different studies and research cohorts. In that vein, it goes without saying that standardization has proved to be an incredibly powerful tool for the human life sciences, allowing for replication and unprecedented extrapolation to take place in the practice of biomedicine. Nevertheless, it depends critically on underlying assumptions regarding the similarities unifying human bodies, pathologies, and etiological factors; in practice, these things are treated as tokens of types. The principle of underlying universals renders particular instantiations commensurate—even in their variation, exposures are able to be compared across individuals and groups. It is no coincidence, then, that in both clinical practice and population-based research statistical quantification—by dint of the mathematical universalism it offers-- has been the most common and transformative tool for standardizing the working objects of biomedicine. In the clinic, pathological processes and states have been abstracted and objectified, defined in terms of standard deviations from a mean; “population,” on the other hand, became a working object of epidemiological knowledge-power only through the enumeration of statistical averages across a pre-defined group (Canguilhem 1989; Foucault 1997).

Forms of salient medical difference that aren’t easily rendered commensurate through statistical quantification (or common qualitative methods of standardization, such as psychosocial questionnaires, as are examined in Chapter 5 of this dissertation), often simply fail to be accounted for in epidemiological studies. These include individual variations in illness experience and disease course that are elided from population averages as well as exposures unique to specific subpopulations that prove difficult to quantify or render commensurate with those found in other research populations—that is, the kinds of local knowledge that truly representative studies generate.[6] As medical anthropologists and science studies scholars have shown time and time again, exposures that tend most stubbornly to resist abstraction and quantification are those rooted in particular histories of social, political, and economic inequality, eradicated by what Epstein aptly refers to as the “flattening” methodological exigencies of epidemiological research, which generate essentialized and reductive understandings of difference (Epstein 2007: 236).

Methodological exigencies linked to the standardization of human subpopulations as working objects of epidemiological study, then, significantly influence the construal of biomedically salient traits used to establish relations of resemblance and difference between individuals and populations in research design. Quantifiable biological characteristics, such average body mass

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[6] It is worth mentioning that epidemiologists Rothman and Greenland describe ideal representativeness as impossibly local, arguing that it would not allow for any extrapolation beyond the original study population.

cutoffs for overweight and obesity, or culturally-driven behaviors that are abstractable and enumerable, such as average tea consumption or daytime naps, tend to be favored over historically unique formations that would be difficult to subsume beneath a global standard or tease apart from context to form individual exposures. While quantified and enumerated traits don't necessarily translate into abstract generalizability—meaning that a finding translates directly to another subpopulation as an intervention or therapy—nevertheless, by rendering variable traits commensurate, they do place knowledge of biomedical difference within a wider realm of relevance, imbuing it with qualities of particularism and universalism, representativeness and generalizability, at once. Subpopulation-specific body mass indices (BMI), for example, may not only help clinicians better identify patients at elevated risk for developing type II diabetes; in addition, evidence of the systemic variation of associations between average body mass and elevated disease risk may also open or advance several venues of etiological research useful to refining a basic causal model of the disease—say, mapping the complex metabolic pathways between diet, growth hormone production, central adiposity, and insulin resistance. It follows that once medial difference is standardized in such a way as to allow it to travel, it becomes possible to mine wider range of epistemic, political, and bioeconomic value from it.

The upshot of science studies and medical anthropology scholarship that critically examines standardization, then, is that 'medical difference' is not a monolithic category; there are fundamentally and formally distinct ways of rendering it, so that the measure of universalism and particularism with respect to its representation in biomedicine exists not as single continuum but is irreducibly plural. Particularistic, or local, scientific knowledge derived from certain kinds of 'differences that make a difference' to health and wellbeing simply cannot be made to travel comfortably or meaningfully across boundaries. And when observational epidemiologists are faced with making selective working assumptions about medical differences that matter in the absence of an unambiguous ontological taxonomy of human resemblance and difference, it is often the case that they confront extraordinary incentives and pressure to exclude those forms, emergent at the nexus of historically contingent and socially thick forces, that don't travel well. There seem always to be, in other words, certain kinds of erasure at work in projects that strive to achieve both representativeness for a specific subpopulation and abstract generalizability, and that erasure seems always to diminish robust iterations of representativeness.

In their discussion of representativeness and abstraction, epidemiologists Rothman and Greenland implicitly acknowledge these erasures, but suggest it is not a problem for their field of practice by invoking familiar disciplinary, ontological, and epistemological divides: As a human life science, epidemiology is predominately concerned with the biological, they argue; representativeness and the descriptive, relentlessly local forms of knowledge it underwrites are more properly concerns of social scientists (Rothman and Greenland 2005: 5-6). But are such erasures so easily dismissed as a disciplinary concern for epidemiologists? Anthropologists, science studies scholars, and global health practitioners who have studied the methodological purging of the more context-bound social determinants of biosocial interactions from this foundational public health science have charted with ethnographic intimacy the negative health consequences this practice can produce for the groups under study (Lock and Nguyen 2010; Fullwiley 2011; (Adams 2013); Farmer, Kleinman, Kim, Basilico 2013). From this vantage, the urgency of accounting for the growing transnationalism in Chinese epidemiology—specifically, how it is shaping configurations of Chinese research subjects as bearers both of critical knowledge about specific drivers of the country's growing chronic disease crisis and coveted forms of medical difference needed to refine universal models of NCD etiology through comparative research—clarifies. It is that urgency that animates this attempt to account for the geo-ethnic identity configured for the GBCS cohort as a politico-moral-epistemic object, asking: What forms of difference were encoded in the geo-ethnicity articulated for GBCS research subjects and what representational limits resulted? What meaning did particularistic knowledge, or "local evidence," take on in relation to it? What implications did it carry for future problematizations and interventions into China's growing chronic disease crisis?

III. The History of Geo-ethnicity as a Taxonomy of Standardized Medical Difference in GBCS

In western biomedicine, the social categories of race and ethnicity have long been used to form a basic taxonomy of biomedical resemblance and difference. Even as the practice of epidemiological science has shifted into a more globally cosmopolitan space, the standardization of medical difference, especially, has continued to be refracted through that history. As Steven Epstein carefully details, there has never been a pat historical consensus amongst biomedical practitioners concerning the ways in which ethno-racially demarcated populations resemble or differ from one another, but debates have tended to revolve around the issue of biology and reflect longstanding traditions of racializing social inequality in Enlightenment thought (2007; see also (Hodgen 1964)). In the U.S. at the turn of the 20th century, Epstein shows, a preoccupation with race-based medicine, which posited the fundamental biological incommensurability of Caucasians and African Americans, fueled reluctance to generalize knowledge across these populations even as the application of statistics to medical research and the prominence of germ theory worked to normalize and objectify an abstract, universal concept of the human body. By the 1970s, ongoing horror over the Nazi legacy of racial science had converged on outrage over more recent examples of racially-based abuse in US research, epitomized by the Tuskegee Syphilis Study, to spur the passage of legislation to protect minority and vulnerable populations in medical research and bolster the idea that systemic biological differences between racial groups did not exist (Epstein 2007: 44). Indeed, as Lock and Nguyen note, this standardized human body, rendered through statistical averages, became the indispensable universal ground upon which comparative population research in biomedicine was organized (2010: 202). Nevertheless, as Epstein notes, the history of using race as a proxy for biologicized difference persisted in 21st century medicine; it was not until 2004, he shows, that the indexing term "racial stocks" was eliminated from the US National Library of Medicine's "Medical Subjects Headings," to be replaced by "Continental Population Groups" (2007: 38).

Since the late 1970s, ethno-racially mediated claims about biological difference and the complex politics and moral sentiments shaping them have not so much disappeared from cosmopolitan biomedical discourse as they have been reconfigured in accordance with two developments. One, as Steven Epstein masterfully tracks, is the institutionalization of what he calls the "inclusion-and-difference" paradigm in US biomedical research (2007: 17). He traces this paradigm to a backlash, beginning in the mid 1980s, from patient advocacy groups in the US against efforts to purge medical research of its racist and racialized biological constructs. For these advocates, measures taken to protect vulnerable research groups and an insistence on biological universalism overlooked what they believed to be a longstanding erasure of women and minorities from the knowledge base of biomedicine, precluding attention to important sex- and race-based medical differences and holding the white male body up as the standard-bearer for human biology. As a result of their work, Epstein shows, human subjects research has been substantially reorganized in the US around social categories of group difference, as major governmental regulatory and funding bodies, including the Department of Health and Human Service and the National Institute of Health, adopted mandates to ensure that women and minorities were included in medical research and that group-based differences were tracked in them (2007:6). Neither greater inclusivity nor attention to group-based differences is an inherently problematic goal for biomedical research; however, as Epstein shows, too often the "inclusion-and-difference" paradigm has, unsurprisingly, generated essentialized and biologically reductive understandings of difference, to the exclusion of those forms rooted in the country's deep history of social, political, and economic inequalities (2007: 236).

The "inclusion-and-difference" paradigm is a US-based phenomenon, informed by the country's unique history of sexual politics and racial oppression; nevertheless, as Epstein observes, the outsize influence that US funding bodies, research institutes, and companies wield in the realm of cosmopolitan life science research means its effects are sure to have reverberated beyond the domestic sector, if unevenly. Indeed, any transnational clinical research collaborative receiving funding from the NIH, for example, would be accountable to the NIH Policy and Guidelines on the Inclusion of Women and Minorities as Subjects in Clinical Research, which outlines sex- and ethnicity-based requirements for research analysis and reporting.[7] To that end, it is worth remarking that, as of 2016, 307 transnational research collaboratives in China are currently operating with NIH grants, a number which constitutes a full 69.1% of all domestic projects receiving overseas funding.[8] For these researchers, certainly, and those seeking to connect with

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[7] Statistics available online at: https://grants.nih.gov/grants/guide/notice-files/NOT-OD-18-014.html

[8] Statistics available online at: https://worldreport.nih.gov/app/#!/

NIH supported projects, the use of ethnicity as an index of medical difference would carry a significant sense of inevitability, if not legitimacy.

In broader cultural terms, this "inclusion-and-difference" formulation—that ethno-racial categories are a meaningful index of medical difference and, as such, the targeted study of ethnic groups in research is a bioethical imperative—only can have supported the growing interest in ethno-racially mediated biological difference emerging from another influential corner of the cosmopolitan human life science community in the late 20th century: population genetics, the disciplinary frontiers of which would soon expand into epidemiology. As sociologist Jenny Reardon tracks in her study of the ultimately abortive Human Genome Diversity Project (HGDP), the stated goal of which was to preserve humanity's genetic diversity by collecting and storing genetic materials from subpopulations around the globe, the rapid development of genomic sciences during this period led to a renewed commitment amongst human life scientists, research funding bodies, and government regulators to the validity of such categories as indexes of medically meaningful biological difference (2005). Notably, as with the inclusion-and-difference paradigm, HGDP proponents sought to justify their project in bioethical terms that departed from the universalizing, secular humanistic grounds of the post-WWII medical ethics tradition. The genetic diversity of ethno-racial human subpopulations, their argument suggested, was bioscientifically meaningful. Therefore, the inclusion of such subpopulations—particularly those in LMICs, for whom historical structural disadvantages had led to underrepresentation in human bioscience—in the rapidly growing knowledge base associated with the new genetics carried the force an ethical imperative.[9]

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[9] It is important to note that, unlike the social and governmental categories of ethnicity and race described in Epstein's book, whose meanings were inflected by the history of race relations and awareness of the social underpinnings of the category in the US, population geneticists involved in HGDP were more both more explicit and narrower in their understanding of the genetic closeness of subpopulation groups as being tied to historical

As Reardon shows, HGDP leaders' efforts to assemble the collaborative infrastructure necessary to realize their project was met with deep resistance, which ultimately forced them to abandon it (2005). Unlike Epstein's inclusion-and-difference movement, it was not initiated by those groups whose underrepresentation it sought to rectify; instead, representatives of those subpopulations in LMICs and other marginalized communities targeted by HGDP viewed the project with deep skepticism, articulated through a postcolonial frame that did not question the truth of claims about their claims equating medical difference to their unique genetic diversity but, if anything, implicitly supported them by accusing project leaders of seeking to exploit it. Indeed, these concerns bore considerable resemblance to Chinese leaders' articulations of the risks involved in transnational collaborative science and shared a common history of expropriation at the hands of Western powers. Despite this failure, however, as the recognition of "Continental Population Groups" on the National Library of Medicine's list of medical subject headers attests, the use of geo-ethnic and geo-racial categorization as a taxonomy for indexing relations of resemblance and difference across diverse population-based comparative research projects and sites persisted. For this reason, such categories can be thought of as examples of what Aihwa Ong and Stephen Collier have called "global phenomena"—those knowledge frameworks, technologies, and methodologies of cosmopolitan technoscience that "have a unique capacity for decontextualization and recontextualization, abstractability and movement, across diverse social and cultural situations and spheres of life," (Ong and Collier 2005:11).

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geographic proximity. Whether this explicit positioning of spatio-temporal proximity as a mediator not of biological relations of similarity and difference, broadly, but genetic similarity, more narrowly, works against the tendency of epidemiologists, who use ethno-racial categories in a more omnibus fashion to index social and biological characteristics, to essentialize and to reduce to biology medical difference merits further exploration. However, as GBCS principal investigators use it in the latter manner, as shown below, that exploration is outside of the scope of this dissertation.

As a "global phenomenon," this geo-ethnic taxonomy constituted part of the conceptual armature with which members of the cosmopolitan epidemiological research community could standardize and operationalize medical difference across their work, synthesizing diverse research populations as working objects of science within a globally comparative framework. That said, as Anna Tsing observes in *Friction*, her ethnographic examination of deforestation and environmental activism in Indonesia, global phenomena, perhaps counter-intuitively, are ultimately emergent, deriving concrete meaning from the "contingency of encounter"—that is, the specific assemblages of actors, ideas, and values whose interactions constitute a de facto negotiation that is generative of specific instantiations of global forms (Tsing 2005:3). In line with her argument, science studies scholars whose work examines of the use of ethnic categories in medical research have highlighted in them this quality. In her study of a bioscience parks in Singapore, for example, Aihwa Ong highlights the generative quality of the "ethnic heuristic" used by her human life science interlocutors, noting "[d]ifferences (race, ethnicity, geography)… are not stable but rather contingent values," flexibly and relationally re-defined by researchers through the reworking of "longstanding notions of Asia.. as a genomic, epidemiological, and environmental continuity" in support of making "strategic claims to leverage Singapore's potentialities in global genomic science" (Ong, A. 2016: xv).

Steven Epstein offers a less optimistic evaluation of this flexibility in his description of hamstrung attempts made at the International Conference on Harmonization of Technical Requirements for Registration of Pharmaceuticals for Human Use (IHC) to include a stipulation that companies account for "ethnic factors" in their research. In this transnational context, "ethnicity," he observes, "describes a bewildering array of difference that might be found between nations," noting that the ICH document lists "nation-specific or region-specific variation in such matters as lean body mass, organ function, genetic polymorphisms, diet, medical practice, exposure to pollution and sunshine, use of alcohol and tobacco, compliance with prescribed medicine regimes, and practices in clinical trial design and conduct, among others" (Epstein 2007: 53). Elsewhere, he attributes the sprawling definitional ambiguity of this term, in part, to the "diverse epistemologies of the social" that are "yoked to the study of biological disease processes" through it (Epstein 2007: 193).

Though they differ in their assessment of the value of geo-ethnicity as a tool for standardizing difference in medical research, Epstein and Ong's accounts are not mutually exclusionary. Rather, they identify both the deep uncertainty and profound generativity of the category and link those qualities in a transnational research context to diverse potentialities that derive from the many social logics of difference and concrete, strategic goals stakeholders bring to the research. Whether and how those potentialities are realized depends on the micropolitics of its operationalization. Epstein's and, from a different analytic vantage, Reardon's accounts of ICH and HGDP, respectively, suggest that efforts to operationalize the concept may not always successful; the diversity of epistemologies, regimes of valuation, and strategic objectives stakeholders impute to the category—and to the project-- can fracture any sort of common ground on which to establish a shared understanding. Ong's work, importantly, shows that when such shared understandings are achieved, they can become generative in ways that reverberate far beyond the strict arena of knowledge production, advancing in her case-study multiple political-economic, biosecurity, and biopolitical objectives of nation- and region-building in East Asia (Ong, A. 2016). All three, however, underscore the extent to which the process of operationalizing geo-ethnic categories in biomedical research is grounded in the particular and the local—and it is with that in mind that I turn, finally, to the configuration of geo-ethnicity in early GBCS work.

IV. Epidemiologic Time, Culture, and Genetics as Geo-Ethnic Difference in Early GBCS Work

In introductory papers presented in *International Journal of Epidemiology* and *Nature* subsidiary *Journal of Human Hypertension*, publications whose impact factors place them in the top 3% and 30%, respectively, of influential international health science journals, GBCS principal investigators make the case for the scientific merit of their project, outlining study details and articulating concrete short-, medium-, and long-term objectives.[10] The case they make acts at once as an appeal to the journals' cosmopolitan epidemiological readership and as reassurance for immediate stakeholders of the study's validity and promissory value in relation to those objectives. Central to their overture is a description of the study cohort as a standardized working object. Identified as "Cantonese," this omnibus geo-ethnic descriptor serves in the papers both as an index of the unique, biomedically salient characteristics borne collectively by GBCS research subjects as well as a value-laden term positioning the cohort within a broader comparative taxonomy of epidemiological subpopulations structured by relations of biomedical resemblance and difference. Bridging these two functions is a historiographic master narrative of the cohort's identity that deploys socio-economic, environmental, biological, and cultural understandings of the lives, bodies, and experiences of Guangzhou permanent residents ages 50 and above—the basic inclusionary criteria for recruitment.

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[10] Journal Impact Factor percentiles available online at: http://mdanderson.libanswers.com/faq/26159; table reports 2016 data available through Journal Citation Reports, a database listing the impact factors for 12,061 science journals in international circulation.

Unsurprisingly, given the foregoing discussion about the importance of establishing relative group homogeneity to designs for studies seeking to pursue abstractable scientific knowledge, these understandings emphasize commonalities among older Guangzhouese. More illuminating, however, is how that homogeneity is narratively produced. The principal assertion underwriting authors' claims about the cohort's homogeneity concerns members' shared, generational experience of the region's rapid socio-economic transformation. Contouring the spatial and temporal dimensions of the history of Guangzhou and the former countryside it has grown to engulf onto Abdel Omran's epidemiologic transition model, the authors argue:

> Uniquely, the lifetime experience of older Guangzhou residents has straddled two macro-environments. Their parents were born into a pre-industrial environment, where living standards had been essentially unchanged for millennia and where male heights (an anthropometric marker of living standards) were similar to those in France at its pre-industrial nadir…. However, with the more inclusive route to economic development taken by the PRC and in recent decades following the establishment of special economic zones near Hong Kong in 1978, Guangzhou has been transformed and its residents' lives with it (Jiang, C.Q. et al 2006: 844).

The temporality of the narrative is marked by a long-enduring period of stasis—the geographic region contemporary Guangzhou comprises was "unchanged for millennia" -- followed by a rapid transformation precipitated by and reducible to economic industrialization, out of which had emerged a metropolis of just over 10 million persons, officially, by 2006. Critically, the temporal sequence delineated by this economic development trajectory constitutes a universal ground for comparison, rendering commensurate spatially far flung environments— 17th century pre-industrial France is transposed onto early 20th century urban Canton and its peripheral rural areas-- and the biologies they shape—average male height is a universal biological index of environmental exposure framed by economic substrate. Importantly, contemporaneous older Guangzhou residents are the product of that environment, historically rooted in it by lineage through an implicit metaphoric projection of claims about economic stasis onto the actual movement of people into and out of the Guangzhou region.[11] Thus, not just places, but emplaced populations, are made commensurate by the spatio-temporality of the narrative. Indeed, the authors assert as much:

> The very recent history of the epidemiologic transition in this cohort potentially provides a unique window into some of the unexplained period effects in the epidemics of chronic diseases associated with economic development…. Specifically, we plan to test whether empirically driven hypotheses mainly developed in response to observations in economically developed Western societies apply to a population at a different epidemiological stage… and potentially with a social patterning of disease more consistent with the early stages of epidemiologic transition (Jiang, CQ et al 2006: 846).

As I discuss in detail in Chapter 2, chronic disease became an object of study for Euro-american epidemiologists toward the middle of the 20th century, when the term appeared in medical journals with increasing frequency in the 1920s and 1930s (Daemmrich 2012). Around the same time, cardiovascular disease, in particular, emerged in the US public imaginary as a killer of white, middle-aged, middle-class men (Fullwiley 2011; Montoya 2011). By the time Omran had formulated his paradigmatic understanding of the positive associations between socio-economic industrialization, demographic change, and epidemiologic transition in the early 1970s, European and American populations were several generations removed from the origins of that tripartite shift. By configuring them as non-coevals of Euro-American populations on a universal trajectory of economic development and positioning them at the beginning of an epidemiologic change the latter had already lived through, this historical narrative fashions older Guangzhou residents into an object of scientific study that not only reveals the chronic disease health risks facing them at present, but also offers access to the origins of chronic disease etiology foreclosed

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[11] As I'll discuss below, the assumption that GBCS cohort members are progeny of the people who historically inhabited Guangzhou and its surrounds is important to establishing its genetic and cultural homogeneity. That said, its also important to understanding the cross-generational (or epigenetic) aspects of chronic disease from the perspective of life course epidemiology—a concept I explain in greater detail in Chapter 5.

as an object of study in Euro-American populations. In relation to a different set of LMIC subpopulations, moreover, it is inflected by the future temporal:

> The older residents of Guangzhou provide a unique opportunity to gain early insights into the effects of the epidemiologic transition, where findings will be relevant to other parts of China transitioning later or at a slower rate, such as the inland industrial cities or the rural areas… and also to other parts of the world currently undergoing rapid epidemiologic transition (Jiang, CQ et al 2006: 844).

Thus, by rendering the GBCS cohort as non-coevals of populations in high-income countries, on one hand, and LMICs on the other, and setting them into ordered relations of difference along an unifying trajectory of epidemiologic transition, the papers' authors are able to convey the grounds upon which the local forms of knowledge they generate may travel comfortably, as Epstein phrased it, into broader realms of epistemic relevance. And they do so in relation to specific groups of imagined beneficiaries, envisioning concrete objectives for that relevance. Of note, it is not just the way in which the GBCS cohort resembles these populations, but also—crucially-- how it differs, that imbues it with that relevance. It is precisely because of its non-coevality with Euro-American populations that the GBCS cohort can be configured as a bearer of the unique epistemic value needed to clarify and refine models of the complex biosocial interactions linking early industrialization and epidemiologic change to chronic disease pathology. And it is by dint of the uniquely recent, rapid onset and progression of transition in this population that it can stand as a model for other LMIC populations, rectifying a blind spot in the current body of general knowledge that serves as the cornerstone upon which new research inquiries build in cosmopolitan epidemiology by compensating for the overrepresentation in it of late industrialized populations whose period effects diverge from those in early transition stages.

The homogeneity imputed to the GCBS cohort through the historical narrative of geographic and demographic stasis extends to two other axes of difference in categorical exposures that constitute the biomedically salient characteristics encompassed by "Cantoneseness" in these early papers. One of these concerns older Guangzhou resident's shared cultural traditions. As the authors explain:

> The permanent resident population is generally from Guangzhou or Guangdong and represent a homogeneous Cantonese group, which despite turmoil and extensive economic transition, have retained traditions and cultural norms. These include lifestyle factors such as the maintenance of traditional cuisine and minimal consumption of tobacco products and alcohol in women, and psychosocial factors such as traditional belief in the need for a diet that balances Yin (cold/dark) and Yang (hot/bright) and offsets imbalance in the body… (Jiang CQ et al 2010: 140; see also Jiang, CQ et al 2006: 844).

The persistence of unique, traditional cultural beliefs and practices in the context of rapid socio-economic change constitutes another form of temporal displacement, in contrastive relation to patterns observed in long-term industrialized populations, that contributes to the value of cohort as an object of comparative research into established lines of general inquiry into risk and etiology. The authors argue:

> Where prevalence rates vary of differential associations exist across different settings this provides the opportunity to reassess potential relationships, particularly those of a potentially controversial nature. This cohort can help therefore not only to assess determinants of disease within the Chinese setting, but also to provide supportive data in Western settings where a hypothesis may not be adequately assessed (Jiang, CQ et al. 2010: 140).

