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Golden Age of Medicine 2.0: Lifestyle Medicine and Planetary Health Prioritized

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The 'golden age of medicine' - the first half of the 20th century, reaching its zenith with Jonas Salk's 1955 polio vaccine - was a time of profound advances in surgical techniques, immunization, drug discovery, and the control of infectious disease; however, when the burden of disease shifted to lifestyle-driven, chronic, non-communicable diseases, the golden era slipped away. Although modifiable lifestyle practices now account for some 80% of premature mortality, medicine remains loathe to embrace lifestyle interventions as medicine Here, we argue that a 21st century golden age of medicine can be realized; the path to this era requires a transformation of medical school recruitment and training in ways that prioritize a broad view of lifestyle medicine. Moving beyond the basic principles of modifiable lifestyle practices as therapeutic interventions, each person/community should be viewed as a biological manifestation of accumulated experiences (and choices) made within the dynamic social, political, economic and cultural ecosystems that comprise their total life history. This requires an understanding that powerful forces operate within these ecosystems; marketing and neoliberal forces push an exclusive 'personal responsibility' view of health - blaming the individual, and deflecting from the large-scale influences that maintain health inequalities and threaten planetary health. The latter term denotes the interconnections between the sustainable vitality of person and place at all scales. We emphasize that barriers to planetary health and the clinical application of lifestyle medicine - including authoritarianism and social dominance orientation - are maintaining an unhealthy status quo.

Key Words: Lifestyle, Health disparities, Medical education, Authoritarianism, Social dominance orientation, Non-communicable disease

INTRODUCTION

"*Lifestyle health risks represent a bottomless pit of incipient disease in family practice...in the well-organized office, no matter how busy, there are various strategies and methods by which physicians can raise their patients' awareness of lifestyle risks and deal with them during the average office visit*"

Shires and Hayward. Canadian Family Physician, 1979 [1].

Although infectious diseases remain a looming threat to humanity, the weathervane of global disease burden is pointing steadfastly in the direction of the chronic non-communicable diseases (NCDs); as stated by experts in glob-

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al health, the term NCDs may obscure the socially-transmitted, pandemic nature of these conditions [2]; the vectors include urbanization, industrialization, poverty, the widespread availability (and marketing) of unhealthy goods, and the often unjust structure of society [3]. The direct and indirect NCD-related costs to society–both financial and in loss of human potential—remain untold. Moreover, NCDs are part of grotesque socioeconomic inequalities, neoliberal philosophies, environmental degradation, disconnection from the natural environment, biodiversity losses, and climate change [4,5].

The dominance of lifestyle driven, socially-transmitted diseases over the last half-century has not been met with an adequate, responsive shift in the training and practice of physicians in western nations; despite awareness of this 'inconvenient truth' [6], institutional medicine (that is, medical schools and the representative organizational structures of 'medicine') remains committed to the primacy of biomedicines and technology. The response to the crisis of NCDs is found in the promise of 'omics', 'precision' and 'personalized' medicine. In North American medical training, the biopsychosocial model isn't taught from a utility perspective [7].

Coincident with the rise in interest in preventive medicine and a holistic form of health which considers root causes, the 1980-1990s witnessed an increased awareness of how individual and collective lifestyles (and the social forces which shape those lifestyles) impact the health of the planet. For example, Jonas Salk, famous for his groundbreaking polio vaccine, argued that the human body was an extension of the functioning whole of the external environments - including its biodiversity, social policies, and cultural practices; since humans are vitally dependent upon the health of the Earth's natural systems (which are, in turn, deeply impacted by human lifestyles), there is an urgent need to discuss the biological, social and cultural aspects of health from the *planetary health* perspective [8]. Thanks in part to the highly-publicized 2015 Lancet Commission on Planetary Health Report [9], the term planetary health has entered the mainstream lexicon; however, as with lifestyle medicine, the saliency of planetary health to 21st century healthcare remains distant from current medical training and practice.

Here, we will explore the history of the growing movement of lifestyle medicine and the related concept of planetary health. The latter term—defined as the interdependent, sustainable *vitality* of all natural and anthropogenic ecosystems (social, political and otherwise) —should be of high-level relevance to the goals of lifestyle medicine. Indeed, although lifestyle medicine and planetary health have not yet reliably found their common ground (certainly a work in progress [10]), we make the case that both are an ethical imperative.

