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Chapter 1: Critical Thinking in Medicine and Health

Abstract:

This chapter addresses why there is a need for experts and lay people to think critically about medicine and health. It will be argued that illogical, misleading, and contradictory information in medicine and health can have pernicious consequences, including patient harm and poor compliance with health recommendations. Our cognitive resources are our only bulwark to the misinformation and faulty logic that exists in medicine and health. One resource in particular – reasoning – can counter the flawed thinking that pervades many medical and health issues. This chapter examines how concepts such as reasoning, logic and argument must be conceptualised somewhat differently (namely, in non-deductive terms) to accommodate the rationality of the informal fallacies. It also addresses the relevance of the informal fallacies to medicine and health and considers how these apparently defective arguments are a source of new analytical possibilities in both domains.

Keywords: argument; critical thinking; expert; health; informal fallacy; logic; medical error; medicine; rationality; reasoning

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LEARNING OBJECTIVES: Readers of this chapter will:

• appreciate the range of mundane contexts in which we are exposed to medical information and health messages.
• understand the different responses that people have to health messages, ranging from indifference and denial to a high level of critical engagement with the content of messages.
• appreciate the need for robust critical thinking skills in medicine and health in order to expose logical errors and conflicts of interest in the health messages we see and hear, participate in sound decision-making about one's own health, and reduce or eliminate medical errors that put patients at risk of death or serious injury.
• have knowledge of what an informal fallacy is and understand that labels such as 'valid' and 'fallacious' are not inherent properties of arguments but apply only to arguments in certain contexts of use.
• understand the logical tradition that surrounds the fallacies, from Aristotle's challenge to the deceptive or false refutations traded by sophists to present-day pragmatic and cognitive analyses of the fallacies.

1.1 Introduction

Imagine for a moment all the different ways in which you are exposed to medical stories and health messages in a typical day. Over breakfast, you turn on the television and hear that a study has found that coffee consumption reduces the risk of coronary heart disease. As you drive to work, a report about dementia comes over the car radio. You listen closely enough to understand that a lack of exercise significantly increases the risk of developing dementia. You get to your office and learn that one of your colleagues was admitted to hospital overnight with a suspected stroke. You are surprised to hear this news as you know your

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colleague is only 50 years old and takes good care of his health. So you go online to learn more about stroke and its causes. You have a busy schedule at work and decide to dash out of the office to buy a sandwich. You normally buy a chicken sandwich but you saw a television programme at home the previous evening about salmonella in poultry. So you decide to 'play safe' and opt for a tuna sandwich instead. You finally get out of work at 6 o'clock. As you drive home, you stop at traffic lights and have a couple of minutes to read an advertisement on a billboard at the side of the road. It states the number of units of alcohol that can be safely consumed in a week. You know that you are exceeding these limits, but you quickly put this thought out of your mind as the lights change and you drive off. Your evening at home passes quickly, and it is not long before you are going to bed. You take one of your prescribed sleeping pills and happen to notice a warning on the box that you should not consume alcohol. You know it has been four hours since you had two glasses of wine over dinner and so you do not consider yourself to be at any harm from the drug.

What I have described above is a series of unremarkable events. Most readers will be able to identify with one or more of the circumstances in this scenario. It illustrates the extent to which medical and health messages pervade our daily lives. On some occasions, these messages leave little permanent trace in our minds. We may read the public health advertisement about safe levels of alcohol consumption and then almost instantly forget it. On other occasions, these messages may have increased salience for us. For example, we may listen to a report about dementia with heightened interest if a family member or friend is suffering from the condition, or if we recently participated in a fundraising event in support of a dementia charity. Whatever response we take to these medical stories and health messages, they involve complex cognitive processes such as reasoning, perception, and language decoding. We may reason, for example, that a message has limited relevance to our personal health because we do not engage in a particular behaviour (e.g. alcohol consumption). Alternatively, we may reason that a message is relevant to our health but that we have little or no individual control over a source of risk (e.g. air pollution), and so any modification of behaviour is unlikely to result in health gains. At other times, a health message may encourage us to avoid eating certain foods, or to take more cardiovascular exercise, or

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to get a flu vaccination or other form of immunisation. The reasoning processes that guide each of these responses are a focus of intellectual curiosity for a wide range of scholars. This book seeks to understand these processes by conducting an in-depth examination of their application to medicine and health.

This book will argue that a special type of reasoning is involved in the mundane scenario outlined above. This reasoning allows us to come to judgement on an issue by means of shortcuts or quick rules of thumb that may be used to bypass knowledge, facts, and evidence about a problem. To this extent, it is a powerful cognitive resource that can serve us well when we are confronted by complex health issues that lie beyond our current state of knowledge. But this resource can also be abused and misused, leading to flawed, defective reasoning. The reasoning in question is best represented by a group of arguments known as the **informal fallacies**. These arguments have occupied a less than auspicious position in the long history of logic. Denigrated for their lack of deductive credentials, these arguments languished in a state of relative neglect until a group of pioneering logicians forced a reconsideration of their logical merits. The work of these so-called informal logicians prompted a sustained effort to characterize non-fallacious variants of most of the informal fallacies. These logicians also pursued a more systematic analysis of the many ways in which these arguments may be used illegitimately during reasoning and **argumentation**. The result of this resurgence of scholarly interest in the fallacies has been new analytical frameworks and theoretical possibilities. The various logical developments that have moved us beyond a wholesale rejection of the fallacies towards a more enlightened approach to the logical merits of these arguments will be examined in section 1.4. But first, we must address a more fundamental question. That is the question of why it is important to have a set of rational evaluative skills that can be applied to medicine and health. It is to this question that we now turn.