While the language is somewhat obscure, it is possible to elicit the intended meaning from context: Chronic disease risk is, quite famously, linked to specific behaviors that tend to cluster with industrialization and rising living standards, such as increased sedentarism, the consumption of obesogenic foods and drinks, and the use of harmful substances like alcohol and tobacco. The implication in these papers is that such lifestyle changes have not yet occurred in the GBCS cohort, who are still moored to the cultural traditions of a bygone socio-economic order. Hence, the cohort offers a good comparative case for parsing the relative contributions of lifestyle factors and other socio-economic, environmental, and biological exposures that tend to be entangled in Euro-American populations. Not only will parsing these relations be useful to local epidemiological risk modeling, but it will also offer a new strategy for controlling for potential confounding in research done in the latter populations, as the authors soon make clear:

> We have already utilized this in the assessment of passive smoking on chronic obstructive pulmonary disease and napping on diabetes and the metabolic syndrome. The low rate of smoking in women, yet high rate of prevalence in men, enabled a much clearer picture of the contribution of passive smoking, which can often be confounded by the residual effects of active smoking in Caucasian populations (Jiang, CQ et al 2010: 140). [12]

The standardization of cultural difference within universal categories of lifestyle risk factors, then, is another strategy for generating local knowledge that can travel comfortably across research subpopulation boundaries in service of specific goals envisioned for the project.

The final axis of medical difference involves population-wide genomic variation, and it too turns on the assumption of the historical stasis of contemporary Guangzhou's emplaced population. Recall, as anthropologists Lock and Nguyen explained, that the assumption of relative homogeneity is key to controlling possible sources of confounding in genetic science, particularly when searching for what epidemiologists call high-frequency, low-penetrance alleles. I explain in greater detail in Chapter 4 that the individual effects of these common inherited variations in DNA sequences, which are collectively theorized to account for most of the apparent heritability of polygenic chronic diseases, are quite small. In order to detect them,

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[12] Indeed, the paper cited here on COPD and passive smoking was highly successful, gaining publication in *The Lancet* and subsequently nominated alongside 11 others to be named *Lancet* Paper of the Year.

researchers require vast research populations with relatively similar genomic structures; this similarity reduces the risk that systemic differences in subgroups of enrollees with different genetic heritages will confound tests for associations between allelic variants and illness. If genetic similarity is a result of historical proximity of peoples, then the assumption of historical stasis—or an absence of movement of different groups into and out of the Guangzhou region across time-- implies a lack of confounding admixture in the GBCS cohort.[13] A shared history of economic exposure and culturally-driven behaviors, moreover, suggests unknown sources of non-genetic biological variation deriving from biosocial interactions are, broadly speaking, controlled for. Indeed, the authors make explicit the importance of geo-ethnic homogeneity to the integrity of the cohort as an object of genomic research:

> We plan to examine genetic, lifestyle, occupational and environmental factors, and life course causes of the common chronic diseases, which are emerging with economic development… [T]he geo-ethnic homogeneity of our cohort helps reduce the risk of population stratification in nested case-control studies on genetic association (Jiang et al 2006: 844).

The integrity of the cohort as a source of coveted material for and object of genomic research, in turn, signifies GBCS's potential to contribute to the extraordinary advances in characterizing and modeling the interactive biomolecular and sociogenic pathways new genomic technologies were expected to bring to chronic disease science. And as with the historical and cultural forms of difference encompassed by the rubric of Cantonese geo-ethnicity, the genetic dimension of geo-ethnicity carries the potential to contribute both to the general body of epidemiological knowledge and methodology, broadly applicable to an imagined universal human subject of

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[13] Note that this spatialized and historicized understanding of genetic relations of similarity and difference does not essentialize biological difference; rather, it subjugates it to history and—to the extent that inter-group ethnic boundaries are theorized to support insularity via marriage practices, etc.-- culture. This is one reason why it is distinct from 20th century biological determinisms of racial science.

biomedicine, as well as to the distinct benefit of populations underrepresented in that body of knowledge. The authors offer by way of example:

> Like other East Asian ethnic groups, Chinese have a relatively high frequency of ALDH2*2 alleles, which slows the metabolism of potentially carcinogenic acetaldehyde, the first metabolite of alcohol... Genetic data from this cohort and the large proportion of never-drinkers will provide the opportunity to examine whether the observed protective effect of moderate alcohol use against cancer mortality in this population may be the artefactual results of genetic differences between users and non-users of alcohol (Jiang, CQ et al 2006: 844).

In other words, the frequency with which an allelic variant associated with reduced efficacy of alcohol metabolism appears in the cohort provides an opportunity to move beyond probabilistic understandings of a correlation between alcohol intake and cancer—the classic risk factor approach to a more precise, causal understanding of the role genetic difference may or may not play in moderating that association via the mechanism of acetaldehyde exposure. Hence, not only could this line of research tailor understandings of a known lifestyle risk factor to Cantonese and those populations (Chinese, East Asian) deemed to genetically resemble them, but also, by clarifying the causal mechanism(s) linking alcohol consumption to cancer risk, stands to carry medical benefits for all persons seeking information about how to imbibe safely. A few steps removed from clinical application, this kind of study also constitutes the opportunity to develop new methodologies with which to improve upon probabilistic approaches to disease exposures and outcome, and therefore the replicability and reliability of knowledge generated through observational studies.[14]

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[14] To expand on this, the kind of research described here uses a technique called Mendelian Randomization (MR), which is a relatively novel strategy that relies on the random distribution of known functional alleles to test the causal relationship of related environmental risk factors on disease outcomes. For proponents of MR, it is akin to relocating the unit of randomization of RCTs from individual subjects to genomes, and offers great promise in terms of improving the replication of observational studies. I discuss MR at greater length in Chapters Two and Four. Here, let it suffice to clarify that one outcome of the use of such a strategy is that it could confirm an independent association between alcohol consumption and elevated cancer risk regardless of ALDH2*2 status; in addition, because ALDH2*2 alleles appear across human populations (even if there is variation in the frequency with which they appear in geo-ethnically defined subpopulations), determining genetic risk in theory could benefit anyone. However, as Steven Epstein notes, one effect of the flattening associated with the use of racial and ethnic categories

This configuration of Cantonese geo-ethnicity along epidemiologic time, culture, and genetics thus encompasses medically salient characteristics and intra- and inter-group relations of resemblance and difference that demonstrate the cohort's epistemic value both specifically to Cantonese, Chinese, and other populations who are historically underrepresented in NCD epidemiology as well as to the advancement of general chronic disease science and the imagined universal human subject who benefits from it. By envisioning discrete, if broad, research ends articulated in relation to outstanding questions about epidemiologic transition, the biosocial interactions that perpetuate pathogenesis, and novel lines of inquiry into the genetics of chronic disease, this configuration resonates with the sentiments of elite epidemiologists in the cosmopolitan chronic disease research community concerning the value of Chinese as an ideal source of experimental subjects. Because the epistemic premises of these sentiments are embedded in the narrative description of the cohort, these papers do more than simply convey information about it. In addition, they issue a rhetorical appeal to this community to ratify the merit of the project and reassure stakeholders differently positioned within the community that their epistemic, institutional, and fiscal interests in the project may be realized.

For collaborators in the UK, Hong Kong, and potential future collaborators outside of China, this assurance suggests that the promissory epistemic value inhering in data from the cohort may be transformed into concrete forms of professional and institutional value. These include, for example, pathbreaking findings about the sociogenic, environmental, and biomolecular contributions to chronic disease etiology wrought by rapid socioeconomic transition; significant

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to index medical difference is that such nuances are often lost in clinical practice. Instead, ethno-racial categories become the basis for profiling individuals for elevated risk in the absence of confirmation that the individual is exposed to the factor for which ethno-racial difference stands proxy (Epstein 2007).

contributions to the emerging fields of omics sciences; influential publications; the receipt of prestigious awards and grants to raise the profile and capacity of their associated institutions; an expanded professional network; the potential to develop new therapeutics targeted to old and emerging biomedical markets alike; and the chance to improve health in typically underrepresented populations—the ethical incentive identified by epidemiologist Neil Pearce as legitimating, if not driving, the spread of transnational epidemiology research to LMIC countries (2004: 1127). For Chinese governmental and scientific collaborators, in addition to these interests, ratification of the global epistemic value of the project would also provide means to pursue specific geopolitical goals concerning the positioning of Chinese chronic disease science within the cosmopolitan epidemiological community. The cutting-edge nature of the project, moreover, as a genetic biobank, would provide a global stage on which to perform competence with respect to the technologies and knowledge frameworks associated with the omics sciences, in line with the governmental goal of advancing technoscientific modernization through the development of powerful domestic biotech and life science sectors.

In addition, this configuration of the cohort as a bearer of important forms of difference whose representation in epidemiological science could preferentially benefit Cantonese, Chinese, and even other East Asian populations resonates with domestic biopolitical goals concerning promoting and safeguarding the health and wellbeing of the population. Indeed, as anthropologists Aiwha Ong and Nancy Chen have argued, the development of a domestic omics sciences sector in China has been accompanied by a growing embrace among Chinese technocratic and scientific elites of strains of biological and cultural exceptionalism that have inflected the nation's approach to biogovernance (Ong and Chen 2010; Chen 2007). The papers' emphasis on the cultural and biological forms of medical difference unique to Cantonese, and the suggestion many of these differences can be extrapolated to other Chinese and East Asian populations resonates with these strains of exceptionalism and the governmental, bioeconomic, and even bioethical logics accompanying them (Ong and Chen 2010). The collection and storage of a vast amount of health information unique to Cantonese (and, by extension, Chinese), moreover, carries the potential to generate the forms of local evidence needed by Guangzhou public health officials to build a more robust epidemiological map of the population as part of their efforts to stymie the growing chronic disease epidemic and, more broadly, meet the health needs of the local populace. Hence, the configuration of the cohort's geo-ethnic identity in terms of medical differences related to culture, genetics, and the regional history of epidemiologic transition, would seem to accommodate, and therefore bring into alignment, the diverse interests of the project's key stakeholders and solicit critical support from their colleagues in the broader cosmopolitan epidemiological community.

Representativeness and Generalizability Revisited

That said, there are good reasons to question whether or to what extent this characterization of the GBCS cohort can truly accommodate these diverse interests without deprioritizing or erasing forms of difference that make a difference to local health needs and outcomes. Again, epidemiologists Rothman and Greenland's distinction between representativeness and generalizability and the tensions the process of standardization introduces between these representational goals are one key to understanding why. Those tensions become apparent through close examination of the knowledge frameworks used to characterize the GBCS cohort's geo-ethnic identity and set it into the relations of medical resemblance and difference along which local forms of exposure become globally relevant. One example is the intradisciplinary controversy surrounding Omran's epidemiologic transition model. Indeed, in the nearly half-century since Omran proposed his theory of epidemiologic transition, its universality has been subject to much debate and revision even as it has been adopted as a foundational conceptual principle by public health practitioners, health economists, epidemiologists, and other members of the chronic disease research community. This debate has been prompted by empirical failures of the Omran model to describe accurately epidemiologic trends observed in post-Soviet nations and elsewhere and has explicitly sought to restore social and historical contingencies erased by the model's framework. [15] For example, several public health scholars have demonstrated the interplay of health systems and morbidity and mortality changes independent of socioeconomic development (Frenk and Sepulveda 1989b); (Caldwell 1990). Others have pointed to examples of disease double-burden or lifespan regression that defy the model's assumption of unidirectional change, linking those phenomena to social, political, and economic conditions unique to specific times and places (Frenk, Frejka, and Bobadilla 1989a) (Frenk, Bobadilla, and Stern 1991). Still others have simply highlighted the importance of heterogeneous aspects of cases that would be lumped together in the same stage (Fetter et al. 1995).

Another tack taken by its critics is to historicize the underlying spatial, temporal, and disease concepts embedded in the theory, tracing their connection to development paradigms and public health concerns that issuing from Euro-American academia. The anthropologist David Reubi, for example, has linked changes in the spatio-temporal logics that structure "theories, practices, and materiality in today's global health and chronic disease complex" to a shift in political science

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[15] Not to turn Omran into a straw man, it's important to note that he developed three sub-models to account for apparent geographic variations in the speed of the transition. Western countries exemplified the classic model and Japan underwent an accelerated version, whereas "most countries in Latin America, Africa, and Asia" exhibited a delayed transition (Omran 2005: 753-754). Not that these distinctions are still one of quantity (speed) and not quality.

epistemes from mid-20th century modernization theory toward more recent globalization theory, showing that the deployment of each in research targeting the global tobacco epidemic leads to different visualizations, modeling, and control efforts across the world (Reubi 2016:188). Physicians Gene Bukhman and Alice Kidder have taken issue with the claim, in line with epidemiologic staging, that common chronic disease burdens have, until the recent changes wrought by globalization, been relatively light in low and middle-income countries—a belief reflected in the recently outmoded description of common chronic diseases as 'diseases of affluence'. Bukhman and Kidder trace the longstanding lack of attention afforded to cardiovascular disease on global health agendas to colonial era medicine's pre-occupation with infectious disease and to a US- and Eurocentric conflation of cardiovascular disease with coronary artery disease in post-WWII international health (Bukhman and Kidder 2008). Armstrong, on the other hand, examines the early 20th century emergence of "chronic illness" as a medical category, linking it to a novel concern amongst U.S. epidemiology and public health practitioners about the ongoing functional impact of diseases with disabling effects as well as to the medicalization of aging (Armstrong 2014).

Collectively, these critiques offer cause to question what consequences the epidemiologic transition framework carries for the generation of local—in the sense of representative—knowledge about both the Guangzhou cohort and the other subpopulations for whose future its epidemiologic present is made to stand. One reason is that they reveal constitutive spatial, temporal, and disease categories used to configure the GBCS cohort as epidemiological past and future of others to be forms of situated knowledge, whose abstract generalization is reflective of historical geopolitical and economic power imbalances that have led to the overrepresentation of American and European experiences and concerns in cosmopolitan epidemiology. Such historically situated epistemic stances, as the anthropologist Cori Hayden demonstrated in her ethnographic study of bioprospecting in Mexico, inhere in the "material practices and histories…idiosyncratic professional and personal interests and well-worn disciplinary practices" that shape the ostensibly universal bodies of knowledge and conceptual frameworks, like Omran's, used to transform groups of people into standardized working objects of biomedical study in relation to new lines of comparative inquiry (Frenk and Sepulveda 1989b). Such historical imbalances, obscured in bodies of abstract scientific knowledge, are precisely that with which Lawrence Cohen is concerned when he warns of the hegemonies concealed in the underlying universals at work in biomedicine (Anderson 2002:650). In light of the manifest empirical failures of Omran's model to adequately describe the presents or model the futures of LMIC populations to which it has been applied, in connection to its concealed parochialisms, the social and historical erasures required to fit the GBCS cohort, a historically underrepresented group, into the narrative deployed in these papers warrant close examination.

Indeed, those erasures aren't difficult to locate in the reductive narrative of economic history and change presented in early GBCS publications. The stasis imputed to the population of Guangzhou and its surrounding countryside belies the extensive history both of movement of people into and out of the area as well as the city's positioning as a powerful regional trade hub with far-flung overseas ties. In contrast to authors' portrayal of the region's economy as having been essentially agrarian for over two millennia before the establishment of the PRC, the pre-1949 history of Guangzhou is rife with episodes of transnational merchant trade, the circulation of foreign goods and bodies, encounter, industry and dynamism that are fairly incompatible with GBCS researchers' depiction of a static and insular agrarian society, beginning from before the Common Era (Anderson 2002). This history linked the local population into far-flung and enduring networks of overseas Chinese communities that circulated goods, ideas, and money far beyond the region. In the 1800s, with the arrival of the British, and later, its early 20th century occupation by Japanese forces, the regional population was exposed to the trauma and suffering of occupation and war, including mass casualties from famine and violence during the Japanese occupation (Madison 2007).

Following the establishment of the PRC, moreover, regional Guangzhou underwent a wholesale political, institutional, and economic transformation, which upended trade and familial networks, collectivized agriculture and existent heavy industries, and incorporated coercive attempts to re-engineer social identities and relations through ideological indoctrination and mass mobilization campaigns that, by dint of the PRC's monopolistic grip on power, proved nearly impossible to resist (Vogel 1969; Watson 2010). The suffering produced by the most notorious of those campaigns-- including the Great Leap Forward, which contributed to a nationwide famine that left 50 million people dead (Watson 2010; (Chang 1991), and the Cultural Revolution, whose lasting impact on Chinese government and professional sector capacities was reviewed above and whose enduring psychosocial effects were underscored by Kleinman (1986), has been well documented. More recently, as we have seen, radical privatization has produced an increasingly stratified society, in which the social and health harms of late industrialization pool in those groups who, by dint of the country's restrictive *hukou* system, are least likely to access social welfare programs and health care. The impact of such historical forces, distant and recent, on the homogeneity and health of the contemporary population of older permanent residents in Guangzhou are largely erased by a historical narrative structured around broad macro-economic trends in line with the methodological and epistemic requirements of population-based comparative research.

One potential consequence of these erasures is highlighted by the scholar Kim Fortun in her ethnographic exploration of the aftermath of the Union Carbide methyl isocyanate leak in Bhopal, India. Fortun examines the deployment in health science and policy of hegemonic master narratives that collapse past and future into the present, resulting in epistemic closure to the contingencies arising from the chronicity of health risk and disease. Openness is displaced by an "anteriorized future" that precludes attending to emergent present risks divergent from an envisioned future, leading to kind of failures to adequately describe, anticipate, and intervene in such risks to prevent or limit suffering (Fortun 2001:354). Certainly, evidence exists for the potential ongoing impact of some of the events omitted from the GBCS cohort's narrated history on present health risks faced by older Guangzhou residents, as Kleinman's demonstration of the link between embodied depressive symptoms and the trauma of the Cultural Revolution shows, as does preliminary evidence of the epigenetic effects of famine on subsequent generations' elevated risk of developing a host of chronic diseases (Lock and Nguyen 2010: 337). Given knowledge of the consequences of political upheaval for morbidity and mortality patterns in post-Soviet nations—which, as Frenk describes, contravened expectations grounded in traditional epidemiologic transition theory—the question of whether the radical political and social transformations Guangzhou has undergone, first under the Maoist state and again during the post-reform era, can meaningfully be reduced to a universal measure of comparative living standards and occupational exposures, merits discussion.[16]

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[16] Indeed, as I discuss in Chapter 5, one of my primary interlocutors, Dr. Bedford, lamented the lack of information on cohort members' class background, noting that this important and indigenous political taxonomy of belonging could likely serve as an important index of discriminatory exposure or informal support networks available to them and their families during times of hardship in their childhood. However, the project's designers understandably felt this question to be too politically sensitive to ask.

This includes contemporary political, social, and economic upheavals, which even in the present are distributing heterogeneous health risks and fates—forms of medical difference-- among diverse subpopulations currently living in Guangzhou. Of great concern in this regard is the city's most marginalized group, some 4.4 million migrant workers—or 44% of the city's population at time of the first GBCS publication in 2006-- whose lack of residency status under the *hukou* system at the time barred them from accessing the social and health welfare programs GBCS cohort members enjoy while simultaneously relegating them to most dangerous and precarious forms of labor in the city's new economic substrate (Jiang et. al 2006: 844). In fact, the narrative's embedded spatial imagery-- of a seamless overlay between, on the one hand, Cantonese heritage, emplacement, and collective experience of economic development, and, on the other, of contemporary rural populations on the brink of inheriting Guangzhou's present-- effectively denies both the presence of migrant laborers, who originate overwhelmingly from rural areas, in the city as well as their alternative experiences of socio-economic transition in the here-and-now. The narrative, in other words, makes a classic categorical mistake, substituting the bureaucratic formulation of rural populations for their lived experiences. Both forms of erasure—of historical and social forces that could be of biomedical salience to older permanent residents of contemporary Guangzhou and of Guangzhouese whose lives an experiences disrupt the narrative homogeneity of the cohort—raise pressing questions about the consequences of the futures that are being anteriorized for Cantonese, diverse subgroups of Chinese, and even more broadly populations in LMICs through the operationalization of GBCS as an object of value for specific ends of population-based comparative research as dictated by the history of epidemiologic transition research.

To the credit of the paper's authors, they do acknowledge some of these erasures. For example, in a second paper, after repeating their characterization of the cohort's pre-PRC historical stasis, noting "Most of the study population was born into a China that was essentially agrarian with a per capita GDP of about US $400 in 1950 being essentially unchanged over 2 millennia" before "a shift of policy in 1978 resulted in the current economic transformation," they clarify:

> There have been several periods of major social turmoil with the Japanese occupation resulting in 20 million dead, and following the establishment of the People's Republic of China in 1949, the Great Leap Forward (1958-1962) and the Cultural Revolution (1966-1976) led to significant mortality and an entire generation without schooling (Jiang, CQ et al 2010: 139).

Likewise, in the 2006 paper, they acknowledge of contemporary Guangzhou, "There are also inequalities, and one particularly relevant to this study is the current difficulty of access to medical care after the large-scale privatization of health care facilities since the 1980s," before relating that a lack of regular medical access via a primary care system is the motivation for recruiting participants from GHHARE, which has the grassroots infrastructure needed to track them, and a primary reason for the exclusion of non-permanent residents from the study (Jiang, CQ et al 2006: 844). This caveat disappears from the 2010 paper, which nevertheless implicitly references it in a discussion of the limits of the cohort's representativeness, "Most of the volunteers were keen to participate because they could receive free health examinations," (Jiang, CQ et al: 141).

The problem with these acknowledgements of the study's shortcomings is that, in the act of stating them, the authors are effectively building their omissions into the study design, after which they disappear. Indeed, for the most part these acknowledgements function rhetorically as caveats that lend temperance to their claims, buttressing the perceived validity of the study by anticipating potential critiques. This rhetorical tactic is by no means unique to GBCS authors;

instead, it is a standard part of scientific writing, as is exemplified by the inclusion of some variation of a "Weaknesses" subsubsection in publication templates. Even those local social forms that are subsequently included as exposure categories, and therefore objects of study, in GBCS tend to be subject to the troubling process of flattening, or reduction, described by Epstein. For example, in its operationalization, the social problem of inadequate health care access is reduced to a single data point—a question about whether participants have health insurance—and the omission of the more complex history of recent de-professionalization is further normalized through the economic parallels drawn between contemporary Guangzhou and early industrialized societies in the US and Europe.

Those parallels, in turn, are facilitated by concepts derived from the political economic histories of early industrialized capitalist societies, such as monetized measures of living standards, like GDP, which cannot easily accommodate the forms of biopolitical governance that emerged under Mao's collectivized public health system. In the latter, of course, capitalist industrialization occurred the before the development of the hallmarks of 20th century biomedical care systems and technologies, naturalizing the link between lower living standards, early industrialization, and the absence of robust health care systems. Such omissions and slippages are not unique to GBCS but, as Nguyen and Lock, Epstein, Fullwiley, and others have shown, inherent to the application of standard designs, taxonomies, and knowledge frameworks in population-based comparative research and can lead to blind spots in resulting scientific knowledge that perpetuate the representational inequities that a project like GBCS seeks to rectify, with real health consequences.

In addition to the forms of erasure perpetuated through the knowledge frameworks used to attribute content to Cantonese ethnicity, a second problematic feature of the standardization of medical difference in GBCS through a geo-ethnic taxonomy is apparent in the way in which, once configured, geo-ethnicity itself tends to be transformed into an essential quality of medical difference, rather than index of underlying characteristics. In his ethnography of US-based geneticists studying the elevated prevalence of Type II diabetes in a Mexican-American population, Michael Montoya describes this slippage as a kind of grammatical shift from a descriptive mode to a prescriptive one. In his telling, historical, cultural, and socio-economic characteristics of a population needed to establish its ethnic homogeneity are “conscripted” into the service of those claims, only to be dropped in favor of ethnicity itself as a source of medical difference (Montoya 2011). One can see the process of conscription at work in these early GBCS papers, as particularistic historical and social claims are selectively mobilized as evidence of the cohort’s homogeneity, only to be either excluded or reductively included as exposure categories in the study itself. Here, too, the careful vetting of information about the cohort is set aside in favor of the rhetorical work done by deploying these claims to establish both the study’s validity and the cohort’s uniqueness, appealing at once to those interested in its value as an object of globally comparative research as to those concerned about ensuring the representation of specific Chinese populations in epidemiological research. The absence of any vetting of these selective claims or the acknowledge historical event and exclusionary criteria that disrupt them, moreover, defers the complexities of representativeness and replaces them with ethnicity itself as assurance of preferential representation.

