The Science and Art of Medicine:
The Physician's Responsibility to Reduce Treatment Uncertainties

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Introductory Remarks

The portrayal of medicine as both science and art is an age-old notion that still resonates today. As Saunders observes, like many other seminal medical texts *Cecil's Textbook of Medicine* begins with an exposition of medicine as an art (Saunders 2000). It is notable that a book dedicated to propagating objective biomedical knowledge to physicians commences by portraying the chief instrument of medicine being "human faculty"; namely, our abilities to listen, inform, empathise and uphold solidarity. The authors of *Cecil's* posit that when it comes to the treatment of disease the physician is more than a mere prescriber of tablets, they are in fact a very part of the prescription and treatment through their aforementioned human faculties.

This is a sentiment shared by one of the greats of modern medicine. In this epoch, few medical students go beyond a few days of their studies without an aphorism or two of William Osler's being recited by their teachers. Osler (1849-1919) precedes the authors of *Cecil's* in his remark that "it is much more important to know what sort of patient has a disease than what sort of disease a patient has" (Osler 2007). Evidently for Osler too, it was crucial that the physician elicit and appreciate the idiosyncratic values of their patient in order to practice medicine proper and provide successful treatment.

Another oft quoted remark of the Canadian physician consists of a wordplay on the longstanding 'medicine as science and art' dictum. Osler notes that medicine is a "science of uncertainty and art of probability" (Osler 2007). I shall base my argument on a revision of Osler's remark, specifically that medicine is *both a science and art of uncertainty*. I maintain that to reflect on the uncertainties surrounding medical treatment, both of these key paradigms of its practice must be engaged with. Only by

doing so can the parties responsible for uncertainty and its reduction within medicine be unveiled. The thesis shall be defended that it is physicians whom are chiefly responsible for reducing treatment uncertainties in medicine. Though many other parties are involved in medical uncertainties, it is the physician who is the fundamental mediator between the science and art of medicine and practitioner of both; it is therefore they that have the greatest capacity and thus responsibility to reduce uncertainty that originates from both of these paradigms of practice.

Concepts of Disease

By definition, medicine involves the diagnosis, treatment, and prevention of disease. Owing to the brevity of this piece, a full exposition of the philosophical debate regarding the concept of disease cannot be offered. Nevertheless, it is necessary to outline the concept of disease that shall be maintained in order to underpin the discussion of uncertainties involved in the treatment of disease.

Kingma notes that there is a pervasive tendency within the literature engaged with this enquiry to defend one of two positions (Kingma 2012). The first position is denoted as naturalism, which holds that disease is a value-free concept that rather picks out cases of *biological dysfunction*. The most influential naturalist account of disease was posited by Christopher Boorse (Boorse 1977) . Normativism is the second position, which correspondingly holds that the concept is *essentially value-laden*. Such a position stresses the undesirability of disease and the harms and hindrances that they bring to the sufferer. Take for example Cooper's normativist account*:*

> By disease we mean a condition that it is a bad thing to have, that is such that we consider the afflicted person to have been unlucky, and that can potentially be medically treated (Cooper 2002).

Philosophers such as Jerome Wakefield have departed from the naturalism and normativism dichotomy by attempting to reconcile the two positions (Wakefield 1992). Such a hybrid position is subsequent to a growing frustration in philosophy of medicine that the dualistic debate is in fact fruitless and a hindrance to offering the clarification

philosophers wish to provide. As Schwartz remarks, "the debate between normativism and naturalism often deteriorates into stalemate, with each side able to point out significant problems with the other" (Schwartz 2007).

A hybrid concept of disease entails that a disease consists of two conditions: namely that it is biologically dysfunctional and that the dysfunction is deemed normatively as harmful or "a bad thing to have"; in other words, a value judgement is being made by the sufferer and/or society which underpins a biologically dysfunctional state consequently being titled a disease. This is a value judgement based on how things should or ought to be. A hybrid concept of disease shall be maintained in this piece for reasons which will become clear as concepts of uncertainty are explored.