ROADMAP TO THE CURRENT REVIEW

Here in our narrative review and commentary, we will focus on the importance of lifestyle medicine within in the context of planetary health (which we view as one-in-the-same). In order to emphasize this connection, we first explore the foundations of medicine's 20th century golden age, the history of contemporary lifestyle medicine, and the coincident rise of the planetary health concept. Next, as a surrogate marker of overall lifestyle medicine knowledge and active promotion of its tenets, we summarize recent studies which have examined nutritional (and physical activity) competency and/or consistent use in practice among medical students and physicians in western nations. It is easy to demonstrate that current physician preparedness and application of knowledge pertaining to the lifestyle aspects of NCDs is woefully inadequate; however, we argue that this fact is shrouded by the stubborn desire for institutional medicine to assure the public that medical doctors are trusted experts in all matters pertaining to health.

After briefly referencing the oft-discussed barriers to the uptake of lifestyle medicine and planetary health, we will turn our attention to an area of research—authoritarianism, social dominance orientation, Machiavellianism and threat to status—which has largely escaped discourse. We describe the ways in which these psychological constructs—individually and collectively—could permeate the power structures of western medicine; we argue that these constructs maintain a status quo which favors biomedicine (and relegates non-technical subjects considered 'soft') while at the same time vigorously protects the idea of physician as lifestyle authority and sees any challenge to this idea as a

threat to status. It is not our contention that these psychological constructs (at individual and larger scales) are the primary reason for the status quo; inertia and the daunting prospect of truly transforming medical training is likely a major contributor.

MEDICINE'S GOLDEN AGE

"We now live in a golden age of treatment and a dark age of preventive medicine. It is time that we express our national interest in efforts that will reduce the price we pay for permitting disease to debilitate its victim before we finally deal with it"

Senator Maureen Neuberger. 1966 [11].

In the quote above, taken from Senate Committee hearings on illness through the aging process, Senator Neuberger was referring to the inadequate prevention of chronic NCDs. Media reports on the 1966 hearings made note of the progress in conquering of infectious disease through sanitation, immunization and effective drugs, but pondered the inability of modern medicine to tackle the growing numbers of chronic, non-infectious diseases [12]. At a time of great social change, it was the beginning of the end of medicine's golden age.

In the first half of the 20th century, and especially during the 1950s, physicians described themselves as being in the golden age of medicine [13,14]; given the relatively rapid advances in surgical techniques, the development of antimicrobials and other drugs, and the 1955 announcement of the polio vaccine success (a zenith moment which galvanized the public), this golden age view, mixed in as it was with other remarkable scientific achievements, seemed entirely justifiable [15]. While institutional medicine-at-large basked in the glow of these achievements (and as we argue, still does to a degree), other discoveries (including Henry Beecher's landmark 1955 placebo research - the public revelation that "*Many a drug has been extolled on the basis of clinical impression when the only power it had was that of a placebo*" [16]), healthcare realities (the cost of an impending epidemic of 'diseases of civilization') and social currents (the questioning of institutions in general) were flowing below the surface. By the mid-1960s, a few 'rogue' physicians challenged the infatuation with the previous decades; distinguished cardiologist Wilhelm Raab MD provided the following admonishment:

"*It is only natural that the contemporary medical students' preceptors, whose generation had sponsored and created such dramatic developments, are still fully pre-occupied with the exciting achievements of their era. Thus, only little thought and even less action was and is being devoted by them to the comparatively dull subject of the mere maintenance of such an apparently commonplace thing as "health"...our future practicing physicians, whatever their special interests, will have to insist upon receiving instruction in the basic principles and techniques of practical prevention of the diseases of civilization - even at the expense of some less important theoretical and ultra-sophisticated diagnostic and therapeutic details. They must learn to preach, on every suitable occasion, the plain, common sense elements of health maintenance, and they must take upon themselves the difficult, but rewarding, ethical obligation to practice themselves what they preach*" [17].

Dr Raab's courage to speak out was notable; he organized the first international preventive cardiology conference in 1964 (focusing on sedentary behavior, high calorie diets, smoking and psychological distress) [18]. He advocated for a plant-based diet, outdoor exercise in natural environments and limitation of screen time [19]. Dr Raab was described as tenacious "*in pursuing his work in spite of the opposition and active resistance of numerous influential critics*" (we will focus on the continued 'active resistance' against lifestyle medicine below) [20].

Golden ages are typically viewed as golden because of technological advances; while many promissory notes have been written on the technological sides of precision (personalized) medicine (that is, the predictive potential and clinical relevance of the so-called 'omics' revolution and microbiome science), their fullest potential is still predicated upon physician-delivery. Thus, the technological sides of 21st century personalized medicine cannot be extracted from lifestyle (and its psychosocial determinants) and the contextual complexities of an individual's environment and total lived experiences. While the 20th century golden age of medicine addressed infectious disease, we argue for a 21st century golden age where the prevention and treatment of

NCDs is prioritized by the implementation of knowledge that already exists. Described below, the principles of lifestyle medicine and planetary health are actionable (and evidence-based) right now [21].

