Effectiveness of Medical Interventions

Jacob Stegenga

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Abstract

To be effective a medical intervention must improve one's health by targeting a disease. The concept of disease, though, is controversial. Among the leading accounts of disease—naturalism, normativism, hybridism, and eliminativism—I defend a version of hybridism. A hybrid account of disease holds that for a state to be a disease that state must both (i) have a constitutive causal basis and (ii) cause harm. The dual requirement of hybridism entails that a medical intervention, to be deemed effective, must target either the constitutive causal basis of a disease or the harms caused by the disease (or ideally both). This provides a theoretical underpinning to the two principle aims of medical treatment: care and cure.

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1 Effectiveness, Health and Disease

Medicine aims to mitigate death and disease. There is much to recommend the platitude that an effective medical intervention is one that improves the health of patients by curing disease or at least treating the symptoms of disease. Effectiveness of medical interventions is a capacity to satisfy these ends. Though fine as a starting point, an analysis of effectiveness of medical interventions based on this platitude leaves many conceptual and practical problems unilluminated.

Some interventions are effective for minimizing pain, or mitigating male pattern baldness, or modulating female reproductive cycles. Other interventions were alleged to treat homosexuality or drapetomania (a slave's urge to escape his master). At least some of these interventions are not properly 'medical', since they are not targeting genuine diseases with the aim of improving a person's health. It is just a sociological accident, such reasoning would go, that physicians have sometimes administered such interventions. This thought, though, depends on a particular view of the appropriate aim of medicine. Re-stating the platitude that effective medical interventions improve health by targeting causes and symptoms of diseases does little to help distinguish effective medical interventions (say, insulin) from medical interventions which are not effective (say, bloodletting), or from interventions which are not medical (say, giving lunches to poor schoolchildren), or from interventions which do not target genuine diseases (say, cognitive behavioral therapy for homosexuality). That is because our platitude depends on the notoriously controversial notions of health and disease.

In what follows I canvass some of the leading conceptual accounts of disease, and defend a hybrid account of disease, which holds that there is both a constitutive causal basis of disease and a normative basis of disease. This entails conceptual requirements for effectiveness. To be effective, I argue, a medical intervention must successfully target one or ideally both of these bases of disease.

There are goals in medicine other than the treatment of disease, and interventions employed to achieve those goals—say, screening modalities, vaccinations, and methods of birth control—do not fall under the purview of my analysis, because my focus is on therapeutic interventions that are intended for treating diseases with the end of improving health (though, as we will see, to be compelling such a statement ultimately must rely on an independently justified notion of disease).

A widely held view is that health is a naturalistic notion, construed as normal biological functioning, and disease is simply departure from such normal functioning. Alternatively, many hold a normative conception of health and disease, which claims that health is a state that we value and a disease is simply a state that we disvalue. A third approach is a hybrid view, which holds that a disease has both a biological component and a normative evaluation of that biological component. A fourth major approach is

eliminative, which claims that notions of health and disease should be replaced by physiological or psychological state descriptions and evaluations of such descriptions. I will call these, respectively, naturalism, normativism, hybridism, and eliminativism. A rich literature has formulated numerous considerations for and against these accounts of health and disease. Though I do not have the space to adequately address all such considerations in what follows, I attempt to highlight the central issues dividing these approaches, show that these different conceptions of disease have different implications for determining what counts as an effective medical intervention, and ultimately defend hybridism and a corresponding theory of effectiveness.

To illustrate the importance of a concept of disease for understanding the concept of effectiveness, consider antidepressants, a class of medical interventions widely employed to treat depression. If, as some argue, most cases of depression are normal responses to the many difficulties of life and do not involve a departure from normal biological functioning (quotidian cases), then quotidian cases of depression are not cases of disease according to the normal biological functioning account of disease.[1] It follows that in a quotidian case of depression, antidepressants cannot be considered effective, since they are not intervening on an abnormal biological function to render it normal. This point is conceptual, not empirical: the notion of effectiveness of medical interventions is not merely effectiveness simpliciter—effectiveness of medical interventions does not refer merely to a capacity for generating some effect or other; rather, the notion refers to a capacity to improve health by modulating the causes or symptoms of disease. There happens to be many empirical studies which show that antidepressants are ineffective for most cases of depression, where "ineffective" means "does not modify subjects' reports of well-being on standardized depression scales, compared with subjects receiving a placebo".[2] The conceptual conclusion of this line of reasoning is that regardless of such empirical evidence, given a certain theory of health, antidepressants cannot be effective in quotidian cases of depression, because the right way of construing "effective" is something like "intervenes on causes or symptoms of disease to improve health" and because quotidian cases of depression are not cases of disease.[3] One's commitment to a particular

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[1] For this interpretation of depression, see (Horwitz & Wakefield, 2007). I discuss this view in more detail below.

[2] The usual scale employed in such research is the Hamilton Rating Scale for Depression. One of the most careful reviews of the effectiveness of antidepressant medication (ADM) concludes that "True drug effects (an advantage of ADM over placebo) were nonexistent to negligible among depressed patients with mild, moderate, and even severe baseline symptoms" (Fournier et al., 2010). Such findings are now ubiquitous; as examples, see (Kirsch, Moore, Scoboria, & Nicholls, 2002), (Nemeroff et al., 2003), (Ioannidis, 2008), and (Kirsch et al., 2008).

[3] It would not necessarily follow that antidepressants should not be used in quotidian cases of depression—perhaps warrant for the use of antidepressants in quotidian cases would be considered similar to drinking coffee or wine (pleasant perks in a day of a hard but otherwise normal life)—but the use of antidepressants

concept of disease is crucial for assessing the effectiveness of medical interventions. In the companion article to this one ('Measuring Effectiveness', published in this issue) I address epistemological concerns regarding how effectiveness ought to be measured. Here I am concerned with the conceptual matter regarding what effectiveness is.

I defend hybridism. Alleged alternatives to hybridism have recently been proposed, and so one aspect of my defense of hybridism is to argue that these alleged alternatives are not compelling. Hybridism about disease entails that for a medical intervention to be deemed effective it must successfully target either the causal basis of the disease in question or the harms caused by the disease. Thus the view presented here provides standards of effectiveness with which to assess particular medical interventions. Moreover, the view presented here provides a theoretical underpinning to the two principle aims of medical treatment: disease cure and symptom care.

2 Naturalism

The most prominent defender of naturalism has been Boorse. Here is his formulation from (Boorse, 1977):

(1) The *reference class* is a natural class of organisms of uniform functional design; specifically, an age group of a sex of a species.

(2) A *normal function* of a part or process within members of the reference class is a statistically typical contribution by it to their individual survival and reproduction.

(3) *Health* in a member of the reference class is *normal functional ability*: the readiness of each internal part to perform all its normal functions on typical occasions with at least typical efficiency.

(4) A *disease* is a type of internal state which impairs health, i.e. reduces one or more functional abilities below typical efficiency.

This is a naturalist account of health and disease because disease is construed solely in terms of a departure from typical biological functioning. This account has a clear implication for the notion of effectiveness of medical interventions: to be effective,

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in quotidian cases (according to this line of reasoning) would not be based on their *effectiveness*. Of course, this line of reasoning would require antidepressants to have at least some capacity to improve subjective reports of well-being, which, as the empirical work cited in the footnote above suggests, is doubtful.

according to this naturalist account, a medical intervention must modify an internal state which is no longer functioning normally and return the functioning of the relevant part or process to typical efficiency.