In other parts of these papers, geo-ethnicity becomes a primary index of population-wide resemblance and difference, slipping from descriptive shorthand of the historical, social, cultural, environmental, and biological bases of resemblance between individuals and groups to one that prescribes similarity and difference. In a lengthy section on ethnic differences in cerebrovascular and cardiovascular disease, for example, authors cite a study in which the high stroke mortality in Chinese populations is contrasted with lower mortality in Japanese and Caucasians; in the same paragraph, they cite another study in which high rates of peripheral vascular disease in Caucasians are contrasted with lower rates in Asians, a grouping that would render invisible differences in Asian subpopulations even as the foregoing raises questions about them (Jiang, CQ et al 2010: 141). Such inconsistencies in the epidemiological literature on ethnic difference in medicine highlight just how common this slippage is and recalls Epstein's observation of the fundamentally inchoate formulation of ethnicity in global population-based comparative research. Ethnicity itself emerges as the standardizing logic for relations of medical resemblance and difference in absence of consensus about what constitutes it. The same slippage can be seen in the unqualified moves from Cantonese to Chinese to East Asian populations as authors envision who stands to benefit from their research. These extrapolations occur despite the careful grounding of Cantonese geo-ethnicity in regional history, culture, and environment, betraying an abstract spatial imaginary of ethnic similarity and difference purged of these other elements. This spatial imaginary allows the promissory value of the cohort to travel from Cantonese to Chinese and East Asian populations (and, indeed, even the omnibus "developing populations"), but does so at the expense of more circumspect consideration of the grounds of such comparisons and what is lost, in terms of representativeness, when they are made.

V. Conclusion

The flexibility of geo-ethnicity to imbue the GCBS cohort with epistemic value that is, at once, particularistic and universal is, finally, the power of its rhetorical function in these papers. One can see how it appeals to the diverse ends stakeholders imagine for the project, from local knowledge that will benefit the residents of Guangzhou, or China, and rectify the underrepresentation of this and other LMIC populations in NCD epidemiology's knowledge base; to the accrual and performance of advanced bioscientific skills, technologies, and forms of institutional merit that increase Chinese science's standing in the cosmopolitan field of epidemiology and better equip the domestic sector to wield advanced bioscience in service of the biopolitical goals of health, wellbeing, and economic prosperity; to the pursuit of basic scientific questions and the professional, institutional, and potentially economic benefits that accrue to them. Critically, this rhetorical power derives from the fact that Cantonese identity and its constitutive parts are not, for the most part, objects of scientific inquiry but part of the design methodology itself. Existing outside of that which can be tested, claims involving the cohort's geo-ethnic identity are largely deferred, rather than examined carefully. For this reason, so too are thornier questions involving whether or to what extent the selective mobilization and erasure of social conditions and historical events from the narrative deprioritize or delimit the generation of knowledge that is robustly responsive to local health needs, or whether such conditions and events disrupt the promissory value assigned to the study through projected extrapolations to other human subpopulations. These deferrals account for the successful use of geo-ethnicity as a technology of interest alignment, aided by the articulation of risk not around the knowledge frameworks of cosmopolitan epidemiology, but instead the quality of Chinese science and the motives of transnational collaborators.

This isn’t to say that the erasures, reductions, and slippages that occur in the configuration and use of geo-ethnicity to characterize and set into comparative relation meaningful medical difference preclude the possibility of generating any knowledge through GBCS that will be responsive to the particularistic health needs of older Guangzhouese or Chinese, more broadly. Indeed, as I discuss in Chapters 3 and 4, GBCS research has brought a number of particularistic benefits to these populations. The problem, rather, lies in the systematic way that the knowledge frameworks used to represent medical difference geo-ethnically not only elide certain forms of local evidence that could have real consequences for public health initiatives in the city, but also do so in a way that forecloses discussion about how to prioritize competing ways of valuing research subjects in relation to diverse hoped-for health, professional, political, and economic ends in a transnational collaborative research context. The absence of such a discussion poses an especially acute bioethical problem in the context of epidemiological science, which, as I explore in the next chapter, is unique among the health sciences in its inherently applied and particularistic aims, as it developed historically to furnish an evidence base for public health interventions to benefit specific populations. As transnational collaborations increasingly bring Chinese bodies into new and universalizing regimes of epistemic, political, and economic valuation, so too does their potential to undermine the normative preferential commitment of epidemiological science to prioritize the health needs of particular populations to grow. Given the real commitment of many GBCS researchers to rectify what they see a unjust and dangerous imbalances in the representation of Chinese bodies and lives in epidemiological science, explicitly recognizing and problematizing the genesis and impact of such erasures and slippages in transnational collaborative research could help to move beyond a bioethical discourse focused on who is represented to toward one that ensures such science works to produce knowledge both of *and* for the health needs of ordinary Chinese.

VI. Coda

While the deployment of Cantonese ethnicity may have done important rhetorical work in the process of realizing and soliciting support for GBCS, its ability to bring stakeholder interests into alignment was nevertheless limited and, indeed, the project founders failed to do so on one important front. As I suggested in the third section of this chapter, the risk discourse surrounding transnational health research collaborations was articulated around the quality of Chinese science, on one hand, and the potential for Euro-American exploitation, on the other, and it was indeed along these lines that the breakdown occurred. The Clinical Trials Unit (CTU) of Oxford University, a prestigious research group who, among other things, was responsible for designing and overseeing the UK Biobank, upon which GBCS was modeled, rescinded its initial commitment of funding and full partnership after a dispute erupted over which collaborating institute would be responsible for storing, managing, and analyzing biological samples taken from GBCS research subjects. As Wen-ching Sung has written, in the late 1990s the Chinese state passed legislation barring the transfer of human biological material out of China in order to protect its domestic health science sector from bioprospecting (Sung 2009). For the Chinese government, protecting its proprietary right to this national resource was a non-negotiable, critical both to protecting the health of the nation as well as to its bioeconomic and technoscientific modernization initiatives. Transferring biological samples to the TCU would not only jeopardize these protective measures, but also deny epidemiologists at the People's No. 12 Hospital sought-after experience in managing the material infrastructure of a genetic biobank—a key biopolitical technology for optimizing the Chinese population's health through emerging 21st Century techno-scientific practices.

CTU stayed on in an advisory role, but the loss of its committed funding and the extra expense of building a state-of-the art facility for collecting, storing, and assaying biologicals at People's No. Hospital dramatically reduced funding for collecting from the research cohort the volume of data needed to prospectively explore the range of diseases and associations GBCS founders envisioned. For this reason, the original cohort processed in 2006 was reduced from 30,000 persons to 2,000 in 2010, from whom a much greater volume of distinct biological data points (phenotypic biomarkers) potentially associated with specifically cardiovascular disease were collected. The reduction both in number of subjects and targeted disease outcomes dramatically changed the course, objectives, and epistemic potentialities associated with the project. This episode is a good reminder of the speculative nature of early representations of such projects, which, like the diseases they track, engender a kind of contingent chronicity shaped and reshaped in real time by research outcomes, funding availability, personnel changes, legislative initiatives, and so forth. Hence, in order to understand how medical difference is conceptualized and operationalized through them, it is necessary to take that chronicity and contingency into account. This is to say, the GBCS I grew acquainted with in 2015 was not the same project represented in these early papers.

Chapter 4: Epidemiological Uncertainty

I. Introduction

When Merida finally looked up, she was blinking back tears. “What do I hope to accomplish,” she repeated my question ruefully, “I have no idea. This research is useless—you can’t prove anything, it’s all associations. You can’t do anything if you don’t know the mechanism.” The emotionality of her response caught me off guard, though I recalled afterwards that Merida, a Guangzhou-born second-year doctoral student at HKU in Dr. Christine Bedford’s Non-communicable Disease research cluster who studied obesity in the GBCS cohort as well as a Hong Kong-based youth cohort, had recently received harsh feedback from peer reviewers on a paper she had submitted for publication in a prominent international diabetes journal. The sentiment, however, was very familiar. Time and again in early conversations with Dr. Bedford and the other members of her research cluster, my interlocutors had characterized their current working environment as one of pervasive uncertainty concerning the credibility of their research outcomes.

Bioscience is an inherently uncertain endeavor, a sentiment that, in its contemporary iteration, social scientists have connected through various theoretical genealogies to the extraordinary technoscientific advances of the 20th and early 21st centuries and subsequent reconfigurations of the relationship between human activity and the natural world (Beck 1999); (Rabinow 2007). Even as the technologies borne of this era radically transformed human capacity to intervene in environmental and embodied processes, evidence spectacular and mundane of their potential to fail and even to harm life gradually undermined progressivist faith in the technical rationalities—political, ethical, economic, scientific—that engendered and governed them. In place of nature or scientific positivism as cultural orders in which to ground moral evaluations of these rationalities, some have argued, has emerged a "reflexive" modernity in which practitioners subject their forms of expertise to "critical questioning" (Ong and Collier 2005: 7). The uncertainty Merida and her colleagues expressed during my time in Dr. Bedford's research cluster exemplified the practices of critical reflexivity in which the broader cosmopolitan epidemiology community engaged as the practitioners of one field of technoscientific expertise. This reflexivity was organized around normative problematizations of methodologies, analytical techniques, knowledge frameworks, and ethical commitments. Threading together these normative concerns was an enduring lack of consensus about how to draw causal inferences from observational research and, relatedly, how best to model disease etiology.

By the time I had embedded myself in Dr. Bedford's cluster, disciplinary debates and normative stances around these issues, publicly staged at conferences and in the pages of august epidemiological journals and privately aired in departmental meetings or huddled at the desks of colleagues, had reached a fevered pitch. For some, the very future of observational epidemiology as a credible science was at stake. The epochal quality of the moment was captured in a frustrated comment Dr. Bedford made one afternoon as we discussed the far-reaching impact of the Framingham Heart Study on cardiovascular disease epidemiology, one of earliest and most influential prospective cohort studies of chronic disease. Referring to Thomas Kuhn's pathbreaking study of epistemic normativity and change in science, *The Structure of Scientific Revolutions*, she sputtered, "Our etiological understanding [of cardiovascular disease] hasn't progressed in 50 years! What we need—desperately, immediately-- is a paradigm shift." The urgency of her call for sweeping reform in the discipline was precipitated, in part, by series of high-profile failures to translate study findings into effective therapeutics that occurred in the first decade of the new millennium. By 2010, the "replication crisis"[1] in the public health sciences had become the subject of fervent examination in both academic and popular media publications, facilitated by an explosion in data availability and papers stemming from changes in higher education, academic publishing, and advances in information technology that began in the 1990s (Begley and Ioannidis 2015); (Pearl and Mackenzie 2018; Vasishth 2017). Using meta-analyses of existent literature, these accounts highlighted the large number of high-impact-factor publications whose findings were overturned or could not be replicated since the closing decades of the 20th century, calling into question the reliability of observational studies to reliably guide predictive health interventions.

While the replication crisis may have appeared to emerge, sui generis, in public consciousness in the 2010s, the disciplinary roots of the debate stretched back into the late 20th century, when prominent epidemiologists began to articulate concerns about the then paradigmatic "risk factor" approach to identifying disease exposures, which was developed by Framingham Heart Study investigators in the middle of the 20th century-- a fact that is not incidental to Dr. Bedford's complaint. Critics at this time noted the failure of risk-factor based approaches to offer precise clinical predictions of disease risk and translate into effective public health interventions. Central to their concerns was the substitution of probabilistic risk assessments for clear, causal mechanisms linking disease exposures to outcomes as well as the individuating and reductionist model of disease etiology that underwrote that move. Some looked expectantly toward the new genetics, which at the end of the 20th century was just creeping above the horizon, to fill out these models with causal mechanisms. Others drew inspiration from earlier paradigms in epidemiological history, calling on the community to strive to develop holistic analytical

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[1] A succinct overview is available online at: https://thewire.in/science/replication-crisis-science

methods that could once more account for the contributions social and environmental forces make to disease etiology, a tradition away from which the risk factor approach, they argued, had pushed the discipline.

It is against this background that the technologies and knowledge frameworks that began issuing from the omics sciences in the first two decades of the 21st century were interpolated into chronic disease epidemiology.[2] In this chapter, I examine how genomics, in particular, articulated with the terms of existing debates over how to refine or move beyond the risk factor approach and inflected associated methodological, technological, epistemic, and ethical problematizations as concerns about the replication crisis intensified calls for reform. My purpose is twofold. First, mindful of the well-justified concerns many social scientists have staked out regarding the impact of genomics on biomedical styles of thought, I show that, while these interpolations were accompanied by a considerable shift of resources into genomics, the molecularization of common terms of intradisciplinary debate over how to rectify the replication crisis was neither so totalizing as to constitute a wholesale shift in epidemiological perspective, as described by philosopher Nicholas Rose, nor, insofar as molecular styles of thought have been absorbed into epidemiology, did it wholly displace alternative framings of disease etiology with geneticized or even reductively biologicized understandings of human biological variation and medical difference (Abu El-haj 2007; Rose 2007:11). Instead, the impact was more fragmentary than the concept of molecularization suggests, failing to produce a consensus regarding how best to

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[2] I don't cover it explicitly here because it has been documented so well and thoroughly by other scholars, but the creeping hegemony of evidence-based approaches in medicine and public health science in the closing decades of the 20th century also had a transformative effect on both research design and evidentiary standards in epidemiology. It created new incentives to ask questions whose outcomes could be generalized and reproduced across wide swaths of humanity, as well as to do the auditing work exemplified by the meta-analytical studies of replicability that precipitated the perception of a replication crisis in the field. For exceptional studies, see Strathern 2000; (Delvecchio Good and Hannah 2011; Kleinman 1997); and Keshavjee 2014, among others.

interpret or rectify the replication crisis. And even as it enabled molecularized framings and operationalization strategies, it also lent support to emerging ecological understandings that emphasized the irreducibility of the contributions biosocial interactions make to pathogenesis—seemingly imbuing a once-marginalized discourse on disease ontology with renewed significance rather than further subjugating it.

The second, related purpose is to map the historical depth and epistemic, methodological, and ethical stakes of contemporary intradisciplinary debates over the replication crisis. While the crisis is undoubtedly fueled, in part, by factors unique to the current institutional and fiscal imperatives of epidemiological science, it also encompasses novel iterations of longstanding uncertainty and disagreement concerning the nature and representation of chronic disease risk and etiology. Contrary to Kuhn's argument, epistemic change in bioscience is rarely characterized by abrupt paradigmatic breaks bookending periods of normal science; in practice, theoretical frameworks are neither so totalizing nor so central to the determination of new facts (Kuhn 1970)(Latour and Woolgar 1986); Latour 1993; (Jones 2013). As practitioners formulate, design, and interpret their work, they must confront these sources of uncertainty and draw from competing conceptual premises, representational and interpretive techniques, and research objectives in hope of decreasing the likelihood that their results will be irreproducible or overturned in the future. Such sources of uncertainty include how (or whether) to account for the influence of social and environmental forces on disease risk and susceptibility in given populations— a problem whose stakes would seem to have been recast with heightened urgency in light of the aforementioned postgenomic shift toward an ecological understanding of biology and disease in the human life sciences. Indeed, as I show in the following chapter, it is through reflecting on the shortcomings of observational epidemiology, prompted by the replication crisis and made concrete in relation to their everyday research practices, that members of Dr. Bedford's research cluster expressed—if indirectly—first-order epistemic premises informing their understanding of the nature of human biological variation and its relevance to representing chronic disease difference in the GBCS cohort. In order to gain critical insight into these reflexive practices and their representational consequences for the GBCS cohort, it is necessary first to situate them within the discursive field of epidemiology's replication crisis and its normative epistemic, methodological, and ethical concerns.

This chapter draws material from publications by prominent epidemiologists, statisticians, and philosophers of science who have shaped intradisciplinary debates over causal inference, etiological modeling, and, later, the replication crisis over the past 25 years. Some of these figures were introduced to me by Dr. Bedford, Dr. Robert Min, one of the post-docs in her research cluster, and another biostatistician at HKU with whom they collaborated often, Professor Ben Crowley. Others were introduced in conversation with epidemiologists from the Harvard School of Public Health, and still others I found through bibliographic references or popular science journalism covering the replication crisis. In addition to these publications, I also draw on interviews and informal conversations with members of Dr. Bedford's research cluster, cardiologists at the Prince of Wales Hospital, a teaching facility affiliated with the Chinese University of Hong Kong (CUHK), which was my institutional home during my fieldwork stint in the city-state, presentations at public health conferences hosted at CUHK and HKU, and interviews with epidemiologists at Harvard School of Public Health and Massachusetts General Hospital.

The chapter body is divided into three parts. In the first part, I examine intradisciplinary concerns over the limitations of the risk factor approach as they were expressed in the closing years of the 20th century. Exploring them mainly through the writings of a prominent father-and-son pair of epidemiologists, I show that these men viewed the deprioritization of social sources of disease risk, morbidity, and mortality as a key weakness of the risk factor approach and believed it offered a partial explanation for the failure to consistently generate findings that would translate into effective preventive medicine programs and therapeutics. In the second part, I examine the impact of technologies, techniques, and conceptual frameworks associated with omics sciences, particularly genomics, on normative problematizations of and proposed resolutions to the shortcomings of the risk factor approach. In the final section, I show that, while the interpolation of genomics frameworks and practices into chronic disease epidemiology had—and continues to have—an enormous impact on both research designs and objectives, it has not resulted in the wholesale erasure of interest in and concerns about developing more robust and localized representations of sociogenic disease risks and determinants. By prompting the shift toward a complex systems paradigm, moreover, it has provided an unexpected, if latent and indirect, source of support for those epidemiologists who are working to do so. As the replicability crisis pushes epidemiologists to rehash the basic concerns about causality and etiology articulated 20 years earlier, the difference that local social contributes to chronic disease risk, etiology, and outcome continues to be a source of uncertainty with which they must grapple.

I. Beyond the Black Box: From Risk Factors to Complex Pathogenesis

In 1996, the late, prominent epidemiologist Mervyn Susser and his son, Ezra, co-authored a set of critically reflexive articles for the American Journal of Public Health that culminated in their call for a transformation in the existent hegemonic approach to representing disease causation and etiology in NCD epidemiology. At once retrospective and speculative, the series, "Choosing a Future for Epidemiology," presented a historical overview of the field's dominant paradigms in relation to distinct eras of practice since its 17th century inception, before declaring that the current approach had reached the limits of its usefulness.[3] Terming it the "black box paradigm," the Sussers explained that this approach "related exposure to outcome without any necessary obligation to interpolate either intervening factors or even pathogenesis," and located its roots in the post-WWII emergence of common chronic diseases as the primary object of concern for US and European public health researchers (Susser and Susser 1996a: 670). Its unique form, they argued, reflected the strangeness and complexity of multifactorial disease etiology-- "major mortal diseases of unknown origin" whose pathogenesis resisted established monocausal models derived from germ theory—and, much like the miasma-driven theories of disease causation that predated germ theory, underscored the fact that the messiness of "the social and physical environment had now to be reckoned with once more" as disease determinants (1996a: 670).

In the absence of a robust framework for conceptualizing multifactorial pathways of disease etiology, and driven by an immediate desire to develop concrete interventions into the increasingly urgent public health crises created by the skyrocketing incidences of coronary heart disease, lung cancer, and peptic ulcer disease in US and European populations, post-WWII epidemiologists turned instead to describing and attempting to account for the uneven

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[3] Even if social scientists have found fault in Kuhn's account of normal science, it sure seems to have resonated with epidemiologists.

distribution of these diseases, with some prominent studies paying particular attention to environmental, behavioral, and socioeconomic factors typical of the white, middle-age men believed to be disproportionately afflicted by them (Susser and Susser 1996a; 671). Early on, landmark research projects, including prominently the Framingham Heart Study, were instrumental in ratifying this approach and its emerging methodologies. By the 1960s, organizers of the Framingham Study had established the concept of risk factors, applying the power of statistics to quantify and measure chance—and thereby "tame" it-- to the epidemiological mapping and clinical management of chronic disease (Hacking 1990). In addition, this study demonstrated the power of the prospective cohort study design as a method for identifying risk factors and measuring their independent effect on a person's disease risk. A. Bradford Hill and Richard Doll's work on the link between smoking and lung cancer, on the other hand, lent credence to the case-control design; in addition, Hill articulated his eponymous, formative guidelines for inferring causality in observational epidemiology from statistical associations between exposure and outcome (Brunwald 1997: 1361; Susser and Susser 1996a:670). As a result of these successes, throughout much of the second half of the 20th century, chronic disease epidemiologists were satisfied to demonstrate **that** an environmental exposure (say, smoking) or biomarker (say, hypertension) was independently associated with disease risk; one need not identify the mechanism constituting that relation for it to provide actionable information for clinical and public health interventions.

However, by the late 1990s, the limits of this black box paradigm to advance epidemiologic understanding of multifactorial disease determinants and to generate effective public health interventions were growing apparent. Common forms of coronary heart disease (CHD) are a case in point. In the US, for example, public health, pharmacologic and biotechnologic interventions into common CHD risk factors, including smoking, hypertension, and hypercholesterolemia, produced a steady decline in the age-adjusted death rates for both CHD and coronary artery disease (atherosclerosis is a shared etiological pathway), beginning in the 1960s, across all categories of age, sex, and race (Brunwald 1997: 1363). But these clinical gains were limited; in the last decade of the 20th century, 50% of CHD patients in the US did not have a single established risk factor for coronary artery disease, suggesting that additional significant risk factors and etiological determinants remained to be identified (Brunwald 1997: 1364). On the preventative side, popular algorithms used to by clinicians assess individuals' relative risk for an adverse cardiovascular event, such as the Framingham model and SCORE, performed unevenly in studies designed to validate their discriminatory power and calibration across different groups, suggesting that unidentified variations between exposures hampered their effectiveness for measuring risk in specific populations (Damen et al. 2016:5–6). Even public heath interventions based on well-established risk factors proved to be of unreliable value; efforts to modify individual behaviors associated with lifestyle determinants, such as diet and exercise, often met with minimal success (Susser and Susser 1996a: 671).

In addition to this sense that the progressive development of powerful clinical and public health interventions into CHD had stalled by the end of the 20th century, a series of high-profile failures of pharmacologic therapies developed using the black box approach began to emerge, resonating with the force of an existential threat amongst epidemiologists who harbored growing concerns about the reliability of the observational methods associated with it. Mixed outcomes from retrospective reviews of randomized controlled trials sparked contentious debate in the early 1990s over the safety and efficacy of the administration of short-term calcium blockers to prevent myocardial infarction, calling into question the underlying observational data on which the therapy was based ((Pearl and Mackenzie 2018; Vasishth 2017); (Pieper 1996); (Broadbent 2013)). This debate presaged what would become the iconic finding around which an emerging reproducibility crisis narrative took shape in contemporary chronic disease epidemiology: a 2002 study showing that hormone replacement therapy not only failed to prevent coronary artery disease in menopausal women, but also increased their risk of heart attack, stroke, and breast cancer (Broadbent 2013; (Conger 2016)).[4] Both events revealed the iatrogenic stakes of common methodological and conceptual concerns chronic disease researchers had, by the end of the 20th century, articulated in relation to the black box approach, imbuing them with ethical urgency.