1.2 Why think critically about medicine and health?

There are several reasons why it is important to have a set of **critical thinking** skills that can be applied to medicine and health. As the scenario in section 1.1 illustrates, we cannot evade

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the relentless exposure to medical and health messages that is part of our daily lives. We would be naïve to think that all, or even most, of these messages are conveying claims that represent some ideal of scientific truth and objectivity. For example, people may not be so ready to accept the claim that coffee consumption reduces the risk of coronary heart disease if they were to discover that a large coffee manufacturer funded the study that produced this finding, or if they were to learn that the study examined a small sample of young, healthy participants over a relatively short period of time. By the same token, a public health advertising campaign about safe levels of alcohol intake loses some of its credibility if a trade association for the alcohol industry has contributed funding to the campaign. It may be legitimately asked if the definition of 'safe' might not have involved a smaller number of weekly units of alcohol if funding for the campaign had not been obtained from the alcohol industry. Each of these conflicts of interest and aberrations of scientific methodology (e.g. the use of a small, unrepresentative sample) passes undetected and unchallenged by people who lack critical thinking skills that can be applied to medicine and health. It is not an exaggeration to claim that medicine and health suffer when citizens, who are deprived of robust critical thinking skills, are unable to hold the individuals, agencies, and organizations responsible for health information and messages to proper rational scrutiny. This point will be emphasized many times in the chapters to follow.

Another reason why it is important to have critical thinking skills about medicine and health is that each of us must make decisions in relation to our personal health. Even negative decisions, for example, the decision *not* to accept an invitation to participate in a cervical screening programme or *not* to take cardiovascular exercise, are still decisions that may be more or less rationally warranted. There can be little doubt that the quality of decision-making in relation to one's personal health deteriorates when critical thinking skills are in short supply. If we use level of formal education as a proxy measure for critical thinking skills,[1] there is clear evidence that individuals with low levels of education experience the poorest health outcomes. Albano *et al.* (2007) found that black men who completed 12 or fewer years of education had a prostate cancer death rate that was more than double that of black men with more than 12 years of education. The best health outcomes tend to be found in people

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with college and university education. Loucks *et al.* (2012) found that individuals with a college degree had substantially lower risk of coronary heart disease after accounting for demographics. These findings hold even when controlling for **confounding variables** such as socioeconomic factors. Although we cannot say with certainty that a low level of education (and, by implication, critical thinking skills) *causes* poor health outcomes, we cannot avoid the conclusion that if we want to achieve significant gains in the health of populations, there must be a sustained effort to improve the critical thinking skills that people apply to their own decision-making in matters of health. This would seem to be an inescapable corollary of most studies that have investigated the relationship between education and health.

A further reason why critical thinking skills in relation to medicine and health are essential is related to changes that have occurred in the delivery of medical and health services to patients. In the healthcare systems of mainly developed countries, there has been a move away from a paternalistic approach to medicine, in which doctors make decisions for their patients and patients are expected to defer to those decisions, towards viewing patients as informed decision-makers in their own right. Many patients now expect to make decisions in conjunction with their doctors about the type of treatment that they will receive, and whether or not to pursue treatment in a particular case (e.g. a patient with terminal illness). However, patients cannot participate in this type of decision-making about their medical treatment if they are not equipped with critical thinking skills. These skills will allow them to interrogate doctors about the side effects of pharmacological treatments rather than simply accept the recommendation that a certain prescribed medication represents the best possible medical intervention. Decisions about whether surgery is warranted in the treatment of a patient, or whether some other, less invasive treatment might not also result in an acceptable outcome, can also only be taken by patients who are in possession of critical thinking skills. These skills allow patients to assess the respective merits of different treatment options, based on information from doctors and other sources (e.g. internet), and to arrive at rationally warranted decisions concerning their medical care. Of course, even when involved in decision-making about their health, patients may not select the most effective treatment option. There is certainly scope for improving the quality of patient decision-making (Fowler

et al., 2011). The development of robust critical thinking skills is a good place to begin this improvement.

Critical thinking skills are also a vital resource for the medical and health professionals who deliver our healthcare. Notwithstanding significant improvements in the standard of patient care in hospitals, it remains the case that medical errors are alarmingly common, and can result in death and significant patient harm. In the United States each year, medical error results in 44,000 to 98,000 unnecessary deaths and 1 million excess injuries (Weingart *et al.*, 2000). Although there are many different causes of these errors, they most often occur when clinicians are inexperienced and new processes are introduced. Procedures to eliminate and reduce the occurrence of medical errors include improved handovers in patient care between medical staff, avoidance of abbreviations (e.g. QD for 'daily') in written medical communication, and two-person checking of medication infusions for accuracy. These technical procedures and communicative strategies are vitally important in reducing medical errors. However, they must be supplemented by cognitive strategies such as the use of critical thinking skills. These skills can expose the diagnostic errors and defective decision-making of medical professionals. Errors may be related to **cognitive biases** such as **availability**, which is the tendency to attribute a clinical presentation to an obvious, readily available, or recent diagnosis. In their discussion of biases in general medical practice, Coxon and Rees (2015: 14) ask 'Should more time be dedicated to this vital psychology in our training and continual professional development'. The answer to this question must surely be 'yes'. At a minimum, such training must involve exposure of medical and health professionals to the type of critical thinking skills that will be examined in this book.

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SPECIAL TOPIC: Errors in medical diagnosis

Much is now known about the frequency and types of errors that occur in medical diagnosis. Many diagnostic errors are related to cognitive biases in the thinking of medical professionals. Improved training in the psychology of these biases in critical thinking courses can help physicians avoid many diagnostic errors. Graber *et al.* (2005) examined 100 cases of diagnostic error involving internists. Ninety cases involved injury, 33 of which resulted in death. Errors were divided into three categories: no fault errors; system-related errors; and cognitive errors. Only seven cases were judged to be no fault errors. Across the remaining 93 cases there were a total of 548 different system-related or cognitive factors. This equated to 5.9 factors per case. Diagnostic error was related to system-related factors in 65% of the cases. Problems with policies and procedures, inefficient processes, teamwork, and communication were the most common system-related factors.

More significant still were cognitive factors which accounted for 74% of diagnostic errors. The single most common cognitive factor was *premature closure* which is the failure to continue considering reasonable alternatives after an initial diagnosis is reached. For example, a patient was diagnosed with musculoskeletal pain after a car crash, only for a ruptured spleen to be identified. Another common cognitive factor was *faulty context generation* in which there is a lack of awareness or consideration of aspects of a patient's situation that are relevant to diagnosis. For example, a perforated ulcer was missed in a patient who presented with chest pain and laboratory evidence of myocardial infarction (a heart attack). Other common cognitive factors were:

Failed heuristics – failure to apply an appropriate rule of thumb or over-application of such a rule under inappropriate or atypical circumstances. For example, a wrong diagnosis of bronchitis was given to a patient who was later found to have a pulmonary embolism.

