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Forsaking Fortune: Luck and Its Limited Utility to Cancer Diagnosis

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Abstract

This paper interrogates the concept of luck in cancer diagnosis. I argue that while it might have some utility for individuals, at the clinical and research level, the concept impedes important prevention efforts and misdirects sources of blame in a cancer diagnosis. Such use, in fact, has the possibility of harming already vulnerable efforts at ameliorating social determinants of health and should therefore be eliminated from research and clinical contexts.

1. Introduction

At the heart of diagnosis is not only a characterization of a given condition, a delineation and predicted progression of symptoms, but also sometimes an expectation of explanation. Especially in cases of complex conditions, a patient might be spurred to ask, "Why me?"—to interrogate where the condition came from, how it arose, or to seek what some philosophers might refer to as a causal story. Cancer diagnoses can be said to be a product of many different causes, from socially determined to intrinsic biological reasons (for a non-exhaustive list of publications that discuss recent and historical understandings of causes of cancer, see Van Helvoort 1999; Gillies 2011; Plutynski 2018; Parascandola 2011). More often than not, though, it is at least somewhat difficult to reach a final conclusion as to why a certain person has cancer. Despite this difficulty, and as clinical attention turns to treatment, however, a patient might still press their physician on this matter. They might understandably linger on questions of "Why me?" And if there is no set of causes readily at hand for the physician to turn to, they might answer that an individual's cancer is simply a matter of "bad luck."[1]

[1] The luck involved in treatment choice and efficacy is a separate issue that I partition for the purpose of this paper.

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The use of "bad luck" to tell a causal story as related to cancer diagnoses is the subject of this paper. In recent years, some cancer biologists have claimed that a significant portion of the variation in cancer risk among tissues is a result of "bad luck," or "random mutations arising during DNA replication" (Tomasetti and Vogelstein 2015, 78). I call this *stochastic* bad luck. This stochastic form of luck, however, is an anorexic construal of how luck can be and is used when telling a story of cancer diagnoses that has, in the past decade, eclipsed many other senses of luck that are at work. Therefore, the first purpose of this paper is to provide a descriptive conceptual analysis of the epistemic role that luck plays in cancer diagnoses.

Here, I discuss not only stochastic luck, but also agnotological luck, which describes luck that has no known cause; hereditary luck, which refers to inherited traits that might contribute to a diagnosis; and environmental luck, which refers to the factors of luck in someone's surroundings that might contribute to a diagnosis. This exercise in conceptual engineering highlights not only the functional role these concepts play in diagnosis but is intended as ameliorative conceptual engineering, with the intent to clarify and correct our notions of these concepts before moving on to their ethical implications (Brigandt 2010; Haslanger 2020, 2000). This conceptual engineering portion of the paper lays the foundation for my first claim—that luck concepts turn out to play an inverse role to the use of jargon in medical contexts.[2] It is well established that although clinicians frequently employ jargon in medical contexts, they also acknowledge that such jargon should be avoided so as to maintain patient understanding (Gotlieb et al. 2022; Allen et al. 2023; Rimmer 2014). The worry in using jargon is that using expert-level explanations will impede layperson understanding. Here, the inverse occurs: luck concepts are often brought in to aid in layperson understanding but they threaten to undermine explanatory content at the level of the expert. This observation motivates my move toward a sort of luck pluralism wherein a fragmentation of the term assists in clarifying its helpful uses and dispenses with its unhelpful uses (Taylor and Vickers 2017).

I divide my rationale for this eliminativism into two parts: the problem of prevention and a concern about blame. Eliminating the vague or general concept of luck in favor of a more pluralist concept accomplishes three goals that are already important to Western medicine and bioethics: it rescues the concept of prevention from an impoverished fate; it establishes a reinvigorated concept of patient autonomy in service of well-being; and it relocates medical risk from an abstract concept to the realm of the tangible. A misuse of luck also allows physicians and medical professionals to incorrectly locate the sources of blame in a cancer diagnosis. If we attribute any causal explanation of cancer diagnoses to luck, we risk ignoring the socially determined factors that contribute to cancer and how they might be controlled for or prevented.

2. The Current Picture: Luck in Cancer

The element of luck in cancer diagnoses comes in many different forms. Often, colloquially, one might refer to "luck," "chance," a "roll of the dice," a "tough break," "misfortune," a "gamble," or a "lottery." These are some examples of how luck is used in the popular media:

[2] Thank you to an anonymous reviewer for this idea.

> The biggest conceptual breakthrough in the war on cancer was the realisation by the 1980s that it is always a genetic disease. Sometimes the genetic flaw is inherited. Sometimes it is the result of exposure to an outside agent such as tobacco smoke or radioactivity. Sometimes it is plain bad luck; a miscopying of a piece of DNA during the normal process of cell division. (*The Economist* 2012)

> Getting cancer is not purely down to genes, fate or bad luck. Indeed, only a small number of cancers are hereditary. (Roberts 2010)

> Everyone said, "It's not your fault that you are sick. Hodgkin's Lymphoma is a bad luck cancer. You can't take your cancer personally." Well, I did. (Hendricks n.d.)

