

# Using Behavioural Economics in Healthcare research

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“What you find when you get in close – close enough to see the furrowed brows, the doubts and missteps, the failures as well as the successes – is how messy, uncertain, and also surprising medicine turns out to be.”

Atul Gawande

The high profile of Behavioural Economics (BE) in recent years has led to renewed focus on the non-rational, unconscious nature of everyday decision-making. In this paper we show the relevance and value of a BE approach to research in a professional area of decision-making which is often thought of as highly rational and evidence-based: prescribing practice.

The paper starts by introducing the basic assumptions and principles of BE. We then introduce an approach which integrates research and BE, which we have called ‘Exploratory Behavioural Economics’. Based on published studies and our own experience of research in the healthcare sector, we then show that prescribing decisions are often based on the types of non-rational and unconscious mechanisms that BE identifies and why this is the case.

## The challenge of Behavioural Economics

On the Behavioural Economics view most of our regular decisions are characterised by six features:

1. They rely on **‘heuristics’** – time and energy-saving shortcuts or ‘rules-of-thumb’ which simplify and speed up decision-making.
2. These shortcuts rely heavily on **sensory cues** – a highly selective subset of the total amount of information that is potentially available for making a decision.
3. The selection and use of these heuristics and cues occurs at an **unconscious level**. Generally speaking people have very limited insight into their own unconscious processes.
4. The processes are subject to a range of **emotional biases** which may result in non-rational or even apparently irrational decisions.
5. Decisions made like this are very **sensitive to the context** in which the decision is made, including factors which might appear to be entirely extraneous.
6. When making decisions in this way we settle for solutions which are **‘good enough’** rather than seeking ‘best possible’ outcomes. What is known in the BE jargon as ‘satisficing’.

We usually have to make our everyday decisions in situations where **time is limited**, where there is **imperfect information**, where **considerations are hard to compare** directly and where complete **certainty about outcomes is not possible** (where there is always room for doubt). The more that these circumstances apply when we are making a decision, the more likely it is that our decision will exhibit the six features listed above.

Although we generally **lack direct access to our own unconscious, emotional reasoning processes** we do have a **strong tendency to post-rationalise** our behaviour. When asked why we have acted in a particular way we tend to answer so as to present ourselves in a positive light, as having made a decision for rational, self-less motives which conform either to whatever social norms we think apply to this type of decision or which fit with our ideal self-image (or at least a self-image which we find comforting and acceptable). Sociologist Charles Tilly has written an entire book describing the various objectives we have when giving reasons for our behavior - giving an honest, accurate account of our motives does not get a mention!

This clearly presents a **challenge to research**: how to get around the tendency people have to post-rationalise their actions to uncover the unconscious contextual and motivational causes underlying their decisions?

### **Exploratory Behavioural Economics: The marriage of BE and MR**

Behavioural Economics is often associated with methods which address this challenge by focusing on behavior in tightly controlled, experimental set-ups. These are broadly of three types:

1. At a fundamental level there are the laboratory experiments which are used to identify and isolate the various heuristics and biases which form the basis of the discipline. These concentrate on behavior, and control the variables driving this behavior, by setting subjects artificial choice tasks designed to highlight a particular bias or heuristic.
2. To test for the presence of these biases and heuristics in *real-world*, decision-making contexts economists use a range of analytical tools and modelling techniques to analyse datasets which record behaviours either for the purposes of a particular study or for some other, unrelated purpose.
3. To test the effectiveness of proposed interventions aimed at changing behaviour randomized, controlled trials are often used. Increasingly popular in the evaluation of public policy, these involve getting a group of individuals or institutions to adopt a new approach, and another very similar (control) group to continue with the old policy. Outcomes from both are measured before and after the trial period and compared to see whether the new approach has resulted in improved outcomes relative to the control group.

These approaches result in concrete, clearly-defined contributions to the overall body of knowledge about their subject matter. But they are limited in the extent to which they can build an integrated understanding of the motivations and processes underlying particular decisions. And it is this understanding of the hidden machinery of decision-making that is needed in order to generate improved policies, products and services, communications and packaging etc. This requires what we might call *Exploratory Behavioural Economics*: a blend of BE and market research, each influencing and benefiting the other.