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Failed perception – a symptom, sign, or finding should be noticeable but is missed by a clinician. For example, a clinician missed a pneumothorax (collapsed lung) on a chest radiograph.

What is interesting is that the factor we commonly attribute errors to – faulty knowledge – was involved in only 11 instances of diagnostic errors related to cognitive factors. For further discussion of cognitive biases and errors in medical diagnosis, the reader is referred to Saposnik *et al.* (2016) and Croskerry (2003).

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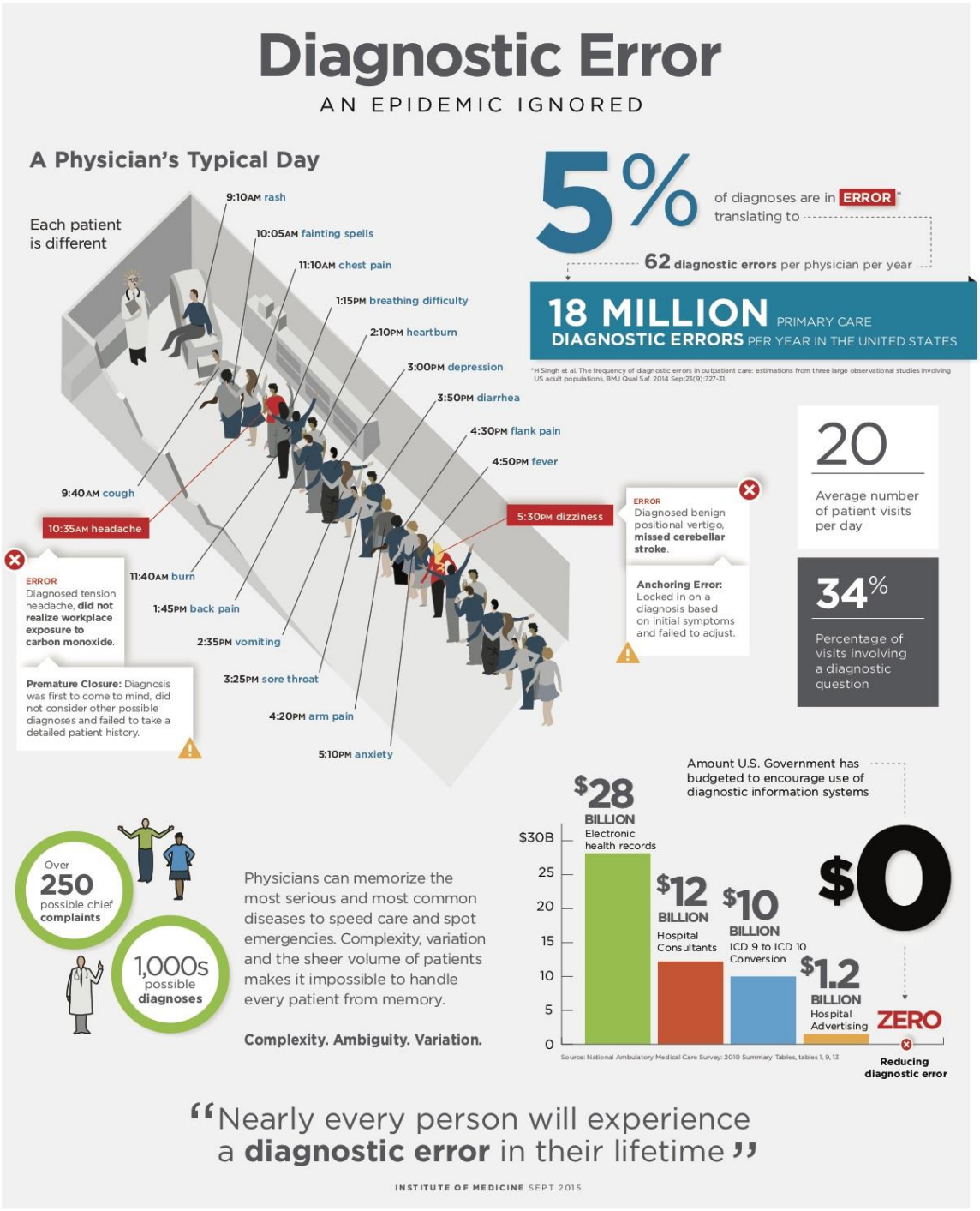

Figure 1.1: The extent to which diagnostic errors occur in medical practice. Illustration appears with permission from VisualDx (www.visualdx.com)

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1.3 What is an informal fallacy?

Thus far, we have established that there is a need for lay people and experts to have robust critical thinking skills that can be applied to medicine and health. The individual who makes decisions about his or her personal health, and the medical professional who diagnoses and treats patients must both be guided in their deliberations and actions by whatever critical thinking skills are at their disposal. These skills can make the difference between good and poor health outcomes for the person who makes decisions about lifestyle choices such as smoking and exercise. They can also make the difference between safe medical treatment and an error that places a patient at risk of death or serious harm. In short, the importance of the skills that will be explored in this section and in subsequent chapters cannot be overstated. Critical thinking skills can ensure our survival when they work well, and can place us at risk of considerable harm when they are used erroneously. These skills are also the means by which we can undertake a rational evaluation of the informal fallacies. Informal fallacies are arguments that fall short of standards of good or valid reasoning (hence, the term 'fallacies'). Moreover, the manner in which these arguments fall short of these standards cannot be captured by formal (deductive) logic (hence, the term 'informal'). In fact, we will see that we have to look well beyond **formal logic** for an explanation of the fallacious character of these arguments. We will have much to say about the informal fallacies and their role in reasoning in medicine and health in the chapters ahead. But first, we must examine some of the logical flaws that can arise in argument and that may lead to the criticism that a fallacy has been committed.