> While many of these cancers can be attributed to drinking or smoking, others can result from viruses such as the Human Papilloma Virus (HPV). Unfortunately, most are due to just bad luck. (Fox Chase Cancer Center 2018)

A majority of the ways in which the concept of luck has been employed in both the academic and popular literature has been imprecise in nature, with the individuals who employ this concept completely unaware of any potential downstream effects. At the center of these uses, however, is some measure of uncertainty. The above examples demonstrate this imprecision and uncertainty: luck is cast as a random process; it is contrasted with hereditary causes of cancer; it is used to indicate randomness and eschew blame from the individual; and it is posed as not a result of a choice, activity, or primary infection.

When one employs the concept of luck in cancer, one employs it, more often than not, (1) as an under-determined concept (they do not have a specific type of luck in mind); (2) in place of a more specific causal explanation (if the person was a smoker their entire life and ends up with lung cancer, they are less likely to employ the concept of luck); and (3) as a way to take blame from an individual (in the case of the individual who has never smoked but nonetheless ends up with lung cancer).

The purpose of this section and the next is to investigate this under-determined concept of luck to motivate more highly determined concepts of luck, which can be properly employed in place of the under-determined concept. These more specific concepts will ultimately be in service of not only patient understanding regarding the origins of their diagnosis, but also in service of scientific accuracy. The goal of this section is to capture an accurate picture of luck in its various forms so as to enhance patient's knowledge of cancer etiology while not risking misconstruction of such explanations from jargon.[3] Furthermore, the use of more highly specified luck concepts on the part of experts will hopefully also have the effect of the under-determined concept of luck falling out of use, making room for more helpful concepts that aid in expert understanding of cancer etiology.

2.1 Luck in Philosophy, Science, and Philosophy of Science

The previous section dealt with the ways in which luck is discussed in the science media, blogs, and patient testimonies, and other popular sources. However, luck, related to one's

[3] Thank you to an anonymous reviewer for suggesting this helpful framing.

health and otherwise, has also been discussed in the philosophical literature. Ronald Dworkin, for example, refers to "option luck," or "a matter of how deliberate and calculated gambles turn out—whether someone gains or loses through accepting an isolated risk he or she should have anticipated and might have declined" (2002, 73). In the realm of cancer diagnoses, "option luck" might constitute things that an individual does to increase their chances of cancer, such as smoking, consuming alcohol and red meat, exposure to the sun or radiation, and other so-called personal decisions.[4] This sort of luck opposes the Dworkinian notion of "brute luck," or luck due to "nature," or "a matter of how risks fall out that are not in that sense deliberate gambles" (2002, 73). Brute luck might sometimes be construed as genetic luck, though Dworkin's focus is righting the wrongs done by such sorts of luck. Often considered among the luck egalitarians, Dworkin focuses on the ways in which justice might be pursued in light of such luck conditions, rather than the biological determinants that cause such conditions.

The behavioral geneticist Kathryn Paige Harden advocates for this sort of luck. She puts forward a view of genetics that allows people to see their genotypes as a source of very important luck built into their very being (Harden 2021). It is important to recognize this sort of luck, she argues, in our quest for justice. For example, if one's genotype indicates an inability to do well in school, one might be less blameworthy if one is "unsuccessful" in that endeavor. In other words, people should not be punished simply for the fact of their genetic differences.

Following the trail of luck out of political philosophy, and into the intersection of science and philosophy, another sense of brute luck might be the effects that are wrought by random mutations in one's DNA that cause various changes that might result in cancer. The cancer biologists Cristian Tomasetti and Bert Vogelstein argue that this random biological process, in fact, is responsible for a majority of the variation in cancer risk across tissues (2015). This empirical assertion will be taken up in more detail in section 3.2.

Nonetheless, not only was Tomasetti and Vogelstein's argument discussed and criticized in the scientific literature, it was also carefully considered by Anya Plutynski (2021), who first posits that luck may refer to different meanings of chance within current scientific discourse. For instance, one might use "chance" to refer to the "formal modeling of a given event or event type," or second, one might say that "chance" is more subjective and involved in unpredictability, which eschews a specific probability assignment. Third, "chance" might refer to the sort of randomness whose effects are "indiscriminate," such as in the case of random genetic mutation. Fourth, it might also refer to the sort of chance that operates as a "proxy for 'probability'," referring to both exogenous and endogenous factors. It is in this fourth sense that Plutynski reasons that one might argue that "*all* cancers are a product of 'chance'." Finally, luck might refer to chance in the sense that strictly intrinsic factors lead to an increase in susceptibility to the disease. Oftentimes, for example, infant deaths due to congenital effects are referred to as outcomes of chance.