The main contribution of market research to this partnership is the range of methods developed by researchers for getting beyond post-rationalised responses and accessing the unconscious causes of behaviour. The following are the ones that we have found are most useful in studies informed by BE.

**Establishing the context in which the decisions are actually made.** Features of the context in which people make a choice can have a major effect on their decisions. However, these contextual triggers or pressures are often overlooked by people when they are asked directly about their decisions. Context can be established by making observations at the site where the decision is made or with direct questions about likely contextual causes of behaviours or attitudes. The fact that respondents often don't consciously associate these contextual features with their choices can be an advantage. It helps us ask about the features in an apparently neutral way, dissociated in the mind of the respondent from questions about their choices. These contextual features can then be explored as causes of the choices at the analysis stage, e.g. with cross-break analysis, regression or by making connections in qualitative analysis.

**Focusing on actual behavior.** Observations made or recorded in real time or as close to real time as possible. In qualitative research, these can include techniques such as participant observation, video-ethnography and accompanied shops. If a quantitative approach is required, then diaries or exit-polls give you close-to-real-time data collection in a cost-effective way. For buying contexts where subtle, reflexive behaviours need to be captured

technology-led methods such as eye-tracking and facial coding of emotions have proved very useful.

**Eliciting descriptions of actual behaviour.** A technique that is perhaps less familiar to commercial researchers but which can be of value is to get respondents to describe to you how they are doing something. This method, sometimes called, verbal protocol analysis, is used by cognitive scientists to understand how people go about higher order mental tasks involving working memory. It can be useful in understanding expert decision-making where conscious problem solving is required. For example, diagnosis and prescription in rare or complex cases can be explored in this way. However, the approach cannot be used to access unconscious processes. It can only explore the way that outputs of unconscious processes are selected, sequenced and combined in conscious working memory. An application of verbal protocols which shows promise in accessing more unconscious processes is to use them in combination with video-ethnography or eye-tracking. Playing back to respondents recordings of their actual behavior and asking them to describe what they were doing, can help to surface more unconscious motives and heuristics, especially amongst respondents with above-average insight into their own motivations.

**Encouraging responses which are not consciously mediated.** Projective exercises seek to reduce the interference of conscious processes by displacing the respondent's conscious attention, at least partially, into a task parallel to the one the researcher is actually interested in. The use of visual stimulus materials as opposed to purely verbal questioning relies on the reflexive, non-verbal nature of the unconscious. Both these methods also leverage the fact that the currency of thought is images and that respondents exhibit greater cognitive fluency when doing tasks which assist them in generating images. Gamifying techniques such as time limited questions can also be used to lower the conscious defences by reframing questions as a form of play and prompting more reflexive responses. In this less serious and less considered context psychological needs such as self-presentation or self-justification are less urgently felt and have less opportunity for expression.

**Using 'Distract-and-Derive' methodologies.** This group of quantitative approaches uses question set-ups to suspend or evade respondents' conscious, rationalizing tendencies combined with analysis methods to measure underlying, unconscious values.

The most straightforward of these approaches include statistical methods such as derived importance measures and techniques to identify latent constructs such as factor analysis. With derived importance methods, for example, rather than being asked directly how important specific attributes are, respondents are asked how well a particular supplier performs on the attributes. The correlations between these performance scores for individual attributes and the supplier's overall performance score are then calculated. These correlations can then be treated as importance measures which avoid respondents' naturally tendencies to exaggerate the importance of rational factors in product choice, such as pricing, and under-estimate the influence of unconscious, non-rational factors such as advertising.

Two, more specialized, distract-and-derive techniques are Choice-Based Conjoint Analysis and Implicit Association Tests (IATs). These involve experimental set-ups built into tasks presented to respondents. In Choice-Based Conjoint exercises the product attributes are organized into specific products which the respondent must choose between. In undertaking the choice tasks the respondent is confronted with a lot of information organized in a way that is familiar from real-world choice situations and so they should rely on the same simplifying heuristics they use in these real-world decisions. The IAT task works by measuring the speed with which familiar associations are made when different items to be tested are linked to one of the terms in the association. The respondent focuses on making the familiar associations but is unconsciously facilitated or inhibited in doing this by the presence of the linked item. So for example, if you systematically link terms like 'Joy' to the term 'Good' more slowly

when a particular brand is shown alongside the term 'Good', that reveals an unconscious dislike of the brand.