Boorse's theory of disease requires a diminished ability of parts or processes to contribute to survival or reproduction for a state to count as a disease (made explicit in condition 2 above). Disease, then, involves a failure of a system to achieve its *adaptive* function. In contrast, Schaffner (1993) and Murphy (2008) argue that a naturalist theory of health and disease is better based on a causal or mechanistic account of function. An entity or activity is properly functioning, on a mechanistic account, if and only if it makes its typical contribution to the operation of the mechanistic system which contains that entity or activity. Boorse (1977) himself employs mechanistic language when he calls a disease a "failure of parts of the body to perform biological functions which it is statistically normal for them to perform," but the ultimate biological function for Boorse's theory is the propensity of a part to contribute, however slightly, to survival and reproduction. One can relax this requirement on the notion of biological function: the internal states which constitute diseases can be thought of in terms of parts of the body which perform certain operations; when these operations are not typically efficient for the end of that particular mechanism, the internal state is a disease (see (Hausman, 2012) for an articulation of what he calls the 'functional efficiency theory' of health). To use the definition of (Bechtel & Abrahamsen, 2005), a mechanism is a "structure performing a function in virtue of its component parts, component operations, and their organization." Thus 'health' is the capacity of one's physiological mechanisms to operate at typical efficiency; a disease is the failure of certain mechanisms (specifically, particular parts and their operations and organization) to perform their particular functions at typical efficiency. I will call this condition for a disease concept *CAUSAL BASIS OF DISEASE*.[4] The corollary condition for the concept of effectiveness—that a medical intervention must modulate the biological basis of disease—I will call *CAUSAL TARGET OF EFFECTIVENESS*. This is a standard widely held among medical scientists and clinicians.[5]

The physiological states which satisfy *CAUSAL BASIS OF DISEASE* are not typically themselves causes of disease. Rather, they are the states that are *constitutive* of a disease; a disease's *basis*; the pathophysiological causes of patient-level symptoms. These

[4] I set off candidate conditions for concepts of disease and corollary concepts of effectiveness of medical interventions by the script used here. Moreover, unless otherwise stated, any use of the term 'effectiveness' should be taken as 'effectiveness of medical interventions', understood roughly as 'capacity to improve health for a member of a demarcated population' rather than the merely empirical notion 'some causal capacity or other'.

[5] The way that medical scientists have conceived of the precise nature of the constitutive causal basis of diseases has changed over time, from a monocausal theory of disease to a multicausal theory of disease. For an insightful account of this change, see (Broadbent, 2013), who argues that instead we should employ a 'contrastive' model of disease.

physiological states may have distal causes, often external to one's body (viruses, poisons, or animal fats, for example). These states may be a cause of *illness*, to rely on the distinction articulated by Boorse (1975). *CAUSAL BASIS OF DISEASE* is about the causal constitution of a disease, and not the causal etiology of a disease. I argue below that *CAUSAL BASIS OF DISEASE* is a necessary but insufficient condition for a state to be considered a disease.

Consider one of my favorite examples: around 1920 Frederick Banting and his young colleague Charles Best discovered that type 1 diabetes is caused by damage to the pancreas, which leads to an inability to produce insulin, and since the normal function of insulin is to control blood sugar, type 1 diabetics have abnormally high blood sugar, which itself causes the phenomenological symptoms of diabetes, such as frequent urination, increased hunger, weight loss, seizures, fatigue, and eventually death. Banting and Best were able to isolate and purify insulin from laboratory animals and inject it into diabetic patients, which is a fantastically effective intervention. Diabetes is well characterized by a naturalist theory of disease—on either of the above notions of function, it satisfies *CAUSAL BASIS OF DISEASE*—and the effective treatment of diabetes with insulin satisfies *CAUSAL TARGET OF EFFECTIVENESS*. This example is prototypical: regardless of what damages the pancreas (the distal or etiological causes of type 1 diabetes, which happen to be poorly understood), the constitutive causal basis of type 1 diabetes is the physiological state characterized by the inability to produce insulin as a result of damage to the pancreas; our knowledge of this constitutive causal basis is extremely well developed and robust; a fantastic intervention for this disease involves targeting its constitutive causal basis by administering insulin.

There are several classes of objections to naturalist accounts of health and disease. One is that it fails to track the way that conditions have been historically classified as disease. A stock example, noted by Ereshefsky (2009) and others, is that of homosexuality, which was long considered a disease, yet now it is not. This change, critics note, was not due to progress in knowledge of biological function or the causal basis of the state, but rather a change in societal values. To such a line of criticism, though, a naturalist has a straightforward rejoinder: naturalism involves a conceptual analysis of health and disease, rather than a historically accurate description of the way particular conditions were in fact categorized as disease.[6] Naturalism shows precisely what was wrong with ever thinking that homosexuality is a disease (namely, that homosexuality does not involve a reduction of biological function below typical efficiency).[7]

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[6] See (Lemoine, 2013) for a discussion of the limitations of conceptual analysis regarding health and disease.

[7] However, according to Boorse's version of naturalism, homosexuality is in fact considered a disease, because it interferes with reproduction. Boorse took care to note that, precisely because his theory of disease is non-normative, the mere fact that homosexuality is a disease according to his theory does not entail that homosexuality is a bad thing to 'have' or that it should be treated—Boorse (1975) claims that biological

A more pressing problem for naturalism, and one which is pertinent for an analysis of effectiveness of medical interventions, is the determination of the reference class within which one ought to assess normality.[8] A person's relevant biological functioning could be compared with the relevant biological functioning of all other people, or all people of the same sex, or all people of the same age category (the breadth of which would have to be determined), or all people of the same sex and age category, or all people who have experienced similar external stressors, or…. Boorse states that the appropriate reference class is an age group of a sex in a species. But Cooper (2002) argues that appropriate reference classes may have to be finer-grained than this. Moreover, determining the appropriate grain of a reference class may involve appealing to non-biological considerations of normality. A person's relevant biological functioning might be within a normal range in some reference classes but be outside a normal range in other reference classes.

To illustrate this difficulty, consider again depression. There is some evidence, albeit inconsistent, which suggests that there are differences in biological functioning between those people diagnosed with depression and those people not diagnosed with depression, and depression and its alleged associated biological functioning are not statistically typical. Thus, if the chosen reference class is constituted by the set of all people, then a person diagnosed with depression will on average have certain biological functions which appear to be abnormal (and thus depression will be properly classified as a disease). However, if the chosen reference class includes only people who have experienced similar external stressors, then it might turn out that on average a person diagnosed with depression will have statistically typical biological functions relative to that reference class. The trouble is that there is no clear or objective way to determine the relevant reference class solely by appeal to biological considerations. In order to determine the relevant reference class one must appeal to considerations that are laden with value judgments that go beyond the facts of the matter regarding biological functioning.

As noted above, some hold that typical cases of depression are normal responses to life's difficulties, and argue that the relevant reference class for assessing the normality of one's biological functioning is the class of people who have experienced similar difficulties

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normality is only an instrumental good. Regardless, as noted above, a naturalist account of health is not committed to an evolutionary account of normal function. On the mechanistic account of function, homosexuality is not, to the best of our knowledge, a disease. And certainly according to a hybrid account of health, homosexuality is not a disease.

[8] Versions of this problem have been raised by Kingma (2007) and Cooper (2002). See also (Stegenga, forthcoming-c) for a radical view regarding reference classes in biology, more generally. A related concern is the 'problem of common diseases': if many or most members of a population have a particular dysfunction (say, tooth decay), then an approach to determining proper functioning which is based on statistical features of a population will fail to consider common diseases as diseases. For discussion, see (Millikan, 1989), (Neander, 1991), and (Schwartz, 2007).