These epistemic concerns were rooted in uncertainty regarding how to make sound causal inferences about patterns of potential exposures and health outcomes —in its pan-disciplinary form, a question so foundational to the empirical sciences that the 18th century British philosopher and mathematician Bertrand Russell felt compelled to name it properly: "the problem of induction" (Broadbent 2013: 10). Their reliance on risk factors enabled post-WWII epidemiologists to circumvent the use of detailed mechanistic explanations, backed by contrastive, empirically grounded demonstrations, to support inferences by turning instead to sophisticated statistical assessments of the probability that the presence or absence of a given exposure was linked, via a relation of dependence, to the presence or absence of a given outcome.[5] Not only did this allow for the quick development of potential public health and

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[4] Conger, K. (2016). "Can You Repeat That? The Crisis in Research Reliability" in *Stanford Medicine,* Summer 2016. Available online at: https://stanmed.stanford.edu/2016summer/can-you-repeat-that-.html#

[5] There is an exhaustive body of literature and accompanying evidence, including textbooks and academic programming, that illustrates a complex politics surrounding claims of association, causality, and their distinction in epidemiology. The well-known injunction, "association does not equal causation," best captures the circumspection this politics encourages when making inferences from the former to the latter. However, as the philosopher of science Alex Broadbent points out, practically and theoretically, the end goal of epidemiology is always to make causal inferences. From a practical vantage, if they were to abstain from making causal claims, epidemiologists would be unable to influence clinical and public health medicine. From a theoretical vantage, there are countless 'mere' associations to be found between exposures and disease outcomes; what distinguishes those epidemiologists are interested in, implicitly, is that they are causally linked to disease (Broadbent 2013: 27).

clinical interventions despite the lack of clarity concerning the complex, biosocial interactions driving multifactorial disease etiology, as the Sussers argue above, but it also constituted a working solution to the strictly limited feasibility of using controlled experimentation to support causal inferences in chronic disease research (Broadbent 2013: 28). Controlled experimentation, the primary methodological solution to the problem of induction in the empirical sciences, involves the manufacture of a state approximating omniscience and omnipotence in service of extreme reductionism, in which an experimenter manipulates conditions such that all variables, with the exception of that whose causal effect she wishes to test, are identical between the subject and the control. In theory, under such conditions, determining whether a given exposure (or variable) results in a targeted outcome is not difficult to do (Bateson 1972: 453).[6]

However, for reasons described in the preceding chapter of this dissertation, in most areas of chronic disease epidemiology, this controlled experimental design is simply not possible: On one hand, the field of potential contributing or ameliorating exposures in which individuals are situated is far too vast to map and control for. On the other, even if it weren't, the extrapolation of an experimental outcome to other groups would be haunted by the specter of representativeness— that is, the concern, particularly acute with respect to multifactorial diseases, that exposures unique to another group might alter or nullify the causal relationship demonstrated in the experiment, rendering any sort of prescriptive health action moot. In addition, the temporality of complex chronic disease progression is too dilatory for experimental time; the ethical and practical barriers to designing controlled experiments that differentially expose persons to potentially harmful behaviors, like smoking, or ascribed social statuses linked

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[6] Of course, it's important to be clear that controlled experimentation itself offers, at best, a kind of believable fiction of omnipotence and omniscience, as plenty of commentators from across the hard, life, and social sciences have acknowledged and demonstrated.

to variations in disease outcomes, such as poverty or race, are too numerous.[7] Hence, the problem of induction in epidemiology takes on a unique form: Framed as a technical issue, it asks how one ought to reliably bridge the conceptual gap between relations that belong to fundamentally distinct orders-- statistical association and causality-- without the totalizing knowledge and mastery of contextual exposures seemingly afforded by controlled experimentation? Framed epistemically, it broaches the limits of controlled experimentation to adequately represent a mode of life that seems to resist objectification through careful parsing into component parts.

As the Sussers note in their article, this problem came to constitute the foremost challenge of post-WWII epidemiology and elicited largely methodological responses from practitioners, as part of what the philosopher and computational statistician Judea Pearl has deemed "the mathematisation of causation" in epidemiology and biostatistics ((Pearl 2000)). While early chronic disease epidemiologists grappled directly with the problem of theorizing the multifactorial inputs of disease etiology—most notably, conceptualizing disease determinants as a "web of causation" rather than relying on the "specific-cause model" of germ theory-- later practitioners grew occupied with developing increasingly sophisticated statistical techniques designed to reduce the likelihood that variables other than the target exposure influence the strength of association-- itself serving as a scaling proxy for causality-- measured between the latter and a health outcome. Such techniques constituted methodological responses to the problems of bias and confounding that, increasingly, were recognized to plague observational study designs, and were a kind of mathematical analog to the empirical mastery of the field of

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[7] Even randomized controlled trials, which are considered the gold standard for epidemiological study design by powerful proponents of the evidenced-based medicine movement, such as the Cochrane Collaboration, are vulnerable to a degree of confounding and bias absent from forms of controlled experimentation implemented in the physical sciences, themselves not invulnerable to such flaws (Broadbent 2013: 75).

potentially causal exposures implied by controlled experimentation (Susser and Susser 1996a: 671). Ultimately, however, these statistical techniques underscored, as much as they resolved, the limitations of the black box approach and its reliance on risk factors in chronic disease epidemiology, as the ongoing preoccupation with and anxiety over causality in epidemiology suggested (Broadbent 2013: 26).

Mervyn Susser had written an early and influential text addressing the methodological challenges to inferring causality within the framework of the black box paradigm, so he was well-versed in ongoing efforts to develop statistical techniques that would resolve uncertainties posed by probabilistic measures of association. This expertise makes his 1996 call for a paradigm shift, which highlighted the impoverishment of such methodological fixes, all the more striking. For the Sussers, this methodological focus obscured more fundamental limitations of the black box paradigm that were illustrated by what they identified as questions of scale. The risk factors upon which black box epidemiology depended, they argued, necessarily entailed a privileging of individual persons as the unit of analysis and central node in the webbed relations of multifactorial causality. Individuals' behaviors, environmental exposures, and clinical indicators generated egocentric maps of the interrelations between multiple determinants implicated in complex disease etiology, while important causal relations that obtained predominately at social and biological scales were, for different reasons, left underexplored. Indeed, as a stark example of the force of this critique, the Sussers pointed to the ongoing failure of epidemiological interventions to stem the ballooning HIV/AIDS epidemic in Africa, despite established knowledge of the infectious agent, transmission vectors, and individual risk factors. Arguing, "…the failure to control [HIV/AIDS] resides in our lack of understanding of transmission and illness *in the social context,"* they concluded that even so-called monocausal diseases were, in fact, driven by a complex of interrelated biomolecular pathways, personal exposures, and structured social processes, all of which were equally integral to the pathogenic process (1996a: 671).[8]

This dramatic example of the irreducibly multi-scalar, multifactorial etiological nature even of infectious diseases heralded the emergence of what the Sussers called an era of "eco-epidemiology," which demanded a practice of epidemiological truth production that embraced "localization and attention to the bounds that limit generalizations about biological, human, and social systems" ((Susser and Susser 1996b: 675)). To facilitate the production of such epidemiological truths, the Sussers called for the implementation of a "Chinese boxes" paradigm, using the figure of these miniature, nested wooden containers to signify a multidimensional framework for disease etiology that attends to interactive causal systems at biological, individual, local social, and global levels. Importantly, at stake in the establishment of this paradigm as a comprehensive response to mitigating the growing sense of uncertainty posed by the problem of causal induction was the very disciplinary nature of epidemiology and complementary human life sciences. Acknowledging that "a concept of causality based on universal laws is pervasive in the sciences," as is best exemplified by the generalizing principles sought in the physical sciences, the Sussers nevertheless argued that this "standard interpretation" of science as universalist practice eclipsed a lengthy parallel history in medicine, biology, and public health that foregrounded the "local accretions and intervening structures" prevailing on individuals embedded in their environments to shape their health—the very kinds of emergent, relational, and contextual differences that a universalist scientific practice systematically erased (1996b: 675; Lock and Nguyen 2010). In other words, the ecological framework for which they

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[8] Emphasis mine.

advocated was not conceptually new; rather, it had, since the advent of germ theory, operated as a form of subjugated knowledge, which the Sussers sought to resuscitate as a counterbalance to universalism in light of what they perceived to be the increasingly untenable reliance on the latter as a representational framework for the complexity of human illness (Foucault 2003: 7).

The Sussers' articles are illuminating for a few reasons. One is that they provide a sweeping overview to key tensions at stake in contests over the future direction of the field at the turn of the millennium, just as the omics fields were poised to radically reconfigure the human life sciences. One major source of tension could be traced to the plasticity and contextual embeddedness of life and its pathogenic processes, which resisted the principles of universalism and reductionism written into contemporaneous scientific norms concerning the laws of causality and experimental methodology. This was, in other words, a problem of difference—including, importantly, the difference that the social makes to disease processes and outcomes. In the final analysis, then, the problems that the Sussers outlined for the black box paradigm were not simply methodological but also metaphysical, involving competing ontological premises regarding the nature of human bodies and diseases. The individualizing approach, exemplified by the black box paradigm, embraces important elements of what Margaret Lock describes as the essentialized, ahistorical body of contemporary biomedicine (Lock and Nguyen 2010).[9] As seen in chapter two of this dissertation, this body could be disaggregated into standardized exposures rendered through discrete data points by quantification (as statistical averages) or enumeration; even representations of medical difference didn't challenge this basic form of reduction. And

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[9] I should note that the individualized approach the Susser described at the turn of the millennium is genealogically related to, but distinct from, the individualized medicine paradigm that has come to dominate particular biomedical subfields, such as oncology, that have been profoundly inflected by post-millennial developments in the omics sciences. I account for these developments and their impact on chronic disease epidemiology in the second half of this chapter.

once disaggregated, those data points could be lifted up out of context and circulated with ever-broadening circuits of valuation, erasing local configurations of biosocial interactions as part of the effort to control for confounders such that an accurate measure of an exposure's independent contribution to disease risk could be measured.

But the Sussers' article pushes back against this ontological construct, suggesting even that one reason the clinical application of risk factors has plateaued is that disease ontology is fundamentally relational—and therefore efforts to individuate exposures will necessarily fall short. Indeed, the body of the eco-epidemiology paradigm is one whose pathological states are shaped by the social and environmental—to abstract it from these relations would be to distort the underlying nature of disease. In this sense, the ontological construct engendered through the Sussers' proposed paradigm bears resemblance to what Margaret Lock has termed "local biologies": the idea that human bodies, their embodied processes as well as their very materiality, are the irreducibly contingent products of historical, cultural, environmental, and biological forces as they converge on individuals and groups in their local context (Lock 1993; Lock and Nguyen 2010).

The reason that the ontological constructs informing biomedical research and practice matter, and that it makes good sense to vet them, is that they index one category of biosocial interaction that shapes the course and outcome of disease (see e.g. Foucault 1963; Strathern 1992; Petryna 2002; (Ingold 2006); Jones 2013). This is because bioscientific representation is also a kind of intervention. Indeed, in her book on the diagnostic practices surrounding atherosclerosis Annemarie Mol makes this point forcefully, arguing, "ontology is not given in the order of things, but instead, ontologies are brought into being, sustained, or allowed to wither away in common, day-to-day sociomaterial practices" of biomedical science ((Mol 2002:6)). The ontological constructs that inhere in these paradigms are part of the knowledge frameworks, research design strategies, technologies and techniques of representation—in short, the everyday sociomaterial practices-- that articulate with actual embodied processes, and it is through those relations—inevitably partial—that such processes are conceptualized and manipulated. To the extent that they exclude sociogenic forces of pathology, they foreclose interventions into them, altering the actual experience of illness and disease outcomes in the process.

While this may seem like unnecessarily complex social theorization, far removed from the everyday practice of biomedical representation, consider a pertinent example concerning representations of medical difference offered by the race and inequality scholar Dorothy Roberts in her 2016 Tanner Lecture at Harvard University: Black Americans are at increased risk of what is known as essential hypertension—that is, high blood pressure that is not the result of a discernable secondary cause. Biological variation, including—since the advent of omics-- genetics and metabolic differences, and behavioral risk factors have been explored to explain this discrepancy. A local biologies approach, on the other, might attend to the cumulative biosocial effects of the historically deep and ongoing discriminatory structures governing racialized lives in the US—a form of structural violence that may also manifest in behavioral factors and metabolic structures. In the absence of such a framework, the social is excluded entirely as a source of pathogenesis—the hypertension is essential.

Another related reason that the Sussers' articles are so illuminating is that they offer an historically grounded account of how ontological constructs are formed, reproduced, and altered in epidemiological practice, highlighting both their emergent and multiple nature as well as the subordination to contemporaneous pragmatic concerns. The “web of causation” view embraced by early post-WWII epidemiologists, the Sussers show, was not novel. Instead, it was rooted in a long tradition in the history of medical practices of viewing pathology as a result of interactions between embodied life and the ecological context in which individuals were embedded, a basic framework that was subjugated, but not eradicated, when germ theory emerged to offer an alternative, objectifying and monocausal model of disease. The subsequent failure to pursue the “web-of-causation” model of disease in post-WWII NCD epidemiology, as the limitations of germ theory’s ontological premises became urgent once again, was not a result of its considered dismissal by practitioners but rather derived from the methodological limitations and public health exigencies of the moment: people were dying and the existent methods and technologies available for an immediate response—statistical measures and the approximation of controlled experimentation-- assumed a reductionistic and abstracting approach to disease ontology. The propagation of this approach, in other words, reflected a pragmatic—and perhaps unthinking-- compromise resulting from the inherent difficulty of rendering commensurate distinct orders of rationality—technical, rational, epistemic, ethical—in the absence of unmediated access to an ontological order in which to ground them.

This paradox of life as a working object of bioscience that is both the assumed ground for and product of the techniques, conceptual frameworks, and technologies of representation available to practitioners resonates powerfully with the arguments presented by Georges Canguilhem in *The Normal and The Pathological,* his pathbreaking study of biology as the elaboration of a philosophy of life. Canguilhem explores the emergence in 19th century positivist medical thought of a conceptualization of the relationship between physiology, or the state of health, and pathology, or the state of disease, that configured the latter in terms of quantitative deviations from the former. This shift, he notes, satisfied a basic mandate of positivist science by flipping on its head the relationship between health and disease. For if, Canguilhem argues, echoing a definition of physiology offered by French surgeon and physiologist Rene Leriche, "health is life lived in the silence of the organs," and hence life is brought to awareness and made the target of intervention only by the experience of illness, then the quantification and identification of pathology and physiology granted biologists access to the latter, allowing for the objectification of life through the elaboration of the universal laws governing both (1989: 91). It was only through this objectifying move, Canguilhem concludes, that positivists could purge medicine of its metaphysical associations with the perfect and evil, fitting it instead within a scientistic framework that grounded therapeutic interventions in foreknowledge of the physiological principles according to which it sought to restore patients to a state of health (1989: 57).

The success of this move, however, turned on the collapsing of qualitative norms into quantitative measures of the normal, rendered statistically from data derived from pathologists and written into the diagnostic tools used in clinical evaluations of patients. This collapse was evinced by inconsistencies in the use of the concept of the normal in medical writing at the time, which obfuscated the character of disease as, first and foremost, a value-judgement indicating a change of state in the experience of ill persons that constituted "a new vital order" rather than simply a measurable dysfunction in the known vital order (1989: 193). The ontological concepts that characterize the working objects of human life science, Canguilhem's study thus suggests, are coproduced alongside the epistemic premises, technological capacities, and experimental modalities that constitute its practices even as they are presented as its ground. This paradox reveals an irresolvable tension between, on one hand, the finality of the objectifying precepts of scientific epistemology and, on the other, the fundamentally normative and ever-mediated modality of life itself, shaped as it is by the interventions, medical and otherwise, humans bring to bear on in it in specific times and places. As such, his work is instructive both as to the source and quality of endemic uncertainty surrounding the ontological nature of disease etiology and difference in NCD epidemiology as well as to the processes through which such uncertainties are managed. Such processes, one can conclude, are also deeply normative, grounded ultimately in value-judgements shaped by the commitments, inducements, and exigencies of distinct and ultimately incommensurable epistemic, technological, and ethical orders that converge on fields of practice and reflected in the ontological constructs that result.

Revealing perhaps their tacit understanding of the normativity of such processes, the Sussers' appeal for a shift toward eco-epidemiology ultimately closed not with the historical and empirical case they built about the nature of causality in relation to multifactorial disease etiology but instead with a particular ethical vision of the discipline. That vision opened with warning about the outsize role that new technological orders play in shaping the ontological premises embedded the working objects of bioscience, a dynamic that Canguilhem too unpacked in his famed work.[10] Acknowledging that the advent of genomic technologies would offer new means to explore causal mechanisms at the molecular level and anticipating that the increasing power of computing technologies would enable powerful new systems-based approaches to modeling those mechanisms, they admonished readers that these technologies could easily perpetuate the marginalization of the social as an object of epidemiological concern. Needed to prevent this from happening, they concluded, was an intense program of socialization, in the

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[10] Again referring to Leriche's work, Canguilhem observes of the relationship between theoretical models and technology in physiology and pathology, "At the risk of offending certain minds for whom the intellect is realized only in intellectualism, let me repeat once more…. technology exists, not as a docile servant carrying out intangible orders, but as advisor and animator, directing attention to concrete problems and orienting research in the direction of obstacles without presuming anything in advance of the theoretical solutions which will arise" (1989: 101; see also 226).

tradition of the medical education paradigm developed by Robert Merton, to instill in epidemiologists “the idea of improving public health as a primary value” (Susser & Susser 1996b:677). What that meant, they clarified, was a commitment to serving particular populations, “informed by notions of social equity, to prevent and control disease” (Susser & Susser 1996b: 677). Only through such an ethical commitment to the particular and to the difference that local social dynamics make to disease risk and outcomes for the members of target populations could the paradigm of eco-ecology be achieved.

II. Genomic Science and the Shifting Bounds of Direct Observation

Given the evident power of technological orders to shape normative ontological precepts configuring the working objects of bioscience, it is not difficult to understand why medical anthropologists, bioethicists, and other social scientists engaged in critical studies of medicine turned their attention in the closing decade of the 20th century to the potential for omics sciences to perpetuate and deepen reductively biological understandings of disease and difference. The emergence of the omics fields of science undeniably brought sweeping changes to everyday sociomaterial practices and technologies available to human life science practitioners, including chronic disease epidemiologists. The phrase “omics sciences” glosses those fields of the life sciences whose aim is to “identify, characterize, and quantify all biological molecules that are involved in the structure, function, and dynamics of a cell, tissue, or dynamics of an organism,” including the study of genomes, messenger RNA, proteins, and chemicals involved in metabolic processes ((Vailati-Riboni, Palombo, and Loor 2017:1)). They grew to prominence within the broader matrix of the human life sciences in the first decade of the 21st century alongside the rapid emergence of new bioinformatics techniques and technologies that transformed scientific capacity to visualize, isolate, recapitulate, and manipulate basic developmental pathways within the human body. The iconic events associated with this period, including the mapping of the human genome in 2001, the development of a technique for deriving human embryonic stem cell lines in 1998, and the rise of bioinformatics, or powerful computing technologies capable of storing and subjecting to statistical testing vast amounts of health information, generated intense hype in public discourse that drowned out, at least initially, a more circumspect sense of sprawling, if indefinite, potentiality amongst most human life scientists involved in basic research.

For many human life scientists, the novel techniques, technologies, and experimental materials these events indexed heralded an era of unprecedented access and ability to map the components of the human body and their functional interrelations by extending the bounds of what could be observed and manipulated to encompass processes at the molecular level. One can see how such developments might be interpreted as a step-change for epidemiological practice. In the early 20th century, Wade Hampton Frost, a Virginia-born epidemiologist who, as the first president of John Hopkin's University's School of Public Health was at the forefront of efforts to professionalize the field in the US, characterized the science's work as "the orderly arrangement of facts into chains of inference which extend more or less beyond the bounds of direct observation" (Vailati-Riboni, Palombo, and Loor 2017). If the Sussers' critique of the black box paradigm exposed the limits of statistical tools subsequently developed for the purpose of making inferences, then the emergence of techniques and technologies that endow practitioners with the new power to visualize and tinker with these processes as they unfold was felt to be revolutionary (Susser and Susser 1996a; Brunwald 1997; Knox 2010). The philosopher Nicholas Rose has termed the sweeping effects of the "epistemological, ontological, and technical reshaping of medical perception" wrought by omics in the human life sciences "molecularization," or "the style of thought of contemporary biomedicine [which] envisages life at the molecular level, as a set of intelligible vital mechanisms among molecular entities that can be identified, isolated, manipulated, mobilized, recombined, in new practices of intervention, which are no longer constrained by the apparent normativity of a natural vital order" (2007:5-6, 9).

Early efforts to incorporate omics-based science into epidemiological practice focused largely on genomics technologies and techniques that would allow for the identification of allelic variants associated with increased chronic disease risk. Prominent among these was the genome-wide association study (GWAS), a technique developed in 2007 for identifying single-nucleotide polymorphisms (SNPs), or allelic variations that are associated—either directly or as a marker of set variations in a nearby DNA sequence (haplotype)-- with increased disease risk ((Kathiresan and Srivastava 2012)).[11] GWAS relies on troves of genomic information stored in databases like GBCS, and harnesses the power of advanced statistical software, to test for potential disease-associated SNPs, or risk alleles, across tens of thousands of individual human genomes (Gibbs et al 2003; Greely 2007). The ability to do cost-effective, rapid comparisons across a large number of whole genomes to identify risk alleles was of particular value to researchers in the field of chronic disease science who were hoping to make headway in identifying new causal relations between exposures and disease outcomes.

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[11] A haplotype is a sequence of DNA variations that are inherited together and hence often a site of potential hereditary disease risk. A succinct definition is available online at: https://www.genome.gov/glossary/index.cfm?id=99.

Again, cardiovascular disease offers an illustrative example of how these technologies were incorporated into epidemiological practice. Researchers had long surmised that there was an important hereditary component to non-Mendelian forms of heart disease risk, based on the predictive value of family history, an independent risk factor for CHD ((Alvord 1949); (Gertler, Driskell, and Bland 1951); (Friedlander, Kark, and Stein 1985); Brunwald 1997; (Hawe, Talmund, and Humphries 2003)). If they could find the genetic underpinning of this association, they surmised, then making causal inferences would be much less fraught. One reason for this supposition had to do with the ongoing influence of the iterative strains of genetic determinism that had dominated 20th century renderings of the relationship between genotype and phenotype in the biological sciences. In her masterful survey of genetics at the turn of the millennium, Evelyn Fox Keller characterizes such understandings as entailing "the primacy of the gene as the core explanatory concept of biological structure and function," (2000: 9). CHD epidemiologists, of course, had long appreciated the pathogenic role of environmental exposures, but if they were going to open the black box of etiology using the tools and framework of omics sciences, what better place to start than with genetics, whose primary causal role in the metabolic pathways of CHD etiology was presumably a given?

The second reason concerns the new grounds omics technologies had created for interdisciplinary collaboration between epidemiologists and human developmental biologists. The increased access these technologies had granted human developmental biologists to the molecular vital order had transformed the value of human cells as experimental materials. Sophisticated recombinant DNA techniques could be used to target allelic variants identified in GWAS studies as potential disease determinants in knockout mice models, confirming a causal relation. Alternatively, organoids, or "tiny, self-organized three-dimensional tissue cultures derived from stem cells" that "replicate much of the complexity of an organ" could be used to link gene expression to disease biomarkers via their role in larger metabolic pathways.[12] Such interdisciplinary collaborations would offer much improvement over more traditional options for confirming association-based studies, which generally relied on developing therapeutics or public health interventions based on association findings and then running trials to evaluate their efficacy. As the failures of hormone replacement therapy so spectacularly demonstrated, carefully characterized metabolic pathways linking genes and common disease biomarkers in disease etiologies offered a much safer basis for intervention than those based on causal inference following the black box model. These tiny, abstracted, and compartmentalized forms of life opened genetic risk factors to a form of controlled experimental vetting that traditional risk factors scaled to the individual or the social had long eluded.

There was precedent in NCD epidemiology for the enthusiasm researchers showed for GWAS, as allelic variants had, for some time, been a target of interest. By the late 1990s, genetic epidemiologists had made little headway replicating studies that identified risk alleles for common polygenic conditions through linkage analysis, then the standard method for identifying genetic components of disease ((Risch and Merikangas 1996:1516)). [13] This replication gap, most concluded, reflected the limited power of linkage analysis to identify the many multiple high penetrance (or common), small-effect genetic variants that, when added together, were believed to comprise the genetic component of such polygenic conditions. GWAS, with its large-scale association testing and examination of SNPs across fully sequenced genomes, seemed to offer an invaluable alternative capable of detecting the weak effects of high penetrance alleles

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[12] Definition of organoids available online at: https://hsci.harvard.edu/organoids

[13] Linkage analysis exploits the tendency of genetic variants in close proximity to one another on a given chromosome to be inherited together, rather than randomly re-assorted during reproduction. This imbalance can be used to locate rare variants associated with disease phenotypes ((Pulst 1999:667)).