The date is November 1986. You are listening to a news report on the radio before you set off for work in central London. The report concerns the diagnosis of a new brain disease in British cattle called **bovine spongiform encephalopathy** (BSE). You have been aware for a number of weeks that farmers have been reporting a strange, new illness in some of their herds, but you have been busy at work and have not dwelt on the details of media reports. But there is something about this particular radio report that makes you sit up and take notice of what is

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said. A government minister is making the following claim with complete confidence: *There is no evidence that BSE transmits to humans*. The certainty with which the minister is expressing this statement leaves you feeling a little disturbed. You know that you and the rest of the listening public are being encouraged to draw the following conclusion: *BSE does not transmit to humans*. The reason you feel disturbed is that you have a friend who is a research scientist at a local university. He has considerable knowledge of **transmissible spongiform encephalopathies** (TSEs) such as **Creutzfeldt-Jakob disease** (CJD) in humans. Your friend told you some time ago that these diseases have a very long incubation period, in some cases of several decades. Based on your recollection of what your friend told you, you wonder how this government minister can possibly be so confident in the reassurances he is offering to the public. You tend to think that his advice to continue eating beef and beef products may not be warranted, particularly at this very early stage in the emergence of a previously unrecognised disease. So you decide that you will exercise caution and avoid eating beef until more is known about this disease in cattle.

Your unease in response to the radio report is fully justified. You and other members of the listening public are being encouraged to accept the logic of the following **argument from ignorance**:

There is *no evidence* that BSE transmits to humans (PREMISE)
Therefore, BSE does *not* transmit to humans (CONCLUSION)

In any argument from ignorance, an arguer reasons from a lack of evidence or knowledge that a proposition *P* is true to the conclusion that *P* is false (conversely, from a lack of evidence or knowledge that proposition *P* is false to the conclusion that *P* is true). The reason this argument leaves you feeling troubled is that you know that its single premise is a particularly weak basis upon which to draw the conclusion. It may well be the case, as the government minister claims, that there is no evidence to this point in time that BSE transmits to humans. But how can this be a strong basis on which to conclude that BSE does not transmit to humans when so little time has elapsed since the emergence of the disease? Should we not suspend

our judgement about the transmissibility of this new disease to humans when the long incubation period of TSEs suggests that it will be some time before transmission can be established? Your questions go straight to the logical flaw in an argument from ignorance – a 'no evidence' statement can only be used to support the truth or falsity of a claim under very specific circumstances. Those circumstances are when a knowledge base in an area is closed (closed world assumption) and has been extensively searched. These circumstances are not satisfied in this particular case. There can be no closed knowledge base when BSE has just emerged in cattle and little is known about this new disease. There is likely to be considerable information about this disease that fell outside of what was known about BSE in November 1986. Your rejection of the logic of the above argument is fully justified as is your decision to avoid any further consumption of beef.

Let us think further about the above scenario. In arriving at your decision that a lack of evidence of the transmissibility of BSE to humans by November 1986 should not be used as grounds that BSE does not transmit to humans, you were influenced by some information about TSEs that was imparted to you by your friend, a research scientist at a local university. You know that your friend has considerable expertise in the area of TSEs. He pursued his PhD in this area and has worked with internationally recognised experts in these diseases. You are inclined to reason as follows:

My friend is an expert in TSEs (PREMISE 1)
My friend asserts that TSEs have long incubation periods (PREMISE 2)
The duration of incubation period falls within my friend's expertise in TSEs (PREMISE 3)
Therefore, what my friend says about the duration of incubation period of this new disease may be taken to be true (CONCLUSION)

You have used what informal logicians call an **argument from authority** or expertise (or *argumentum ad verecundiam*, to give it its Latin name) to arrive at the conclusion that substantial probative weight should be attached to your friend's claim. To the extent that each of the premises in this argument can be supported – for example, that your friend's

expertise in premise 1 is real rather than imagined – it is a rationally warranted argument for you to use in your consideration of whether to accept the conclusion of the earlier argument from ignorance.

It emerges that in this single scenario there are two informal fallacies operating alongside each other. But only one of these arguments (the argument from ignorance) is weak or rationally unwarranted (a true fallacy, as it were), while the other argument (the argument from authority) has considerable rational merits. This demonstrates an important feature of the informal fallacies, that they can be more or less rationally warranted in different contexts of use. For that assessment to be made in each individual case, we had to appeal to a wide range of considerations. We had to decide how much evidential weight we could attribute to a friend's expertise in an area and what might constitute an acceptable passage of time for the effects of a new animal disease on human health to become apparent. These are the very judgements that place an evaluation of the informal fallacies well and truly beyond the scope of formal (deductive) logic. They require that we develop new frameworks of analysis that prioritise non-deductive criteria in argument. In the next section, we will consider what some of those criteria look like and the journey that the fallacies have taken en route to them. But before doing so, we return to the issue of when a fallacy is not so fallacious after all.

Let us return to the above scenario. The date is now June 1987. You are listening to the radio again before you leave for work. There is a report on the radio about a recently published epidemiological study that found no evidence of a link between **scrapie** (a TSE in sheep) and CJD in humans. The study involved a 15-year investigation of CJD in France as well as a review of world literature. The reason this report catches your attention is that the number of cases of BSE in cattle is beginning to increase significantly and the disease is now featuring in most major news programmes. Your increased level of attention to the news report on your radio is part of a wider heightened public interest in BSE. The conclusion of the epidemiological study forms the premise of the following argument from ignorance:

There is *no evidence* that scrapie in sheep causes CJD in humans (PREMISE)

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Therefore, scrapie in sheep does *not* cause CJD in humans (CONCLUSION)

You feel reasonably confident in accepting the conclusion of this argument. Your confidence stems from the fact that there is extensive knowledge of scrapie and CJD following this long epidemiological study of both diseases. The knowledge base on these diseases may be presumed to be closed (closed world assumption). Also, the investigators who undertook this epidemiological study conducted a review of world literature. This review amounted to an extensive search of the available knowledge of these diseases. With both conditions satisfied, you feel reasonably secure in concluding, like the investigators of the study, that scrapie does not cause CJD in humans.