(e.g. Horwitz & Wakefield, 2007)). But why this reference class is the appropriate one is unclear. If I receive a head injury during a whiskey-soaked bar fight, is the appropriate reference class for assessing the state of my head all those people who engage in whiskey-soaked bar fights, or just all those people who enter a bar, or just all people? Of course, in any of these reference classes the biological facts regarding my head are the same. But the determination of the state of my head as an injury—as something abnormal—depends on the choice of reference class. In the class of people who engage in whiskey-soaked bar fights, the state of my head might be perfectly normal, and if this is the only ground upon which dysfunction is based, then this reference class has an unintuitive consequence (namely, that my head is not unhealthy). Critics of naturalism would hold that this consequence is unintuitive because it is compelling to think that the state of my head *harms* me, regardless of the chosen reference class for assessing the state's normality.[9] If the head injury case is sufficiently similar to the case of depression (broadly construed, both involve causes which mitigate health, and on some construals of quotidian cases of depression, those causes are extrinsic, as was the cause of my head injury), then those who hold views like Wakefield's must give a compelling reason to think that, in quotidian cases of depression, the appropriate reference class is the set of people who have experienced similar stressors. Whatever reasons those may be, they cannot be constituted by biological facts alone.

The reference class problem is closely related to the other central problem with naturalist accounts of health, and one which motivates its main competitors: determining the basis of harm.

Critics of naturalism hold that the badness of certain biological states is not determined by the biological features of those states alone. Mere departure from statistical normality is insufficient for a state to be deemed harmful. A five-foot tall man does not have a disease merely because he has an abnormal anatomy and that abnormality creates difficulty in finding a mate to reproduce with. This is true, of course, even once we have decided on an appropriate reference class. Not just any biological abnormality will satisfy *CAUSAL BASIS OF DISEASE*. Naturalist theories of health must explain why diseases are harmful, and critics claim that any basis of harm attribution will be value-laden. As we saw above, Boorse's theory requires a disease to involve an impairment of normal functional ability, and Boorse appeals to survival and reproduction to specify which

[9] Objecting to the analogy on the grounds that it involves an injury rather than disease would miss the point (and would, moreover, rely on a thorny distinction between injury and disease). A similar case could be easily constructed in which environmental stressors caused a disease and for which it would be unintuitive to hold that the relevant reference class for assessing normality is the set of people exposed to the environmental stressor. Indeed, if the relevant reference class *were* the set of people exposed to the environmental stressor, that stressor could not be discovered to be a stressor in the first place (since there would be no contrast class to speak of).

functions matter. But critics have noted that evolutionary biology does not specify natural traits for populations, that humans have many goals besides those associated with survival and reproduction (Ereshefsky, 2009), and some have even claimed that evolutionary biology does not afford a distinction between normal and abnormal function (Amundson, 2000).[10] Appealing instead to a mechanical account of function will not resolve this worry, since not all departures from normal mechanical functioning constitute problems for health—only those departures from normal mechanical functioning that we *care* about or that cause us *harm*, critics claim, constitute problems for health.

In short, naturalism faces several conceptual difficulties. It is noteworthy, though, that the central concerns with naturalism raised above do not deny *CAUSAL BASIS OF DISEASE* as a *necessary* condition for a concept of disease. The reference class problem can be stated as: in order to determine whether or not *CAUSAL BASIS OF DISEASE* is satisfied, the appropriate reference class must be determined. And the normativist challenge can be stated as: in order to determine whether or not some departure of normal functioning constitutes a disease, a normative evaluation of the biological state in question is required. These challenges deny that *CAUSAL BASIS OF DISEASE* is *sufficient* as an explication of disease, but these challenges do not deny that *CAUSAL BASIS OF DISEASE* is *necessary*. This is not to say that no one has denied the necessity of *CAUSAL BASIS OF DISEASE*—I discuss such a claim below—but most challenges to naturalism do not entail a challenge to the necessity of *CAUSAL BASIS OF DISEASE*. In §4 I provide several reasons to think that *CAUSAL BASIS OF DISEASE* is in fact a necessary condition for the concept of disease. We thus have the beginnings of an analysis of the conditions that a medical intervention would have to satisfy to be deemed effective: *CAUSAL TARGET OF EFFECTIVENESS* holds that a medical intervention is effective if it modulates the constitutive causal basis of a disease (in §5 I discuss this condition in further detail).

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[10] (Walsh, 1996) proposes an account of biological functions which supports the function/malfunction distinction:

> The/a function of a token of type *X* with respect to selective regime *R* is to *m* iff *X*'s doing *m* positively (and significantly) contributes to the average fitness of individuals possessing *X* with respect to *R*.

This account is meant to accommodate both historical and ahistorical functions. Contributions to fitness by a trait, according to this account of biological functions, can only be determined relative to the total set of social, developmental, and physiological features of the environment that also affect the fitness of individuals with that trait.

3 Normativism

To call a condition a disease, according to a normativist conception of disease, is to claim that a person with that condition is somehow harmed. It is the disvalue of a condition which makes it a disease, rather than mere biological facts about the condition itself, according to normativism. To return to an example mentioned above, homosexuality was once considered a disease, but now it is not, and normativists can explain this change by noting that the change was not due to a development in our knowledge of the biological basis of sexuality, but rather was due to a development in society's attitude toward homosexuality—homosexuality was once broadly disvalued, and now it is not.

An insightful normativist theory of health and disease is offered by (Cooper, 2002). Cooper argues that a disease is a state that "is a bad thing to have [or be in], that is such that we consider the afflicted person to have been unlucky, and that can potentially be medically treated." These three requirements are all necessary and jointly sufficient, according to Cooper, for a state to be considered a disease. The first is a classic normativist requirement: a state must be bad for a person. This is aligned with the view discussed above that mere biological difference ('abnormality') is insufficient for a state to be considered a disease. Cooper's example is hair color: a redhead is biologically different from the norm, but does not thereby have a disease merely in virtue of this particular abnormality, since her hair color does not cause her harm. (There is a causal basis of redheadedness: a recessive gene which leads to high levels of the pigment pheomelanin and low levels of the pigment eumelanin). Of course, Boorse's theory also returns an intuitive verdict about hair color—assuming red hair does not lower one's propensity for survival or reproduction, then redheadedness is not a disease, even though it is statistically atypical. But if we abandon the adaptive notion of function for a causal-mechanical notion of function, the appeal to propensity to survive and reproduce is not available to distinguish rare biological states that are diseases from those that are not. The normativist has a conceptual resource that the (causal-mechanical) naturalist does not: since redheadedness is not a bad thing to have, it is not a disease.

I will call the condition that a state be disvalued in order for it to be deemed a disease *NORMATIVE BASIS OF DISEASE*.

What are the implications of *NORMATIVE BASIS OF DISEASE* for the notion of effectiveness of medical interventions? If *NORMATIVE BASIS OF DISEASE* is held to be a necessary condition for disease, then one way for a medical intervention to be deemed effective is if it modulates a state that is harmful and thereby mitigates the harm. I will call this *NORMATIVE TARGET OF EFFECTIVENESS*.

Normativism has been criticized on the grounds that it is unable to distinguish conditions that are intuitively thought of as real diseases (say, type 1 diabetes) from conditions which are alleged to be diseases merely because the conditions are disvalued.