LIFESTYLE MEDICINE, PLANETARY HEALTH

The importance of lifestyle as a general theme—diet, exercise, sleep, mental 'hygiene' and climate exposure—has resonated within most medical systems through recorded history. In the latter half of the 20th century researchers and policymakers began to use the term 'lifestyle' in relation to health and disease; for example, in 1979, the United States (US) Surgeon General's Report on Health Promotion & Disease Prevention (Healthy People) estimated that lifestyle accounted for the cause of mortality in half of cases, while environmental factors (especially airborne pollution) was estimated to account for a further 20% of the annual mortality. The Report mentioned lifestyle(s) eleven times and reframed the meaning of mortality causes and complexities [22].

Fourteen years later, US government scientist J. Michael McGinnis and colleague William Foege published their landmark study; once again, smoking, dietary choices, lack of physical activity and excess alcohol were the primary factors in the annual burden of mortality and chronic disease [23]. Put simply, modifiable lifestyle practices account for 80% or more of premature death in modern society. The findings of McGinnis and Foege have been replicated by other groups over the years [24]. In 2018, high BMI, smoking, and high fasting plasma glucose remain the three most important risk factors in the United States; while there have been some gains in smoking cessation efforts, substance abuse is on the rise, physical activity remains far from sufficient and an unhealthy diet remains the status quo [25]. Mortality from NCDs is a surrogate marker of preceding loss of quality of life—the root causes are taking both years from life, and life from years.

In sum, there is little question that lifestyle is the corridor through which humans can either promote the sustainable vitality of person, place and planet, or conversely, detract from health at each of these scales. Lifestyle medicine, inclusive of attention to planetary health, is a modern imperative across all fields of medicine/health professions (for definitions of lifestyle medicine and planetary health, see references [26,27]). Since physicians maintain a very high level of trust in society—and multiple opportunities exist in which physicians can educate and advocate for lifestyle factors which promote health at all scales—it would be expected that medical training and knowledge concerning lifestyle and health in the 21st century would be commensurate with the burden of disease and the urgency of planetary ill-health. However, as we describe below, such is not the case.

NUTRITION, LIFESTYLE TRAINING

"Most physicians care little about diet and care less. And our best medical schools continue to turn out graduates unable to write even a quantitative dietetic prescription, which is an elementary matter, to say nothing of writing one which shall also be balanced and qualitatively appropriate. The recent graduate, as well as the old practitioner, is still apt to confuse the practice of medicine with the use of drugs to an extent which I feel sure will soon be universally recognized as unduly large"

Edward C. Cornwall, MD 1919 [28].

As evidenced by Dr Cornwall's frustration a century ago, the relegation of nutrition in training and practice has been a persistent theme in post-industrial medicine; he correctly predicted that drugs would have an unduly large place in 20th century medicine, but the justification for a pharmaceutical-minded medicine was warranted, especially with the profound advances in antimicrobials, vaccines and other highly-effective medicines. Science discovered, clinical/public health medicine implemented, and society benefited immensely—particularly in regard to infectious disease control. However, as the 20th century passed its mid-point, it was clear that the laboratory medicine set in motion by Abraham Flexner's report was leveraged by commercial interests to mold a medical training dominated by biomedicine (as opposed to psychosocial and lifestyle approaches) [29,30].

Although there have been changes to western medical school curriculum over the decades, the lack of plasticity

and rigid nature of medical training - reform without meaningful transformation [31]—is an ongoing problem (explored in detail elsewhere [32-34]). As described below, the available literature would suggest that the mismatch between medical education and preparedness for the epidemic of NCDs cannot be solved by tinkering around the edges of the curriculum. Indeed, individual medical students - those with the least power in the structures of institutional medicine - are taking to the pages of medical journals to express their displeasure with the absence of lifestyle medicine in curriculum [35].

The concerns of students are backed up by many published studies. First, we can look at the current state of nutrition education in westernized medical programs; the majority (70%) of US medical schools are unable to meet the 25 hours minimum nutrition education. Didactic training largely escapes clinical training for preparedness for NCDs and remains largely devoted to preclinical (e.g., biochemistry) contexts [36-38]. As a result, the majority of students report that they are ill-prepared for clinical nutrition counseling [39-41] and poor scores on clinical nutrition exams reflect such self-disclosures by students [42]. On the other hand the medical school educators report that nutrition education is satisfactory [43].

Among North American cardiologists, 90% report nutrition education was either absent or parse during fellowship training, 59% reported no nutrition education during internal medicine training and 1/3 reported receiving no nutrition education at all during in medical school training [44]. Absence of nutritional training translates into lack of knowledge; a variety of studies have shown that practicing physicians struggle with tests querying even basic knowledge on micro/macronutrients, dietary influences on lipids, the ability of soluble fiber to influence cholesterol, etc. [45-48]. These are not passing grades; indeed, one recent study involving pediatrics residents found that average number of correct answers (52%) on basic nutrition knowledge [49] was comparable to patient groups who completed the same 18-question test [50,51].