What this new scenario illustrates is that the rational merits of the argument from ignorance do not inhere in the argument itself. On some occasions of use, the argument is a true fallacy that we are rightly disinclined to accept. On other occasions, the argument has obvious logical strengths and we have little hesitation in accepting its conclusion. The difference lies entirely in the conditions under which the argument is advanced. We will see in the next section that most logicians and philosophers have tended to treat arguments as inherently fallacious or valid. So it is argued that there is something in the very nature of the informal fallacies that distinguishes them as weak or bad forms of reasoning. It is then the task of the logician to identify the logical flaw in question and caution against its use. This view of the fallacies has dominated most of the long history of logic. Against this logical tradition, there is a quite different way of thinking about the fallacies. This involves coming to the task of argument analysis without pre-determined categories of valid and fallacious argument. Rather, the rational merits of arguments emerge from the contexts in which they are advanced. This pragmatic turn in the study of fallacies aims to reconnect arguers to the arguments that they advance. We will see below that this connection had largely been lost in the work of logicians and philosophers who discussed the fallacies. This pragmatic turn has made possible many of the present-day analyses of the fallacies, including an approach to the fallacies that has particular relevance to medicine and health. This is the view that fallacies can serve as

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facilitative **cognitive heuristics** during medical and health reasoning. It is to an examination of these issues that we now turn.

CASE STUDY: The beef burger incident

The scenarios described above are based on real events, namely, the emergence of BSE or 'mad cow disease' in British cattle in the 1980s. In May 1990, John Gummer, the then UK agriculture minister, attempted to reassure the public about the safety of British beef by feeding a beef burger to his 4-year-old daughter Cordelia in front of the press during a family outing to a boat show. John Gummer was attempting to communicate the following message to the public: *British beef is so safe to eat that I am prepared to feed it to a member of my family. You should follow my lead and do the same*.

Gummer was widely criticised for his actions, and not only because his daughter appeared to be disgusted by the burger and refused to eat it. Many people argued that John Gummer was illegitimately using personal circumstances – the fact that he was prepared to feed beef to one of his own children – to persuade the British public to accept the claim that beef was safe to eat. The use of personal circumstances to support a claim in argument is generally regarded as a weak or flawed form of reasoning. This is particularly true when there is an inconsistency between what an arguer claims and what his personal circumstances suggest he believes. In the latter case, an opponent may rightly charge an arguer with a circumstantial *ad hominem*. But no such inconsistency occurred in the case of John Gummer. He stated that 'beef is safe to eat' and his personal circumstances – encouraging members of his family to eat beef – were entirely consistent with that statement. So was a charge of logical fallacy against him warranted? Or were

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we simply disturbed by the sight of a young child being coerced into eating a beef burger that she clearly did not want to eat?

Even aside from Gummer's apparent logical consistency between his claim and his personal circumstances, there was still a concern for most people about his choice of argumentative strategy in this case. For some people, the young girl's evident disgust at the beef burger led them to doubt Gummer's claim that his family was eating beef and beef products. In fact, Cordelia looked as if she had never so much as encountered a beef burger. For other people, John Gummer was operating with political motives, and was prepared to defend the interests of the beef industry at all costs, even if this meant putting human health at risk. His sense of political expediency may have trumped all other concerns including any concern for his daughter's well-being. These responses suggested that despite Gummer's evident logical consistency, the public perceived character traits that led them to doubt the veracity of his claim that beef was safe to eat. So while his circumstances withstood logical criticism, his character did less well in this regard. The public had effectively levelled a non-fallacious *ad hominem* argument against John Gummer.

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Figure 1.2: John Gummer and his daughter Cordelia on the front of *Private Eye* in May 1990

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SPECIAL TOPIC: What's in a name?

When it comes to the fallacies, the answer to this question is 'quite a lot, actually'. Many of the terms that you will encounter in this book are found in everyday language where they are used in a way that is not connected to logic and reasoning. An example is the use of the expression 'begging the question'. One begs the question when one assumes the conclusion-to-be-proved in the premise or premises of an argument. An example from recent personal experience illustrates the logical use of this fallacy. In a meeting to discuss student grades, a somewhat frustrated head of department asked those present at the meeting: 'Why did so many of the students get 'A' grades?' To which the reply came: 'Because they did very well'. This logical use of the expression has now been surpassed by a non-logical use in which the term means *raise the question*. In an article in *The Guardian* in May 2010, David Marsh stated that of 32 mentions of 'begging the question' in *The Guardian* and *Observer* over the previous year, all 32 uses had the meaning *raise the question*. This is despite the fact that *The Guardian* style guide advises:

> 'begs the question is best avoided as it is almost invariably misused: it means assuming a proposition that, in reality, involves the conclusion […] What it does not mean is 'raises the question', and if you can substitute this phrase, it has been used wrongly' ('Begging the question', *The Guardian*, 24 May 2010).

My point is not one relating to language standards in journalism. It is simply to make readers aware that not every use of words like 'begging the question' relates to logical fallacies. Even the term 'fallacy' is used in ways that are not related to logic and argument. When used in this book, the term means *weak or fallacious argument*. However, in everyday use the term 'fallacy' means a *false*

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belief, false claim, and even a *myth*. These non-logical uses of the term are illustrated below. The underlined word in each example captures the meaning of the word 'fallacy':

'The 10,000 step **fallacy** – and five other health myths to ignore' (*The Telegraph*, 21 February 2017).

'There are varying degrees of absurdity in the **fallacies** President Trump peddled during his first week in the Oval Office. Perhaps the most damaging was his insistence that millions of Americans voted illegally in the election he narrowly won. Mr. Trump first made that false claim in late November (*The New York Times*, 27 January 2017).

Just like begging the question, we would do well to recognise these non-logical uses of the term 'fallacy' and be able to set them apart from the logical use of this term that is of interest to us in this book.

1.4 The logical journey of the informal fallacies

The logical journey of the fallacies begins in Aristotle's *Sophistical Refutations*. For Aristotle (384 BC-322 BC), sophistical refutations had the appearance only of genuine refutations in argument. These illegitimate attempts to appear 'wise' and gain the upper hand in argument became the stock-in-trade of sophists who turned these deceptive techniques into a highly stylized rhetorical practice. Aristotle's disdain for these techniques could not be clearer:

> '[I]t is the business of one who knows a thing, himself to avoid fallacies in the subjects which he knows and to be able to show up the man who makes them […] Those, then, who would be sophists are bound to study the class of arguments aforesaid: for it is worth their while: for a faculty of this kind will make a man seem

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> to be wise, and this is the purpose they happen to have in view.' (*Sophistical Refutations*, section 1, part 1)

Aristotle identified two styles of refutation, one which depends on the language used and the other which is independent of language. In illustration of **amphiboly**, a language-dependent refutation, Aristotle presented this example in which there is play on the 'double meaning' of the expression *sight of*: 'There must be sight of what one sees: one sees the pillar: ergo the pillar has sight'. Aristotle used a refutation that depends upon the consequent to illustrate a refutation that is independent of language: 'since after rain the ground is wet in consequence, we suppose that if the ground is wet, it has been raining; whereas that does not necessarily follow' (section 1, part 5). For Aristotle, these refutations are simply fallacies employed by sophists whose aim is to achieve 'the semblance of wisdom without the reality'.