This line of criticism can seem compelling when the basis of evaluation is a value system different than one's own, though ultimately this line of criticism is misguided. For example, (Ereshefsky, 2009) argues against normativism by appealing to the alleged disease 'drapetomania'. This condition, coined by a physician in the southern United States in 1851, was said to be an illness that some slaves had which caused them to try to escape from their masters. Ereshefsky writes:

> From our contemporary perspective, we think that it is wrong to call drapetomania a disease. We believe that drapetomania was not a disease then and is not a disease now. But if you are normativist, you cannot say that those American doctors were wrong to call drapetomania a disease. All you can say is that we have different values than those nineteenth century doctors. (2009, p. 224)

However, one can be a normativist about disease without being a relativist about values. It is not true that a normativist can *only* say that we have different values from those doctors in southern nineteenth century United States: a normativist can say that we now have *better* values. Thus a normativist could say that some doctors in the southern nineteenth century United States were correct (narrowly construed) to call drapetomania a disease, because according to their values having slaves escape was bad, but such doctors were incorrect (broadly construed) to call drapetomania a disease, because their values upon which the badness of escaping slaves was based were unwarranted. Conditional on the acceptability of any set of values (including values that sanction slavery), Ereshefsky is correct to say that normativism lacks the conceptual resources to condemn the categorization of escaping slaves as diseased; but conditional on the acceptability of only *warranted* values (which I presume do not include the sanction of slavery), Ereshefsky is incorrect to say that normativism lacks the conceptual resources to condemn the categorization of escaping slaves as diseased, because a normativist could say, quite simply, that such categorizations were based on an unjust social system (the immorality of slavery). Given some basis of warrant for values, normativism about health has the conceptual resources to criticize disease categories as appropriate or inappropriate.[11]

As suggested by the first paragraph of this section, one argument in favor of normativism is that it can account for some historical vicissitudes of disease attributions. Some conditions have been considered to be a disease at one time in history, and now are no longer considered to be a disease, and an explanation for this change is that such conditions are no longer disvalued.

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[11] Of course, one could question where such a basis of warrant for values comes from. This is not the place to defend a general non-relativistic ethical theory.

Someone with naturalist inclinations might say that a more central problem for normativism is that it does not require biological dysfunction in order for a state to count as a disease. This objection can go awry, however. Modifying Cooper's example of the redhead, suppose that one's hair color *does* cause one harm. Suppose that in a particular society red hair is associated with sin and thus redheads are shunned. Our redhead, in this society, would be diseased according to a normativist. Though the naturalist might complain—there is nothing physically wrong with the redhead!—in fact *CAUSAL BASIS OF DISEASE* is satisfied under both the adaptive account of function (because the redheads are shunned, they are less likely to survive and reproduce) and the causal/mechanical account of function (because the state is constituted by a relatively rare genetic difference-maker). Thus the normativist and the naturalist might agree on some seemingly odd disease attributions.

Some harmful states, however, do not have an identifiable constitutive causal basis, and it is compelling to think (for many such states) that this is not merely an epistemic shortcoming. Think of wealth inequality, dishonesty, and a taste for country music. It is a stretch to think that there is a physiological constitution of such states (there are, of course, causes of such states, but as noted above, *CAUSAL BASIS OF DISEASE* is not the requirement that there be distal etiological causes of states, but rather is the requirement that there is a constitutive causal basis of a state). What can the normativist say about such states? Either a normativist can base disease attributions solely on states which are disvalued based on constitutive causal-mechanical dysfunction (e.g. the badness of insufficient insulin production), or else a normativist can make disease attributions on at least some states which are disvalued not because of constitutive causal-mechanical dysfunction (e.g. the badness of wealth inequality, dishonesty, and country music). The first option holds *CAUSAL BASIS OF DISEASE* to be a necessary condition of diseases, in addition to an explicit requirement that a state be harmful in order to be a disease (and thus the view would be a version of hybridism, discussed below). The second option entails that some classifications of states as diseases are unintuitive, and are better thought of as a departure from political, moral, or aesthetic values, rather than as a disease.

Take, as an example more realistic than redheadedness, profound poverty, which is a state that any defensible value system ought to consider troubling, and anyone in that state is unlucky and is harmed in virtue of their poverty. At first pass, normativism must say that poverty is a disease. One could speak of poverty as a social disease, perhaps, but this metaphor aside, poverty is not a disease like type 1 diabetes or syphilis. The wrongness of poverty is a wrong of society, and though poverty is a harm to individuals, it is not a wrongness constitutive of an individual. There can be no penicillin for poverty.[12]

[12] There presently happens to be no penicillin for cancer either. However unfortunate, this is a historical contingency. There can be no penicillin for poverty because poverty is not constituted by a causal-mechanical dysfunction of a person.

In short: either normativism collapses into hybridism or else normativism makes unintuitive disease attributions.

A way out of this dilemma is to distinguish those bad states that are diseases from those bad states that are other forms of badness, such as poverty, dishonesty, and having a taste for country music. The standard normativist way to do this is to hold that a disvalued state is a disease if society is organized such that the disvalued state is attended to by physicians, rather than, say, welfare counselors, fact checkers, or music critics. Cooper argues for a way to make such a distinction (2002). Her third condition for a state to be considered a disease is that the state must be medically treatable. Diabetes is medically treatable with insulin. Poverty is not medically treatable, though it is socially treatable. So diabetes is a disease and poverty is not.

A problem with this solution to the dilemma is that the *medically treatable* requirement is too expansive. For instance, I am especially drowsy in the morning, more than most, and this drowsiness is treatable with coffee, and so—together with the fact that this drowsiness is bad for me (because it impedes my work) and renders me unlucky (because my drowsiness is unusually somniferous)—according to Cooper's account, my morning drowsiness is a disease. Cocaine could have an even perkier effect on my morning drowsiness. Merely from the badness and unluckiness of my morning drowsiness, and from the fact that caffeine or cocaine can treat my morning drowsiness, it should not follow that my morning drowsiness is a disease. A normativist might respond: doctors do not administer coffee or cocaine! That, however, is a thin sociological contingency upon which to base a theory of disease. Indeed, Cooper's suggestion simply pushes the question regarding disease attribution back a level. What makes interventions that mitigate diabetes *medical* while interventions that mitigate poverty or morning drowsiness non-medical? Naturalism (and hybridism) has a straightforward answer to this question, but I do not think a compelling answer can be given by normativism. Moreover, medical practitioners employ many interventions for states which are not diseases, such as contraceptive pills (Murphy, 2008). Further, physicians are unable to treat many diseases. Thus, the *medically treatable* condition is neither necessary nor sufficient for disease attribution (Boorse, 1977).

Worse for my present purpose, given my central concern regarding the notion of effectiveness, is that appealing to the condition 'medically treatable' is circular. This is not a problem for Cooper's account of disease *per se*; rather, it is a problem if one were to adopt Cooper's account of disease for the purpose of explicating the notion of effectiveness of medical interventions. A state is medically treatable if and only if there could be an effective medical intervention for that state. Here I am trying to determine what an effective medical intervention is; an intuitive though vacuous answer is that an effective medical intervention is one which increases health by mitigating disease; a normative theory of health requires a notion of 'medically treatable'; thus, a normative

theory of health requires a notion of effective medical interventions, so a notion of effective medical interventions is needed to explicate the notion of effective medical interventions. Indeed, a naturalist view is that the *medically treatable* condition gets matters backwards. A state is medically treatable *because* the state is a disease and an effective medical intervention might exist for the state, not the other way around. There is no penicillin for poverty *because* poverty is not a disease.

The fundamental insight of normative theories of disease is that biological dysfunction does not in itself warrant disease attributions, on any account of biological function, because disease attributions require valuations of states, and the basis of such valuations is not provided by biological facts alone. The problems raised in this section for normativism are challenges for *NORMATIVE BASIS OF DISEASE* if this condition is taken to be *sufficient* for disease attributions. But the problems are readily addressed if *NORMATIVE BASIS OF DISEASE* is taken to be merely a *necessary* condition for disease attribution. And I have given reasons to think that *NORMATIVE BASIS OF DISEASE* is a necessary condition for disease. Thus one way for a medical intervention to be effective is for it to modulate a disease state that is harmful and thereby mitigates the harm caused by the disease. This condition I will call *NORMATIVE TARGET OF EFFECTIVENESS*.

Earlier I suggested that the criticisms of naturalism allow that *CAUSAL BASIS OF DISEASE* is also a necessary requirement for the concept of disease. Thus we have two proposed necessary requirements for the concept of disease, which suggests an alternative to naturalism and normativism.