**Counter-bias questioning techniques.** On subjects where a researcher suspects that a particular response bias is likely, questions can be framed to counter that particular bias. For example, if social acceptability bias is considered a potential threat, a researcher may deploy 'permission-giving', framing questions in such a way as to make respondents feel comfortable about admitting to motives or strategies they may feel inhibited about sharing.

### **The contribution of Behavioural Economics**

Most of the techniques in the previous section will be familiar to researchers. They are methods that have been used in research, in many cases, for decades and that were developed to get around rationalised responses and access the unconscious causes of behaviour. So what does BE bring to the merger?

Firstly, it has halted the tide of literal-mindedness that has affected even qualitative research in recent times. The decline of the psychoanalytic model of the mind, the need for customer immersion and the organizational demand for greater transparency, have all made it harder to argue openly for an approach that acknowledges the unconscious dimension to decision-making. The rise of BE has made it easier to rebut the notion that if a respondent doesn't actually say it, it's not a valid finding. And with emerging disciplines such as Big Data, social analytics and neuro-marketing grabbing headlines with often sweeping dismissals of the value of interview-based methodologies, the arrival of a high profile justification for a depth psychology approach to research could not have come at a better time.

Secondly, BE can sharpen our science. Its use of experimental design to isolate the effects it is studying puts analytical considerations centre stage in the approach to research. This is especially important when it comes to structuring the dialogue with respondents. BE also reminds of the many ways in which responses to questions can, like any other action, be contaminated unconsciously by prior experience or altered by a particular choice of words.

The third and most distinctive contribution is the range of decision-making heuristics and biases identified by Behavioural Economics and related fields such as cognitive psychology. A key early stage in Exploratory Behavioural Economics is to develop hypotheses from the BE literature to test in the interview. First we review what is already known or can reasonably be inferred about the decision-making task we're researching. Then we identify the range of unconscious decision-making mechanisms which could potentially affect this type of decision, and develop explicit hypotheses and lines of enquiry about the role which these mechanisms might play, to be tested in the interview.

At least a hundred different biases which can affect choice-making either directly or indirectly have been identified, together with dozens of heuristics. These should be reviewed for their relevance to the decision or behavior being studied. There may also be behavioural effects in other fields of the human sciences which may shed light on a decision. We have found relevant phenomena in disciplines such as anthropology, evolutionary psychology, developmental psychology, learning theory and ecological rationality.

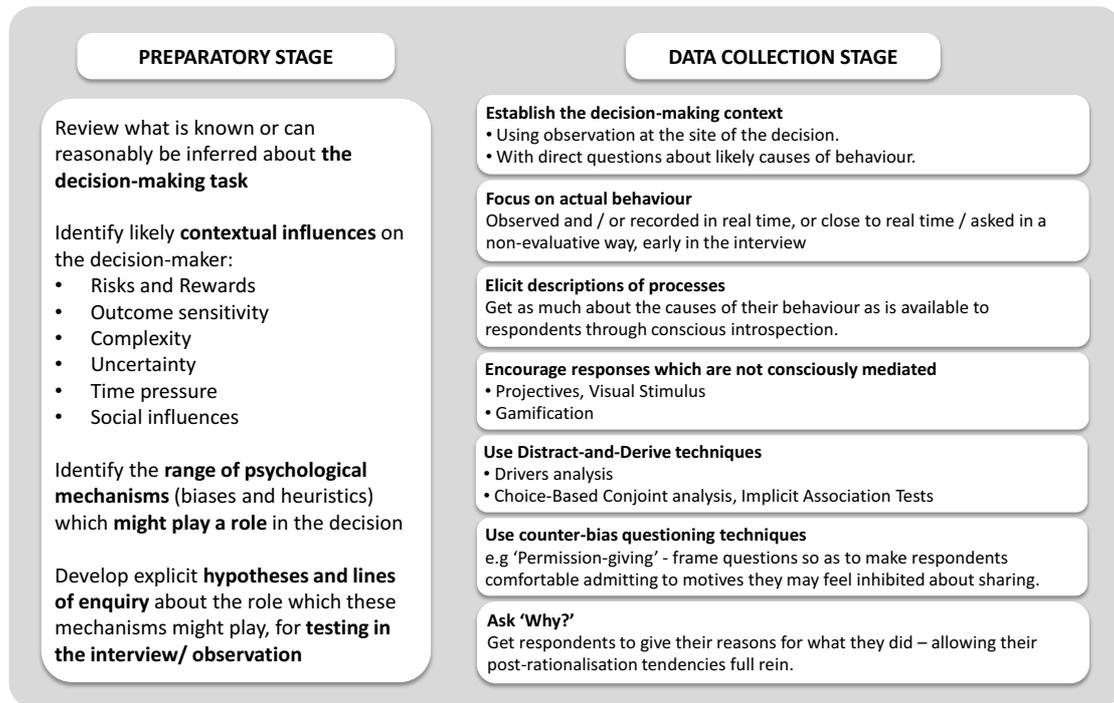
There is a set of contextual influences, constraints and incentives that should be considered when preparing to research any type of real-world decision. The following questions should be asked at the outset of any Exploratory Behavioural Economics study:

- **Risks and Rewards.** What does the decision-maker believe they stand to gain from getting this decision right and what might they lose if they get it wrong?

- **Outcome sensitivity.** What would count as getting the decision right in the mind of the decision-maker?
- **Complexity.** How difficult is it to make this decision? How many factors should be considered and how much information is available?
- **Uncertainty.** There are many types of uncertainty that can affect a decision. But these can be broadly divided into those which are external and those which are internal to the decision-maker.
  1. **External uncertainty** stems from the absence or remoteness of material to base a decision on. This may be a lack of available information or the lack of immediate feedback about the correctness of a decision: the further in the future the outcome of a decision will be known, the greater the external uncertainty.
  2. Sources of **internal uncertainty** include lack of existing expertise about the type of decision and personality type: an individual can have all the information necessary but lack the ability to process it; a well-informed expert may experience considerable uncertainty about a decision because they are an anxious or diffident personality type.
- **Time pressure.** How much time is available to make this decision?
- **Social influences.** What social pressures, either conscious or unconscious, direct or indirect, is the decision-maker under?

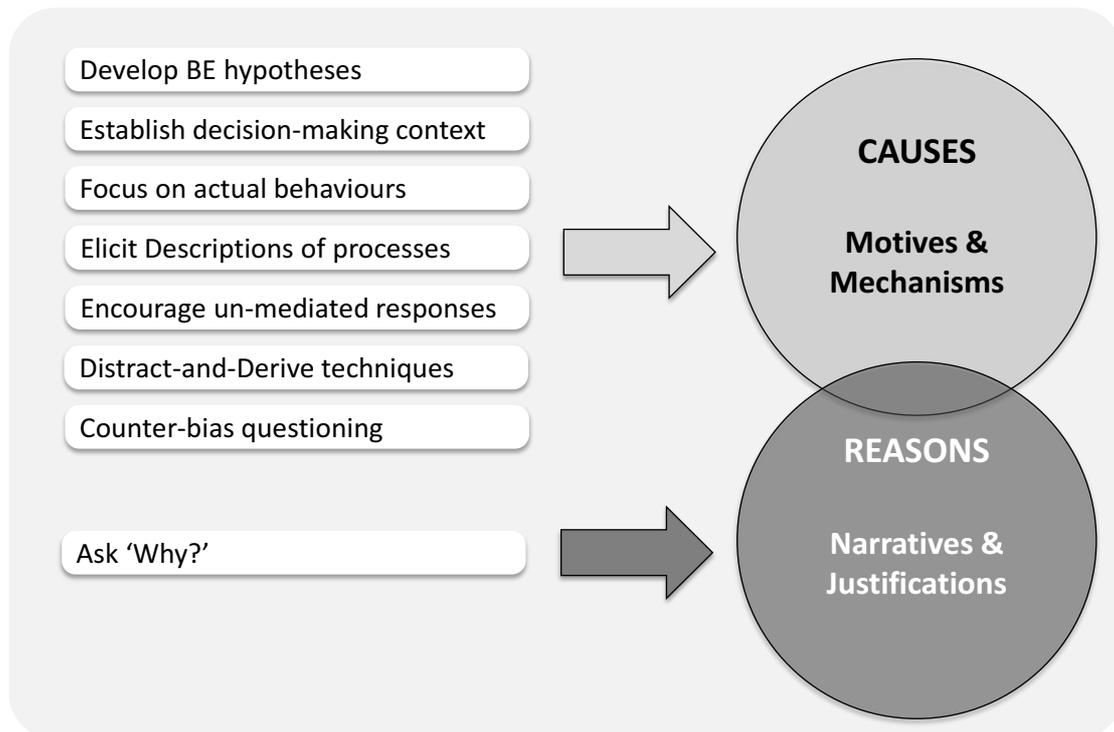
Figure 1. below, summarises the initial stages of a research study from a Behavioural Economics perspective.