(Risch and Merikangas 1996: 1517; (Blanco-Gómez et al. 2016:667)). Epidemiology, moreover, with its conventional expertise in designing comparative studies of exposure variation within large groups of people, was well-positioned to adapt the parallel design structure of GWAS into its field of practice (Broadbent 2013; Brunwald 1997).

And yet, as Fox Keller anticipated, the practice of omics sciences and subsequent knowledge of human developmental biology has, to an extent, undermined the conceptual basis for etiological models informed by the genetic determinisms of the 20th century.[14] As the geneticist Sarah Knox explains, the assumption that the combined effects of genetic and environmental determinants of polygenic disease are additive (that a disease phenotype is the result of a specific genotype plus a set of environmental exposures) has lost ground to a systems-based understanding of molecular biology in which "gene expression and function can vary based on the surrounding micro-environment, which varies in response to multiple internal and external cues" ((Knox 2010:12); (Loscalzo and Barabasi 2011)). In this non-liner model of pathogenesis, the value of a risk allele, in terms of its expression and function, is not fixed but rather in flux, determined by the shifting relations in which it stands to enzymes, transcription factors, and metabolic pathways that are themselves influenced, both directly and through the epigenome, by environmental factors. Anticipating this shift toward a complex systems paradigm, Joseph Loscalzo, Chief of Medicine at Brigham and Women's Hospital in Boston and Professor of Theory and Practice of Medicine at Harvard Medical School, argued as early as 2007 that the fluidity of risk alleles would limit their clinical usefulness, rendering them "insensitive for preclinical diagnoses" and supportive of a disease classificatory system that "lacks specificity in defining disease unequivocally,"

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[14] This is not to say that genetic determinism no longer influences styles of thought in the life and social sciences, social policy, and the bioeconomy. Rather, it is to say that limitations of genetic determinism as a conceptual framework for polygenic disease research has created additional space for vying alternative frameworks.

(Loscalzo et al 2007: 1). Even for a classic Mendelian pathology such as sickle cell anemia, he concluded, “genotype cannot invariably predict the phenotype of this disease” (2).

Indeed, this shift toward a complex systems paradigm casts into sharp relief the relative lack of progress over the last 25 years in epidemiological research into potential NCD risk alleles. To return to cardiovascular disease as an example: Significant investment in GWAS and related genomic sequencing techniques have validated 50 genetic loci associated with CHD biomarkers, but as one paper noted, “… [B]uilding public health interventions on even the best of these genetic risk factors is not simple… it has been difficult to identify a single significant variant that that can be targeted for the development of therapeutic interventions” ((Fallin, Duggal, and Beaty 2016)). Moreover, the cumulative estimated effect of these loci on disease risk falls far short of that which is estimated based on heritability studies using families and twins ((Morris 2017)). By another estimate, the 1.6 million SNPs known to be associated with CHD, but not necessarily linked to specific biomarkers, explain just 26.8% of CHD heritability, whereas the familial history-derived estimate is upwards of 50% ((Natarajan 2018: 1984); Fallin, Duggal, and Beaty 2016). This failure of genetic risk alleles to account for heredity is not limited to cardiovascular research but occurs across studies of complex traits and is known as the “missing heritability complex” (Blanco-Gomez et al 2016; Morris 2017). While this effect may have to do in part with yet-undiscovered risk alleles, in line with the shift toward a systems-based paradigm in human developmental biology, it also likely is demonstrative of the extent to which the expression and function of these alleles themselves are contingent upon the metabolic feedback loops in which they are imbricated and the macro-exposures—including social forces—interacting with and shaping those feedback loops (Loscalzo 2007).

The most promising development to come out of genetic cardiovascular epidemiology in the past 25 years, the use of polygenic risk scores to stratify conventional risk factors for coronary artery disease (CAD), does increase the accuracy of algorithms used to predict absolute risk of developing CAD at that point in a patient's life. The most accurate of these scores, the metaGRS, which was developed by researchers at Cambridge University though meta-analysis of earlier scoring models and includes 1.7 million CAD-related allelic variants ((Inouye et al. 2018)). Not only does stratifying patients into metaGRS quadriles increase the accuracy of conventional risk factor scores, allowing clinicians to differentiate between patients who would otherwise be lumped together in risk strata, but it also allows for the early identification of genetically risked patients. Because most conventional risk factors—which include biomarkers such as adiposity and hypertension as well as lifestyle factors such as smoking status and alcohol consumption—are age-dependent (that is, they tend to appear with the onset of adulthood or, for biomarkers, well into it), they do a poor job of identifying at-risk patients early in life. This is problematic because the pathogenic processes believed to contribute to CAD occur across the life course. Indeed, as Dr. Bedford explained to me, and as the historical characterization of the GBCS cohort should make clear, risk exposures can be traced to fetal conditions and even across generations. Thus, the development of an accurate cumulative genetic risk score (theoretically, for those patients with access to personalized medicine) allows for the possibility of preventative therapies that can ameliorate or even arrest pathogenic processes before they develop into full-blown disease. For example, preliminary studies show that polygenic risk scores can be used age-independently to identify patients at increased risk of atherosclerosis, allowing for the targeted preventative prescribing of statins (Natarajan et al 2018).

But metaGRS is modeled on conventional risk factors and hence is subject to the same weaknesses. The association between genotype and disease development is still probabilistic—indeed, under the complex systems approach, it must be, since not only the expression but also the function of allelic variants are dependent on metabolic signaling inputs and the macro-exposures they interact with. Hence, clinical the application of the risk score, derived from population averages, to any individual person is still limited to likelihood. For example, under the metaGRS score, a 70-year-old man in the highest genetic risk quadrille who is also at elevated risk by dint of all conventional factors still has a 40% chance of not developing CAD (Inouye et al 2018). While a 60% score may be solid ground for taking preventative measures for this patient profile, the risks drop precipitously for the highest quartiles of women of all age groups and men of who are young adults or middle-aged (Inouye 2018). Thus, they are of little value to the patients in this group who, against the odds, will develop CAD, even as they encourage profiling that may lead practitioners to be more dismissive of early indicators of poor health in the clinical setting as idiosyncratic experiences or wacky lab results.

As Pradeep Natarajan, a cardiologist at Massachusetts General Hospital who runs a genetic epidemiology research lab and whose group was one of the first to develop the statistical methodology behind polygenic risk scores, notes, one major drawback is that these scores lump together allelic variants implicated in distinct pathogenic processes. Hence, even if they improve risk prediction, they may not be informative in terms of choosing the most effective preventative therapy for a patient, because, like traditional risk factors, they don't offer etiological insight (2018: 1895). Likewise, he notes, they are prone to the same circularity issue sociologist Troy Duster identified for the use of ethno-racial taxonomies used to demarcate genetic research populations, as you'll recall from the last chapter. Namely, Natarajan notes, as the metaGRS scores rely on population-specific data, mostly from European and US-base biobanking project, they may not be accurate for non-western populations.

With regard to this last point, however, it is important to keep in mind that Natajaran himself is heavily invested in research that explores genetic variability and cardiovascular disease risk in Southeast Asian populations. In a 2017 interview with me, one of his post-docs was less concerned about the fit of polygenic risk scores across geo-ethnically defined human subpopulations.[15] He noted high-penetrance, low-frequency variants that demonstrate a more Mendelian association with heritable forms of high LDL cholesterol, known collectively as familial hypercholesterolemia, do show some significant variation between subpopulations, but they are nevertheless extraordinarily rare. On the other hand, the low-penetrance, high-frequency variants included in polygenic risk scores are so diffuse and common, he reasoned, their distribution across the global population is likely much more random. His own research on cardiovascular genetic risk in an Indian population, he said, preliminarily bore this out. Polygenic risk scores, he surmised, are significant for several reasons: as an important addition to an arsenal of clinical decision-making tools with respect to identifying and treating at-risk patients; as an initial mooring for basic etiological research into the metabolic pathways in which they are involved; and as a sophisticated technique for stratifying and refining the use of conventional risk factors that may be transferrable to other forms of chronic disease. But if significant advances were to be made in the prevention and treatment of CHD and CAD, he concluded neither polygenic risk scores nor genetic epidemiology alone would be the source.

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[15] At the time of our interview, the paper on metaGRS had not yet been published, so this comment does not refer to it specifically.

III. Conclusion: Replication and Uncertainty in the Era of Complex Systems

Undeniably, an enormous amount of fiscal and institutional investment has shifted into contemporary genetic epidemiology since the late 1990s. If NIH funding can reasonably serve as a proximate of global spending trends, then it is telling that in FY 2019, genetics was slated to receive $8.428 million dollars from the NIH, the highest amount of 285 research fields receiving funding. This trend has held steady for some time.[16] As Mouin Khoury, director of the Office of Public Genomics at the US CDC, observed in 2013 with the characteristic understatement of a research scientist, "Since 1993, genetic epidemiology has evolved from a relatively obscure specialty to a mainstream scientific discipline with impact on medicine and health" (Khoury 2013).[17] This impact has been fragmentary in subtle, yet important, ways: Even as genomics and its sister fields significantly reoriented research efforts toward the molecular, the unexpected findings—and failures-- that resulted pushed human life scientists toward renewed appreciation for the plasticity and contextual embeddedness of life.

Indeed, as geneticist Sarah Knox makes clear, the complex systems paradigm goes beyond merely challenging a deterministic style of thought that assumes the fixed functionality and unidirectional causality of gene expression. More fundamentally, it exposes a contradiction between a basic ontological premise embedded in controlled experimental methodology—namely, that causal mechanisms can be parsed and isolated, and their effects measured, with an objectifying finality that is independent of the embodied network of functional processes in which they are situated—and the apparently relational value of functional etiological terms

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[16] With the exception of the catch-all "prevention," which eclipsed it at over 11 million. Figures available online at: https://report.nih.gov/categorical_spending.aspx

[17] Available online at: https://blogs.cdc.gov/genomics/2013/09/12/genetic-epidemiology/

involved pathogenic pathways. Knox clarifies, “The term complexity applies not just to the number of causal exposures (e.g. smoking, diet, toxicity, genotype) but to the multiplicity of integrated systems that interact in response to these exposures.” (2010: 12). As we have seen, recognition of this contradiction is not unique to contemporary systems biology. The difference between additive and integrative bears recursive resemblance to those distinguishing ontological constructs at play in Canguilhem’s exploration of mechanistic and vitally normative configurations of life, the Sussers’ distinction between black box and Chinese box paradigms, and Lock’s discussion of the universal standardized body of biomedical research in contrast to her own theoretical elaboration of local biologies.

Its persistence in a postgenomic context, however, shines a critical light on normative problematizations of the replication crisis that were established by the middle of the 2010s, as concerns about low rates of research replication reached a fevered pitch. Genetic epidemiology largely didn’t provide the hoped-for refuge from operationalization issues plaguing observational epidemiology, while other technologies and techniques associated with the rise of omics sciences, such as the use of a “big data” approach to identify associations between potential exposures, biomarkers, and disease endpoints, generated new methodological pratfalls, like p-hacking and the ability to circumvent hypothesis-driven research. Much of the intradisciplinary discourse surrounding the current replication crisis has focused on its perceived institutional drivers, deriving mostly from perverse incentives created by the pressure to publish headline-grabbing research. A recent op-ed from Nature is representative. Entitled “Rein in the Four Horsemen of Irreproducibility,” the author invites her colleagues to imagine themselves in the year 2040, when, she predicts, “we will look back at the last 60 years… and marvel at how much time and money has been wasted on flawed research” ((Bishop 2019:435)). This eventuality is a foregone conclusion, she argues, unless her colleagues join “the movement to make science more robust” and work to eradicate what she has termed “the four horsemen of the reproducibility apocalypse,” namely, “publication bias, low statistical power, P-value hacking, and HARKing (hypothesizing after results are known)” (435).

The author asserts that her concern with irreproducibility makes her an outlier in the field, but in fact the problems she identifies appear to be the subject of a broadly shared consensus among epidemiologists. They were repeated to me in conversation with Dr. Bedford and members of her research cluster, a professor of epidemiology at the Harvard School of Public Health to whom Dr. Bedford had directed me as an example of someone whose approach to rectifying the replication crisis she otherwise vehemently disagreed with, and friends from graduate school who are trained in public health sciences. They are featured in the editorial pages of prominent public health journals and dozens of think-pieces published across the epidemiological blog-o-sphere, then shared on Twitter and exhumed by popular news media sites. I attended a public health conference in Hong Kong that dedicated an entire afternoon of panels to unpacking them. There is virtually no doubt these are real, urgent problems that diminish the quality of research designs and outcomes and contribute to low reproducibility rates in observational epidemiology. Beyond them, however, that consensus frays as practitioners broach and debate less flagrant sources of scientific fallibility. In its place, the questions broached by the Sussers 20 years earlier reappear: What is the proper domain and scale of epidemiological analysis? How can one reconcile its current methodological limits with the nature of its potential objects of study? What is the identity of epidemiology as a scientific discipline—that is, what constitutes good epidemiological science? Whom, or what principles, should epidemiological research strive to serve? And often, as we saw above and I demonstrate ethnographically in the following chapter, these debates refer back to normative value judgements that have no immediate empirical resolution but instead must weigh incommensurate orders of thought, practice, and being.

Though problematizations are inflected by the institutional and methodological concerns described above, the many of the underlying sources of uncertainty animating these questions remain the same as those addressed by the Sussers 20 years earlier, implicitly touching on tension between the apparent nature of disease etiology and the use of universalizing and reductive forms of scientific practice as an archetype for epidemiology. Indeed, nowhere is this tension more visible, it would seem, than in the replication crisis, which is defined by the frequent failure of epidemiological knowledge to conform to a basic measure of the validity of scientific truth production. As awareness of the infrequency with which observational results are reproducible has grown alongside a body of evidence in the human life sciences of just how inseparable are the external and embodied processes of health and pathology, it has become more and more difficult to defer the question of whether these failures can, in part, be attributed to the systemic erasure of local historical, social, and political differences, such as were explored in Chapter 3, through common techniques of standardization and efforts to approximate the forms and conditions of controlled experimentation in epidemiological science. In this context, the replication crisis has furnished a powerful opportunity to grapple directly with what Georges Canguilhem described as the organic normativity of life; that is, to recognize that “the form and functions of the human body are the expression not only of conditions imposed on life by the environment but also of socially adopted modes of living in the environment” (1989: 269). If forms of life and pathology are no simply reactive to, but to some extent constituted by, local social and built environments, then the common distinction introduced by epidemiologists Rothman and Greenland in the previous chapter, that representative knowledge of such phenomena is the proper object of social science and not the human life sciences, appears untenable.

Chapter 5: Aging, Loneliness, and Wellbeing in Guangzhou City

I. Introduction

“What we old people fear most is loneliness” (*women laoren zuipa gudu*). Mrs. Ke set down her teacup and watched intently as I worked to register the significance of her words. She and I had spent the last two hours discussing her life history—lengthy, at 83 years-- and experiences as an elderly person living in Guangzhou over morning tea at TaoTaoJu, her favorite dim sum restaurant. At the outset our conversation had been open and easy and, despite having just met, it had seemed as though we were developing a rapport. The stories she told of her youth and middle age were at once familiar and deeply moving, revelatory of a singular and resilient life scaffolded by the major social and political upheavals of China’s tumultuous 20th century.

But as we shifted focus to the contemporary moment, our conversation grew muddled. I explained that I’d recently moved to Guangzhou to learn about how older residents of the city experience chronic disease risks and illness, and that I was interested to know the impact these things had on her life. In response, Mrs. Ke launched into a meandering description of a group of peers from her neighborhood community center with whom she socialized regularly through activities like morning tea (indeed, many of the group were at the restaurant with us that day), exercise, and cultural outings. I tried several times to redirect her, asking pointed questions about her current health status and listing common examples of social and environmental determinants of disease, but she continued to talk about the community center group until dim sum service ceased and waiters began to shuffle through the dining room with armfuls of laundered tablecloths and clean place settings.

When I pressed her one last time, somewhat abruptly, to speak about health risks, she made her pronouncement on loneliness and suddenly the connection materialized: if Mrs. Ke had lingered over her activities with the community center group, then it was probably because those relationships figured crucially in her lived experience of managing the felt threat loneliness posed to her health and wellbeing. I wanted to know more, but morning tea had drawn to a close; Mrs. Ke's friends were filtering out of the restaurant and I could see she was eager to do the same. Disappointed at what felt like a missed opportunity, I thanked her for talking to me, told her I was very glad to have met her, and promised to be in touch soon.

In the months that followed, as I made ethnographic inroads into neighborhood community centers that hosted group activities similar to those in which Mrs. Ke participated and grew close to other city residents through Chinese language classes, academic circles, and work as a preschool English teacher in a neighborhood at the outskirts of the city, I heard a lot about the specter of loneliness in old age. It became clear that the concern was not idiosyncratic to Mrs. Ke but in fact widely shared amongst the older city residents and families I knew, and that the form of group-based peer sociality Mrs. Ke had described in our first meeting was a common conduit through which the threat of loneliness was managed. Indeed, this form of sociality even received indirect local government support through municipal backing for the establishment and staffing of neighborhood community centers and elderly activity centers, spaces designed for use by older residents, in which it seemed to flourish.

Yet, despite the apparent importance of loneliness to their Guangzhou cohort, which was recruited through the neighborhood community centers I worked in, and a solid body of epidemiological evidence adducing to it as a risk factor for CHD, the most common source of chronic disease morbidity and mortality globally, my Hong Kong interlocutors had failed to measure it in their GBCS study. When I raised the issue with Dr. Bedford, she explained that she lacked the time and resources to "dream up a rigorous measure" of loneliness and expressed skepticism over whether it could ever be shown to be causally, rather than just associationally, related to CHD etiology. Comparing epidemiological studies on loneliness to those on the relationship between CHD and stress in the mid-20th century, she suggested that such psychosocial factors become "empty buckets" in which yet-unidentified etiological factors are collected, obfuscating rather than clarifying disease risk and progression models.[1] Such "empty bucket" factors, in her opinion, epitomized precisely why the contemporary field of chronic disease epidemiology was undergoing a reproducibility crisis and lacked scientific authority. For reasons epistemic and practical, she concluded, it was better to focus her group's energies on factors that could be clearly identified and standardized, and whose causal impact on disease processes could be adequately assessed.

In this chapter, I develop an ethnographic account of loneliness as a felt risk factor for poor health among older Guangzhouese in the hope of illustrating what is at stake for GHHARE members in the ongoing de-prioritization of social determinants of chronic disease risk, morbidity, and mortality across multiple sites and periods of GBCS research. As I suggested in Chapter 2 of this dissertation, GHHARE members are excluded as agential stakeholders in the representational practices shaping GBCS research questions and objectives; in one sense, then, this chapter is intended to be a rejoinder to that exclusion. But it is also motivated by the persistent tension mapped throughout this dissertation between the technological, epistemic, and

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[1] For a review of the history of the "stress hypothesis" in cardiovascular research, see McLeod and Smith 2002 "Commentary: Stress and the Heart, 50 Years of Progress?" in *International Journal of Epidemiology* 31(6).

ontological orders that are brought together in GBCS research, yet never quite seem be rendered fully commensurate. Those normative and qualitative dimensions of life that overwhelm abstracting and essentializing efforts to fix it as proper working object of epidemiology constitute a form of difference that can only rendered legible through knowledge grounded in shared time, space, and experience. Indeed, this is precisely why Canguilhem stubbornly insisted on the primacy of the clinical and the experiences of ill persons; why there is, he maintained, "no objective pathology" (1989: 226). Thus, my objective here is not simply to develop empirically an argument for why research subjects like those in the GBCS cohort ought to be meaningfully included in the representational practices of transnational chronic disease reach but also to offer a methodological account of how inclusion ought to be done.

The chapter body is divided into four parts. In the first, I explore epidemiological scholarship on loneliness alongside studies and theoretical elaborations from the humanities and social sciences, highlighting the value of an interdisciplinary perspective. In the second, I draw on ethnographic work on Guangzhou to complicate the popular perception that a decline in filial piety in post-Mao China is a primary driver of loneliness in older Chinese. In the third and fourth sections, I discuss older interlocutors' experiences of loneliness as a felt risk to health and wellbeing and highlight several practical strategies they have developed in order to prevent the onset of loneliness. I close the chapter by arguing these practices reveal a local foundation on which an effective public health intervention into the phenomenon of loneliness in older Chinese may be built, as older Chinese are already deploying such strategies to new, prosocial and health-promoting ends—a form of caring for one another-- in response to contemporary conditions in Guangzhou that generate a felt threat of loneliness.

II. Loneliness as Epidemiological Object and Subject of Critical Social Theory

Social and behavioral scientists have been studying the health effects of loneliness, in one form or another, for some time. Much of this work focuses on the link between loneliness and CHD. In their comprehensive 2005 review of the existent state of knowledge regarding the epidemiology of CHD, Michael Marmot and Paul Elliot trace the origins of contemporary epidemiologic inquiry into psychosocial risk factors by the US biomedical research community to "a widespread belief among the general [US] public, fostered by the media, that psychological and social factors influence risk of disease," which, by the mid-1970s, had garnered the attention of scientists ((Marmot and Elliot 2005:363)). In Marmot and Elliot's telling, over the next three decades, scientific concepts of psychosocial risk factors became increasingly refined; by 2005, there existed a significant body of literature exploring the influence of subjective and objective aspects of social support on CHD etiology and prognosis through longitudinal observational studies. While their meta-analysis of this literature ultimately upheld the hypothesis that there is an association between social support and CHD etiology and prognosis, Marmot and Elliot noted that the publications reviewed were hampered by common design and methodological problems that continued to trouble the field during my time in Hong Kong: difficulty controlling for confounding and bias in observational studies; insufficient definitional and measure standardization for psychosocial factors; publication bias toward positive results; and an institutionalized lack of transparency regarding hypothesis drift and data-dredging (406). The result was an ongoing absence of clarity concerning the mechanisms through which social support was linked to CHD etiology.

This absence of clarity was reflected in the expansive breadth of studies developed around potential etiological pathways. These studies interrogated potential linkages between social support and everything from “psychobiological pathways involv[ing]… neuroendocrine, autonomic, and immune responses” and problematic behavioral factors like smoking, excessive drinking, and poor dietary, exercise, and sleep habits ((Steptoe et al. 2004)) to comorbid mental illnesses and psychological stressors like depression, anxiety, low self-esteem, and hostility ((Hawkley and Cacioppo 2010)). For analytic rigor, most of these studies distinguished between loneliness, a subjective experience of dissatisfaction with the quality of one’s social relationships, and social isolation, a quantifiable lack of social connections or contact (Steptoe et al 2004) and sought to measure the impact of each as potential risk factors for CHD. To do so, they used range of validated measures and methods. These included the popular Revised UCLA Loneliness Scale, a self-administered survey consisting of 20 statements to which participants responded by indicating degree of agreement or disagreement on a scale of 1 to 4, from which was derived the simplified Three-Item Loneliness scale for use in telephone surveys of large research populations ((Hughes et al. 2004)). They also included measures of objective social isolation, such as the Berkman-Syme Social Network Index, rooted in methods developed by social anthropologists ((Kawachi et al. 1996)). Notwithstanding these increasingly sophisticated variable category distinctions and measures, however, Marmot and Elliot noted of the studies in their 2005 meta analysis, “Despite the interest in social support, there is little consensus on how it is measured; therefore variables from ‘high love and support from wife’ to ‘social network index,’ to ‘social isolation’ were included,” (2005:395).