4 Hybridism

Hybrid accounts of disease draw on insights of both naturalism and normativism. A prominent example of a hybrid account of disease in the context of psychiatry has been proposed by (Horwitz & Wakefield, 2007). Disease attribution, according to such accounts, involves two conditions: a state must be biologically dysfunctional, and that dysfunction must be deemed harmful. Hybridism maintains both *CAUSAL BASIS OF DISEASE* and *NORMATIVE BASIS OF DISEASE* as necessary and jointly sufficient conditions for a state to be considered a disease.

What are the implications of a hybrid account of disease for the notion of effectiveness of medical interventions? Since hybridism holds both *CAUSAL BASIS OF DISEASE* and *NORMATIVE BASIS OF DISEASE* as necessary conditions for a state to be considered a disease, successfully intervening on either condition alone is sufficient for a medical intervention to be considered effective. That is because, since both conditions must be satisfied by a state for that state to be considered a disease, if an intervention modulates one of those conditions then that intervention goes at least some way toward mitigating

the status of the state as a disease. A medical intervention need only satisfy one of *CAUSAL TARGET OF EFFECTIVENESS* or *NORMATIVE TARGET OF EFFECTIVENESS* to be deemed effective.

I discussed above the fundamental reason for thinking that *NORMATIVE BASIS OF DISEASE* is a necessary condition for a concept of disease, namely, that the badness of diseases cannot determined by biological facts alone. I take this to be conclusive: *NORMATIVE BASIS OF DISEASE* is indeed necessary.

I also noted that eminent examples of diseases—such as diabetes, cancer, and all infectious diseases—satisfy *CAUSAL BASIS OF DISEASE*. This, though, is merely suggestive, and is not a conclusive argument that it is a necessary condition for a concept of disease. Indeed, Cooper (2002) argues against the necessity of *CAUSAL BASIS OF DISEASE* as follows:

> Claiming that diseases must have a biological basis would be too strong because there might be some mental diseases where there is nothing wrong with the patient's brain. It might turn out, for example, that irrational phobias are completely indistinguishable from reasonable fears by the neuro-sciences. (p. 277)

Indistinguishability of psychiatric states by neuroscience should not be taken as evidence that the states do not have distinguishable causal-mechanical bases, because present-day neuroscience may lack the technical sophistication to distinguish such bases. If, on the other hand, Cooper's indistinguishability claim is taken to be not merely epistemic but ontological, then, to the extent that one is committed to physicalism, one will find the claim mysterious. But there is a more practical counter-argument to Cooper. A commitment to *CAUSAL BASIS OF DISEASE* is held by most contemporary research psychiatrists in practice. One of the central contributors to the DSM-V, the most recent edition of the canonical diagnostic manual of psychiatric disorders, claims that

> the implicit belief that there is an underlying, incompletely understood brain-based dysfunction for the behavioral, cognitive, emotional and physical symptom syndromes is the de facto definition of mental disorders used by most members of the DSM-5 Task Force and Work Groups (Regier, 2012).

CAUSAL BASIS OF DISEASE is not too strong of a condition, is assumed by leading psychiatric researchers, and should be maintained as a necessary condition for disease attribution.

Moreover, *CAUSAL BASIS OF DISEASE* affords a critical perspective on some contemporary therapeutic practices. Consider Cooper's own example, the reification of the state called 'social anxiety disorder' as a disease based on the fact that the drug paroxetine (Paxil) is alleged to have a beneficial effect on people categorized with social anxiety disorder. It is appropriate to call social anxiety disorder a disease, according to Cooper, because it: (i) is a bad thing to have, (ii) is an unlucky state, and (iii) is medically treatable. Suppose, for the sake of argument, that it is true that social anxiety disorder is treatable by paroxetine. One might argue that because it is treatable by a

pharmacological agent, we have very good reason to think that social anxiety disorder has a constitutive causal basis (even if we do not yet know what that basis is).[13] On the other hand, suppose that one maintained the conviction that social anxiety disorder does not have a constitutive causal basis; this might be motivated by the thought that (as its name suggests) this state is constituted by phenomena at a social, rather than physiological, level. Thus if *CAUSAL BASIS OF DISEASE* were held as necessary for a concept of disease then social anxiety disorder would not be considered a disease. A social ill, perhaps, but not a disease. Accordingly one might hold that paroxetine is not an effective medical intervention for social anxiety disorder. This is not to deny that paroxetine has an effect on people categorized with social anxiety disorder—which is merely an empirical claim, and a modest one at that, since all sorts of things have effects on all sorts of people, such as baseball bats and coffee—but rather this is to make the conceptual point that if *CAUSAL BASIS OF DISEASE* is a necessary condition for a state to be a disease, and if social anxiety disorder does not satisfy the condition, then it is not a disease, and thus there can be no effective medical intervention for it. In short, *CAUSAL BASIS OF DISEASE* is a conceptual standard with which one can evaluate alleged medical interventions for an alleged disease.

Despite such a commitment to *CAUSAL BASIS OF DISEASE*, present medicine does not understand the constitutive causal basis of many alleged diseases (elsewhere I reject as unwarranted the magic bullet rhetoric often used to describe the alleged mechanisms of most medications). This limitation is especially salient in psychiatry. Thus one might ask: what policy ought a hybridist have toward intervening on alleged diseases about which we lack knowledge of their physical bases, given the hybridist's commitment to *CAUSAL BASIS OF DISEASE*? Hybridism does not entail any particular treatment policy: not knowing a constitutive causal basis does not imply that there is no such basis, and so an epistemic limitation of not knowing the constitutive causal basis of a particular disease would not entail that the conceptual requirement of *CAUSAL BASIS OF DISEASE* remains unsatisfied.

In order for a medical intervention to be effective, its target must be a disease, and thus both *CAUSAL BASIS OF DISEASE* and *NORMATIVE BASIS OF DISEASE* must be satisfied. But an intervention must target only one of the bases of disease to be effective, thus only one of *CAUSAL TARGET OF EFFECTIVENESS* or *NORMATIVE TARGET OF EFFECTIVENESS* must be satisfied. Hybridism therefore provides an elegant theoretical underpinning to the two primary aims of medical treatment: cure and care. If a medical intervention satisfies *CAUSAL TARGET OF EFFECTIVENESS* then the intervention can be used to *cure* (or at least mitigate the constitutive causal basis of) a disease. If a medical intervention satisfies *NORMATIVE TARGET OF EFFECTIVENESS* then the intervention can be used to *care* for patient

[13] (Tsou, 2012) presents a detailed case to argue a similar point: pharmacological interventions have served as tools in the refinement of neurobiological theories of mental disorders.

with a disease. Some medical interventions target the constitutive causal basis of a disease—antibiotics, say—and for this reason alone are valuable, though such interventions are additionally valuable because in virtue of eliminating the constitutive causal basis of a disease they also eliminate the normative basis of the disease. Some medical interventions modulate only the symptoms of a disease without modulating the constitutive causal basis of the disease—pain relievers, say—and for this reason alone are valuable. Some medical interventions modulate the constitutive causal basis of a disease's symptoms without thereby curing the disease—insulin, say—and so the constitutive causal basis of such diseases are not eliminated but the intervention provides value to the patient thanks to mitigation of symptoms (and thereby at least some mitigation of the normative basis of disease). In short, hybridism explains why medicine has, as two primary aims, cure and care. Hybridism also explains why cure is a more fundamental aim than care—because cure typically also offers care, but not vice versa.