Concepts of Uncertainty

Uncertainty is defined as the state of being "not known or definite". Therefore, when we talk of treatment uncertainties in medicine, we are talking of not knowing or being definite with regards to the success of any given treatment for a disease. Given the hybrid conception of disease that has now been outlined, I shall elucidate upon two consequent categories of uncertainty:

i. *Scientific uncertainty*, which relates to a treatment's implications within the biological dysfunction aspect of disease. In other words, uncertainties as a result of unknown or non-definite biomedical empirical knowledge with regards to the effectiveness of a treatment.
ii. *Normative uncertainty*, which relates to a treatment's implications upon a patient's value judgement on their state of disease. This results from not knowing how a treatment will fair in reinstating a patient's value judgement on how things should or ought to be for them *contra* the "bad thing to have" of their present disease.

Note the parallels that can be drawn between the contemporary and historical conceptions of medicine as a science and an art and these conceptions of uncertainty. Returning once more to Osler, scientific uncertainty results due to a lack of knowing

"what sort of disease a patient has"; a lack of understanding with regards to the empirical, pharmacological aspects to a disease's treatment i.e. uncertainty in the science of medicine. The normative conception of uncertainty relates instead to knowing "what sort of patient has a disease"; a lack of understanding with regards to the value judgements made by a patient as to why their condition is not how things ought to be i.e. uncertainty in the art of medicine. Or as *Cecil's* authors would comment, neglecting to apply that most useful of medical instruments – human faculty. These two notions of uncertainty shall now be expanded upon in turn, in order to defend the thesis that it is chiefly physicians who are responsible for reducing treatment uncertainties within medicine.

Scientific Uncertainty

The backbone to medical practice is adept comprehension of its basic sciences. Fields such as anatomy, the study of the material structure of the human body; physiology, the study of the biochemical regulatory mechanisms of the human body; and pharmacology, the study of drugs and their biological actions, form the foundation of any physician's education and subsequent practice. Such empirical knowledge is crucial in decision-making with regards to treatment regimes. Take for instance the treatment of insulin for type 1 diabetes. Through empirical knowledge of the dysfunctional destruction of insulin-producing beta cells in the pancreas and its consequences upon physiological sugar metabolism, medicine has come to a pharmacological understanding of the efficacy of insulin.

Whilst mechanistic understandings of disease and treatments are a key element to a physician's teaching; there is another side to causal explanation in medicine that is also stressed in education. Russo and Williamson highlight this, observing that medicine makes "causal claims on the basis of evidence both of physical mechanisms and of probabilistic dependencies" (Russo and Williamson 2007). In contemporary medicine it is the latter aspect that is holding ever increasingly influence, as made clear by the burgeoning evidence-based medicine (EBM) movement.

EBM gained traction in the 1990s as a response to a growing discontent within medicine. This dissatisfaction was owing to the reliance upon a physician's individual experience in making treatment decisions, which led to widely varied outcomes. In other words, treatment uncertainties. By applying the tools of clinical epidemiology and population-based data to individual patient care, such disparities were hoped to be rid of. The aim was for the best standard of care to be delivered uniformly. Take this widely-cited definition of EBM as posited by Sackett in the *British Medical Journal*:

> Evidence based medicine is the conscientious, explicit, and judicious use of current best evidence in making decisions about the care of individual patients (Sackett et al. 1996)

Ensuing from this was the notion of evidence hierarchies, a way of sorting the quality of evidence sources. In randomised controlled trials (RCTs), trial participants are randomly allocated to receive either a placebo, an "on-the-market" comparator drug or the experimental drug. Ideally, both researchers and participants are furthermore "blind" to this allocation. RCTs are orated to medical students as the "gold standard" of evidence, indeed one textbook goes as far to say, "if a study wasn't randomised, we suggest that you stop reading it and go on to the next article in your search" (Sackett et al. 2005).