Yet in her assessment of luck, both with regard to cancer diagnosis and in scientific discourse more broadly, Plutynski (2021) comes to two conclusions: (1) there is inconsistency in the ways in which the scientific literature talks about luck; and (2) this inconsistency has led to confusion in the literature. With these conclusions, Plutynski lends

[4] Note that these are complex risk factors, some of which might more readily fit under the "environmental luck" category later on. This is also not to say that it is appropriate, accurate, or morally right, but rather an option for conceiving of luck in this conceptual area.

much-needed nuance to a conversation employing a broad conceptualization of luck. Still, more varied characterizations of luck are needed to fulfill the goals of cancer biologists, physicians, epidemiologists, and others. This call to action is the focus of the next section.

3. Four New Luck Concepts

3.1 Agnotological Luck

The first of the new characterizations of luck is what I will refer to as *agnotological luck:* one's cancer diagnosis is a result of agnotological luck when there is no known causal story for the diagnosis. Using luck in this manner communicates ignorance with regard to such a causal story, but also indicates the possibility that there is not a need for such a causal story because when one receives a cancer diagnosis, it is sometimes more important to focus on treatment options, rather than spend more time on a diagnosis' etiology. This sort of luck is important in a clinical setting to alleviate any potential blame from the individual patient.

A few examples might be helpful in depicting this sort of luck in action. One blogger claims of her skin cancer that "it's simply luck, whether good or bad. I didn't 'deserve' getting cancer," and of a young woman who perished as a result of the disease: "Dawn certainly didn't 'deserve' to die. A roll of dice has left me cancer-free (as far as I know) …" and of her prospects, "if I am lucky (very, very lucky) my cancer will not return" (Punch Drunk 2013). In another blog, Tricia Wilkinson states of her lung cancer diagnosis: "I chalk this diagnosis up to bad luck and possibly genetics" (Wilkinson 2023). Both of these examples use luck as an explanatory mechanism for cancer etiology: the first asserts that the individual's cancer is not a result of factors she had control over; she goes further to employ a notion of chance or uncertainty as to whether a treatment option will work, and ties the actual cancer itself to the notion of desert. The second, on the other hand, seems more simply to use the concept of luck as a stand-in for a causal explanation: her cancer might be due to genetics, or it might be due to some other feature of life.

As helpful a concept as this notion of agnotological luck might be for an individual, the concept only goes so far. Whereas agnotological luck might have utility in a patient's daily life, in a more research-based setting, agnotological luck might not be a helpful concept, and might even have the effect of impeding efforts toward accountability for social determinants of health, a possibility that is discussed in section 5.2. Picture a clinical setting, where a clinician is met with the question of "Why me?" when diagnosing their patient.[5] In this case, the concept of bad luck serves as a stand-in for an explanation of an individual's cancer diagnosis—whether it be attributable to random chance, a genetic predisposition, or environmental factors. This sort of luck, therefore, can also serve as a pseudo-explanation for offsetting blame from the patient's actions or environments, giving the physician an escape from making an undue causal claim when they do not know the answer. Justin Birckbichler, writing on his journey with testicular cancer, recounts his doctor saying, "'This isn't a hereditary cancer nor are there environmental factors … It's just a bad luck cancer'" (Birckbichler 2018). With a wave of a hand, this physician moves from the explanatory

[5] Thank you to a participant of the International Roundtable for the Philosophy of Medicine (2023) for this example.

portion of a visit to looking at treatment. The explanation of "just bad luck" fills the social role of explanation but it fails to fulfill its epistemic role of explanation.

Luck can be a powerful explanation, which offsets personal blame or responsibility, especially when there are few other options to explain a diagnosis. Indeed, some cancers, such as Hodgkin's lymphoma, are referred to as "bad luck" cancers, removing personal responsibility from the diagnosis (Hendricks 2024). Yet, even lung cancer, so often associated with smokers, is often said to be a result of bad luck. While smokers are at risk of the disease, "undiscovered causes" might also be to blame, and therefore the disease can be chalked up to luck (Weiss 2019). While this testimony does not necessarily make the diagnosis less personal, the upshot is that there is less focus on personal choice as a source of blame. The power of the explanation, here, is that it is relatively all-encompassing and very general, rather than being a highly specific source of cause.

3.2 Stochastic Luck

The second sort of luck—which has received some attention in the scientific and popular literature—is what I refer to as *stochastic luck*. If an individual receives a cancer diagnosis as a result of stochastic luck, their cancer is the result of random mutations in their DNA. This sort of luck has its origins in the Tomasetti and Vogelstein finding that "only a third of the variation in cancer risk among tissues is attributable to environmental factors or inherited predispositions" (2015, 78). The majority of this variation in cancer risk is instead due to what they refer to as "bad luck." This stochastic bad luck refers to the random mutations arising during DNA replication, an empirical claim that assumes we are able to demarcate between these stochastic effects and environmental influences related to cancer.