One might hold that a way to satisfy *CAUSAL TARGET OF EFFECTIVENESS* could be to give a patient a drug that targets the constitutive causal basis of the patient's disease but simultaneously kills the patient due to other effects of the intervention. Detonating a nuclear bomb on a cancer patient is sufficient to eliminate the causal basis of the patient's cancer, for example. However, the pre-theoretic starting point of my analysis is that an intervention is effective if (and only if) it increases a person's health by targeting a disease, and thus an intervention which decreases a person's health while targeting their disease (by killing them, say) cannot be deemed effective. (To address the further question of what it means to increase a person's health would require a positive account of health, which is beyond the scope of this paper.)

Hybridism avoids the problems with naturalism and normativism noted above. Take the reference class problem for naturalism. Suppose a young man has a physiological abnormality—a deficiency of *x*, say—which causes erectile dysfunction. Further suppose that deficiency of *x* becomes more common as men age, until it is quite typical among men in their 70s. I take it as intuitive that the young man has a disease, while an old man who has the same physiological state which causes the same patient-level symptom does not have a disease. A hybridist could explain this in two ways, corresponding to the two requirements of hybridism. First, a hybridist could say that the difference between the old man and the young man is that the state of the former satisfies *CAUSAL BASIS OF DISEASE* but the state of the latter does not. To do this, the hybridist needs a way to delineate the reference classes such that the physiological state of the young man is deemed abnormal but the physiological state of the old man is deemed normal. Recall that naturalism has no purely 'natural' way of delineating reference classes, but a hybridist can appeal to social values such that when it comes to assessing sexual function, the appropriate reference class to assess the young man is, say, men under 60, rather than all men. Second, a hybridist could say that the difference between the old man and the young man

is that the state of the former satisfies *NORMATIVE BASIS OF DISEASE* but the state of the latter does not. To do this, one would have to make the case that the young man is harmed by his state but the old man is not. A hybridist, again, can appeal to social values to do this.

5 Eliminativism

A popular recent view is that medicine will be able to do away with disease concepts altogether as we gain more knowledge regarding the pathophysiological processes underlying the states that we categorize as diseases. This view, which I will call eliminativism, holds that the dispute between naturalism, normativism, and hybridism will eventually dissolve once we gain enough biological knowledge.

Depending on the precise formulation of eliminativism, the view is not very different from hybridism. For instance, the form of eliminativism proposed by (Ereshefsky, 2009) holds that "we should frame medical discussions in terms of state descriptions and normative claims"—descriptions of physiological states or psychological states and value judgments of those states (see also (Hesslow, 1993)). Ereshefsky criticizes certain aspects of particular hybridist accounts, such as the commitment to an evolutionary account of function in Wakefield's version of hybridism, and thereby holds his own account as distinct (we have already seen, though, that hybridism does not require an evolutionary account of function). The virtue of Ereshefsky's approach is that it affords a separation of debates regarding state descriptions from debates regarding normative evaluations of those states.

A similar proposal by Lange (2007) claims that we ought to dispel with coarse-grained disease categories in favor of finer-grained state descriptions. But nothing about hybridism is committed to coarse-grained categorizations of states as diseases. A good hybridist could say: the finer the grain of our categories, the better. If the grain happens to be at the level of biochemical or physiological mechanisms, all the better. Nevertheless, having a name for such states can still be useful—says the hybridist—for teaching medical students, communicating with patients, administering healthcare systems, and predicting patient outcomes. A state description might be "autoimmune destruction of pancreatic beta cells, which causes insulin deficiency and thereby an increase in blood glucose levels", and the evaluation of such a state might be (universally) "bad", but to the medical student, patient, physician, and insurance program, the state remains type 1 diabetes.

Thus, for my purpose, the implications of eliminativism for the notion of effectiveness of medical interventions are similar to that of hybridism. The requirement of a physiological state description just is *CAUSAL BASIS OF DISEASE*, and the requirement of a normative description just is *NORMATIVE BASIS OF DISEASE*. Ereshefsky's proposal is to keep debates about state descriptions distinct from debates about their respective evaluations.

That is perfectly amenable with hybridism. The key difference with respect to understanding effectiveness of medical interventions is that hybridism holds that effectiveness requires the targeting of a disease (either its causal basis or its normative basis, or ideally both), whereas eliminativism holds that effectiveness is more simply a matter of targeting some state or other, without requiring that such a state be conceptualized as a disease.

As (Cooper, 2002) rightly notes, whether or not a condition is classified as a disease can have broad economic and social consequences. For example, the decision of a payer (insurance company, individual, or government) to fund treatment of a particular physiological state often depends on whether or not that state is properly considered a disease. Replacing the employment of a disease concept with the employment of physiological state descriptions would eliminate a central consideration in such decisions. To put this another way, medicine is primarily concerned with intervention. One must often decide which states to intervene on and which to not. It is often necessary that an individual patient make such a decision, but it is almost never sufficient, because other decision-makers, especially physicians and payers (insurance companies, governments) must also decide that some state should be intervened on. The conceptualization of a state *as a disease* is often invoked to justify such decisions. For example, some interventions are considered appropriate treatments, because they target diseases, whereas other interventions are considered enhancements, because they modulate normally functioning biological processes. Granted, the distinction between treatment and enhancement has been the subject of much controversy; but much of the basis of this controversy depends on a concept of disease. Without a disease concept one dispels with a foundation for making many of the important social, legal, and economic decisions in medicine.[14]

In short, my preferred theory of disease is hybridism. But the difference between hybridism and eliminativism is slim. Eliminativists maintain requirements exactly like *CAUSAL BASIS OF DISEASE* and *NORMATIVE BASIS OF DISEASE* for those states deemed to be the proper target of medical intervention.

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[14] Ereshefsky argues that in technical discussions medical scientists tend to dispel with disease categories in favor of state descriptions (just as biologists use the terms 'gene' or 'species' in public forums while articulating the technical details of the subject for their colleagues without relying on such abstract terms). Here, for instance, is the eminent psychiatrist Kenneth Kendler discussing the unwarranted reification of disease categories: "social forces—reimbursement policies, grant review committees and journal editors—sometimes enforce a false hegemony for diagnostic manuals beyond that intended by its creators or warranted by the quality of its often tentative scientific support" (Kendler, 2012). It is these social forces, says Kendler, which leads medical discourse to employ talk of diseases and a construction of hegemony of such discourse via their diagnostic manuals, rather than the technical details of the subject matter in question.

6 Discussion

What is an effective medical intervention? What are the conditions that a medical intervention must satisfy—what must a medical intervention do and what ends must it bring about—to be considered effective? My starting point was the platitude that an effective medical intervention improves health by targeting disease, and I argued that since the best theory of disease is hybridism, an effective medical intervention must satisfy either *CAUSAL TARGET OF EFFECTIVENESS* or *NORMATIVE TARGET OF EFFECTIVENESS*.

The analysis of effectiveness thus far entails that effectiveness of medical interventions is a relational property, in which the relata are (i) a causal capacity of the intervention, and (ii) properties of a circumscribed set of people who have a particular disease. The type of causal/mechanical dysfunction that is the constitutive causal basis of a disease is a property of those people that have the disease in question, and the corresponding harm caused by the disease is a harm to those people that have the disease in question. Since effectiveness of medical interventions is characterized by a causal capacity to intervene on the biological dysfunction of a disease or the harm that such dysfunction causes (or both), effectiveness is a relational property between (i) and (ii).

(Ashcroft, 2002) notes that a medical intervention might have a physiological effect (it intervenes on a physiological mechanism), a clinical effect (it modifies objectively measurable symptoms), a patient-relevant effect (it modifies subjective reports of well-being), and a population-relevant effect (it modifies the health of a population). One might assume that effects at higher levels supervene on effects at lower levels: population-relevant effects supervene on patient-relevant effects, patient-relevant effects supervene on clinical effects, and clinical effects supervene on physiological effects. *CAUSAL TARGET OF EFFECTIVENESS* seems to prioritize the importance of an intervention's effects at a microphysiological level. However, this way of thinking about an intervention's effects is an intellectual quagmire. Why emphasize the microphysiological level? A friend of supervenience will hold that if an intervention modulates parameters at a microphysiological level, then the real causal action must be happening at a lower level still. Little weight should be placed on the ontology of such levels; (Thalos, 2013), for example, forcefully argues that nature does not come packaged into such neat levels.[15] However, for some of our most effective medical interventions—those aptly described as 'magic bullets'—it is at least pragmatically useful to think of their effects as operating primarily at a particular level, usually microphysiological.