Painstaking efforts to unravel and find order in the warp and weft of myriad threads weaving loneliness into CHD underscore the immense complexity of the task. Success materializes, for example, as a positive association between loneliness, as rendered by the R-UCLA scale, and elevated fibrinogen, which is a protein involved in bloot clot formation that can also serve as an unmodifiable cardiac risk marker, shown to be independent of social isolation, low emotional support, depression, hopelessness, self-esteem, sleep problems, and a host of common demographic variables (Steptoe et al 2003). Yet even this incredibly circumscribed association is provisional: another dataset, another scale, another model controlling for another set of confounders, and it could simply fail to reappear. At times it is hard to envision such sustained efforts as anything other than acts of faith. A 2016 meta-analysis of studies on loneliness and social isolation underscores the difficulty researchers face in their efforts improve their understanding of how such psychosocial factors get into the body: "The influence of social relationships on mortality is comparable with well-established risk factors, including physical activity and obesity. Yet, compared with our understanding of these risk factors, we know much less about the implications of loneliness and social isolation for disease aetiology" ((Valtorta et al. 2016:1009)). In other words, ten years after Marmot and Elliot's systematic review, and in spite of these efforts, researchers were still grappling with the basic question of whether or not the observed association between social relationships and CHD was of etiological significance.

The 2016 meta-analysis ultimately provided more support for the hypothesis that poor social relationships are a risk factor for developing, and not just dying from, CHD. It also found no difference in association strength between studies that measured loneliness and those that measured social isolation (though the latter outnumbered the former by a ratio of 6 to 1). Crucially, these outcomes allowed the authors endorse public health programs targeting social isolation and loneliness as part of a strategic policy approach to CVD prevention, at least in the high-income countries where reviewed studies had been conducted (Valtorta et al 2016: 1015).[2] In this way, the review also demonstrated the practical utility of studying loneliness and social isolation as risk factors for CVD etiology. It was possible to generate evidence strong enough to support public health intervention recommendations, which, as you'll recall from Chapter 3, was one of the primary goals of epidemiological research, according to my Hong Kong interlocutors. Even so, as its authors acknowledge, the 2016 review was also limited by potential epistemic and methodological flaws implicated in observational epidemiology's reproducibility crisis: The inability to show causality or control for unmeasured sources of confounding and reverse causation; publication bias and lack of transparency concerning analytic process; and lack of standardization across studies.[3]

If epidemiological work on loneliness has focused primarily with the problem of how to standardize loneliness as a working object of science—that is, to define what is consistent and specific about it-- then social scientists have tended to focus on the relationship between experiences of loneliness and broader social and historical events. There is a considerable amount of critical social theory connecting individual experiences of disaffection and dislocation to rapid upheavals in cultural, economic, and political macro-orders through profound

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[2] The prospective cohort studies included in Valtorta et al's systematic review were conducted in the following regions and countries: Europe, North America, Australia, Japan, Russia (2016:1011).

[3] In systematic reviews, lack of standardization is reflected in the degree of heterogeneity between compared studies. The 2016 review, for example, included studies that measured loneliness, social isolation, or both, to measure the association of social relationships and CHD etiology; within each of those categories, studies varied in terms of assessment tools used and confounders controlled for. A test for heterogeneity indicated that these variations resulted in studies that measured slightly different phenomena, which in turn could call into question the meaningfulness of the average risk size estimated via the meta-analysis. Accounting for sources of heterogeneity can clarify the meaningfulness of the risk size measured. However, the authors were hindered in doing so owing both to the small number of studies that met criteria for inclusion in the review (of almost 36,000 potentially relevant publications, 23 met inclusion criteria; 3 tested loneliness, 18 tested social isolation, and 2 tested both) and a lack of information concerning how the studies were carried out.

disruptions to the normative social relations and values those orders entail. The dehumanizing social effects of the industrial revolution in England spurred Marx to write of the alienation and loss of purpose that characterized a new class of workers' relationships to each other, to their employers, and even to their own commoditized labor within the early capitalist system (Marx 1998).[4] Durkheim's "anomie" captured a pervasive sense of moral dislocation experienced in response to the "derangement" of conventional norms governing interpersonal relations as a result of rapid economic differentiation, such as France underwent during the 18th and 19th centuries ((Durkheim 1951)). And Weber described the tragedy of modern life as a form of "disenchantment" associated with the cage-like rationality that came to define 20th century Western institutions in the public and private sectors alike ((Weber 2013)). Indeed, the very idea of Modernity, as a temporal era defined by the scientific, political, and economic revolutions of which these theorists wrote, has stood as an index for experiences of rupture, loss, and estrangement from self and other. Thus, it would seem that abrupt transformations of what Kathleen Stewart termed the "Cultural Real"—that is, the symbolically mediated, socially constructed worlds humans inhabit-- disrupt established forms of community-making and modes of interpersonal relation that traditionally have conferred a sense of belonging and purpose on individuals in a given society ((Stewart 1996)).

One can draw a compelling analogy between the rapid, sweeping economic and political changes that transformed Europe in the 18th and 19th centuries and China's ongoing revolutions in the 20th and early 21st centuries. Indeed, as I suggested in Chapter 2 of this dissertation, this historical

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[4] For a moving account of the relationship between forms of work (work, labor, and activity) and their relationship to self-realization and ratification that both critiques and extends Marx's observations about the process whereby capitalist forms of labor leave workers estranged from their humanity, see Hannah Arendt's *The Human Condition* (1958).

similarity is the basis of GBCS epidemiologists' rhetorical appeals to the transnational bio-scientific community to which they belong to recognize the universal value of older Guangzhouese as a chronic disease research population. Moreover, there are powerful points of resemblance between the social effects early critical theorists identified as being generated by changes to Europe's political and economic order and the way that loneliness is described and experienced by those I met in Guangzhou. For the latter, loneliness is not simply indicative of a personal experience of lacking fulfilling relationships but instead indexes a loose and shifting network of ideas and sensibilities-- about belonging, self-worth, purpose, and being at home in the world—that are mediated through interpersonal relations whose experiential forms are shaped by the greater economic and political order. Indeed, reflections on the ongoing changes to China's political and economic order were rarely absent from accounts of loneliness given by my interlocutors young and old alike. Hence, the intensification of concerns about loneliness in older Chinese is, no doubt, related to these changes and their consequences for normative social relations.

This body of critical social theory provides important analytical orientation for understanding the significance of China's recent, rapid political economic change to understanding the phenomenon of loneliness in older citizens; it is also instructive in thinking about how the concept of loneliness articulates, through normative interpersonal practices and cultural values, with experiences of identity, belonging, self-worth, and community. Informed by this body of work and encouraged by conversations and ethnographic interactions with tutors and colleagues, community center staff, retirees, and their adult children, I came to think of loneliness not simply as a psychosocial state or an objective condition of social isolation, though both of these forms could be found in the stories presented below. But it also clearly served as an index of fundamentally interpersonal and dynamic processes of self-valuation, emplacement, community-making, and belonging. The phenomenon of loneliness emerged out of relationships strained or broken by shifting social, economic, political, and cultural pressures of the post-Maoist order as they manifested locally, for example, in changing household patterns, labor organization, or neighborhood composition. It had a discursive dimension, the substantive content of which could not be syncretized but instead was distributed in fragmentary fashion across these relationships and articulated with respect to individuals' positioning within them as well as the broader sociological and cultural matrix. And it changed as it was articulated and encountered through interpersonal flows of experience, in response to actions undertaken not just by elders who feared or felt loneliness, but also family, friends, and peers who worried about it, for example, in connection with their sense of responsibility to look after an aging relative or a habituated ethos that connected the realization of self to the care of others. In this sense, the ontology of loneliness—as an idea, a discursive construct, an experience-- struck me as being fundamentally relational, something that could not *be,* as Annemarie Mol has suggested, apart from the living social networks, contexts, and discursive elements that continually (re)constituted it.[5]

III. "I Worry for My Parents:"[6] Filial Piety and Loneliness as Discursive Construct

In the weeks after meeting Mrs. Ke over dim sum, as recounted briefly at the start of Chapter 4, I began to get to know people and to carve out niches of community in Guangzhou. Talk of loneliness in older adults seemed to follow with near ubiquity. It emerged unbidden in conversation with newly made acquaintances; headlined news articles in *Guangzhou Ribao*, the

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[6] Fang Guowei, interview with the author.

municipal government's official paper, and its more independent competitor, *Nanfang Ribao;* and made regular appearances as a trending topic on *Weibo*, a social media platform popular with young and old alike in China. At the time, I was waiting on an affiliation letter from a local university that would greatly increase my chances of being permitted to do field work in the community centers and, having arrived in the city knowing absolutely no one, had few easily accessed opportunities for sustained social interaction. So it occurred to me that, in finding loneliness everywhere, perhaps I was simply responding to my own emotional preoccupations. But over time, through conversation and interaction with a growing number of peers, I came to see that this fear was unfounded. China's aging population problem (*laolinghua de wenti*) was undeniably linked to the widespread perception that loneliness amongst older adults was a growing threat to social harmony and even a portentous indicator of the moral danger posed by contemporary China's changing economic and cultural milieu.

In an effort to assuage my sense of isolation and to improve my shaky Mandarin language skills, I began taking lessons at a Chinese language school in Tianhe, the city's shimmering new commercial district, several days a week. The school offered hour-long sessions with tutors-in-training free of charge, which worked with my meager budget. The tutors I rotated through ranged considerably in age and backstory, but most were eager to discuss personal dimensions of the problems China faced as an aging society (*zhongguo laolinghua wenti*) when I broached the topic of my research. Jiahui, a 25 year old college graduate who was transitioning from a career in journalism with the hope of going abroad to teach Chinese languages, lit up with excitement when I told her I had come to the city to study how older Chinese experienced and managed health and wellbeing concerns in the context of the country's ongoing economic and social transformations. “Ah, yes,” she said, “I wrote some articles about this problem. Have you heard of the empty nest syndrome (*kongchao zonghezheng*)?”

I had not—at least not in a Chinese context. Jiahui explained that she’d written several articles about the phenomenon for her previous job at a local news blog in response to growing popular concern about the rising number of older adults living apart from their children in urban Guangzhou. I’d read scholarly articles about the impact of housing and economic reform on multigenerational households ((Ikels 1996);(Ikels 2004) (Zhang, Y. 2015)), but these tended to focus on the decline of the family as the primary source of caregiving for the elderly rather than pathologize the emotional experiences of parents whose grown children had moved out. Jiahui assured me that “empty nest syndrome” had entered the lexicon to describe parents who struggled to come to terms with the absence of a child (or, less frequently, children) who had moved to other parts of the city or even the country for study, work, or to establish families of their own.[7] “It’s a common concern,” she told me, describing worried conversations she’d had with friends about how to minimize their parents’ feelings of separation and loss. The articles she wrote grew out of these conversations, offering general advice and practical strategies to young adults for how to recognize and respond to empty nest parents’ emotional distress.

For Jiahui and many other young adults I spoke to, the problem of loneliness facing their parents and grandparents was inevitably refracted through anxiety over the perceived erosion of filial piety in post-Mao China. The felt moral imperative to care for and honor their aged parents’ needs above their own was wedded to normative practices they found difficult to fulfill in the

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[7] One crowd-sourced online dictionary defines empty nest syndrome as the state of one’s heart and mind (*xinli*) being out of tune as a result of one’s child/ren having moved away. https://baike.baidu.com/item/空巢老人/63555. More recently, the term has grown to encompass single young adults who live alone or apart from their families (*nianqing kongchao).*

changed socio-economic order marketization had wrought. The expectation to co-reside with one's parents in order to provide material, fiscal, and psychosocial support on a daily basis conflicted with large scale changes in educational and employment patterns that pressured children to move out to attend university or pursue a job opportunity. It conflicted too with changing cultural values and practices that placed new emphasis on individualism, romantic love, and the nuclear family ((Yan 2003);(Rofel 2007)). And it became increasingly burdensome to meet caregiving expectations, in particular, as the demographic distortions created by China's One Child policy left a generation of adult children with the full responsibility of caring both for two aging parents and, perhaps, a child of their own (Greenhalgh 2008). Reflecting on "empty nest syndrome" thus may have been a way for young adults facing such pressures to grapple with their own sense of moral incertitude as much as it was a reaction to their parents' expressed distress.[8]

The perception that Deng Xiaoping's Opening and Reform measures had indeed precipitated a crisis in the conventional mores governing familial relations is widely shared across different levels of Chinese society. Administrative responses to this perceived crisis include a series of laws passed in […] by the central government in an effort to ensure that adult children provide adequate support for their aging parents. For the government, such laws are intimately linked to broader strategies to promote social harmony and to use existent social structures to meet the care needs of a rapidly aging population in the wake of the demographic distortions wrought by the One Child Policy. These laws dictate everything from the responsibility an adult child has to provide material support for his or her parent, an elder support strategy that is reflected in state

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[8] For an exceptional account of local understandings of gerontological issues being shaped by cultural anxieties stemming from rapid socio-economic change in a developing country, see Lawrence Cohen's *No Aging in India: Alzheimer's, The Bad Family, and Other Modern Things.*

welfare plans that envision the family as the primary source of support for aging adults, to the codification of more diffuse expectations of emotional support, as is seen in recent media coverage of a law requiring adult children living apart from their parents to call them regularly. At a local level, many of the older adults I met addressed the filial piety crisis more obliquely, often through the deployment of common stereotypes of post-Mao generations as selfish. One 79-year-old former newspaper editor I knew through a friend who had worked as a reporter in Guangzhou before beginning a PhD program at Hong Kong University described contemporary young Chinese adults as materialistic, pampered, and unwilling to forego their own desires in order to meet those of their parents. She summarized dismissively, “They are all little emperors, even though they have their own children now.”

Widespread consternation over the decline of filial piety, as indicted by the perceived failure of adult children to adhere to eldercare practices normatively expressive of them, emphasizes the deep importance of values governing interpersonal relations between set social roles, particularly those within the family, to the traditional maintenance and reproduction of China’s social order. Indeed, as Fei Xiaotong suggests in his classic work on Chinese sociality, *From the Soil*, a person’s failure to “uphold moral obligations of his or her network ties…” could cause “the entire social system to collapse” (Fei 1992:124). Not just social worlds, but the reproduction and ratification of selves too are at stake in the abdication of filial piety. As Fei argues, in contrast to a Western ideology of self that emphasizes individualism, envisioned as the struggle to transcend social roles, Chinese theories of self rest in the dutiful enactment of one’s social roles; the failure to perform such duties results in the perception that one is “less than human” (1992:25). By extension, the failure of others to ratify one’s relational role through proper interpersonal practice may go beyond mere disrespect to call one’s humanity into question. Fei argues, “To be a human in Chinese society is to be linked to others—to one's parents, siblings, children, and friends—and to fulfill the obligations of those linkages" (25). Hence, a disruption or rupture in those linkages, reminiscent of epidemiological measures of social isolation and loneliness, may in fact open onto a more complex experience of existential precarity in which both the stability of one's social world and identity are at stake. Filial piety may be central to the production of a sense of ontological security in older Chinese if, as Fei maintains, familial roles are the most important in a series of differentially valued relations based on social and biological proximity to an individual.

That said, assessing the impact of disruption by privatization to the normative practices of filial piety on the wellbeing of older Chinese is not as straightforward as an analytic borrowed from Fei's sociology would suggest, and for good reason. Fei completed his work just before the CCP's rise to power in 1949; in the intervening years, the Confucian worldview upon which filial piety rested came under attack by Maoist ideologues, most explicitly through the Anti-Confucianism Campaign of the early to mid 1970s ((Goldman 1975; Gregor and Chang 1979)). In an urban context, especially, more diffuse efforts to replace family with nation as the most meaningful unit of identity and allegiance under Mao involved the formation of small groups (*xiaoqu*) of co-workers, students, and cadres for regular ideological study and self-critique (Whyte 1974). These efforts to reorganize the Confucian hierarchy of differentially valued relations, such that party replaced family as the primary social category of importance, no doubt were experienced as coercive (Watson 2010). Nevertheless, as the ethnography presented in this chapter suggests, for those generations of Chinese who were subject to them, these efforts also generated alternative ways of finding purpose, engaging in community-making, and establishing modes of belonging to be adapted in response to the felt threat of loneliness in the contemporary moment. Indeed, as Andrew Kipnis reminds readers in his 1997 survey of the production of *guanxi* and *ganqing,* the practical and emotional bases of interpersonal ties through which Chinese recreate both normative social worlds and ratified selves, actors have some agency with which to maneuver, generating new forms of these things in response to changes to the existent order (Kipnis 1997:10).[9] Thus, it would seem that Confucian and Maoist social ideologies both constitute resources upon which retirees may draw as they seek to generate such ties today.

In other words, the decline of normative practices associated with filial piety is doubtless a central social change effected under Mao and, later, the Opening and Reform Period, that contributes to contemporary ways of imagining, talking about, and responding to loneliness in older Chinese. However, the neatly unilineal rationale linking a perceived decline in filial piety to loneliness in older Chinese through the dissolution of the multigenerational household and stressors on the obligation to care for aging parents created by the unintended consequences of the One Child Policy, the individualism of neoliberal subjectivity, and education- and labor-driven geographic mobility, simply cannot account for the ways in which older urban Chinese have adapted to contemporary conditions. Instead, it is more likely that they have drawn on multiple social ideologies in attempts to generate new relationally defined roles through which to shore up their senses of social self and belonging and to accept changed practices around established roles.[10] Moreover, in addition to the possibility that talk of loneliness constitutes an idiom through which younger adults reckon with perceived obligations to their aging parents, the central government's deliberate invocation of filial piety as a basis for delegating the fiscal and

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[9] Kipnis rightly notes that he owes this insight to Pierre Bourdieu's practice theory.

[10] There is an important distinction to be drawn here between the urban retirees with whom I worked and the left-behind elderly of rural China, whose socioeconomic status, material conditions of life, and social worlds differ dramatically from those found in a major metropolis like Guangzhou. As an ethics of the particular suggests, understanding loneliness in rural elderly would require close ethnographic work and cannot be extrapolated from the Guangzhou group represented in this ethnography.

material burden of eldercare to the family complicates any straightforward claim to causal linkage between filial piety and the experience of loneliness in older urban Chinese.

Indeed, in his telling, one acquaintance's effort to end an "empty nest" situation through a creative solution to co-residence backfired spectacularly. Changpu was a 38-year-old administrator whom I met much later in my fieldwork, when, in an uncanny parallel to many immigrant situations in the United States, I took a job teaching basic English to preschoolers in order to provide financial support to my aging mother, who was struggling back home to meet living expenses while caring for her terminally ill partner. The school had outsourced the class to the company that hired me; Changpu was my direct boss and the company's liaison to school management. Twice a week, he would drive me to class in a southern Panyu neighborhood at the outskirts of the sprawling city—a trip that would have taken 90 minutes by public transit but was reduced to 35 in his neat, modest sedan. Because he had studied sociology as a college student and remained interested in the sociological questions generated by contemporary China's profound transformations, we often talked about my research during our rides. One day he offered the following story:

> I moved to Guangzhou from Anhui [Province] in 1995. I met my wife in college [in Guangzhou] and after we graduated we both found jobs here. But we worried about leaving our parents behind. Hers were still in Hong Kong [where she grew up] but her sister had also moved to the mainland. I am an only child. So after a while we decided to move them [all four parents] to Guangzhou. We got them an apartment next to ours and moved them in together so that they wouldn't be alone. But they weren't happy! My wife's parents didn't speak Mandarin and mine didn't speak Cantonese, so they couldn't talk [to each other]. My parents couldn't get used to the food. And they all missed their friends and neighbors. So they left. Now her parents are back in Hong Kong and mine are in Anhui. They're much more comfortable.

The preference Changpu's parents and in-laws expressed to remain in their established homes rather than move to be with their children isn't anomalous. In her landmark longitudinal study on the impact of housing reform on elderly Chinese living in Guangzhou, Charlotte Ikels found that a majority of the 31 elderly couples (in their 70s and 80s) who had co-habited with their adult children when she first interviewed them in 1987, but were living alone by the time she returned in 1998, shared this preference. For many of these couples, living apart from their children offered increased autonomy and allowed them to remain in familiar neighborhoods where they had established social ties (Ikels 2004:340). Continuing to co-habit with their children, on the other hand, would often require them to move into a new neighborhood, owing to early housing reform policies that were in some ways unique to Guangzhou.[11]

Ikels notes that China's Center for Aging Research published similar results for older urban residents in their National Study of Urban and Rural Elderly, undertaken in 2000; she summarizes the findings: "Nearly as many preferred to live apart [from their children] (41.5%) as wanted to live together (43.7%)" (Ikels 2004: 339). [12] Ikels' findings complicate any narrative that focuses exclusively on the challenges privatization posited to the existent domestic order, suggesting that it also may gave carried liberating potential for older Chinese to pursue new desires and preferences unthinkable within Confucian or Maoist frameworks. Such newfound freedoms, in other words, were not just for the young. Indeed, Farquhar and Zhang found similar evidence of older Beijingers pursuing new desires and

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[11] The Opening and Reform government sought to restore property rights to the overseas Chinese whose homes had been confiscated during collectivization. Since the population of overseas Chinese landowners in Guangzhou was very high, this meant that a significant portion of the housing stock had to be restored. As a result, many of the work units responsible for selling apartments at heavily subsidized rates to their employees as part of the government's early reform policy could not simply sell the apartment their employees were currently living in. Instead, they built new housing, often in underdeveloped parts of the city where land was cheaper and more readily available. The effects of this landowner's rights restoration policy were particularly impactful in Liwan, which historically was the seat of Guangzhou's merchant class, whose bad class background and overseas connections led to many of them losing their homes and fleeing the country post-Mao.

[12] Original citation is 2000 National Study on Rural and Urban Elderly, *Zhongguo Laoling Kexue Yanjiu Zhongxin* 2003: 208).

self-indulging forms of life by reworking conventional technologies of the self, such as exercise, medicinal food consumption, and spiritual practices, to pleasurable ends (2012). And though their Foucauldian framework emphasizes the individual subject, it is notable that many of the pleasure-seeking activities Farquhar and Zhang show older Beijingers participating in involve the invocation and reproduction of peer relations and national communities of belonging.

Like Changpu, other tutors I met at the language school likewise emphasized the role of peer relations over familial in mitigating the risk of elder loneliness. Guowei, a 23-year-old student who visited his grandparents weekly at their home in Haizhu, one of the oldest districts of the city, felt that his paternal grandmother maintained good health and a sense of wellbeing (*jingshen shenti jiankang hao*) but worried about his grandfather, pointing to a difference in the degree to which they socialized with their peers as the cause of his concern. While his grandmother regularly was active and outgoing, exercising, eating, playing majiang, and taking daytrips *(riyou)* to touristic sites with friends, his grandfather rarely left the house. Instead, he sat at home most days watching television for hours on end; on recent trips to the apartment, Guowei noticed, it was becoming harder to persuade his grandfather to turn off the television to visit.

This withdrawn and inactive man diverged markedly from Guowei's childhood memories, in which his grandfather seemed to delight in taking him along on visits to neighborhood shop proprietors, majiang companions, or resident committee colleagues, with whom he'd linger conversationally at small plastic sidewalk tables over cups of tea or bottles of *Qingdao*, or gossip loudly in backrooms packed with men and hung heavy with smoke. In the last decade, however, friends had moved or passed away, familiar shops had closed, and his grandfather had developed mobility problems that made it difficult to walk the neighborhood as he once had. From Guowei's vantage, then, the changing social conditions of the neighborhood mingled easily with the onset of physical limitations as part of the historical narrative that explained his grandfather's current health status. And, like many of the people I got to know in Guangzhou, Guowei did not distinguish between the psychosocial and physical when describing that status. Instead, his grandfather's isolation was evidence of poor mental and physical health (*jingshen shenti buhao*); the two were not thought apart.