I am not alone in questioning the Tomasetti and Vogelstein approach. One strain of retort to this empirical claim has focused on the detrimental effects that it could possibly have on prevention efforts (Couzin-Frankel 2015a, 2015b). Others have lamented the fact that this mathematical theory could not possibly capture the complexity of variation in cancer (Wu et al. 2016). And still others have counted oversights by the original authors in the types of cancers considered as well as the sorts of intrinsic risks considered (Nunney and Muir 2015; Albini et al. 2015). Adriana Albini et al. (2015) argue that instead of saying that "two thirds of 'all cancer types' are due to 'bad luck' … rather the proportion is two thirds of the relatively few cancer types investigated."

Plutynski (2021) also responded to Tomasetti and Vogelstein (2015), expanding on what luck can mean to cancer variation. Her assessment ends by asserting that the sort of chanciness that Tomasetti and Vogelstein present "is problematic, because stem cell turnover is neither the exclusive, nor unconditional, endogenous factor at work in relative cancer incidence." The point here is that cancer etiology is a product of a complex causal chain. This sort of argument is common in causation: Judea Pearl, for example, asks why we consider the striking of a match a better explanation for a fire than the presence of oxygen (2000, 308). In the case of the match and the oxygen, the match represents the probability of necessity (PN) and the oxygen represents the probability of sufficiency (PS), both of which are important for causing a fire in this case. The striking of the match is important because of the intent behind it.

Cancer does not have intent but we might be in a place to assess which causal explanation of cancer etiology is most appropriate. Stochastic luck plays an important role

in cancer incidences in two specific cases: (1) for certain types of tissue that have higher turnover rates than others. Per Tomasetti and Vogelstein (2015), there is a higher turnover of stem cell rate for colorectal and skin tissues, which explains why incidences of those sorts of cancer are higher than others (for example, bone stem cells turn over at a lower rate and therefore there are fewer instances of various osteosarcomas). And (2) an explanation of stochastic luck might be appropriate in the cases of various individual differences in aging that promote the sort of stochastic events Tomasetti and Vogelstein (2015) describe (Minteer et al. 2023).

3.3 Heritable Luck

There is also the possibility of *heritable luck,* the so-called roll of the dice that occurs when one inherits genetic material from one's parents that might influence one's chance of cancer. One might be tempted to refer to stochastic luck as heritable luck but while stochastic luck refers to random mutations made in the DNA of an individual, or somatic mutations, heritable luck refers to already mutated genes being passed down from a parent to a child, also known as germ-line mutations. In other words, a cancer diagnosis is a result of heritable luck when it is the result of mutated genes passed down from the parents.

For example, an individual who has inherited the BRCA1 or BRCA2 gene from one of their parents may have a higher predisposition than others for breast and some other sorts of cancers, and any cancer that is a result of having inherited one of the BRCA genes is cancer that is the result of heritable luck (National Cancer Institute 2024b). Heritable luck is the sort that might be first encountered in the office of a genetic counselor. Especially if one has had a history of breast cancer in their family, a family physician might urge that individual to seek genetic testing for variants that might predispose them to also acquiring that disease. Indeed, what is now known as "the Angelina Jolie Effect," after the American actor and filmmaker, women who are tested for and found to carry the BRCA genes, similar to the actor, are far more likely to receive prophylactic mastectomies in an effort to aid the prevention of developing the cancer (Hill Schnipper 2021).

Heredity is sometimes chalked up to being "100% brute luck" (Farrelly 2008), resistance to common conditions, such as cancer, or having a predisposition to cancer, is due to chance (Buchanan et al. 2000), or traits that are a result of the genetic lottery (Lagay 2001; Harden 2021). The concept of heritable luck might map somewhat neatly onto Plutynski's (2021) fifth conception of "chance in science," or rather "'intrinsic' causal factors that increase relative vulnerability to disease." And in these cases, a physician might use the concept of luck to suggest that the patient is not to blame and also to explain the cause of the cancer to their patient. Heritable luck might also relate to the Dworkinian sense of brute luck, which is distinguished by a separation from anything caused by social structure and, often, from the justice side of things. Dealing with brute luck "requires eliminating all disadvantaging deficits in capabilities for which an individual is not responsible, whether or not they are the result of disease or impairment or merely the result of bad luck in a natural lottery for (otherwise normal) capabilities" (Buchanan et al. 2000, 109).