For example, some antibiotics interfere with the reproductive mechanisms of infectious bacteria, and it is useful to characterize the causal action of such antibiotics at this scale (of cellular machinery). In some cases we have fairly good epistemic access to

[15] For a detailed account of levels as they are employed in explanations in neuroscience, see (Craver, 2007).

the relations of effects at various scales—insulin binds to a cellular receptor, causing many microphysiological effects, which decreases concentrations of sugars in the blood, which mitigates neurological symptoms (e.g. pain and vision loss) and cardiovascular symptoms (e.g. heart attacks), which enhances the quality of life of diabetics. For our most impressive medical interventions—which prominently include the examples of antibiotics and insulin—it is compelling to say that *CAUSAL TARGET OF EFFECTIVENESS* is satisfied, despite reservation about an ontology of levels.

However, for many medical interventions we have limited epistemic access to their effects at various scales, and limited knowledge of the relations between effects at various scales. For example, some drug therapies for multiple sclerosis appear to reduce 'white lesions', purported to be 'biomarkers' or physiological correlates of the disease, but these drugs have little impact on phenomenological (patient-relevant) symptoms of multiple sclerosis in the long run (see (Lavery, Verhey, & Waldman, 2014) for a discussion of the various sorts of outcomes measured in clinical trials on interventions for multiple sclerosis).

Consider another example. Because high cholesterol is said to be a risk factor for heart disease, interventions to lower cholesterol have been widely prescribed. As one critic of cholesterol-lowering drugs notes, what ultimately matters with respect to avoiding heart disease is whether or not a patient does in fact develop heart disease, but because high cholesterol has itself become a target of intervention, "you can define a treatment's success as [causing] a lower cholesterol level, as if cholesterol is of itself the problem" (cited in (Moynihan & Cassels, 2005)).[16] This standard of success is problematic, according to such critics, because the causal basis of heart disease is vastly more complicated than mere high cholesterol levels. Lowering cholesterol levels to mitigate heart disease does not satisfy *CAUSAL TARGET OF EFFECTIVENESS*. This is a problem because, as Moynihan & Cassels (2005) note, for many people "the drugs may be useless, wasteful, and harmful"—useless, wasteful, and harmful because for the vast majority of people with high cholesterol the drugs do not mitigate heart disease but are costly and have numerous side effects.[17]

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[16] A review of the evidence on cholesterol-lowering drugs concluded that for men who have not suffered heart disease, these drugs have only "small and clinically hardly relevant improvement" (Vrecer, Turk, Drinovec, & Mrhar, 2003). See the companion article to this one ("Measuring Effectiveness") for a discussion of how effectiveness ought to be measured (Stegenga, forthcoming-a).

[17] Moreover, as with many other states which are alleged to be diseases or precursors to disease, the definition of what counts as high cholesterol has been weakened over time, which has increased the number of people deemed unhealthy due to high cholesterol. The basis of this lowered threshold is controversial for both clinical and financial reasons. Moynihan and Cassels (2005) report that of the nine experts on the panel that revised the guidelines regarding cholesterol in 2004, eight had financial ties to pharmaceutical companies all of which manufactured cholesterol-lowering drugs. The guidance provided by this panel

For an intervention to be effective, it will not suffice that it has some effect or other on some level (perhaps physiological, perhaps clinical, perhaps…). A medical intervention may have an effect on one level but not another, and that level may be unimportant with respect to both *CAUSAL BASIS OF DISEASE* and *NORMATIVE BASIS OF DISEASE*. As noted above, merely modulating a parameter such as cholesterol concentration in the blood is insufficient to satisfy *CAUSAL TARGET OF EFFECTIVENESS* when attempting to intervene on heart disease. It might not matter to a particular patient that he has a cholesterol concentration above a certain threshold, because this cholesterol concentration is not likely to cause any phenomenological patient-level symptoms (let alone heart disease or early death), and therefore a drug which is effective only at lowering cholesterol would be ineffective at modulating parameters that matter to the patient. Likewise, merely mitigating any harm is insufficient to satisfy *NORMATIVE TARGET OF EFFECTIVENESS*. That is because, for a medical intervention to be deemed effective, it must target a genuine disease. Consider again an example that I used earlier: suppose antidepressants do in fact improve patients' moods in quotidian cases of depression, and further suppose that such cases are not genuine diseases because they do not satisfy *CAUSAL BASIS OF DISEASE*—some might be tempted to call such drugs effective for such cases, but the hybridism I defended above holds that interventions can only be deemed effective if they target genuine diseases, and thus antidepressants cannot be deemed effective for such cases.

Medical interventions can be effective to varying degrees of demographic and situational generality. The distinction between efficacy and effectiveness goes some way to addressing this. Efficacy is usually thought to be a causal property of an intervention which manifested in a particular controlled setting, whereas effectiveness is usually thought to be a causal property of an intervention which has the potential to manifest in settings more general and less controlled than the particular experimental setting in which efficacy was demonstrated.[18] Thus the usual way of thinking about the notion of effectiveness, as distinct from the notion of efficacy, holds that effectiveness is a more general property than mere causal efficacy manifest in a particular experimental environment. The following condition is therefore insufficient as an analysis of effectiveness:

WORKS SOMEWHERE

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increased the number of people deemed to be in a state (high cholesterol) that is modifiable by drugs produced by financial backers of the panel members by many millions.

[18] The question I pose here (an analysis of the conditions of effective medical interventions) is distinct from that posed by (Ashcroft, 2002) (a metaphysical analysis of the notion of clinical effectiveness). Ashcroft tells us what effectiveness means; I want to know what a medical intervention must do in order to be considered effective. Ashcroft's analysis of effectiveness is 'capacity to achieve some outcome', whereas mine is 'capacity to cure disease or modulate symptoms of disease'.

> An intervention satisfied *CAUSAL TARGET OF EFFECTIVENESS* or *NORMATIVE TARGET OF EFFECTIVENESS* for some group of subjects in a particular experimental setting.

WORKS SOMEWHERE might be the beginning of an explication of the concept of efficacy, but does not provide a compelling account of effectiveness. Cartwright (2012) distinguishes *WORKS SOMEWHERE* from two other kinds of causal claims that are candidate analyses of effectiveness, and which are suggested by the usual distinction with efficacy. Since Cartwright is mostly concerned with causal claims in social policy, I modify her account to apply to medical interventions. One kind of causal claim that could serve as an explication of effectiveness is:

> *WORKS GENERALLY*
> An intervention satisfies *CAUSAL TARGET OF EFFECTIVENESS* or *NORMATIVE TARGET OF EFFECTIVENESS* for a class of patients in varied settings.

An intervention could be effective for certain types of people in certain circumstances despite not being universally effective.[19] The demarcation of the types of people for whom the intervention is said to be effective can be as broadly or narrowly defined as the details of the particular disease and intervention require. *WORKS GENERALLY* is the view that a medical intervention should work for a well-defined class of people and circumstances.

Another candidate is:

> *WORKS FOR US*
> An intervention will satisfy *CAUSAL TARGET OF EFFECTIVENESS* or *NORMATIVE TARGET OF EFFECTIVENESS* for this particular patient.