Recent studies on knowledge and preparedness for physical activity counseling among medical students shows that this, too, is subpar. For example, in the United Kingdom, medical students report lack of familiarity with established physical activity guidelines and underestimate the role of physical activity in the global disease burden [52]; schools devote a total of 4.2 hours of physical activity training (vs. 109 hours average on pharmaceutical knowledge) throughout the entire curriculum [53]. In North American research, one study showed that vast majority of graduating medical students felt unprepared to provide appropriate exercise counseling [54]; primary care residency programs provide only 2.8 hours of didactic training on obesity, nutrition, and physical activity combined [55]. Most students acknowledge that they are unaware of current physical activity recommendations, but among those claiming to have awareness, only 2% correctly identified national guidelines [56]. Voids in physical activity training and knowledge (particularly with strength training guidelines) have also been reported in Australian medical schools [57]. In the United States, formal training on physical activity is absent from the curriculum in most medical schools [58].

These pronounced voids in training are reflected outside the walls of medical schools; although majority of patients are interested in receiving lifestyle guidance [59], practicing physicians are often unaware of specific lifestyle guidelines and are not actively engaging with patients on the important aspects of lifestyle medicine [60,61]. Consider that most (60%) office visits by obese patients involve a complete *absence* of physician engagement with lifestyle counseling/health education [62]; more specifically, only about half of overweight/obese patients with ≥ 1 cardiovascular disease risk factor (and currently not meeting physical activity guidelines) receive advice to increase physical activity [63]. Despite the American College of Rheumatology's osteoarthritis management guidelines recommend exercise as a first-line, nonpharmacologic strategy to manage arthritis symptoms, 40% of patients receive no such counseling [64]. Alarmingly, among those with arthritis *and* overweight or obesity, approximately 75% of adults with overweight and 50% of those with moderate obesity (BMI 30 to < 35) are not receiving any provider weight-loss counseling [65]. The Royal College of Ophthalmologists maintains specific lifestyle counseling criterion for age-related macular degeneration, yet patients report that physicians rarely discuss the major portions of the guidelines [66]. Evidence also indicates that whether or not a physician engages in lifestyle

guidance is a product of their own belief systems; that is, regardless of existing evidence supporting the importance of lifestyle, if a physician maintains the *belief* that lifestyle will not affect outcomes, they are unlikely to engage in such counseling [67].

Perhaps most concerning are the lifestyle counseling gaps in pregnancy; physicians are not providing thorough lifestyle guidance during prenatal visits [68,69]. Lifestyle medicine involves more than merely asking about smoking during pregnancy; rather, it means following clinical guidelines concerning specific referral, assisting and following up on smoking cessation care. On this score, opportunities are missed and performance in providing appropriate smoking cessation care to pregnant women is low [70]. Indeed, effective approaches in lifestyle medicine cannot be equated to simple check-off boxes advising patients to "eat less fat and cholesterol" and "exercise more" [71-73].

This background becomes all the more disconcerting when viewed through the prism of planetary health; since physicians hold the trust of society, it is incumbent on the medical schools to educate its students on the realities of lifestyle vis à vis the health of person, place and planet. For example, the healthy, nutritionally-dense, plant-based diets that favor health promotion are also (due to their lower greenhouse gas emissions and environmental impact) those which support planetary health [74-77]; the conclusions of the Dietary Guidelines Advisory Committee (which independently critiqued the 2015 US Department of Agriculture and US Department of Health and Human Services Dietary Guidelines for Americans) were clear: "*a dietary pattern that is higher in plant-based foods, such as vegetables, fruits, whole grains, legumes, nuts, and seeds, and lower in animal-based foods is more health promoting and is associated with lesser environmental impact than is the current average US diet*" [78]. Modifying the Mediterranean diet and opting for plant-based proteins and eggs (vs. meats) improves sustainability and reduces environmental impact by up to 86% (based on multiple indicators), and still provides adequate nutrients [79]. On the other hand, if the global expansion of western-style dietary patterns rich in animal products continues unabated through 2050, it would increase global greenhouse gas emissions by 80% and require an extra 740 million hectares of additional cropland (that is, compared to a healthy diet modeled as an average of Mediterranean, pescetarian and vegetarian diets) [80].