Heritable luck differs from brute luck, however, in scope. Brute luck ultimately describes a concept that is more broad and all-encompassing than heritable luck. The result of distinguishing between the two is not only a greater specificity, and therefore a finer grain of detail, but also better explanatory power. While brute luck, for example, might

encompass the sort of stochastic chance described by Tomasetti and Vogelstein (2015), heritable luck is marked by a greater specificity. Instead, it might be more closely likened to the sort of luck discussed by Harden (2021), who offers the possibility that various social characteristics, such as educational attainment, financial stability, and mental illness, among others, are the result of one's genotype.

The more specific concept of heritable luck might solve one particular problem. On some occasions, patients who notice patterns of cancer diagnosis in their families might be brushed off by their doctors as simply noticing a pattern of bad luck. Indeed, they may well have bad luck in my sense of heritable bad luck. But conceiving of the pattern as bad luck can suggest that it is just coincidental and does not reflect facts about the patient's heredity. This is exactly what happened in the case of Carrie Davis, who went to her father's doctor noticing that both he and her grandmother had been diagnosed with the same rare brain cancer, glioblastoma multiforme (ABC News 2014). Davis then reached out to a researcher at Baylor College of Medicine, whose research on the matter uncovered a rare genetic mutation that could possibly lead to an increased risk of this sort of cancer (Choi et al. 2023).

3.4 Environmental Luck

An additional concern is *environmental luck,* the sort of chance involved in a cancer diagnosis in which one's surroundings are to blame in causing a cancer diagnosis. It might be said that someone's cancer diagnosis is a result of environmental luck when it is related to a cluster of environmental factors that are known to cause cancer. This concept is captured somewhat by Plutynski's (2021) fourth sort of chance, where probabilities for the cancer can be assigned, given intrinsic and extrinsic factors. While Plutynski's account encompasses both extrinsic and intrinsic causes of cancer, environmental luck specifically focuses on those extrinsic factors of the sort that contribute to variation in cancer rates. One might argue, for example, on the one hand, that it is a personal decision to smoke cigarettes, rather than an environmentally determined activity. On the other hand, this same habit might be seen as a systemic issue where cigarettes were marketed to a certain generation as being both a status symbol and a "cool" activity, as well as a safe habit (for a detailed history, see Wailoo 2021). Cultural habits and their understandings do not die easily. Sun exposure might be considered another borderline case. While purposefully tanning in the sun, not wearing sunscreen, or going to tanning parlors might be considered a personal choice, and therefore subject to "option luck," living in a sunny place, or a high elevation, or working outside might be considered a matter of environmental luck.

Environmental luck might also relate to some of the social factors that determine health. Broadly speaking, these might refer to food insecurity, education, income and social protection, housing, social support, affordable healthcare, and attention to working conditions. Richard Rothstein's *The Color of Law* argues convincingly that racial segregation in housing was not only a matter of individual choice, but rather a result of systematic *de jure,* given that unconstitutional segregation resulted in a system of segregation in housing (2018, 15–16). This has resulted in "forty-eight percent of African American families, at all income levels, hav[ing] lived in poor neighborhoods over at least two generations, compared to 7 percent of white families" (2018, 338). Exposure to poverty in this way not only has social consequences, such as a having fewer high-earning role

models, but also health consequences, including less access to adequate healthcare and healthy supermarkets, higher exposure to air pollutants, and so on.

Within the context of variation in cancer rates, policies such as these might come to bear on screening rates and access to medical care. Regarding this concern of equity of access, it bears mentioning that the burden of cancer incidences is not shouldered equally by all members of the population, and this is largely due to "environmental luck." The statistics are stark: overall, Black men have the highest rate of new cancer diagnoses in the United States, as well as the highest overall death rates (National Cancer Institute n.d.). Hispanic/Latino and Black/African American women have higher incidence rates of cervical cancer than other groups (National Cancer Institute 2024a). African American/ Black men have a higher incidence and mortality rate of prostate cancer than non-Hispanic white men and a higher incidence rate of lung cancer than any other racial/ethnic group (Zavala et al. 2021). These racial health disparities are often the result of what I refer to as environmental luck because they are the result of sociocultural factors, which affect entire populations, rather than personal choices.

Take the statistic about Black men and prostate cancer as an example. Black men are less likely overall to be screened for this sort of cancer and when it is detected, it is more likely to be aggressive. Furthermore, they are less likely to receive cutting-edge treatment after a prostate cancer diagnosis (Lillard Jr. et al. 2022). The facts reported in these statistics are socially constructed because, importantly, they result from certain social structures and inequities that manifest in people's health. Similar disparities exist among other racial and ethnic minorities as well: disparities in liver cancer incidence and death rates are particularly striking in Asian American and Pacific Islander populations, and are in large part due to these populations having higher rates of exposure to risk factors for liver cancer, such as hepatitis B and C infections, chronic liver disease, obesity, alcohol consumption, smoking, and type two diabetes (American Cancer Society 2023).[6]