Although the causal claim in *WORKS FOR US* is more specific than the causal claim in *WORKS GENERALLY*, the epistemological requirement for warranting a claim of the former type is stronger than the epistemological requirement for warranting a claim of the latter type. That is because claims of type *WORKS FOR US* require justification for *WORKS GENERALLY*,

[19] A widespread view in medical research is that although the epistemological requirements for warranting causal claims of the type *WORKS SOMEWHERE* are high—usually thought to require evidence from randomized trials—once these standards have been met, there are scant additional epistemological requirements for warranting causal claims of the type *WORKS GENERALLY*. For example, Guyatt, one of the central figures in the evidence-based medicine movement, and his colleagues propose that extrapolating from *WORKS SOMEWHERE* to *WORKS GENERALLY* should be the default practice: "results of randomized trials apply to wide populations unless there is a compelling reason to believe the results would differ substantially" (Post, de Beer, & Guyatt, 2012). For shortcomings of this view, see (Fuller, 2013), (Stegenga, 2014), and the companion article to this one (Stegenga, forthcoming-a).

plus justification that the specific conditions regarding the particular patient under consideration are such that the causal claim expressed by *WORKS GENERALLY* applies to this particular patient.[20]

In a brief account of effectiveness of medical interventions, (Howick, 2011) adopts a principle akin to *WORKS FOR US* as one of three necessary conditions. An effective medical intervention, according to Howick, must "be applicable to the patient being treated." This condition is obviously important—it is what clinicians and patients want to know anytime they decide whether or not to use a particular medical intervention. True, the effectiveness of a medical intervention is constituted in part by a causal capacity of the medical intervention, and it is reasonable to suppose that this capacity transcends the idiosyncratic details of any particular patient (Ashcroft, 2002). However, this capacity may or may not operate for some particular patient, for mundane reasons (a drug for male potency will not manifest this particular capacity when administered to a female), for more subtle reasons (a birth control pill may not cause thrombosis in a particular woman, despite its capacity for causing thrombosis, because it inhibited pregnancy which itself is a cause of thrombosis), and because the constitutive causal basis of many diseases is so complex (a statin may not prevent a heart attack in a particular patient despite its capacity for lowering cholesterol, because the causes of heart attacks are manifold and complex). The interest of a patient and her physician is whether or not some medical intervention will manifest its capacity *for that patient*, and so it is causal claims of the type *WORKS FOR US* that matter to determining effectiveness.

As noted above, it takes more than merely modifying some physiological parameter or other to satisfy *CAUSAL TARGET OF EFFECTIVENESS*. This condition holds that a medical intervention must modulate physiological parameters associated with the particular disease being intervened on. Not all effects of a medical intervention are relevant to the causes or symptoms of the targeted disease, however. Many effects of medical interventions are irrelevant to the disease in question or are themselves harms, often called 'side effects' or 'adverse effects' of medical interventions. Interventions target the constitutive causal basis of a disease to varying degrees of specificity. Adverse effects are familiar examples of effects of medical interventions which modulate parameters other than those that cause or constitute a disease. But an effect of a medical intervention that

[20] For *WORKS GENERALLY* and *WORKS FOR US* it is *patients* who are intervened on, whereas the target of intervention in *WORKS SOMEWHERE* are research *subjects*. This reflects the idea that the causal claim in *WORKS SOMEWHERE* is limited to an experimental setting, whereas the causal claims in *WORKS GENERALLY* and *WORKS FOR US* apply to clinical practice. The verb tense of the three kinds of causal claims is meant to represent the typical ways in which such claims are made—we talk of a particular RCT, in the past tense, as having suggested that some causal relation was instantiated; we talk of certain interventions, in the present tense, as having causal capacities; and we talk of certain interventions, in the future tense, as reliably manifesting this causal capacity when we in fact use the intervention.

does not modulate parameters that constitute a disease does not have to cause harm. Such an effect might modulate a parameter in a way that provides some non-disease specific benefit to a patient, or in a way that provides neither harm nor benefit to the patient, while not modulating parameters relevant to the disease in question. An intervention with only such effects as these would not satisfy *CAUSAL TARGET OF EFFECTIVENESS* and thus would not be effective relative to the disease in question.

I have spoken thus far as if *CAUSAL TARGET OF EFFECTIVENESS* and *NORMATIVE TARGET OF EFFECTIVENESS* are conditions that are either satisfied or not by some particular medical intervention. This idealization permitted me to explore aspects of effectiveness without pesky complications, but it is, obviously, false. Medical interventions can satisfy the conditions of effectiveness to varying degrees. Effectiveness is something to be measured. I examine the measurement of effectiveness in the companion article to this one, and argue that measuring effectiveness has three significant methodological challenges, and these challenges contribute to overestimating effectiveness in practice.

7 Objections

I have argued that to be deemed effective a medical intervention must meet one of two conditions: *CAUSAL TARGET OF EFFECTIVENESS* and *NORMATIVE TARGET OF EFFECTIVENESS*. Medical interventions widely deemed to be effective, such as insulin and penicillin, satisfy both of these conditions; medical interventions that are effective at mitigating only the symptoms of a disease satisfy the latter condition.

I anticipate several objections. Perhaps the foremost objection will hold that effectiveness is merely an empirical matter. If a carefully conducted clinical trial shows that a medical intervention modifies some particular measured parameter—this objection goes—then that intervention is, by definition, effective. If another ten or a hundred trials show similar results, all the better. This objection depends on a narrow construal of effectiveness. I have argued that effectiveness is a theoretical concept that depends upon other theoretical concepts, namely health and disease. The conceptual content of effectiveness entails that it is not sufficient for an intervention to modulate just any parameter, regardless of the strength of that modulation or the number of trials in which such modulation has been replicated.

One might hold that the view proposed here has too narrow a view of the goals of medicine. Physicians do more than simply treat diseases—cosmetic surgery, abortion, and contraceptive practices, for example, are all activities of physicians—and the standards of effectiveness defended here do not apply to such activities. Such an objection is based on a misunderstanding of my thesis. I grant the multifaceted goals of medicine and the plural activities of physicians. One central and definitive goal of medicine, however, is the

improvement of health by intervening on disease, and it is for this central goal that my analysis applies.

One might note that many medical interventions now employed do not meet either of the conditions I have argued for here (as suggested by several of my examples), and thus my account does not reflect medical practice. However, the account of effectiveness of medical interventions proposed here is prescriptive, rather than a description of features of all medical interventions alleged to be effective. To the extent that there is a mismatch between the standards of effectiveness of medical interventions that I have proposed here and what are taken to be effective medical interventions, I hope that my account is revisionary. That said, although properly defending the point here would take more space than is possible, my account of effectiveness does track those medical interventions that are generally considered to be highly effective compared with those that are not. As examples: insulin and penicillin satisfy *CAUSAL TARGET OF EFFECTIVENESS* and *NORMATIVE TARGET OF EFFECTIVENESS*, while it is controversial whether or not statins and antidepressants satisfy either of these conditions.

A similar objection could be pressed: the conditions that a medical intervention must meet in order to be deemed effective, according to the account proposed here, constitute too high a standard. According to this stringent standard, very few medical interventions ought to be deemed effective. This response, of course, is not an objection to the arguments that warrant the view itself, but is merely an objection to a possible entailment of the view. As noted above, the conditions defended here for effectiveness are in fact satisfied by those medical interventions which are widely taken to be among the best medical interventions, some of which—like insulin for treating diabetes—I employed as illustrations of the conditions. Insulin, and other medical interventions like it which satisfy the conditions proposed here, serve as 'gold standards' of effective medical interventions, and show that, while the conditions I propose are stringent, they are indeed attainable. However, in the companion article I argue that the measurement of effectiveness faces three methodological problems, and in practice these problems contribute to overestimating effectiveness. If these problems of measurement were better addressed, our estimations of the effectiveness of many medical interventions would be more accurate and lower than they now are.

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