The Oxford Centre for Evidence-Based Medicine places systematic reviews of RCTs as its "best" form of evidence at level 1a, whilst scientific first principles are designated the poorest form at level 5 (OCEBM Levels of Evidence Working Group 2011). The reason behind this ranking is the conviction that research methodologies such as RCTs are able to greatly reduce bias and control for cofounding factors. However as shall now be explored, there are fundamental problems that exist within these methodologies that lead to scientific uncertainty. A wide range of responsible parties could be elected such as researchers and the pharmaceutical industry; however, in line with this essay's thesis it shall be argued that it is the physician that should bare most of the responsibility.

In *Medical Nihilism,* Stegenga points out that part of the problem with such evidence hierarchies is that they involve "ideal types" rather than "evidence tokens" (Stegenga

2018). In other words, there is huge difference between a trial conducted ideally and the reality of what happens in practice. Stegenga highlights how a wide array of bias creep in when one observes the reality of EBM practice. A few examples shall now be given to show how this leads to scientific uncertainty.

One fundamental problem is that of selection bias. Though randomly assigning subject into trial groups is a mainstay of the minimisation of bias in RCTs, how can we ever be sure that findings in an 'ideal' trial group shall manifest in a broader 'real' group of patients? As Cartwright states it, "for policy and practice we do not need to know "it works somewhere". We need evidence for "it-will-work-for-us" claims" (Cartwright 2011). Take for example the drug varenicline, marketed as a short-term nicotine abstinence therapy. Despite high rates of cardiovascular comorbidities in smokers, such concurrent disease was largely excluded in the trials that lead to varenicline's licensing, marketing and prescribing. In fact, only one RCT was performed involving those with cardiovascular disease pre-marketing. Yet when a meta-analysis of 14 post-marketing RCTs was performed, a statistically significant increase in serious adverse cardiac events was reported (Singh and Loke 2012). Therefore a physician extrapolating from 'ideal' trials, as offered to them by industry and journal articles, can open a door to scientific uncertainty in their treatments owing to such selection bias.

Another issue is that of publication bias. Most clinical research is funded by the pharmaceutical industry who inherently desire positive findings, so their experimental drugs can be brought to market. This research is subsequently performed by clinical scientists who, at worst, have financial conflicts of interest with the pharmaceutical industry; or at best, have a clear academic motivation to be published. Given most trials are funded by industry, this leads to a distinct bias in favour of publishing positive findings over negative ones. Therefore, when surveying and critically appraising the literature, physicians only get half of the story. By only ever being able to rationalise on a backdrop of incomplete research data for a specific drug, physicians unknowingly allow further scientific uncertainty to enter their practice.

There is one further aspect of scientific uncertainty I shall elucidate, which relates to the statistical presentation of results of clinical trials. Once pharmaceutical companies have

their products approved, they commence their marketing. One way in which they make their products attractive is through misleading statistical representation of their effectiveness. Trial results are often presented as relative, rather than absolute, risk reductions. Take for example the case of statins and the WOSCOPS trial. Researchers impressively claimed that the study "reduced deaths from coronary heart disease by 28%" in men with very high levels of a certain form of cholesterol (Wise 2017). However relative risk indicates the percentage decrease/increase of an intervention versus placebo or a competitor intervention. Absolute risk reduction i.e. the reduction of risk for a single individual if they take the treatment, was shown as 2.3% for the same trial (Wise 2017). If this figure is then presented as a 'number needed to treat' (NNT), it shows that 40 people must be treated for one to benefit.

Clearly there is a great deal of difference between presenting the efficacy of a treatment to a patient as 28% versus "out of 40 people that take this drug it will benefit one of them". Such unclear data presentation was described in an editorial of the *BMJ* as "incomplete and misleading risk information"; in other words, it leads to great scientific uncertainty (Wise 2017). Research has shown that this misleading presentation of risk reductions has an impact on clinician's views of drug therapies and thus influences their decision-making in treatment (Naylor, Chen, and Strauss 1992).