Conversations with Changpu and Guowei underscored the extent to which loneliness was not simply a discursive and psychosocial idiom through which anxieties and distress about the decline of Confucian moral order in contemporary familial relations could be expressed. Instead, as subsequent ethnographic work with retirees bore out, it was an irreducibly heterogeneous phenomenon, involving ideas and processes as disparate, for example, as emplacement—the social, material, and sensible features of a particular locale that confer a sense of belonging and familiarity on individuals—housing policy, and physical decline within the framework of unique life trajectories that nevertheless shared a set of local cultural and historical commonalities. The unhappiness and dislocation Changpu's parents expressed, for example, could be traced to the severance of everyday social ties as a result of their move, as well as to an alienating unfamiliarity with the food, customs, and language of their new home. It is, moreover, clear from Guowei's story that one didn't have to move several hundred miles to experience such dislocation. As Ikels found, policies designed to privatize the housing stock in Guangzhou resulted in longtime neighbors and coworkers either being reassigned to or purchasing housing in far-away neighborhoods, thus accelerating the fragmentation of social groups organized around work units (*danwei* in Chinese) during the Maoist era (Ikels 1996, see also footnote 9). In addition, they led to increases in average indoor living space per person, thereby eroding Liwan district's typically public domestic life, which had resulted from severe space restrictions during that same period that forced residents out-of-doors or into shared areas for activities like preparing food, laundering clothes, socializing, and even sleeping (Zhang J. 2005).[13] These local, material manifestations of China's sweeping privatization policies under Opening and Reform utterly transformed the social and material constitution of Guowei's grandfather's neighborhood, rendering his inhabited world strange and converging on his declining ambulatory power to contribute to a situation which he grew increasingly isolated.

Considered together, these conversations also underscored how easily one could misunderstand loneliness without attending to firsthand experiences of it, regardless of how familiar one was with the local social context and individuals involved. Changpu's misguided attempt to intervene in a situation he believed left his parents feeling lonely reflected an assumption, shared by Jiahui and her friends, about his duties with respect to the normative expectations of familial piety and the emotional impact his failure to meet those duties would have on his parents. His story resonated with my own inability to understand Mrs. Ke's appreciation of peer relationships during the conversation recorded at the

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[13] It is difficult for me to imagine how public spaces in Liwan must have been inhabited before housing reform if, as Zhang Jun suggests, many ordinary domestic activities that used to be carried out in open spaces have now moved behind closed doors. As an American whose formative years were spent in a fishing village on a tiny, overgrown island in the Atlantic, and whose nearest neighbor was a few woody acres away in any direction, I never quite overcame a sense of surprise at the range of my neighbors' activities in public. The most vivid memory I have of this is when, on an early morning run along the northern bank of the Pearl River, I stumbled upon three old men sitting on concrete stairs descending into its waters, soaping up in preparation for a bath.

beginning of Chapter 4. Having already discussed her traumatic experiences during the Cultural Revolution, when she and her husband were harassed daily by neighbors and Red Guard soldiers owing to their employment at an American missionary-run hospital and consequent bad class background,[14] I found it unthinkable that the peer sociality that was once a source of such capricious and abject suffering could later bring her comfort and belonging. It resonates, too, with the many American physicians and epidemiologists I've spoken to about this dissertation since returning from fieldwork, who, upon learning of my interest in loneliness, invariably respond, "I had no idea that was a problem in Asia—they're so family oriented."

Each of these instances is an example of what Michael Jackson refers to as an "epistemological error," the attribution of an inevitable meaningfulness or ontological force to the cultural norms and historical events that shape individual experience ((Jackson 2007:82)). Instead, Jackson argues, recalling Kipnis's position on subjectification, "cultural experience is neither inner nor outer, but an emergent property of the two," and exhorts social scientists to attend to the "'potential space'… in which every individual negotiates… his or her own particular compromise between what is given and what he or she effectively brings into being" (81). If loneliness, as a culturally mediated phenomenon, is contingent on interpersonal relations, socio-cultural processes, discursive forms, built environment… and so on, then it is also an outcome of individual and group agencies-- the relative valuation older urban Chinese place in the here and now on, say, multigenerational households as an expression of filial piety or historical traumas suffered at their peers' hands. It is the outcome of strategies they have developed for negotiating interpersonal and social contexts and the experiences their beliefs and actions bring into being.

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[14] "*Siwu nian meitian bei rao le, ranhou meishi*"

Experiential knowledge of loneliness may not explain its connection to the psychobiological pathways that lead to systemic inflammation or arterial hardening, but, if we are to follow Jackson, it is critical to understanding the shifting assemblages of sociogenic pathways, cultural values, and human actions that produce, mitigate, or prevent loneliness. Without such knowledge, even the best-intentioned interventions may lead to two sets of elderly parents living far from home, unable to speak to one another, alienated and unhappy in their children's presence.

IV. Retiree Community Centers: "Potential Spaces" of Community-Making and Relations of Belonging

Six weeks after arriving in Guangzhou in early January 2014, I finally received the letter of affiliation I'd been waiting on from Sun Yat-sen University (*Zhongshan daxue*), a local institution with nationwide prestige whose endorsement would facilitate my research. Letter in hand, I slowly wound my way down the worn, narrow sidewalk of Enning Road toward the Liwan district headquarters of Guangzhou Health and Happiness Association for Respectable Elders (*Guangzhou zunlao kangle xiehui*), stopping every now and again to step carefully over ancient, gnarled tree roots that had irrupted through the pavement. The damp winter air hung thick with particulate and carried an unmistakably metallic taste. An unfavorable, if not unusual, combination of winter weather patterns, high manufacturing volume in surrounding industrial areas, and increased use of coal-burning stoves to combat the current cold snap had caused the district's typically poor air quality to deteriorate even further. It now registered, I'd joked in an email to friends back home that morning, "apocalypse purple," according to the US Consulate's color-coded air quality index.

Nevertheless, the narrow street teemed with life: Wiry men whizzed by from every direction on decrepit three-wheeled bikes fitted with plywood beds to haul outlandishly large loads of construction materials, or commercial products, or bushels of dried foods I stood no chance of identifying. The uniform metal doors of cramped shophouses lining either sidewalk were rolled up to reveal hawkers selling all manner of cheap goods, often with small children at their sides. *Majiang* crowds, with their telltale cigarette smoke and vibrant commentary, spilled out of the hidden neighborhoods whose labyrinthine network of alleyways emptied into the road. Old women in darned quilted coats shuffled to and from the open-air market up ahead carrying small plastic bags to hold freshly butchered meat for the evening's meal. Apart from the near-ubiquity of surgical masks, there were few signs that the day's abysmal pollution had impeded the commercial and social lives of Liwan's residents, rooted as they seemingly continued to be in public, open-air spaces. People simply did what they could to protect themselves, then got on with things.

After a moment's hesitation that morning, I too had decided that the chance to get on with things was worth risking the consequences of being exposed to such bad air. I'd visited the Health and Happiness Association headquarters once before. Eighteen months earlier, during a preliminary summer research trip to the city, I decided to drop by unannounced, despite having been warned that I wouldn't get far without a proper introduction and letter of sponsorship from a Chinese academic institution. The skeptical expressions with which staff members had greeted my efforts to introduce myself that summer quickly confirmed the soundness of this advice. Ever since, despite making exciting advances in my Hong Kong-based fieldwork, my plans for research in Guangzhou had been in a holding pattern. It was frustrating, and had grown evermore so in the preceding month and a half, since I'd moved into an apartment just blocks away from the headquarters for the express purpose of doing research there. I finally had the letter; I was lonely and behind; it was time to get moving, PM2.5 count notwithstanding.

As I rounded the final bend before the row of *qilou*[15] housing the headquarters, my heart began to race. I reached the building, pushed open the creaking wooden door, and made my way up a dark staircase to the third floor. Since my last visit, the wall opposite the third-floor landing had been painted a soothing mint green and stenciled with cartoons of smiling young children. Above them, pink and purple characters announced, "New Baby-Friendly International Early Education Center" (*xin aiying guojie zaojiao zhongxin*). Blinking, I checked the address I'd recorded 18 months earlier against the map on my phone, then the placard on the front door-- this was the spot. I wandered into a neighborhood nestled behind the row of *qilou* and flagged down an old man sweeping the street with a crude straw broom. "Excuse me," I asked, "But do you know where the Guangzhou Health and Happiness Association for Respectable Elders is?" He cocked his head inquisitively. "Sorry, I'm looking for an elderly community center (*laoren huodong zhongxin*) in this area—do you know it," I tried again. "Elderly community center," he repeated, "Do you mean the one run by Starlight (*xingguang ban de)*?" "No, the Guangzhou Health and Happiness Association for Respectable Elders." He hadn't heard of it.

It took another week of anxious waiting and much help from Ryan, the postdoc in Dr. Bedford's research cluster to whom I had grown close, to sort out what had happened to the original center. Ryan spoke to a few Guangzhou-based GBCS epidemiologists responsible for liaising with the

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[15] A type of building unique to Southeast Asia, including Guangdong province, that incorporates Western-style architectural features—most prominently, an arcade—into traditional shophouses (Zhang, J. 2015: 25).

Health and Happiness Center's staff to track cohort members, who clarified that several of the centers in Liwan had undergone an administrative change. It turned out that affiliates of the Starlight Program, which, I later learned, was a nationwide initiative to provide community-based support services for the elderly, had indeed recently assumed responsibility for the center I'd previously visited, and in doing so moved it to a location within the neighborhood abutting Enning Road.[16] Ryan wasn't sure what had prompted the change or what it entailed, but he was able to give me an updated address for the old Health and Happiness headquarters as well as that of another community center in Fangcun, an area of Liwan southwest of the Pearl River, that had also been involved in recruiting the original GBCS cohort.

By happy coincidence, Mrs. Ke had invited me and a visiting friend from graduate school to her home in Fangcun for dinner the evening Ryan passed along updated addresses, so we decided to drop by the center near her home beforehand. We found the narrow, single-story building that housed it a block and a half from the Fangcun metro station, just off a main thoroughfare, obscured by leafy trees. We opened a side door and entered a dim spacious room divided by a pony wall, to the left of which sat a long wooden table under a row of high windows. Beyond it hung an enormous bulletin board covered inch for inch with brightly colored flyers. The space to the right of the wall resembled a communal living room; at the far end, an old TV perched on a metal shelf sat next to a freestanding magazine rack hung with periodicals. An older man and woman had drawn two of the many worn folding chairs dotting the space's perimeter close to the television and, hunched forward, were engrossed in a program. "Hello?" I asked loudly. The man swiveled around with a look of surprise and I scrambled to introduce myself, holding the letter

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out in supplication. He crossed the room and read it with a furrowed brow, then, looking up, smiled broadly and motioned for us to sit at the table.

After serving tea in small paper cups and offering a cigarette to my friend, who, being male, was the appropriate recipient of such a gesture of hospitality, the man introduced himself as Mr. Li, manager of the center. He had been born 63 years earlier in northern China and spent much of his adult life as a member of the CCP, working in local government in Guizhou, before defecting from party and country in the late 1990s to pursue jade mining interests with former military friends in Burma, now Myanmar. It so happened that my friend was visiting from Myanmar, where he was doing anthropological research in a region popular with Chinese mining entrepreneurs. As the two men found common ground in their shared experiences abroad, Mr. Li began to relish his storytelling, making long, interesting digressions into such topics as the political and logistical challenges of mining in Burma and common causes of jade price fluctuations. He eventually explained that after having had mixed success in extraction, he decided to follow his adult son to Guangzhou, where he would try his luck at the distribution end of the jade market, working as a middleman for friends who continued to run mining operations. His wife had immigrated to Guangzhou several years before him to help their son and daughter-in-law with childcare, so the move would allow them to reunite. Mr. Li and his wife now lived with his son's family in an apartment the son had purchased in a newly constructed high-rise nearby.

Though Mr. Li had renounced his membership in the CCP years before, he continued to show interest in the work of local governance, and upon moving to Guangzhou befriended various grassroots authorities in his area. It was a friend in his neighborhood's street office who had asked him to serve as the day-to-day manager of the community center on a volunteer basis two years earlier. Before accepting the post, Mr. Li had not been a patron of the center and, as far as he knew, it had always been part of the Starlight Program; he had not heard of the Health and Happiness Association. In Mr. Li's telling, the center functioned predominately as a recreation and social support organization for retirees from the surrounding area, in collaboration with the local community committee charged with providing care and support services for the elderly and disabled, and ultimately under the auspices of the neighborhood street office. At the time in 2014, the official retirement age was between 50 and 55 for women and 60 for men in China's urban areas. Unlike the Health and Happiness Association, whose members were assessed a nominal yearly fee, retired residents of Fangcun could use and attend events at the Starlight Center for free; the center's operating costs were funded largely through the China Welfare Lottery in combination with municipal grants. However, one had to meet additional criteria to qualify for the center's subsidized home care services, which were intended for infirm elderly with meager finances and no family support. Such persons were referred to the center by the community committee.

Mr. Li estimated that fewer than 20 people had been recipients of home care services during his tenure as the center manager. Common examples of such services included the subsidized procurement and delivery of home goods, food, and medicines to non-ambulatory or convalescing persons. Most recently, Mr. Li had arranged for the purchase and installment of a telephone for a disabled widow. The center also worked with Ministry of Health officials, semi-municipal volunteer organizations, and private agencies or freelance workers to arrange long term medical care and domestic help at a subsidized cost, as well as social visitation. While social workers, nurses, and professional domestic workers were involved in long term care provision, much of this support work was performed by volunteers recruited through the center—an example of younger or healthier retirees caring for their less fortunate peers. These volunteers delivered needed items and services—the widow's telephone, for example—on an ad hoc basis and also engaged in certain activities, such as social visitations, regularly. When necessary, members might also alert Mr. Li to a vulnerable older person who may be in need of services; he, in turn, would refer the case to the elderly welfare committee for evaluation. It is worth noting that committee was also staffed entirely by volunteers, most of whom were also retirees.

Most of the center's work, however, revolved around its designation as a social and recreational space for retirees. This work included formal group activities such as life-long learning classes in everything from computer fluency to calligraphy; wellness seminars and free health checks run by clinicians or nurses recruited from Fangcun's public hospitals; daytrips to historic sites and other points of interest organized by companies belonging to the city's budding domestic tourism industry; and even counseling sessions run by municipal social workers. It also included informal group activities such as movie and television show screenings; park outings for exercise, opera or music troupe performances, or even patriotic sing-alongs; and majiang and other games of chance. Center patrons were also free to use the space to read, watch TV, and socialize as they pleased. While center affiliates from the elderly welfare committee and semi-municipal organizations worked with Mr. Li to organize many of the formal group activities, center patrons would also arrange them from time to time. Mr. Li recalled one patron who enlisted her son, a cardiologist, to run a seminar on heart health for the center. Another invited a Ministry of Agriculture-linked State Operated Enterprise (SOE) that specialized in apiculture and offered perks of increasing value, including free daytrips, in exchange for quarterly, monthly, or biweekly purchases of their food products, to make a presentation touting the various health benefits of honey. The informal activities were almost uniformly organized by center patrons and usually involved groups of friends, many of whom had introduced each other, chain-like, to the center, agreeing to do a certain activity at a given regular time.

In Mr. Li's telling, a couple of hundred more-or-less hale retirees, ranging in age from early 50s to late 80s, had participated in these activities over the course of his tenure. And while some did make a habit of using the space for independent reading or TV watching—particularly those who sought refuge from sweltering homes at the height of Guangzhou's tropical summer-- the great majority of patrons preferred to join the group activities, suggesting the centrality of this form of peer sociality to the character of the recreational space. Anecdotally supporting Mr. Li's latter assertion was the fact that, besides him, only one person was at the center when we arrived late that afternoon, a time when group activities were unlikely to be scheduled owing to the conventional rhythms of domestic life. As I later learned, this apparent preference for peer group sociality and activities for retirees was in fact capitalized on by the Starlight Program's policy directives as a means to enhance the wellbeing and welfare of older Chinese. Sociologist Zhang Hong reports that the program, which was established in 2001 at the direction of the central government to provide funding for the improvement of community-based care services and facilities for the elderly, included a provision earmarking "13.5 billion yuan" for the construction of "32, 490… community centers for elderly people [nationwide], where people can have a rich social life." Notably, Zhang finds these facts and figures in an August 6, 2004 China Daily article about the Starlight Program entitled, "Helping Seniors Feel Less Lonely " ((Zhang 2007)).

Later that evening, as I described meeting Mr. Li to Mrs. Ke and her husband over dinner at their home, I grew curious as to why they didn't use the community center. After all, Mrs. Ke clearly valued the opportunity to engage in group activities with her peers as a way to mitigate the threat of being lonely and to reap the benefits an active social life carried for her health and overall sense of wellbeing. "Ah, we don't need it," she laughed in response. Both of the couple's sons had emigrated out of the country for graduate school, the eldest leaving in the late 1980s and the younger following a few years later. Neither had chosen to return, instead turning New York and Toronto, respectively, into their adoptive homes. As a result, for the past quarter century, Mr. and Mrs. Ke had been tasked with developing and maintaining active, purposeful lives and meaningful relationships without the option of being intimately involved in the daily lives of adult children and their budding families. This was long before the decline of multi-generational households, and its impact on the normative practices of filial piety, became a cause of national concern, or the municipal government began investing in facilities designed to foster community for China's burgeoning population of retirees.

Mrs. Ke had retired from her position as a nurse in a public hospital in Guangzhou at the end of the 1980s, right around the time her older son left for New York. Her husband, a well-respected doctor at the same hospital, stayed on for another decade, long past the official retirement age for public employees at the time. Mrs. Ke struggled at first with boredom and a sense of listlessness, which she learned to assuage by continuing to cultivate friendships with other retired women she knew from her work unit, as well as by preoccupying herself with her younger son, who was single and enrolled in a local university at the time. After that son left for Toronto, she became involved in one of her neighborhood's residents' committees, but found the group tedious to work with, and, preferring to socialize with people she and her husband knew from the hospital or through more casual interactions in the neighborhood where they lived, soon quit. Born in Vietnam and raised mostly in an orphanage on Hainan Island, she had no extended family of her own to visit, but by the early 2000s both of her sons had established successful careers abroad and were able to fly her out for extended visits with their budding families. Once her husband finally retired, he joined her on these visits. However, according to Mrs. Ke, the two never seriously considered emigrating themselves. Instead, with their sons' help, they bought a new apartment in Fangcun, just across the river from where they'd lived in Xiguan (the northwest area of Liwan district), and continued to exercise, eat, play majiang with acquaintances from work and their neighborhoods, as the compositions of those groups changed around them.

Mr. and Mrs. Ke's situation was relatively unique amongst the retirees I met in Guangzhou. They were very well-educated and had an extremely broad range of interests. Mr. Ke, for example, harbored a deep love of literature and read avidly; he even once showed me his Chinese language copy of an Ibsen anthology in hopes of discussing the plays with me and looked more amused than disappointed when I told him I hadn't read any. They were financially comfortable, with stable pensions from the hospital and additional support from their immediate family (one son, in particular, had a lucrative job in finance) as well as Mr. Ke's extended family, which had natal ties to Guangzhou but many of whose members had fled the country around the time of the PRC's establishment. They were unusually worldly; Mr. Ke read English language newspapers online, and both had traveled extensively in their retirement. And there was something else: The orphanage in which Mrs. Ke was raised had been established by Protestant missionaries from the United States, and though she was reluctant to offer specifics, something about the religiosity of her early caregivers had stuck, because she was quietly involved in Guangzhou's Christian community, and even attended weekly mass at one of the churches nearby. Of all the retirees I met in Guangzhou, I felt closest to Mrs. Ke, and she generously shared much of her life, present and past, with me. But Christianity was a subject about which she never felt comfortable opening up.[17] Nevertheless, she did give me the impression that her cautious involvement with the local Christian community in later life, as it became safer to do so, may have offered an additional means of coping with the felt threat of loneliness.

Though the specifics of Mr. and Mrs. Ke's shared biography were unusual amongst the retirees I grew acquainted with in Guangzhou, nevertheless the characterization that emerged from their stories of later life as a period marked by intensified, ongoing efforts to cultivate meaningful connections with persons and groups, real and imagined, to achieve a sense of purpose and belonging, resonated strongly with the way in which those I met in the community centers described in. And, as I'll show in greater detail in the following section, a common set of events or conditions shaped Mr. and Mrs. Ke's efforts to do so. Retirement, changes in housing and neighborhood composition, absentee children, the waning significance of political units such as the *danwei*, or work unit, and neighborhood committee, that once dominated public and, to a great extent, even private life—these are the recurring tropes that structured individual narratives of the profoundly transformed world in which retirees' quests for identity, meaning and belonging in later life unfolded (Kleinman 2006). Mr. and Mrs. Ke were able to use their finances, learning, rapport with co-workers and occupational status, considerable overseas network, and exposure to American missionaries as resources through which to cultivate membership in new social worlds, be it the imagined community of English language fiction and newspaper readerships, the transnational networks of family, mediated by new technologies like Wechat's video call feature, which allowed for a type of distance-collapsing immediacy of

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communication still unimaginable when their first child moved across the world, or the moral community ratified and reproduced through the weekly ritual of collective Christian worship.

For other retirees I met, the community centers themselves were a primary means through which to cultivate such social worlds in response to their fragmented and reassembled social contemporary. In this sense, such centers constituted both a physical and figurative "space," to recall Jackson, where retirees could, collectively and as individuals, "negotiate" the givens of their transformed world, drawing from shared histories and intimate knowledge of past social forms and cultural values, to bring into existence new, prosocial ways of inhabiting that world. The cultivation of peer relationships was not simply incidental to this adaptive work; instead, as I show in the following three stories, which illustrate different kinds of activities through which this re-worlding work occurred, participants were motivated to advance not only their own quests for belonging, purpose, and community, but also those of their peers. Hence, I argue, the work that unfolded in the community centers was animated by an ethic of peer caregiving that was at once a response to, and integral part, of the sociality of loneliness in retirees that standard epidemiological measures and commonsense framings fail to represent.

V. Three Stories: On Memory, Dance, and Health

Memory:

It was early April, a mere six weeks after the raw winter day on which I'd first met Mr. Li, and already the wet heat of Guangzhou's creeping subtropical summer gave its air a quality of visual distortion, blurring the outlines of objects in motion as if they were traveling through something viscous. The hot air was invasive, seeping through doors and windows to pool in the darkened interiors of rooms that offered little shelter from it. Next to me, Mr. Li wiped his brow and offered to refill my cup of water from a large electric kettle on the commode beside him. Cold water, even under such conditions, was unthinkable—it was, Mr. Li explained, bad for digestion. Overhead, a crooked ceiling fan turned languorously. I shifted in my wooden chair, uncrossing a leg to send the sweat accumulated behind my knee cascading down my calf. I tapped my foot quietly to stay awake. Finally, the front door opened. Three women in their mid to late 80s entered and walk slowly over to the long wooden table where we sat, chatting loudly as they went. Mr. Li greeted them happily in his broken Cantonese and rose to pour their tea. Each woman carried with her an old family photograph; some of them dated to before the establishment of the People's Republic. A social worker, young and female with a bright face, entered from the adjacent kitchen carrying a large platter of dumplings and several small bowls. She set the food in front of the women as they settled into their seats, arranging their photographs with care in the center of the table before serving themselves from the platter.

Mr. Li had invited me to attend what, for lack of a better term, I described in my fieldnotes later that spring day as a "counseling session," designed to allow community center members to reminisce about events in their past with the aid of material relics that, I mused when I first saw them, like Proust's madeleine, might return their bearer to a life and self otherwise no longer accessible. Or perhaps, I considered, the point was the undeniable materiality of the objects, offering a kind of solid, publically ratified existence to events and beloved persons otherwise confined to the spectral realm of private memory. When he issued the invitation, Mr. Li had offered by way of explanation for the session only, "Nobody wants to listen to us old people," before assuring me that, although the weekly gathering was open to all members of the center, only those in their 70s and 80s ever showed up.

As the women ate, Mr. Li made introductions, explaining that I was an anthropologist from Harvard who was interested in China's aging population. Next to me, Jackie, a 20-yr-old Guangdong native and student at [what was the name of the vocational school he attended?] who I'd hired as a translator, chimed in, "She wants to know how you protect your health" before repeating the whole exchange to me in Mandarin.[18] The women looked confused, so I quickly explained that Mr. Li had invited me to sit in on their a group meeting as a way to understand what kinds of activities center members were involved in, and that I was happy to leave if they felt my being there was an inconvenience. This time, the social worker, Ms. Jin, cut Jackie off before he could translate, turning to face the women to do so herself in a slow, loud voice. The women leaned in, listening carefully to her explanation before facing me with looks of friendly curiosity. Aunties Lam, Wong, and Hui, Ms. Jin explained, were happy to have me sit in, though they couldn't understand why anyone—let alone a foreigner from a prestigious American educational institution-- would be interested in hearing their stories.