Already in Aristotle, we are beginning to see features of the fallacies that would come to define this group of arguments for subsequent generations of logicians and philosophers. For Aristotle, we are under an obligation or duty to avoid fallacies in our own argumentative practice and to expose fallacies wherever they occur. These practices are devoid of any rational merit and should not remain hidden from view. The pejorative character of the fallacies is already firmly established in Aristotle. There is also in Aristotle a feature of the fallacies that was lost to later generations of philosophers but which has more recently been restored. That is the view that these arguments arise in the context of a dialectical exchange between a proponent and an opponent in argument. Against this context, a fallacy is a deceptive dialectical move that is advanced with the aim of prematurely closing down a discussion or confusing an issue to the point where one's opponent in argument accepts a weak or false claim. It is an arguer's failure to advance a claim in argument through legitimate means only that marks out the fallacies as a deviation from rational procedure. This view of the fallacies informs many present-day analyses of these arguments, as we will see in subsequent chapters.

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Following Aristotle, a succession of logicians and philosophers expressed their disdain for the fallacies. In the seventeenth century, the Port-Royal logicians Antoine Arnauld (1612-1694) and Pierre Nicole (1625-1695) distinguished between the different ways of reasoning ill (so-called sophisms) and bad reasonings which are common in civil life and ordinary discourse. A fallacy in the former category is **begging the question**. This is 'clearly altogether opposed to true reasoning, since, in all reasoning, that which is employed as proof ought to be clearer and better known than that which we seek to prove' (*Port-Royal Logic*, Third Part, Chap. XIX, Part II, p. 244). Appeals to grounds other than reasons in argument give rise to fallacies in the category of bad reasonings. For the Port-Royal logicians, grounds such as self-love, interest and passion should not convince us in argument: 'what can be more unreasonable than to take our interest as the motive for believing a thing? […] it is only the truth which must be found in the thing itself, independently of our desires, which ought to convince us' (Third Part, Chap. XX, Part I, p. 263). Clearly, there were no merits in either sophisms or bad reasonings as far as these seventeenth century thinkers were concerned.

This pejorative view of fallacies was continued by John Locke (1632-1704). In Book IV of *An Essay Concerning Human Understanding*, Locke introduced four arguments that will be familiar to present-day readers as the 'ad fallacies'. These arguments were ***argumentum ad verecundiam*** (appeal to modesty), *argumentum ad ignorantiam* (appeal to ignorance), ***argumentum ad hominem*** (appeal to a man's character, principles or practice), and *argumentum ad judicium* (appeal to the foundations of knowledge or probability). It is only the last of these arguments which 'advances us in knowledge and judgment', according to Locke. *Ad verecundiam*, *ad ignorantiam* and *ad hominem* may dispose us for the reception of truth without helping us to attain it:

> 'I may be modest, and therefore not oppose another man's persuasion: I may be ignorant, and not be able to produce a better: I may be in error, and another man may show me that I am so. This may dispose me, perhaps, for the reception of truth, but helps me not to it: that must come from proofs and arguments, and

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> light arising from the nature of things themselves, and not from my shamefacedness, ignorance, or error' (Book IV, Chapter XVII: Of Reason).

In his *Logic: or The Right Use of Reason*, Isaac Watts (1674-1748) adds three of his own 'ad fallacies' to Locke's list: *argumentum ad fideum* ('an address to our faith'), *argumentum ad passiones* (an address to the passions), and ***argumentum ad populum*** (an appeal to the people). He also discusses 'several kinds of sophisms and their solution'. These sophisms include Aristotelian sophistical refutations and later additions to the class of fallacies: ***ignoratio elenchi***; ***petitio principii***; *non causa pro causa*; *fallacia accidentis;* ***secundum quid****;* **composition** and **division**; ambiguity and imperfect enumeration. Watts continues the pejorative theme about the fallacies which he describes as 'false argumentation'. In his introduction to the sophisms, he states:

> 'As the rules of right judgment and of good ratiocination often coincide with each other, so the doctrine of prejudice […] has anticipated a great deal of what might be said on the subject of sophisms: yet I shall mention the most remarkable springs of false argumentation, which are reduced by logicians to some of the following heads' (Part III, Chap. III, Sect. I, p. 266).

In his *Elements of Logic*, Richard Whately (1787-1863) proposes a logical view of the fallacies. The emphasis of this view of the fallacies is 'a scientific analysis of the procedure which takes place in each' (Book III: Introduction, pp. 168-169). Whately divides the fallacies into those 'in the words' (the conclusion does not follow from the premises) and those 'in the matter' (the conclusion does follow from the premises). An argument can be a fallacy even if the conclusion follows from the premises if the premises should not have been assumed (e.g. *petitio principii*) or if the conclusion is not the required conclusion but an irrelevant one (e.g. *ignoratio elenchi*). Whately describes for the first time errors related to the use of analogy. A category of material or non-logical fallacy that deserves special mention is what we have been calling the 'ad fallacies' – the *argumentum ad hominem*, *argumentum ad verecundiam* and

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the *argumentum ad populum*, to name just three. In Whately's account, we see the first acknowledgement that certain uses of these arguments are anything but fallacious. He writes:

> 'There are certain kinds of argument recounted and named by Logical writers, which we should by no means universally call Fallacies; but which *when unfairly* used, and *so far as they are* fallacious, may very well be referred to the present head; such as "*argumentum ad hominem*," [or "personal argument,"] "*argumentum ad verecundiam*," "*argumentum ad populum*," &c.' (Book III, Sect. 15, pp. 236-237; italics in original).