Thus far we have been using voids in nutritional knowledge as a surrogate marker for the larger aspects of lifestyle medicine in the anthropocene (Fig. 1); best practices in lifestyle medicine will require a deep understanding of the interconnectivity of many variables influencing individual and community lifestyle choices; this includes, but is not limited to, screen media use, sleep quality, psychological distress (and perhaps more importantly, the presence of positive emotions such as optimism), socioeconomic disadvantage, personal/community resources, availability of safe/usable green space (natural environments), concentration of fast-food/convenience stores (and their targeted marketing) and food deserts, allostatic load, and the presence of airborne toxins and/or environmental degradation [81-83]. Others have called attention to the complete absence of required environmental education in North American medical schools (some offer electives); given the realities of climate change and environmental degradation, the authors ponder how future physicians can provide expert guidance to individuals and the public without adequate training and accountability for competence [84].

In sum, although there has been a good deal of research demonstrating that medical students are not being prepared to be experts on lifestyle vis à vis the epidemic of NCDs - and that most practicing physicians cannot be considered as experts in lifestyle guidance - there has been little formal recognition (by institutional medicine) of this reality. Of

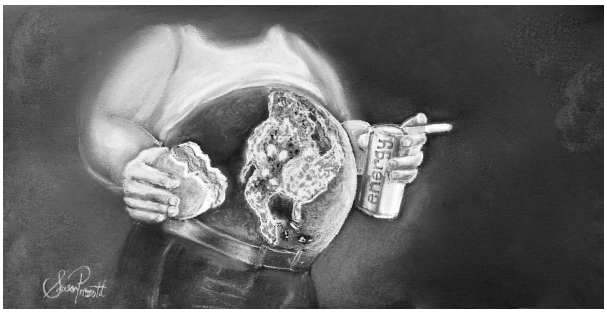

Fig. 1. Dysbiosis of Scale. Neoliberalism promotes the goods and services which contribute to literal and metaphorical dysbiosis (Greek = life in distress); it blames the individual, offers solutions in the form of supplements/medications/gadgets, and deflects from the large-scale forces which maintain health inequalities and threaten planetary health.

course, the *potential* of newly trained physicians as trusted authorities in matters of lifestyle as they pertain to health and disease is enormous, but the evidence shows that at this time lifestyle medicine remains, absurdly, its own 'branch' of medicine. The absence of lifestyle training is a matter of ethics; educators and clinicians can, and should, be held to ethical account for incompetency and an inability to address the lifestyle matters of NCDs in a reliable, evidence-informed manner [85,86].

BARRIERS TO CHANGE – AUTHORITARIANISM, SOCIAL DOMINANCE

"Given the benefits of lifestyle medicine interventions, it would seem that our health care system would rush to embrace this movement; however, nothing could be further from the truth. Through the decades, leading proponents of lifestyle interventions have faced resistance or marginalization"

Balazs I. Bodai, MD, et al. 2018 [87].

Today, the evidence surrounding lifestyle factors in prevention, treatment and health promotion is robust. Thus, in the contemporary medical environment where evidence-informed practice is the basis of care, lack of evidence cannot be cited as the barrier to transform medical training. Physicians have oft-described persistent barriers to the adoption and institutionalization of preventive treatment, education and counseling practices in clinic - described in detail elsewhere, these include lack of time, pressures to handle more pressing issues, lack of resources and perceptions of lack of (convenient) evidence-informed materials, lack of reimbursement or financial incentives, low expectations of benefit, concern about offending patients (e.g. suggesting weight loss), lack of confidence in outcome benefits, and low self-efficacy (confidence in delivering preventive/lifestyle care) [88].

These oft-mentioned barriers to the widespread uptake of lifestyle medicine into clinical care are salient, but they do not provide a rationale as to why medical schools refuse to do more than tinker around the edges, and they cannot explain why the champions of lifestyle medicine have been marginalized and made to feel an 'out-group' within institutionalized medicine. Inertia might explain avoidance of the daunting task of deep, Flexner-like revisions to the medical curriculum but it cannot provide a rationale for deprecation. We provide a different perspective on the 5-decades-old status quo. We suggest that an exploration of authoritarianism and social dominance orientation (plus the related construct of Machiavellianism) might provide insight into the institutional resistance and marginalization faced by lifestyle medicine.

The roots of our argument can be traced to public health physician and biostatistician Halbert L. Dunn (1896-1975) who promoted the idea high-level wellness; Dunn contended that the prerequisite to individual and societal high-level wellness (vitality) is the opportunity to maintain a healthy lifestyle which includes a sense of purpose and creative expression [89,90]. The barriers to high-level wellness, Dunn argued, were institutional authoritarianism, clinging to dogma, lack of critical analysis skills (manifest in uncritical allegiance to "teams" in political, economic, occupational, academic and other social spheres), and the inability "*to re-examine previous beliefs in the face of new facts or situations which bring to light contradictions*" [89]. In particular, he was concerned that scientific findings could be selectively used/misused/ignored by socially-dominant elites (individual leaders, dominant organizations, or self-appointed experts) and authoritarians to the detriment of human wellness [91].