Physicians have a direct responsibility to not mislead their patients with information regarding treatment effectiveness. Though blame can be placed on the pharmaceutical and academic community for misrepresentation of results, the statistical skills required to present trial findings as NNT for example are minimal and are covered in medical school curricula. Physicians have an obligation to critically appraise research and present results in a clearer manner, such as NNT, for their patients. This is particularly relevant given that some of these treatments can have rather serious side effects. Then a difference such as that of a "28% decrease" versus "1 in 40 will benefit" may be crucial in assessing a risk/benefit ratio for an individual.

With regards to the issues of publication and selection biases, it at first appears as though there is not a great deal that can be done by physicians. Such problems clearly indicate profound disturbances within medical research methodology, which unless a

physician enters academic medicine they are unlikely to be directly responsible for. Nevertheless, one of the key duties of a physician is their role as a patient's advocate. Physicians have a responsibility to educate, inform and inspire their patients about their health and therefore society too (General Medical Council 2018).

As a pertinent example, take the physician Ben Goldacre. He has done much to raise public consciousness of these issues in medical research through his public speaking and writings, for example in his excellent *Bad Pharma*. By raising public awareness, motivating societal action and demanding change; political pressure shall start to mount upon academic and industrial bodies hopefully leading to alterations in their practice. In addition to scrutinising research, presenting findings to their patients in a non-misleading way, physicians should emulate the socially-concerned advocacy of a physician such as Dr Goldacre if they are to wholly engage in their responsibility to reduce scientific uncertainty in medical treatments.

Now is an apt time to return once more to Osler. His remark that "one of the first duties of the physician is to educate the masses not to take medicine" is particularly pertinent when the effectiveness of a given medicine is questionable due to research bias or misleading statistical representation in medical literature (Osler 2007).

Normative Uncertainty

As defined earlier, normative uncertainty results from not knowing how a treatment will fair in reinstating a patient's value judgement on how things should or ought to be for them *contra* the "bad thing to have" of their present disease. This notion shall now be explored further, and it be highlighted where the physician has responsibility for its reduction. To outline the importance of values to medical treatment, a case study shall be recounted from the literature (Fulford 2008):

> Diane Abbot, an academic art historian suffering from bipolar disorder, commenced treatment on lithium. Medically, this proved successful. She had minimal side effects, her lithium levels were well controlled, and the frequency and intensity of her mood swings were reduced.

> Nonetheless, a few months later, at a follow-up appointment with her physician, she announced her decision to cease lithium therapy. When her reasoning was explored she stated that she could "no longer see colours". Colours had "lost their emotional intensity" owing to their blunting by the lithium; clearly, an effect that would have dramatic consequences with regards to her frame of values as an art historian. After open discussion of her values and the evidence-base for her condition; it was agreed by Diane and her physician that she would obtain short-term neuroleptics when she appeared to be entering a "high" rather than continue with a daily lithium regime.

From a purely evidential perspective, the lithium treatment Diane received was optimum. One could argue that the new solution, though better from a value-based perspective, goes against the EBM principle of acting upon the best evidence. This would be misguided. Sackett was clear in stating that EBM does not only involve "best evidence" but also its integration with "clinical expertise" and "patient values", which he expands on as a patient's "own personal preferences and unique concerns, expectations and values" (Sackett et al. 2005).

If a physician fails to elicit a patient's values, then even if they practice on the basis of the best evidence that has been critically appraised and presented in a non-misleading manner, great uncertainty around treatment can exist. Uncertainty existed in Diane's case as the initial physician who prescribed her lithium did not explore "what sort of patient" had the bipolar. From Diane's value framework as an art historian, the loss of her sensitivity to colour may in fact be more of a "bad thing to have" than even bipolar itself; indeed, that is what is somewhat implied by her decision to cease the therapy.

The only way in which such normative uncertainties can be avoided is through ample use of that chief instrument of medicine, human faculty. As Hans-Georg Gadamer notes "mutual understanding" is crucial and can only arise from "the dialogue [physician and patient] sustain between themselves". Eliciting a patient's value framework requires both the patient's openness and the physician's listening skills and empathy. Once

elicited these values must be integrated with discussion of possible consequences upon them by various treatment options if normative uncertainties are to be reduced.