Whately makes the point in relation to the *argumentum ad hominem* but he intends it to apply to the other arguments in this category. Essentially, he argues that there are occasions in which a man should be prepared to admit a conclusion which is 'in conformity to his principles of Reasoning, or in consistency with his own conduct, situation, &c.' (pp. 237-238). A conclusion so admitted is not fallacious but is 'allowable and necessary':

> 'Such a conclusion is often both allowable and necessary to establish, in order to silence those who will not yield to fair general argument; or to convince those whose weakness and prejudices would not allow them to assign to it its due weight' (Book III, Sect. 15, p. 238).

The point about the non-fallaciousness of these arguments remains somewhat undeveloped in Whately's account. However, his discussion nevertheless marks an important break with the hitherto dominant view of these arguments as invariably weak or fallacious forms of argument or reasoning.

John Stuart Mill (1806-1873) devotes the whole of Book V of *A System of Logic* to a discussion of the fallacies. Mill believes that no philosophy of reasoning can be complete without a theory of bad as well as good reasoning. Bad reasoning involves our being seduced into not observing the 'true principles of induction':

> ‘It is, however, not unimportant to consider what are the most common modes of bad reasoning; by what appearances the mind is most likely to be seduced from the observance of true principles of induction’ (Book V, Chapter I, Sect. 1).

Given this emphasis on induction, it is unsurprising that inductive fallacies are the focus of Mill’s classification system. As Mill expands his system, we see the names of a number of familiar fallacies beginning to appear. For example, under Fallacies of Generalization Mill includes ***post hoc, ergo propter hoc***. This arises ‘when the investigation takes its proper direction, that of causes, and the result erroneously obtained purports to be a really causal law’ (Book V, Chapter V, Sect. 5). Under Fallacies of Confusion, Mill discusses the fallacy of ambiguity, *petitio principii* and *ignoratio elenchi*. The ‘confusion’ in these fallacies consists in misconceiving the import of the premises, in forgetting what the premises are, and in mistaking the conclusion which is to be proved, respectively. It is in Mill that we find the most explicit description yet of **false analogy**. For Mill, false analogy does ‘not even simulate’ an induction:

> ‘This Fallacy stands distinguished from those already treated of by the peculiarity that it does not even simulate a complete and conclusive induction, but consists in the misapplication of an argument which is at best only admissible as an inconclusive presumption, where real proof is unattainable’ (Book V, Chapter V, Sect. 6).

Mill also discusses deductive fallacies under Fallacies of Ratiocination. These cases are ‘provided against by the rules of the syllogism’. Under Fallacies of Ratiocination, Mill addresses *à dicto secundum quid ad dictum simpliciter*. This fallacy is committed ‘when, in the premises, a proposition is asserted with a qualification, and the qualification lost sight of in the conclusion’ (Book V, Chapter VI, Sect. 4). In general, although Mill achieves an expansion of the class of fallacies, his account does little to challenge the logically dominant view that these arguments are flawed forms of reasoning.

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And so this view of the fallacies as aberrations of logic and reasoning persisted unchanged until the latter half of the 20th century. In 1970, Charles Hamblin published his groundbreaking text *Fallacies*. Hamblin's frustration with the weaknesses of what he called the 'standard treatment' of the fallacies in introductory logic textbooks is evident in some early remarks in this book:

> 'And what we find in most cases, I think it should be admitted, is as debased, worn-out and dogmatic a treatment as could be imagined – incredibly tradition-bound, yet lacking in logic and historical sense alike, and almost without connection to anything else in modern logic at all. This is the part of his book in which a writer throws away logic and keeps his reader's attention, if at all, only by retailing traditional puns, anecdotes, and witless examples of his forbears' (Hamblin, 1970: 12).

By way of illustration, Hamblin considers the treatment of amphiboly in the textbooks. He argues that many of the examples of this fallacy offered by textbook authors are not arguments at all. Moreover, even if these examples of the use of ambiguous verbal constructions could be made into arguments, they would have little prospect of persuading anyone that they are valid. Hamblin believed that the way to address the weaknesses in the standard treatment was to institute a more systematic approach to the study of fallacies. He aimed to achieve this through the development of a formal dialectic, a formal analysis of rules of dialogue that may be used to capture the dialectical flaws of different fallacies. In illustration of this approach, let us consider how Hamblin analyses the fallacy of *petitio principii* or begging the question within formal dialectic. Hamblin begins with a brief description of the structure of two dialectical forms of this fallacy:

> 'The simplest possible such argument is 'Why A? *Statements* A, A⊃A'; and, if S and T are statements equivalent by definition, another is 'Why S? *Statement* T. Why T? Statement S'' (1970: 271; italics in original)

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Hamblin aims to prohibit these argument sequences by means of the following rules:

> 'Why S?' may not be used unless S is a commitment of the hearer and not of the speaker.
> The answer to 'Why S?', if it is not 'Statement – S' or 'No commitment S', must be in terms of statements that are already commitments of both speaker and hearer (1970: 271).

In relation to the argument sequence 'Why S? Statement T. Why T? Statement S', the second of these rules guarantees that where statement T is offered as a justification of S, both T and T⊃S must already be among the commitments of the speaker and the hearer of the dialogue. In such a case, however, the further question Why T? is prohibited by the first of these rules – the questioner is prohibited from asking a question about a statement to which he is already committed.

The details of Hamblin's formal dialectic are less important than what it reveals about his view of the fallacies. It is clear that for Hamblin the type of **circular reasoning** that occurs in *petitio principii* is to be prohibited in formal dialectic. So, even as Hamblin seeks a more systematic approach to the analysis of the fallacies, he remains committed to the largely pejorative characterization of these arguments that dominated historical accounts. It would take later logicians to lay siege to the **deductivism** that is implicit in Hamblin's analysis, and that leads Hamblin to develop increasingly sophisticated formal dialectical rules with which to prohibit the fallacies.