Although recent elections in North America and Europe have underscored the ways in which public and planetary health is threatened by political authoritarianism and elitism [92-94], the topics of social dominance orientation and authoritarianism aren't restricted to political parties and their operatives; these psychological constructs are of relevance to all institutions, including those which maintain dominant 'in-group' status such as westernized medicine [95] and science [96]. Authoritarianism is described as *expecting or requiring people to obey; favoring a concentration of power; limitation of personal freedoms*. Several authoritarianism scales have been validated, and higher scores on such instruments are associated with broad aspects of prejudice, rigid adherence to mainstream convention, and stigmatization of out-groups; furthermore, authoritarianism predicts aggression toward out-group members, hyper-vigilance to

threats against non-conformism, and an intolerance to diversity and the viewpoints of differing cultures [97-99]. The authoritarian cognitive style is devoid of nuance and fine-grained discourse; out-groups are generically painted with broad-brush strokes in simplistic, all-or-none fashion [100].

Researchers have noted that authoritarianism often runs hand-in-hand with the related psychological construct of social dominance orientation (SDO); indeed, the tandem of authoritarianism and SDO is so potent that researchers refer to combination as the "lethal union" [101]. Higher levels of SDO reflect attraction to prestige and hierarchy within social structures; higher scores on SDO instruments predict the entitlement and acceptability of high-status groups to dominate other groups, and reflect the degree to which an individual accepts the maintenance of social and economic inequality. SDO scores also predict prejudice and obscure awareness that powers gained from dominant social positions are being used for personal gains [102,103]. On the other hand, lower scores on SDO scales predicts empathy, and greater concern for matters of social justice and inequalities [104]; since SDO reflects a desire to gain and maintain status, the construct is characterized by a hypervigilance against any challenges to privileged status and the associated benefits [105].

Separate but related to authoritarianism is Machiavellianism; higher scores on Machiavellianism scales typically reflect lower levels of empathy, conscientiousness, agreeableness and emotional intelligence, and higher levels of cynical beliefs [106]. Of relevance to our present discourse concerning the intentional marginalization of the less powerful (or the aforementioned "*opposition and active resistance of numerous influential critics*" faced by lifestyle medicine pioneer Dr Wilhelm Raab), Machiavellianism is also associated with the derogation of others who violate preconceived standards and intentional induction of shame and embarrassment in the target [107,108]. The detrimental consequences of Machiavellianism (at various scales - individual and group) is currently the subject of intense research within business and other organizational structures [109].

The idea that authoritarianism, SDO and Machiavellianism might permeate medical institutions to a degree that it interferes with global health concerns (our focus here on the interrelated priority of lifestyle medicine and planetary health) has escaped discourse. However, there is a body of research (albeit rarely cited in the mainstream) which demonstrates authoritarianism and/or SDO is at concerning levels among students upon entrance to western medical schools, that such levels are *increased* through medical education and then reinforced through the institutional levels of medicine [110-115]; levels of authoritarianism and/or Machiavellianism in medicine predicts judgment on certain patients for making unhealthy lifestyle choices, and is associated with negative attitudes toward those with chronic pain, substance abuse and unexplained symptoms [111,116,117]. Older research has demonstrated that medical students scoring high in authoritarianism are less likely to have accumulated undergraduate courses in sociology, anthropology and psychology, are uncomfortable with topics that are not concrete and precisely delineated, more likely to view psychiatry as a low prestige specialty, and the least likely to take a 'whole person' (patient-oriented) perspective in regard to the physician's role [118]. Interestingly, the technical specialties (surgery, anesthesia, or those with low patient discourse) score higher on SDO, authoritarianism and/or Machiavellianism vs. general practitioners, pediatricians and/or psychiatrists [118]. Inside medicine itself, the gradient of bullying, unprofessional behavior and dominance has been reported to be *from* the technical specialties toward general practitioners and other disciplines with high patient engagement [119-121].

There have been very few plausible reasons for medicine's decades-old evasion of lifestyle medicine; the most reasonable one takes us back to the 20th century golden age and the desire to replicate the model of its bench-side successes. Medical science is intrinsically reductionistic and we are all beneficiaries of the massive investments in the reductionist scientific methods (and its application in clinical settings). The painstaking toil of reductionist science continues to provide untold benefits to humankind. But so does painstaking public health research; the magnetic lure of reductionism may obscure that the active ingredient in broccoli is simply broccoli. The sophistication of reductionist science shores up the social status of medical expertise - Nobel Prizes aren't the domain of public health and lifestyle medicine; even without bringing financial incentives into the

equation, the system is geared toward the silver bullet and 'active ingredient' solutions [122]. Lifestyle medicine isn't a shiny, glittery object. In Dr Raab's words:

"*Part of the blame belongs to the average American physician. Fascinated by dramatic new diagnostic methods, scrambling to keep up with the proliferation of new therapies,* [the physician] *has little time to concentrate on the comparatively dull and nebulous subject of disease prevention...nor should the often-heard cry for "more research" ever serve as a mere excuse for not doing something - and soon - about our grave national health emergency. For when a house is on fire, those who live in it do not sit down amid the smoke and flames to discuss the need for more research into the chemical and physical laws of combustion. They call the fire department*" [123].