These environmental luck factors are not necessarily, however, racially bound. Often, they are a matter of circumstance or social class. One poignant example of so-called environmental luck manifests in where one lives. Residents of Coldwater Creek, Missouri, a town first affected by uranium processing during World War II, have experienced a cluster of cancer diagnoses, as well as individuals with a whole host of medical issues, though this has not been acknowledged by officials (ABC News 2014). Having lived here, one might say, and then experienced medical issues, such as the incurable chronic myelogenous leukemia that one woman was diagnosed with, might have been the cause of environmental bad luck. Yet, as I show in the next section, there are serious reasons why we should not only be careful when referring to the cause of these issues as luck, but also take measures to eliminate all talk of luck from our vocabularies in these scenarios. As the concept of luck migrates from laypeople's speech to the realm of cancer biologists, physicians, and other specialists, however, the potential for harm multiplies. Parsing the luck concept into its varied forms helps clarify what is meant by the term, thereby mitigating the potential for harm.

[6] For more on the social construction of health and approaches, see Valles (2019).

4. The Utility of the Luck Metaphor

Philosophical discussion of metaphors and the role that metaphor plays in science is extensive (Hesse 1966; Black 1962; Bradie 1998). Within this literature, there have been essentially three main ways of discussing how metaphors are or might be used within science. First, metaphors might play "a rhetorical or communicative role (which would include pedagogical purposes and talking to nonscientists);" second, they might serve "a heuristic function in the creation of new ideas and hypotheses;" and third, they might play "a cognitive or theoretical function in the formulation of scientific explanations" (Reynolds 2018, 62). In his book *The Third Lens: Metaphor and the Creation of Modern Cell Biology,* Andrew S. Reynolds invokes a fourth role for scientific metaphors, which is of relevance to my argument here. He states that metaphors might be used "as tools or instruments of intervention and manipulation, which result not just in changes in our perception of the thing to which they are applied (cells and organisms, or how we understand them), but also in alterations to the very material being or nature of the reality in question" (2018, 158).

In the course of scientific investigation, so the argument goes, there is not only the need for material interaction with the world at large, but also conceptual analysis, which "involves the intellectual dissection and rearrangement of ideas, concepts, and other representations of the 'external world'" (Reynolds 2018, 158). In the case of a nascent cell theory, the use of the metaphor of a cell as a chemical factory or laboratory was critical in allowing scientists the conceptual tools to think about the possibilities of different components and processes of the cell as a whole. This metaphorical understanding of the cell drove the creation of hypotheses, and subsequent experiments and investigations, that were crucial for analyzing a cell in a particular way:

> The attribution to cells of internal signaling pathways and a circuit-like logic regulating their biochemical activity would seem to have served as such a probative tool, which has encouraged scientists to dissect the cell (both conceptually and experimentally) into the relevant components corresponding to the purported signals, receptors, effectors, switches, and so on. (Reynolds 2018, 158)

In other words, the concepts drive investigation, which in turn drives a better concept.

This particular conceptual role of metaphors that Reynolds (2018) has created forms the foundation for the main concern of this paper: if there is a relationship between concepts, some of which are embodied by metaphors or metaphorical language, and both the objects and trajectory of scientific practice, it is important to have a clear idea of those concepts, what work they might inspire, and how they might affect research trajectories. In the case of luck, I have identified two main possible ways that an under-determined concept of luck might have negative outcomes for cancer research. It might, for one, negatively influence efforts toward prevention, especially in the domain of ameliorating social determinants of health. It also, as argued below, has the possibility of inspiring an unproductive sense of blame, removing blame from some of the social and environmental forces that contribute to cancer diagnosis. These two concerns make up the bulk of the next section.

5. Eliminativism About Luck-Talk

In this section, I argue that an under-determined concept of luck is a blunt tool, which might result in some dire consequences when used in clinical and research contexts related to cancer. Although an under-determined concept might have some utility on the individual level, when used colloquially, in this section I suggest an eliminativism of luck talk in research settings. When the luck concept is used in an under-determined manner in these settings, it threatens to undermine the explanatory content at the heart of a diagnosis. This represents a new sort of concern in the field of health communications: whereas most past scholarship has looked at the ways in which jargon inhibits patient understanding of a concept, this work does the opposite, arguing that a concept introduced to the literature to help patients' understanding might have unforeseen and unwanted conceptual repercussions.

Most existing critiques of luck have to do with what I have referred to as stochastic luck, per Tomasetti and Vogelstein (2015; Albini et al. 2015; Rozhok, Wahl, and DeGregori 2015). These critiques, however, fail to acknowledge the myriad ways in which the concept of luck is operationalized when discussing cancer, and how the metaphor has the possibility of pervading research practice.