**Figure1. Exploratory Behavioural Economics: the initial stages**



The last line of inquiry in the data collection stage is to ask respondents why they behaved or decided as they did. Getting respondents to give their reasons for what they did, allowing their post-rationalising tendencies full rein, is important to a comprehensive understanding of most decisions. There is a risk with focusing on causes that the decision-maker is largely unconscious of, that you overlook the importance of what *they believe they are doing*. A decision-maker may be brought to the threshold of a decision by unconscious or suppressed causes, but still seek conscious justification to cross the line and make the decision. If you fail to provide the necessary support for that final justification, you risk losing them at the last step. As we have noted, consumers and buyers often have a need to reconcile their choice with their image of themselves as rational, principled, altruistic etc. Moreover, in many professional decisions, such as prescription decisions, there are budget limits, regulations or directives which the decision-maker will be consciously aware of and which will set constraints on what options can be selected.

**Figure 2. Causes and Reasons**



### **Analysis and interpretation**

Generating hypotheses at the start of a study could lead to the psychological trap of looking only for information that supports your theory at the analysis and interpretation stage. Behavioural Economics comes with its own set of warnings against this error in the form of a number of biases which our understanding can be subject to. Of particular relevance here are 'Confirmation bias' - the tendency to look for and highlight information that supports a theory and ignore evidence that challenges it – and 'Congruence bias' – testing one hypothesis directly rather than testing alternatives to it. The safeguards against this risk will, again, be familiar to most researchers.

In quantitative analysis significance tests can be used to guard against these errors. If the difference on a variable between a control and experimental group is not large enough, you must reject your causal hypothesis. If a regression analysis accounts for only a small percentage of the variance in a dependent variable, then you know that something was missing from the list of variables you hypothesized as being important causes of a behavior.

In qualitative research the following measures should be taken to guard against the risk of narrow theorising:

- Generate a number of different hypotheses at the outset.
- Try to find hypotheses to test that are mutually exclusive or at least in tension with one another.
- Remain open to the possibility that any given hypothesis could be wrong.
- Involve a number of researchers in the analysis and interpretation.
- If you can't decide between two or more hypothesized causes for a behavior report on all of them. Then to weight them or decide between them either conduct quantitative research or compare the different practical considerations attached to actioning each of them and prioritise those which are achievable.

### **Methodological note**

One of the most criticised aspects of Grounded Theory is its insistence on inductive method, its view that the researcher should avoid all preconceptions at the beginning of a study and make no hypotheses before starting the data collection process. A number of critics have pointed out the impossibility of freeing oneself from preconceptions. We always bring our own distinctive mental schema to any experience or data. Moreover, believing that you can be free from preconceptions makes it more likely that you introduce your schema into the analysis without realizing it. Explicitly generating hypotheses based on effects found in experimental psychology makes it less likely that you will inadvertently introduce your own biased, implicit assumptions into the analysis and interpretation.