Medicine-at-large is sensitive to criticism [124]; it is likely that the resistance to Dr Raab's criticisms is similar to the barriers encountered by contemporary physicians who advocate for lifestyle medicine. We posit that authoritarianism, SDO and Machiavellianism may be at play. This can explain why lifestyle medicine advocates are (despite their adherence to evidence) cast as 'out-groups' and justifies the view that it is unnecessary to truly transform the training of physicians commensurate with healthcare needs in the 21st century. To admit otherwise - that is, to expressly concede that the physician as currently trained is not an expert in all matters of health, including lifestyle and environmental variables - would be a threat to status.

Rigid thinking may also be preventing the emergence from the mid-20th-century modern paternalistic infectious-disease model of teaching; in the late 1970s, when lifestyle medicine was a sapling, a commentary in the *New England Journal of Medicine* postulated that the field of lifestyle medicine was wide open for magic (as in pseudoscience): "*The new theory is that most of today's human illness, the infections aside, are multifactorial in nature, caused by two great arrays of causative mechanisms; the influence of things in the environment; and one's personal lifestyle...it has become common belief that the environment will have to be changed, and personal ways of living will have to be changed, and radically. These things may turn out to be true...but it will take a long time to get the necessary proofs. Meanwhile, the field is wide open for magic*" [125]. The same author pejoratively pinned lifestyle with holistic medicine: "*Science is especially endangered these days...the most magical of all is the new discipline known as holistic medicine. All you have to do is live right and you can become indestructible*" [126].

Four decades later—with plenty of 'necessary proofs' concerning lifestyle, the environment, and NCDs—we argue that medicine's unwillingness to take charge of 'the field' has only left a larger void to be filled in by the magicians who operate outside the bounds of evidence-based lifestyle medicine. To what extent are fad diets, exercise substitutes in a pill - and all manner of gadgets - merely a space to be filled by medicine's vacuum? On the other hand, the authoritarian who claims that lifestyle medicine is already 'just medicine' (inferring that its already being taken care of by contemporary medicine-at-large)—or insinuates that it isn't a high-level concern—is, in our opinion, no less a charlatan or magician.

ACTION ORIENTATION AND RESEARCH PRIORITIES

"Application of the biomedical model outside its limits is unscientific; advocacy of such application promotes dogma and is antiscientific"

George L. Engel, MD, 1996 [29].

As western medicine marches deeper into the 21st century, its golden era of infectious disease control and scientific miracles now in the cultural rear-view mirror [127], it is increasingly evident that the health of person, place and planet are inseparable. In order to address this 'new reality', nothing short of a Flexnarian transformation of medical education will suffice. Of course, there have been many calls for adding some additional hours in nutrition or exercise counseling to an already-crowded medical curriculum; such small steps are obviously important but run the danger of acting as check-off boxes that mask the deeper mismatch between medical education and 21st century needs.

In the so-called post-truth world, filled with medical misinformation, the first steps to recovery entail an earnest and unqualified admission on the part of institutional medicine

that it has a problem; just as public health acknowledged, two decades ago, that "*we need a little humility, we need to recognize that the environmental movement has been doing public health's work for the past 20 years or more in drawing public attention to the health effects of environmental problems*" [128], medicine, too, might concede that some experts in evidence-informed lifestyle medicine/holistic health have been doing clinical medicine's work in promoting a lifestyle for personal, public and planetary health for nearly half-a-century. Recovery requires an admission that very few medical doctors are currently experts in lifestyle as it pertains to health. Flexner went to work with the understanding that medical training was in disarray; he was assessing the damage with an eye toward remediation.

The academic transformation of 21st century medical education must include lifestyle medicine and planetary health perspectives throughout the training and continuing medical education processes; a single module will not suffice. Students and resident physicians require exposure to lifestyle medicine in community practices as formalized extensions of the university-based medical schools; such experience within affiliated, multispecialty clinics can immediately demonstrate the value of reducing health disparities and ecological injustices via lifestyle interventions [129]. Of course, like any other aspect of scientific medicine, lifestyle factors in health - and the efforts of lifestyle medicine to address them - will always be a moving target; there is much known [130], but also much to be discovered concerning best practices [131]. However, there is little in the way of student accountability concerning the established evidence; only a small fraction of board/licensing questions involve detailed clinically-relevant nutrition and other lifestyle knowledge [132].