In this section, I continue discussion of the issue of prevention, a problem that Jennifer Couzin-Frankel (2015b) and Albini et al. (2015) also contend is a potential worry for cancer research. I continue by expanding the conversation regarding the relationships among blame, responsibility, and luck. I contend that cancer patients, their families and physicians, and medicine as a whole benefit from—at the very least—a pluralist notion of luck, and possibly even dismissing luck from the conversation of cancer research altogether.

5.1 The Prevention Problem

As mentioned in section 3.2, one strain of the critiques of using the concept of luck has to do with efforts of prevention. The critique here goes that if the majority of cancer is thought to have to do with random genetic mutations in an individual's body, which vary within different sorts of tissues, medical professionals and population health experts might be less likely to prioritize any sort of efforts related to the environment or heredity that could contribute to the cause of cancer. Tomasetti and Vogelstein (2015, 81) state: "These results could have important public health implications. One of the most promising avenues for reducing cancer deaths is through prevention. How successful can such approaches be?"[7] This provocative question instantiates Reynolds' (2018) approach to metaphor in science, in which an idea or concept changes perception of the issue. Calling any sort of prevention efforts into question naturally caused quite a bit of alarm in the cancer biology committee (Couzin-Frankel 2015a, 224). Critics such as Couzin-Frankel argue that just because chance plays a part in diagnosis does not mean simply that there is nothing we can do about cancer. Yet Tomasetti and Vogelstein's approach (2015) demonstrates a willingness, at least on the part of some researchers, to poke holes in these preventative measures.

[7] Arguments such as this have been seen before. An especially egregious example comes from Arthur Jensen's paper, "How Much Can We Boost IQ and Scholastic Achievement?", in which he argues that social and environmental interventions into education will have a limited impact because IQ and educational attainment is mostly due to "prenatal influences" (Jensen 1969, 2).

Cancer biologists divide prevention efforts into primary and secondary, with primary prevention efforts being categorized as those before cancer is detected, and those that lead to the discovery of cancer or precancerous states being categorized as secondary; both are at risk here (Spratt 1981). One particularly specious form of this effort toward prevention is the lack of consideration of racial health disparities, a topic that implicates primary prevention efforts. If most incidences of cancer are biologically determined incidences of luck based on this sort of stochastic influence of random mutation within an individual, one might question whether we should care about variable incidences of different cancer types between different populations or about differing outcomes in cancer between populations, such as those that occur when examining racial health disparities. Conversations regarding a general idea of luck obscure finer-grained understandings of how that stochastic luck is potentially influenced by other notions of luck, which might further cast shadows onto population health efforts.

An approach that prioritizes stochastic luck mirrors the classic divide between individual health and public (or population) health (Arah 2009). If one is to take Tomasetti and Vogelstein (2015) at their word that a majority of variation in incidences of cancer is due to stochastic luck, researchers risk missing other factors that might influence those stochastic effects. An approach focused on stochastic luck risks missing questions about social, economic, and environmental causes via biological randomness, and therefore decenters the concern of social inequities that contribute to racial health disparities. Using the concept of environmental luck, however, decenters the individual and relocates the potential cause of cancer in one's environment.

Let us return to the observation in Valentina A. Zavala et al. (2021, 318) that African American/Black men have a higher incidence and mortality rate of prostate cancer than non-Hispanic white men, and investigate one of the reasons for that fact—Black men are less likely to be screened for prostate cancer than their white peers.[8] Now, there are several ways in which we might work to prevent that. Physicians might, for example, not simply assume that their Black patients have been screened for prostate cancer, and instead proactively recommend it. There also might be community efforts made toward education on this sort of cancer, its screening, symptoms, and diagnosis. Recent studies have investigated the efficacy of using education efforts through community health workers, in a variety of contexts, at improving health outcomes for Black men with prostate cancer (Mbugua, Karanja, and Oluchina 2022; Makarov et al. 2021). A focus on environmental luck—rather than stochastic luck— shifts the explanation for higher incidence and mortality rates of this sort of cancer away from the individual toward a sociohistorical explanation of environmental conditions that created the context in which racial health disparities such as this thrive.

It is also the case that most cancers "are the consequences of several hits. Furthermore, in the real world, or even in a 'simulated real world,' cancer does not match completely with calculated probability" (Albini et al. 2015). The overt focus on the sort of stochastic probability that Tomasetti and Vogelstein (2015) have in mind does not capture even a close to accurate picture of cancer. It also unhelpfully collapses what are possibly several different constructions of the luck concept. Whereas a focus on stochastic luck risks an overemphasis

[8] There are good reasons to be wary of screening efforts in the name of cancer prevention—see, for example, Plutynski (2021) and Biddle (2020)—but I sideline these concerns for the purposes of this paper while recognizing that these arguments themselves far too often sideline issues of racial health disparities.

on the individual, opening up the concept of luck to stochastic and environmental luck might reinvigorate preventative efforts on multiple levels.