The implications of treatment side effects upon a particular individual is merely one way in which normative uncertainty manifests. By integrating a value-based approach to practice, alongside EBM, physicians are able to reduce other normative uncertainties. A study in rectal cancer patients showed that if patients values were elicited, they reported much greater involvement in the decision-making process of their treatment (Kunneman et al. 2015). If a patient feels more involved in their treatment they are greater inclined to be compliant with their treatment regime, which is thus more likely to be effective than if used haphazardly (Nunes et al. 2009). Even with the best of evidence, critically appraised to seek out bias, if the treatment is not taken in the prescribed and researched manner it may be either ineffective or leave one worse off than having no treatment at all due to side effects.

Unfortunately, there are great barriers to integrating patient values in medical practice. As Gadamer goes on to comment, in modernity "the opportunities for doctor and patient to enter genuine dialogue with one another are extremely limited". Gadamer highlights that whilst the patient waits in the surgery "the doctor is always responsibly preoccupied with discussing and treating the previous patient. Moreover, patients themselves are often preoccupied […] with the atmosphere of apprehension which pervades the waiting room itself" (Gadamer 1996).

The organisation and management of contemporary medicine does not give allowance to the kind of dialogues essential to an exposition of values. Genuine discussion and acknowledgement of values is a reciprocal endeavour, which requires time and openness from doctor and patient alike. With the current norm of less than ten-minute consultations between patient and general practitioner, deemed "not fit for purpose" by the Royal College of GPs, it is difficult to see how a comprehensive exposition of a patient's values can take place in contemporary medicine even if it is desired by both physician and patient (Stokes-Lampard 2017).

The Responsible Physician

In the preceding discussion on scientific and normative uncertainties in medicine, a wide range of parties have been identified as partly responsible. From biased researchers, suspect practices within industry, physicians' inadequate critical appraisal and statistical skills, to the extreme time pressures caused by healthcare organisation. I maintain the position that it is most essentially the physician whom is responsible to reduce such uncertainties. Out of all the parties that one may label as responsible to reduce uncertainties, it is only the physician that straddles the science and art of medicine.

As outlined prior, the historical notion of medicine being a science and art is directly implicated in our conceptions of disease. As treatment is directed towards disease, it was subsequently argued that uncertainties in treatment can also be of two forms – scientific and normative. Following the exploration of these two forms of uncertainties it is now clear that the physician is responsible for uncertainties of both variety. Physicians rely upon a foundational grounding in biomedical science and empirical data from research – which they are responsible for critically appraising and presenting to patients in a non-misleading manner. Furthermore, they also have direct interpersonal engagement with patients, who bring their myriad and idiosyncratic value systems to every consultation of which physicians are responsible in eliciting to reduce normative uncertainties.

Indeed, it is because of this unique perspective that physicians are seen as advocates and educators. With a greater knowledge base of the science of medicine than the public yet interfacing with them in the daily distribution and application of such knowledge, physicians have a responsibility to inform and stand up for their patients. Dr Goldacre was highlighted as an example of a physician who has done just so in his public speaking regarding the pharmaceutical industry and corruption within medical research. Furthermore, the physician can callout organisational changes and defend

consultation times in the name of reducing normative uncertainties and providing care that allows consideration of values, as per the Royal College of GPs.

Though inevitably, the reduction of uncertainty within medicine shall require motivated action from a wide-range of differing parties, this essay has defended that the best place to commence is with physicians themselves. In Osler's terms, it is only the physician who straddles between knowing what disease a patient has, and what patient has a disease. Given the perspective this offers, as practitioners of both the art and science of medicine, physicians have a substantial foundation upon which to become advocates, educators and leaders in the task of reducing treatment uncertainties within medicine.

Word Count – 3917 excluding bibliography

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