In addition to the incorporation of further scientific (lifestyle-related) knowledge into course curriculum, we argue that medicine-at-large needs to reevaluate its criteria for medical school entrance; interestingly, Joseph Merrill, MD, (who published several studies on authoritarianism in medicine) found that those who had the highest scores on the 'science' portion of the Medical Colleges Admission Test were more likely to hold antipathy toward patients, have higher need for dominance and had stronger opinions on the Totalitarian-Authoritarian-Dogmatism questionnaire [117]. There seems to be an urgent need to explore authoritarianism, SDO and Machiavellianism at entrance, throughout training and in later physician performance. Surprisingly little is known concerning the motivations of those who 'win' the highly competitive spots in medical school. Who is in it for the status and financial rewards? Some research shows that medical students with an overt dislike of integrative medicine score higher on status motivations and lower on agreeableness [133] (of relevance here because lower agreeableness often correlates with higher authoritarianism, SDO and Machiavellianism [134]); at some point we need to start weighing the candidate's organic chemistry and physics scores vs. attributes which favor humanism in medical care in the anthropocene [135].

Progress in lifestyle medicine and planetary health requires interdisciplinary perspectives and inter-professional training which underscores that 'leadership' in the broad field of health (wellness/vitality) doesn't belong to medical doctors by default [32]; however, higher SDO is associated with an unwillingness to engage in inter-professional education [136]. Machiavellianism also requires study in this context; for example, higher scores are associated with problematic work behavior among physicians [137], greater awareness of academic incivility (meaning they are cognizant of the disruption), and such individuals are more likely to perceive academic incivility as appropriate behavior [138]. Machiavellianism is also linked to excess social media use, cybertrolling and cyberbullying [139,140]; does collective narcissism - the unrealistic belief in the greatness of one's particular group [141] - exist with certain sectors of medicine, is it impeding progress, and if so, how can it be addressed?

Movements toward lifestyle medicine with planetary health in mind will require knowledge on the extent to which physicians bring preformed opinions and dogma (especially political) into clinical settings. Authoritarianism and/or SDO predict lower levels of environmental concern (including the serious realities of climate change), and a hierarchical, human dominated view of nature [142-145]. The fact that human health is dependent upon planetary health leaves no room for opinions which contrast with scientific consensus concerning climate change; while most physicians

agree that climate change is ongoing and that human activity plays a role, almost half of physicians (polled by the American Academy of Allergy, Asthma and Immunology, published Dec 2015) are at odds with the single correct scientific consensus (that is, climate change is ongoing and it is caused mostly by human activity) [146].

CONCLUSION

"Society granted physicians status, respect, autonomy in practice, the privilege of self-regulation, and financial rewards on the expectation that physicians would be competent, altruistic, moral, and would address the health care needs of individuals and society. This arrangement remains the essence of the social contract"

Sylvia R. Cruess, MD and Richard L. Cruess, MD, 2004 [147].

If medicine-at-large continues to neglect competency in lifestyle medicine it will risk rendering the social contract null and void. The gravitational tug of ever more science, specialization and personalization can certainly provide potential benefits; however, it can pull medical practice away from the grand confluence of 'good for people, good for the planet'. We have posited that progress in lifestyle medicine (in the context of planetary health) requires a more fine-grained understanding of the ways in which authoritarianism and social dominance orientation (at individual, institutional and other scales) could support the status quo and/or interfere with meaningful solutions to serious global health problems.

The fallacious idea - maintained by medicine-at-large - that most physicians in western nations are currently lifestyle 'experts', or that it is "just medicine" (an oft-used statement that infers evidence-based lifestyle medicine is both widely taught and frequently deployed), is, in our opinion, at odds with the social contract and an important barrier to change. Whether or not this is a conscious process or simply inertia is a matter of debate and a suitable subject for research. In any case, the seriousness of global health problems - at scales of person, place and planet - force medicine-at-large to reevaluate its current medical school recruitment strategies and required prerequisites.

Medical practice of a given age has only ever been a 'form.' The function has always been to add years to human lives, and life (vitality) to human years, while minimizing the imposition of harm. The form of medicine should follow its defining function; today, the preponderance of chronic disease and premature death is preventable by lifestyle means, and thus, medicine is duty bound to address this fact. Moreover, healthy people cannot reside on an uninhabitable planet, and thus medicine is also duty bound to address the confluence of human and planetary health; in sum, there is no medical discipline that can contribute meaningfully to the health of people and planet alike *other* than lifestyle medicine. The 21st century golden age of medicine awaits.

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