5.2 The Blame Game

A direct result of using a broad concept of luck, as opposed to the more specific ones that I have suggested above, to explain causes of cancer is that it inspires an unproductive use of blame. When used colloquially, the concept plays the helpful role of divorcing blame from the individual; the utility here is derived from an understanding that an individual is not personally responsible in a robust way for their state of health. Yet in research contexts, the use of luck—stochastic luck, in particular—can impede productive conversations regarding accountability for systems that should be held responsible for health at the population level. One of the major problems that occurs when employing a broad notion of luck is that it privileges a generality of explanation. The problem here is one critiqued by Nancy Cartwright (1983, 9–10), who invokes Aristotle's *Nicomachean Ethics* (Book II, Chapter 7), which says that "among statements about conduct those which are general apply more widely, but those which are particular are more genuine" (Bartlett and Collins 2011). Yet this betrays the fact that individual diagnoses and explanations of those diagnoses are inherently individual and particular. This sort of "explanatory power" though is "no guarantee of truth" (Cartwright 1983, 10). Not only does this not guarantee truth, but the breadth of this explanatory power might actually cause real harm, both personally and in the broader social situation.

The generality of this explanation also serves to overemphasize the role of blame to a single patient, rather than the often very important sociocultural issues affecting disease. The way luck is used, more often than not, in the realm of cancer diagnoses invokes a distinct lack of knowledge.[9] Determining that a cancer diagnosis is the result of this sort of agnotological luck might have some effectiveness on the individual level when communicating, but when looking at trends in population variances in cancer, as in the Tomasetti and Vogelstein (2015) piece, it might be well worth the time and effort to investigate the upstream causes of cancer.

The issue of "bad luck," especially as a negative knowledge claim, also implicates the issue of scientific and medical literacy. Using the concept of luck tacitly indicates that patients might not be able to discuss the stochastic randomness that sometimes accompanies cancer diagnoses. Albini et al. (2015) make the claim that Tomasetti and Vogelstein (2015) use the phrase "bad luck" due to the "unjustified guilt experienced by many oncology patients and their families when a cancer with no apparent cause occurs." Yet, instead of using this broad concept of luck, which admittedly could be helpful in one-on-one cases of talking to patients in the clinic, what the general idea of luck critically misses is the systemic issues that are present in our medical system. Instead of thinking about luck, we should think about what is *behind* the luck: the system that positions individuals in a place of blame or responsibility for their own medical conditions, which themselves are very often the result not of luck but of systemic sociocultural issues that affect different populations at various rates. Beyond this, however, there is also the more foundational issue

[9] One might be tempted to invoke the concept of epistemic luck, here, as in Pritchard (2007) and elsewhere. Although there might be work to be done on the relationship between epistemic luck and diagnosis, this is outside the bounds of this paper.

that some might misconstrue the use of luck talk for the understanding that there is little they can do to improve their chances of not getting cancer by improving their lifestyle or avoiding other sorts of exposure because of the misconstruction of most cancer simply being a matter of "luck" (Albini et al. 2015).

6. Conclusion

Cancer is a disease marked by figurative language. Conversations surrounding the battle language of cancer and other military-inspired terms and phrases might be traced to Richard Nixon's 1971 "war on cancer," but the use of terms such as "warrior," "battle," or "fighter," have blossomed since (Sample 2019; Gomez 2022; Thrive Editorial Board 2019). With terms like these also comes the tendency to view cancer patients as beacons of never-ending positivity, a monolithic battalion of inspiration warriors, and sometimes tragic endings of lost battles. In recent years, it has been more commonplace to consider such figurative language, especially metaphor, as not "just inconsequential window-dressing or *façons de parler* used by scientists to communicate difficult ideas to a popular audience of nonscientists; they can be integral to the formulation of a theory and constitute the core of action-guiding programs of research" (Reynolds 2018, 2). This paper explores just one such concept, the relationship between how the concept of luck is used in different contexts and cancer diagnosis.

I have expanded the picture of luck with regard to cancer, describing not just stochastic luck, but also agnotological, hereditary, and environmental luck. I subsequently argued that we ought to be eliminativists when it comes to talk of luck in cancer in research settings. This is for two main reasons: first, talk of luck risks sidelining prevention efforts. If most of cancer is simply a matter of luck, one might argue, there is no point in attempting to prevent cancer, whether through individual or community-level interventions. Furthermore, talk of luck emphasizes a particularly unproductive version of blame, offsetting blame from institutions and relocating it in this amorphous and imprecise concept. The heart of this exploration is an emphasis on the possibility of harm, either direct or indirect, to patients who have been diagnosed with cancer. It is not my hope to rid talk of luck from ordinary speech but rather, first, to advocate for medical professionals, and those in places of power with respect to new cancer patients, to be more precise with their explanations of the causes of cancer and, second, to consider the possibility of harm at stake by using such an imprecise concept.

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