## **Behavioural Economics in Healthcare**

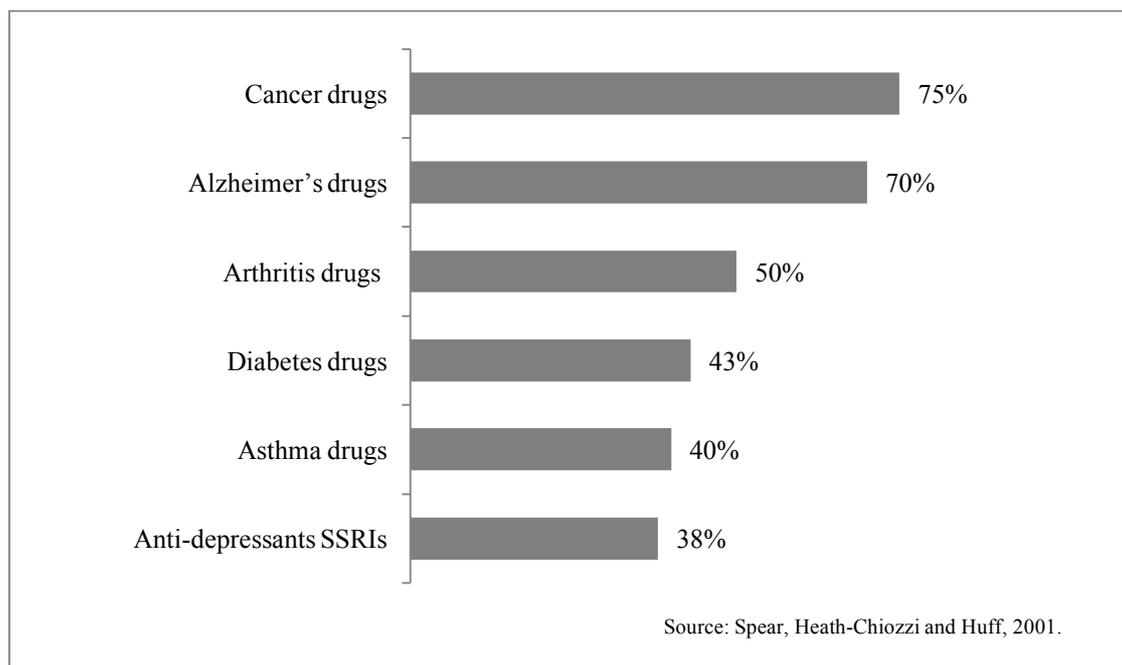
Having outlined what is involved in Exploratory Behavioural Economics, we now turn to the issue of its relevance and application to healthcare research: the features of prescribing decisions which make Behavioural Economics a natural approach in the healthcare field and some of the specific heuristics and biases which result from these features.

### **Prescription under Uncertainty**

The less certain we are about the outcomes of a decision, the more likely we are to use simplifying heuristics. Decisions about which treatment to prescribe are subject to uncertainty of two sorts:

- There is often uncertainty about the initial diagnosis. Patients with the same underlying illness may present with different symptoms. And different conditions may present with similar symptoms. For example, without a blood test, it can be difficult to distinguish between viral and bacterial respiratory tract infections and mental health conditions such as bi-polar disorder, schizophrenia and anxiety disorder can be very difficult to tell apart because they share many of the same symptoms. The picture may be further confused by comorbidity.
- The other main source of uncertainty when prescribing is around the likely response of any given patient to a particular treatment. Just as patients differ in the symptoms they exhibit, so patients respond differently to treatments. What works for one patient with a condition, may not work for another patient with the same illness. Figure 2. below, shows exactly how common it is for a drug not to work for some patients even though it has worked for others.

**Figure 3. One drug to cure them? Percentage of patients for which a particular drug in a class is ineffective**



The more uncertainty there is from either of these two sources, the more likely a prescriber is to rely on heuristics to arrive at a treatment decision.

### **The high cost of time and cognitive effort**

The less time we have to make a decision the more likely we are to simplify decisions by using 'heuristics' (i.e. short-cuts or rules of thumb). And the time available to healthcare practitioners for diagnosing and prescribing treatment for each patient is very short. The Royal College of General Practitioners estimates that the average number of consultations carried out per year by a GP in England is about 11,000. This equates to an average of about 60 patient contacts per GP, per day, and an average appointment length of about 10-15 minutes. Half of specialist consultants in the NHS feel they are 'always' or 'often' under excessive pressure. Only 12% feel they are 'rarely' or 'never' under excessive pressure. Reliance on heuristics under such conditions is almost inevitable.