At Ms. Jin's prompting, Auntie Hui retrieved her family photograph from the center of the table and opened the session, identifying who the persons were and how they were related to her—siblings, mother, father, paternal grandparents-- before giving voice to selected memories of them. Auntie Hui's stories revolved notably around episodes of political violence that befell her family in the late 1930s and 40s and bookended the period in which the photograph was taken.[19] All but the youngest of her siblings featured in the photograph had, by that time, endured the acute violence and daily hardships wrought by the Japanese seizure of Canton during the Second Sino-Japanese War; in the years that followed, her paternal grandfather and father were

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[18] Explain why you needed a translator especially for the older population in the community centers.
[19] Auntie Hui could not remember the exact year in which the photograph was taken but believed it to be sometime in the early 1940s.

disappeared in connection with political purges that accompanied the CCP's rise to power in 1949, while she, her mother, and her siblings were forced to flee their family home in the middle of the night. She remembered her mother's hands trembling as she ushered the children out of the front gate.

As Auntie Hui continued to recall details of the violence that rent her family asunder, Jackie's translations grew slow, and finally stopped. "These are difficult things to talk about," he explained apologetically. I told him not to worry. I was recording the discussion and could have someone translate it later; I didn't want him to do anything that made him feel uncomfortable. We sat quietly for the rest of the session, with Jackie slumped low in his chair, head down, disappearing into a game on his phone that was all crudely animated creatures and primary colors and excessively punctuated point notifications in soft bubble characters.

When I finally had the recording of the aunties' stories transcribed, I was able to understand Jackie's reticence more readily. What the women described *were* difficult things—the violent loss of family and home, the grinding anxieties of extreme social upheaval and economic and material privation, the decompensating effects of abrupt and total political disenfranchisement. Such experiences animated their stories with a striking vividness that suggested the women needed no mnemonic to recall them or to imbue them with the force of reality. After the session ended that day, Ms. Jin had helped me to ask a few general questions based on what little I understood of the activity. Most pressingly, I explained, I wanted to understand why the women participated—what they hoped to get out of it. "It's important to remember one's family," Auntie Hui had responded simply.[20]

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[20] Per Ms. Jin, "*Juanhuai zuxian hen zhongyao.*"

It did not stretch the imagination to interpret her response within the Confucian framework filial piety. But sitting around a table eating dim sum and recalling the terrible fates loved ones had suffered stuck me as a different kind of engagement with kin and past than the more formal and family-bound rituals of ancestor commemoration facilitate. No doubt, publicly recounting these memories constituted a form of care for their loved ones and, as such, enabled the women to realize the self-affirming role of filially pious daughter and granddaughter. And, at the same time that it allowed them to reproduce and, in a sense, belong to, a social world constituted by kinship ties and organized around Confucian values.[21] But traditional Confucian and ancestral worship practices offered these same opportunities, and an explanation that relied entirely on a Confucian framing could account neither for the kinds of memories, of violence, of suffering, the women dwelled on, nor for the intensity with which they recalled them. Equally important to the session, then, seemed to be the opportunity it provided the women to acknowledge and affirm through interpersonal exchange the ongoing impact of a world in which such terrible experiences could occur.

I thought back to Mr. Li's pithy explanation of why the center organized such opportunities for recollection, to Jackie's evident discomfort, to the women's puzzlement over my interest in their group, and I wondered who, if not each other, could or would do the work of responding to and affirming such memories and the needs attendant on them. The zeitgeist of contemporary China is inflected with the future temporal; students and working age adults are looking ahead, striving to achieve Xi Jinping's Chinese dream of personal material comfort and global geopolitical

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[21] For more on memoralization as a form of caregiving, see Lisa Stevenson's Life Beside Itself: Imagining Care in the Canadian Arctic.

ascendance. Given this environment, it is no wonder, as Mr. Li and the women insist, that few show abiding interest in their memories of the nation's tumultuous past. The women's shared historical experiences provided a common ground on which to stake out a social space for memoralization that other important relationships in their lives—for example, with their children or grandchildren, the latter of whom would have been reasonably close to Jackie in age—may have lacked. From this vantage, it appeared that the women's geographic and generational ties played a crucial role in the politics of social memory surrounding painful lived experiences of the Second Sino-Japanese War and establishment of the People's Republic ((Jing 1996)).[22] By coming together to collectively recollect these events, Auntie Hui and her friends drew not only on Confucian ideology and practices to care for their deceased loved ones, but also to create a situation in which they could care for themselves and, crucially, each other in the present. In the process, they produced an empathetic community of peers in which their defining experiences from a markedly different era and local world would continue to matter.[23]

Dance:

I hurriedly half-jogged down Longfeng West Rd in a state of heightened alert, checking for bicycles and scooters as I bounced between sidewalk and street to overtake the pedestrians in front of me. I was late to meet Mrs. Kuang, who had agreed to wait that morning at the entrance of Liwan Lake Park so that we could walk together to the spot where her dance group gathered weekdays at 9 am after their grandchildren had been dropped at school. Mrs. Kuang was a

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[22] Of course, there are plenty of popular media sources in China documenting Japanese atrocities during the Second Sino-Japanese War. However, what I'm interested in here is a form of social suffering in which interpersonal relations and communication provide acknowledgement and a sense of affirmation to those in whose memories such events continue to figure prominently. While seeing tales of Japanese violence may do some of this work, it's not clear that it shores up the self and provides a sense of empathetic community in the way that another person listening and responding to one's experiences can.

[23] Another, less explicit, example of this kind of social memory work came from the other community center where I did fieldwork. There a group of younger retirees, mostly in their late 60s and 70s, would meet at a nearby park in the mornings to sing patriotic songs from the Maoist era.

member of the Xiguan community center off Enning Road that I'd initially failed to find in the winter of 2014. When, in the days after meeting Mr. Li, I finally managed to find the Xiguan center at its new address, Ms. Kuang had quickly taken me under her wing, promising to invite me along to the many activities she and her friends from the center organized for themselves. In the months that followed, she had invited me to meals, opera outings, card games, even a weekend trip to an eco-tourism area south of the city. However, most often, we danced. On this morning, I'd just returned from a three-week trip home to Boston and hadn't been dancing in over six, so worried that I may have forgotten where to meet the group inside the park. As I drew near the entrance, Mrs. Kuang called me over eagerly and had already turned to head inside by the time I caught up to her and I offered a breathless apology.[24] "These no need to be polite" she said, batting it away before adding, "Have you eaten? You look like you've lost weight—you're too thin!" And with that, we picked up where we had left off.

Mrs. Kuang and the members of her dance group, 12 retired women in their late 50s and early 60s who lived in Xiguan areas close to the Enning Rd. center, had grown to be something like surrogate caregivers for me in China. They fretted over my health, where I lived, my ethnographic project and how I was getting on in the country, which, they felt unanimously, was a difficult place for a foreigner to grow accustomed to. Most intensely, they worried my marital status. As a single, childless female academic in her 30s, I was a stereotypical *shengnu*, or leftover woman, and they feared that I was trading my future happiness as a mother and wife to spend time with old women for a project that made little sense. More than one had offered to introduce me to a nephew in Beijing who, they had been quick to note, was tall, employed in a

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[24] Liwan district was far from the financial and metropolitan centers of Guangzhou and, as a result, few foreigners spent any time its neighborhoods. With my strawberry-blonde hair, blue eyes, and prominent nose, I wasn't difficult to pick out of a crowd.

good job, and owned his own home. So focused were they on their concern for me that I'd initially found it difficult to lean anything about them; it was only after several joining them on several outings to the park that they finally felt confident enough in my wellbeing and safety to talk about their lives at all.

When Mrs. Kuang and I reached the rest of the group that morning, it was clear their concern had not abated in my absence; if anything, it had grown. They asked about my mother and her terminally ill partner, whose declining health, they knew, was the reason for my trip, and wondered whether I had found time to reconnect with my former boyfriend. I gave them a quick update as we moved into formation, spreading out in rows of four persons until we had created something like a human square. Up front, Mrs. Kuang rose to face us after popping a CD into the battery-powered boom box sitting on the ground behind her. Familiar slow, tinny music wafted out as Mrs. Kuang turned rhythmically in place, trailing one extended arm gracefully in her wake. The group fell quiet and began to follow Mrs. Kuang's movements with varying degrees of precision. To my left, Mrs. Zhu gave a nod of encouragement as she executed each step with an air of habituated comfort; behind me, Mrs. Luo swayed in place, arms clutched crosswise across her chest, eyes shut and face toward the sky, humming softly to the song.

We danced in relative silence for a few songs, until Mrs. Pan, in the front row, abruptly called out an inquiry about Mrs. Chen, who was missing from the group that day. "Her husband is still sick," Mrs. Zhu responded, prompting commentary from several others. Eventually I gathered that her husband had recently been released after a two-week hospitalization, and that Mrs. Chen was now struggling to care for him as well as her young grandchild, whose parents worked long hours and relied on Mrs. Chen heavily for domestic support. Her friends felt the burden was too much for Mrs. Chen and worried it would take a toll on her wellbeing (*jingshen*). Indeed, Mrs. Zhu had visited the home two nights earlier to deliver a meal she'd prepared and concluded from her low spirits that it already had: "It's not good for her health to sit inside all day; surely she can leave him alone for a few hours in the morning." A consensus emerged that the husband and adult children were too demanding, and that Mrs. Zhu should return to the home later that day to encourage Mrs. Chen to join the dance group in the park the following morning. With that, the hour was up and the women began to disperse, many heading home to take care of housework or to a market to shop for the day's meals.

Much has been written about the historical, cultural, and explicitly political dimensions of public dancing Mrs. Kuang's group engaged in, which is known as *guangchangwu*, or square dance, in reference to the fact that it entered popular consciousness as an activity frequently held in the public squares that were a standard feature of urban construction projects of 1990s ((Seetoo and Zou 2016)Seetoo and Zhou 2016: 26). Journalist Guan Jun notes that the (mostly) older women who participate in this form of dance came of age during the hyper-politicized 1960s and 70s, and thus had been "intensely absorbed" in the Red Guard, the Sent Down Youth movement, and similarly totalizing mass campaigns that linked social action and identity tightly to the Mao's revolutionary nation-building project and its imagined beneficiary, the people ((guan 2014)Guan, J. et al 2014: 35). Guan and his co-authors read the dancing as an attempt to recreate collectivist social forms and activities in response to subsequent changes, including the declining importance of the socialist *danwei* as a primary unit of social life for retirees, an "inter-generational communication gap" between these age cohorts and those born after Opening and Reform, and the decline of the multigenerational household, that have left this generation feeling culturally dislocated (35.). Huang Yongjun offers an even starker analysis, linking their engagement in collectivist social forms specifically to this generation's efforts to repair a fractured sense of self (*duanliegan)* that resulted from the dramatic social and political upheavals they endured (Huang, Y. et al 2015: 26). Tracing the genealogy of collective dancing through ritualized performances designed to generate a sense of unity under the Maoist regime to earlier forms of collective work and play pre-socialist rural China, Seetoo and Zhou suggest that it offers a performative recreation of the social roles and values associated with a longer history of collectivism (2016: 42). Square dancing, these writers imply, ultimately meets the sensibilities of "a certain habitus inculcated… in the collectivist era that remains fundamental to the spatiotemporal practices of citizens…, the places they make," and, I would add, to their strategies for establishing a sense of belonging and purpose in the contemporary moment (Farquahar and Zhang 2012: 92).

Mrs. Kuang and her dance group all belonged to the generation these writers are concerned with, and hence were exposed to the same potentially dislocating effects of the economic reforms that decollectivized and depoliticized everyday day life in the post-Maoist era. Unlike other retirees of this era whom I met at the Xiguan community center, notably a group that held semi-regular gatherings to sing patriotic songs from their youth, these women didn't explicitly lament the end of the Maoist period or express feelings of epochal dislocation and loss. Nevertheless, it was clear from our conversations that square dancing was an important strategy for cultivating and reproducing satisfying relationships in response to subtler challenges presented by their status as relatively young, healthy retired women in the contemporary socio-economic order. Like Mrs. Chen, several of the women had retired from frankly tedious jobs only to spend an extraordinary amount of time and energy caring for grandchildren and attending to domestic needs of an adult child's family in addition to their own. Mrs. Luo, for example, had retired at 50 from her job as a low-level production manager at a state-operated clothing manufacture enterprise in nearby

Foshan only to find herself “serving as a domestic helper (*baomu*)” as she jokingly put it, in her son’s household six years later. While she clearly found purpose in helping to care her son’s fledgling family, she was also straightforward about the fact cleaning, cooking, and providing childcare on daily basis was a burden that could, at times, leave her feeling lonely and trapped within the domestic sphere. Dancing offered her a respite from this, providing the chance to broaden and enrich her social world by cultivating relationships with people who shared her interests and understood her ambivalent attitude toward her familial duties. Mrs. Shen, on the other hand, had moved to Liwan from Haizhu with her husband 18 months earlier, when her daughter offered them an apartment available through her husband’s work. The new apartment was much nicer than their previous residence, but the move away from the Haizhu neighborhood where they had lived for the last quarter century proved difficult, especially for her, as her husband still worked. Mrs. Shen sought out the community center and ultimately joined the dance group in order to cope with her feelings of isolation and create a social life for herself in the new neighborhood.

All of the women in the group had similar stories illustrating how they were able to cope with challenges that could have left them feeling isolated or socially diminished in part by deploying a collectivist form—group dance—to new ends. In other words, their experiences support the arguments set forth in the square-dancing literature reviewed above, and it is not my intention to challenge anything in that work. What I want to do instead is to highlight the acts of peer-caregiving that went on between members of the group and to suggest that such acts were fostered, in part, by interpersonal principles of mutual responsibility and concern for others invoked by square dancing and related collectivist social forms. In his study of small groups (*xiaoqu*) and political rituals in the early decades of the Maoist era, Martin Whyte describes the

CCP's strategy of grouping small numbers of cadres, students, and co-workers together for political study and ideological inculcation as part of leaders' efforts to replace family with nation as the basic unity of interpersonal loyalty in the country. The success of this strategy turned on generating feelings of intragroup solidarity and "mutual concern," such that participation in group activities enabled an individual to feel that he was "simultaneously doing things for others and the nation" as well as for himself (Whyte 1974: 16). This ethic of mutual responsibility and concern-- indeed, surveillance-- was fundamental to collectivist ideology and practice during the Maoist era, and there is no denying that it led to terribly dystopian outcomes, notoriously exemplified, perhaps, by the peer-on-peer violence of the Cultural Revolution or the zealous policing of women's bodies during the One Child Policy.

That said, I want to argue that it also carried the real potential to foster prosocial actions and attitudes towards one's peers, and that this potential was reflected in the involved concern the women in Mrs. Kuang's dance group displayed toward one another. One might plausibly read the group's determination to intervene in Mrs. Chen's situation out of concern for her wellbeing as an act of friendship, and in a sense it was. But the women in the group weren't uniformly old friends; while a few had known each other for some time, most had met over the past year or two through the community center. Their watchfulness over Mrs. Chen's wellbeing and willingness to intervene in her situation did not come from the sense of entitlement and familiarity associated with long-term friendship. Nor did this solicitousness occur only between members of the group who were old friends; over the course of eight months exercising with the women, I witnessed multiple examples of the group taking collective decisions to act on behalf of one member. When Mrs. Luo inexplicably disappeared for three weeks in the summer of 2014, the group dispatched Mrs. Kuang, the apparent leader, to cajole her into returning; when Mrs. Pan's schedule changed, making it difficult for her to meet at 9 AM, the group pushed back their start time by 30 mins. The very nature of the activity itself was defined as much by the dancing itself as it was by the gossip the women engaged in— anticipating and hashing out problems in their own lives and each other's— while doing so. Even the care they showed me, which surpassed talk to include meals, introductions to friends who might be helpful to my research, even, once, an escort to the airport so that I would not have to struggle through the metro with my overstuffed suitcases, reflected the attitude that because I was part of their dance group, I was, in some important sense, their responsibility.

In practice, this principle of mutual concern and responsibility constituted a powerful form of community-making, ensuring that women who were part of the dance group would not be left to their own devices when faced with a set of circumstances that threatened them with isolation or a lack of the support of peers who could identify with the common challenges they faced as young female retirees. The women's responsiveness to such situations as they unfolded shaped the ever-changing social dynamic of loneliness by serving as its constitutive counterpart, reinforcing communal ties in precisely the situations in which the felt risk of loneliness was greatest. The Enning community center, in turn, constituted the physical and social space in which such peer groups could be formed, offering access to a community of generational cohorts outside of *danwei* association, length of neighborhood residency, and so forth, without raising economic barriers for those whose financial futures suffered under the pension reform of the late 1990s.

Health:

The final story I want to relate involves Mrs. Hua, a 73-year-old woman I met in the Enning Rd. community center in April 2015, just two months before I left China. Like many of her peers in the Fangcun and Enning centers, Mrs. Hua was keenly invested in *yangsheng*, or "nurturing life," through traditional forms of exercise, dietary practices, the consumption of health information, and the cultivation of hobbies thought to promote health and wellbeing (Farquhar and Zhang 2012: 18). As Farquhar and Zhang suggest in their exhaustive study of such practices in contemporary Beijing, the culture of *yangsheng* is not limited in scope to health and happiness but constitutes something like the Aristotelian concept of the good life, incorporating a range of self-cultivation techniques that bolster physical wellbeing, enhance carnal pleasure, and promote the development of virtuous characteristics and spiritual health. This holistic approach to life cultivation, as well as the practices involved, have a long, if not linear, history in Chinese ethical traditions such as Confucianism and Daoism, as well as Traditional Chinese Medicine; they are inflected, too, by more recent develops under Maoist collectivism and contemporary Chinese socialism. Farquhar and Zhang's work suggests that such practices are a central strategy for Beijingers seeking stability in a constantly changing national order, and that their performance constitutes a virtuous social role for aging Chinese, insofar as the cultivation of health alleviates the burden aging adults place on the state and family and the visibility of health elders demonstrates the strength of the Chinese nation and culture (2012: 129; 145). Thus, *yangsheng* practices touch meaningfully upon issues of personal and social precarity; identity, purpose and self-worth; and the integration of traditional and contemporary orders—all things identified in this chapter as shaping the discourses and practices that surround loneliness and, more broadly, social self- and community-making efforts older Chinese.

It both bears mentioning and is not surprising, then, that *yangsheng* was broadly popular amongst community center members I met.[25] Mrs. Hua stood out in this regard, however, because of the way in which she incorporated peer-caregiving and a quest for purpose into the practice, tying these things explicitly to her struggle to stay socially engaged following the death of her husband. Mrs. Hua had been a member of the Enning community center for six or seven years, before it changed hands from the Health and Happiness Association to Starlight affiliates; several friends from her apartment block, where she had lived since the early 2000s, recruited her to join along with them. For years, she and her friends used the space primarily to socialize through informal leisure activities. The Enning Rd. center was much larger than the Fangcun and offered spacious, comfortable rooms in which to screen television shows, play cards, share meals, and escape the relentless tropical heat in summer. When her husband passed from lung disease in 2014, however, she found herself searching for ways to pass long stretches of the day she once spent caring for him. Neither of her children lived with her-- one had emigrated to Hong Kong with her husband; the other remained in Guangzhou, but had a busy family of his own, which managed to visit her twice weekly at most—so she had little to do apart from socializing with her peers.

An avid consumer of health and wellbeing literature, which she often passed along to friends along with instructions for daily habits or specific treatments to prevent chronic diseases commonly associated with aging, she began to think about organizing a health seminar for her peers at the community center. Resident committee members charged with overseeing the center occasionally enlisted social workers, nurses, or, less frequently, physicians, to present on a

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[25] I’ve chosen not to focus on yangsheng as such in this chapter in part because Farquahar and Zhang have done such a thorough job of exploring it, but also because I want to stay grounded in the narrower question of loneliness and the related mitigating social forms that aren’t represented in standard measures of it.

specific aspect of preventative health, but Mrs. Hua felt that she could contribute by sharing with her peers the everyday approaches to and habits for health and wellbeing promotion gleaned from the literature. She approached community center staff with the idea, who not only supported it but also donated a small amount of funding to cover expenses for things like photocopying instructional handouts. Mrs. Hua estimated that over 30 people showed up to the first seminar; their enthusiasm for it was so great that the center asked her to turn it into a weekly event. In time, the seminar transformed into something like a group study session, where members would come together to share information, discuss readings, or learn specific exercise techniques, in relation to a specific topic. At times, Mrs. Hua would ask another center member or even an outside expert to lead the meeting; or, when necessary, she would do it herself. Always, though, she took responsibility for organizing the event.

Fittingly, the topic of the session I sat in on was depression in older adults, selected by the municipal social worker who had been engaged to lead it that week. Thirteen community center members showed up to listen to her give a short presentation on risk factors for depression—with a strong emphasis on empty-nesters, how to recognize it, and what behavioral changes and resources were possible to prevent or alleviate it. The conversation that followed was lively and somewhat roving. One woman described her personal experience as an empty-nester, drawing lengthy commentary from the group. Another shared information from a self-help pamphlet she had brought along that listed specific techniques for maintaining spiritual balance, while a third pulled out his smart phone to pull up the popular Weibo account of a cheekily self-described "lonely granny." After the session had drawn to a close, Mrs. Hua reflected on its popularity with center members, quickly relating it to the impact it had on her own sense of dissatisfaction following her husband's death, saying: "After my husband died I found life unfulfilling, but promoting health is very important, especially for older folks." [26] Organizing health seminars allowed Mrs. Hua to transform her personal interest in and knowledge of health promoting strategies into something useful for others. In the process, she was better able to cope with the loss of her husband, filling the time she once spent caring for him with the important work of helping her peers to care for themselves and, by striving for health, the performative duty of caring for their families as well.

Significantly, her choice to do so through a self-organized study group, designed to share information that may empower aging individuals to participate more effectively in the project of preserving their good health, bears genealogical traces of the political study groups described by Whyte as having been engineered in the early decades of the Maoist regime (1974). And, as Farquhar and Zhang make clear, the practice of *yangsheng* by older Chinese does resonate with a national political project that emerged in the 1990s, which sought to encourage preventative health behaviors that would minimize the burden of chronic disease in the country's rapidly growing older adult population, in line with the WHO's emphasis on a utilizing a preventative framework for chronic disease in developing countries (2012: 128). Efforts to shift responsibility for health onto the individual also coincided with the dramatic retrenchment of the welfare state in the mid-1990s, including the privatization of the country's health care sector, which sent out-of-pocket costs soaring and effectively priced large swathes of the population out of the biomedical health care market (2012: 129).[27] These efforts, which included a propaganda campaign for which the Ministry of Health oversaw the promulgation of an onslaught of behavioral-based preventative health materials, including magazines and books in the style Mrs.

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[26] " *Wo laoban qushi zhihou, richang de shenghou bingbu manyi, ke baoyang shenti hen zhongyao, youqi shi baoyang laolingren de*."

[27] Most notably, the 1994 tax reform, which dramatically reduced central redistribution and devolved responsibility for budgetary funding onto provincial and municipal governments.

Hua so avidly consumed, were apparently somewhat successful. Farquhar and Zhang's finding, noted above, that elderly Beijingers they knew viewed personal health conservation as a kind of national duty to avoid burdening the state with the costs of their care resonates with the values frequently expressed by retirees I met in the community centers. Given this context, it may be that Mrs. Hua found a socially-validating role and established ties of belonging not only with the actual community of peers at the center, but also in relation to the imagined beneficiaries of her work at the national level.

VI. Conclusion

I suggested in the opening section of this chapter that the practices in which my interlocutors engaged could inform local public health interventions designed to decrease the experience of loneliness in older Guangzhou residents. As the foregoing ethnographic anecdotes suggest, a central feature of these practices is that they are not merely self-protective but deeply prosocial, organized around mutual acknowledgement and valuation of shared experiences, a willingness to be responsible for the health and wellbeing of another, and a belief in the firm link between self-care and care for another. Indeed, I have gone so far as to suggest that these practices are forms of peer-caregiving. As such, they are also instructive as to how one might begin to build a public health practice around an ethic of care, and the integral position that experiential forms of engagement and knowledge may hold in such a practice.

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