Research into what psychologists call 'cognitive fluency' has shown that information of a kind or in a domain that we are not fully familiar with requires greater cognitive effort to process than information of types or in domains that we are fully conversant with. We have found that the wider the range of conditions that healthcare practitioners deal with the more likely they are to use simplifying heuristics when prescribing for a particular condition, especially those conditions that are lie outside what they consider to be their core area of competence.

And indeed, there is considerable evidence of reliance on a range of simplifying heuristics in healthcare practitioners' decision making.

### **Heuristics and norms on prescription**

One of the most common heuristics used by prescribers that we find in our research is trial and error. The trial and error approach involves making repeated, varied attempts until a satisfactory outcome is achieved. It tends to be deployed where definitive knowledge is lacking and typically attempts to find *an acceptable* solution, not necessarily *the best* solution.

Trial and error is a rational approach to prescribing for chronic conditions where a practitioner will see a patient repeatedly or under any circumstances where the first line of treatment has not worked for a patient. The aim of 'personalized medicine' is to significantly reduce reliance on trial and error by predicting the most effective treatment for a given patient using genomics and blood assays. But at present the range of conditions where different treatments are indicated for different groups of individuals is fairly small and the cost in terms of time and money of conducting tests is often quite high. Even if big advances are made on both of these issues, the predictive power of these tests is likely to remain a matter of probability, so trial and error will still be necessary to some degree.

Trial and error works well in chronic diseases with obvious symptoms and where response to treatment is reasonably quick. But in acute illnesses, in diseases that produce no clinically obvious symptoms (so-called 'silent diseases') or in diseases where response to treatment is slow or outcomes delayed, it is much less effective. In these situations, second-hand empirical evidence is needed to compensate for the absence of the direct feedback used by the trial and error heuristic to determine effectiveness. This usually takes the form of data from clinical trials or statistics about outcomes from use by other prescribers.

The trial and error approach sets a high standard for proof. And when prescribers have to use a substitute indicator of therapeutic efficacy issues of credibility can become a problem. A study into the adoption of beta-blockers to reduce mortality rates after myocardial infarction (heart attack) showed that one of the key factors determining whether beta-blockers were being used was the provision of clinical evidence of the effectiveness of the treatment and that the credibility of this evidence was paramount.

In a large scale US study of therapeutic practices in depression and other chronic conditions, researchers found extensive use of heuristics centred on 'norms' - the prescribing of a small group of drugs (sometimes only one) to all patients with a particular condition. The authors concluded that in most cases these heuristics were probably optimal in light of the time limitations on consultations and the ability of practitioners to gather and process information about the patient's condition. But they also found evidence that, in a small but significant proportion of consultations, physicians appeared to be making prescription decisions that completely ignored or drastically over-simplified the differences between patients' conditions.

### **The Familiarity Principle and the Similarity heuristic**

All other things being equal, we tend to prefer things which we are familiar with to ones which we are less familiar with. Successful marketing of a new product, especially in risk-averse contexts, often succeeds not by differentiating the product completely from existing products in the market, but by positioning it as the same but better. Medical practice, whilst it may be open to the idea of new treatments, nevertheless has to focus on each individual patient. Practitioners cannot risk sacrificing the interests of the patient for the sake of advancing medical knowledge in general. This combination of a commitment to long-term progress with concerns about the immediate interests of the patient makes reliance on the similarity heuristic quite likely.

This has implications for companies introducing new drugs. When a new treatment is communicated to practitioners what is new about it can get filtered out. Instead of making room for the new concept in their existing understanding, practitioners may unconsciously alter the concept to fit with their existing knowledge in that area. (In the language of psychologists, instead of accommodating their current schemas to the new concept, they assimilate the concept to the schemas). This can be a particular problem for treatments where the benefit, though significant, is not immediately obvious but only emerges in the longer-term.

### **The role of social influence and conformity bias**

Professional and in-role pressures to conform to perceived best practice amongst peers. To take a position that differs from the consensus is risky. Even if you're wrong, there's a certain safety in numbers. 'No one ever got fired for buying IBM' not necessarily because IBM was better than the competition or never produced a poor product, but because even if IBM did get it wrong everyone agreed IBM was the one to buy so no one could fault your decision. And this is true in medicine.

Another finding of the study on beta-blocker adoption was that besides data on clinical effectiveness, physicians also wanted to see data which showed that other physicians were using beta-blockers. They wanted the reassurance that their peers in their own or other hospitals were using the new treatment. In similar vein, a study on the adoption of new antipsychotic drugs found that prescribers working in solo practices were slower to adopt the new drugs than those working in group settings such as group practices or hospitals.

### **Availability bias**

The availability bias is the tendency to attach more importance to factors which we find it easier to bring to mind. This bias can be a major factor in decision-making in frontline medical practice.

In the study of prescribing practices in depression it was found that doctor's prescriptions reflected the severity of the conditions they were presented with, but showed no evidence of responding to the worsening of a patient's condition between appointments. Their decisions were being based on the immediate evidence in front of them rather than taking into account the next layer of information which would be a little less available, requiring as it did additional communication with the patient or referral to notes on the previous consultation.

There is clearly an awareness within the healthcare sector that the time-pressured and cognitively demanding environments they work in makes practitioners prone to the availability bias. Respondents in the beta-blocker study identified the need for a range of reminders of the importance of beta-blockers to ensure that the option was not overlooked. Hospitals in the study used a range of ways to reinforce the reminder. These included chart and poster-based reminders, embedding beta-blockers in treatment pathways and protocols and incorporating the drug into discharge procedures, right through to hiring care coordinators to remind doctors of their benefits and provide feedback on how much they were using them.

We find that healthcare professionals often value visits from sales reps from pharmaceutical companies precisely because they provide a form of reminder about a particular drug. These visits are part of the props which healthcare practitioners use to overcome the challenge presented by the availability bias.

### **When is a Behavioural Economics approach indicated?**

Most everyday decisions, whether they are made in consumer or work contexts, exhibit at least some of the features we noted at the start of the paper. So aspects of the Behavioural Economics approach can be applied to a wide range of research projects. It is particularly useful in situations where there is debate about the likely pace of future change in a market. The biases and heuristics are fairly ancient habits of mind and tend to adapt only slowly and with considerable encouragement to new practices, products and services. BE is also very

helpful in understanding cases where buyers or consumers appear to be behaving in unexpected, irrational ways, or in ways which do not serve their best interests. It is also of value in situations where the motives and processes underlying decisions are likely to be unconscious either because they are made very quickly in absolute terms or because, as in healthcare, they have to be made quickly relative to the amount and complexity of information that has to be processed.

Some people may feel uncomfortable about the use of Behavioural Economics, especially in an area like healthcare. By using an understanding of unconscious, 'irrational' processes to influence decision-making, aren't we misleading people into acting in ways they would not choose to act if they were making the decision in a rational way, taking all (and only) the relevant information into account? Of course it could be used for those purposes. But as we have seen, in real-world decision-making contexts like medicine limitations of time and information mean that prescribers have to use heuristics. The objective should be to provide information and other support in ways which help the prescriber to make the right decision for the patient under these circumstances. The cognitive scientist Gerd Gigerenzer has shown that if the way information is presented is designed with an understanding of the range of heuristics that people use (what Gigerenzer calls the 'adaptive tool box'), then quick decisions can be made which are consistently as good or better than those made by extensive, rational reasoning processes.

In the near future digital applications may enhance healthcare practitioners' ability to make rational, informed decision in many areas of diagnosis and prescription. It has been argued that medicine, along with other professions, will be transformed by expert systems capable of performing many of the tasks currently undertaken by highly trained humans, but without the frailties of reasoning and motivation to which humans are prone. The potential for science and technology to do this was understood over a century ago by the philosopher A.N. Whitehead: his reasoning is an uncanny anticipation of Behavioural Economics.

It is a profoundly erroneous truism . . . that we should cultivate the habit of thinking of what we are doing. The precise opposite is the case. Civilization advances by extending the number of important operations which we can perform without thinking about them. Operations of thought are like cavalry charges in a battle — they are strictly limited in number, they require fresh horses, and must only be made at decisive moments'.

The extent to which expert systems can replace human reasoning in medicine remains to be seen. But it does seem likely that aspects of frontline medical work will at the very least be supported by capable technology. Of course, even if that is the case, the need for humans to filter, simplify (and in the process distort) information when they make decisions is unlikely to disappear. Because the information landscape in such a future world will be even more complex than the one that confronts us today.

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