Deductivism is the widely held, though often implicit, view that the only way to conduct logical analysis is to resort to deductive techniques and norms. The norms implicit in the deductivist attitude to the study of logic are captured by the soundness doctrine, the idea that a good argument is one that is deductively valid and has true premises. Johnson (2011: 30) observes that deductivism is deeply entrenched in the history of philosophy. From this

position, its effect on the analysis of the fallacies has been particularly profound. For if the soundness doctrine is the standard of a good argument, then most of the arguments that people use in their daily affairs (indeed, in philosophy itself) are fallacies. As soon as we commit to deductivism, we are prejudiced from the outset to find these arguments weak when, in fact, all we have done is apply an incorrect (that is, deductive) standard to their evaluation. Historically, this has been the fate of the arguments we are calling informal fallacies. But while most logicians and philosophers were blind to, or unwilling to challenge, their own deductivism, a new generation of philosophers was not prepared to uphold the deductive ideals of their predecessors. A significant catalyst for this change was developments in the teaching of logic. In the 1970s, undergraduate students in North American universities began to question the relevance of formal deductive logic to the evaluation of the social, moral, and political arguments that they were confronting in their lives. Logic instructors too were finding it increasingly difficult to defend the prominence given to **deductive logic** in the curriculum. Howard Kahane (1971: v) recalls the moment when it became clear to him that instructors could no longer continue to teach deductive logic as the only, or even the most important, form of logic:

> 'In class a few years back, while I was going over the (to me) fascinating intricacies of the predicate logic quantifier rules, a student asked in disgust how anything he'd learned all semester long had any bearing whatever on President Johnson's decision to escalate again in Vietnam. I mumbled something about bad logic on Johnson's part, and then stated that Introduction to Logic was not that kind of course. His reply was to ask what courses did take up such matters, and I had to admit that so far as I knew none did. He wanted what most students today want, a course relevant to everyday reasoning, a course relevant to the arguments they hear and read about race, pollution, poverty, sex, atomic warfare, the population explosion, and all the other problems faced by the human race in the second half of the twentieth century.'

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A new approach to logic that could respond to the concerns of these students was beginning to take shape. This approach examined the use of arguments in context over formal relations between propositions in deductive logic. So-called **informal logic**, as the 'new' logic became known, had significant implications for the study of fallacies. When assessed in the contexts in which they were advanced, many previously weak or fallacious arguments appeared not so fallacious after all. Logicians began in earnest to characterize non-fallacious variants of most of the informal fallacies. Two logicians in particular, John Woods and Douglas Walton, were particularly prolific in this regard, publishing many papers on non-fallacious variants of the fallacies that has continued to the present day (Walton, 1985a, 1985b, 1987, 1991, 1992; Woods, 1995, 2004, 2007, 2008). As the following remarks of Walton (1996: 153) demonstrate, models of reasoning that are based on presumption lay at the heart of these new analyses of the fallacies. **Presumptive reasoning** provides a reasonable, but tentative basis for decision-making in those circumstances where knowledge is incomplete, and deductive validity and soundness are not in contention:

> 'Presumptive reasoning […] is closely related to a type of argument called the *argumentum ad ignorantiam* (argument from ignorance), traditionally held to be a fallacy. However, arguments from ignorance are not always fallacious. In many cases, absence of knowledge to prove a proposition constitutes good presumptive grounds for tentatively accepting that proposition as a commitment […] Presumptive reasoning enables practical reasoning to go ahead in variable circumstances where knowledge is incomplete'.

Non-fallacious variants of several informal fallacies, including the argument from ignorance, have been analysed in the context of public health reasoning (Cummings, 2002; 2004; 2009; 2010; 2011; 2012a). Their use in this context is warranted by the fact that we often need to take urgent health measures in a context where evidence and knowledge are lacking. But as we might suspect with the informal fallacies, their remarkable journey does not end with the characterization of non-fallacious variants of these arguments. For when analysts began to uncover the epistemic virtues of the fallacies, it was not long before they started to conceive

of these arguments in terms of facilitative cognitive heuristics during reasoning (Walton, 2010). Four of these fallacies-as-heuristics were recently experimentally tested in a large-scale study of public health reasoning (Cummings, 2012b; 2013a,b; 2014a,b,c,d,e). Findings from this study have been discussed at length elsewhere (Cummings, 2015). On the model of fallacies-as-heuristics that was central to this work, the informal fallacies are mental shortcuts that can bypass expert knowledge that lies beyond the cognitive grasp of the lay person. They are an adaptation of our cognitive resources to a lack of knowledge in domains such as public health. A quite different conception of fallacies-as-heuristics is to be found in Walton (2010). For Walton, the informal fallacies represent shortened or abridged versions of the extended critical questions that can be posed of arguments. We will have more to say about both these conceptions in subsequent chapters. Suffice it to say, the view of fallacies that they represent is a far cry from the pejorative characterizations of these arguments that have dominated most of the history of logic.

CASE STUDY: Health experts warn…

In most health messages we are exposed to, argumentation is usually interspersed among other types of discourse (e.g. explanatory discourse). To the extent that a health argument is present, it can be difficult to identify it and reconstruct it in terms of its component premises and conclusion. Some premises may be missing altogether and have to be supplied by the argument analyst. Those premises that are present can have a number of different functions. Some may report claims made by health experts who are often affiliated with universities or research institutes. Other premises may describe facts and research findings about the health issue that is the focus of the message. The conclusion usually takes the form of a recommendation, either to avoid or modify a risky behaviour (e.g. smoking) or to adopt protective health measures (e.g. immunization). To illustrate these

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components of a health message, consider the following story about coconut oil that appeared in various media outlets in 2017:

Health experts warn against coconut oil

Coconut oil raises cholesterol just like other saturated fats do, warns the American Heart Association.

The health benefits of coconut oil have been questioned, with US authorities warning it raises cholesterol in the same way as other saturated fats.

A new paper released by the American Heart Association urges consumers to ditch coconut oil and instead opt for polyunsaturated fats.

"Because coconut oil increases LDL cholesterol, and has no known offsetting favourable effects, we advise against the use of coconut oil", the association advised.

The advice is in line with the 2013 Australian Dietary Guidelines that says foods predominantly containing saturated fat such as butter, cream and coconut oil must be limited.

Kellie Bilinski, an accredited practising dietitian and spokesperson for the Dietitians Association of Australia says the bottom line is that coconut oil is a saturated fat and there is not enough evidence to suggest using it.

"We know saturated fats are linked with cardiovascular disease", she said.

There is also a large body of evidence showing that polyunsaturated fatty acids (PUFAs), found in foods like salmon and walnuts, reduce cholesterol and can even raise 'good' cholesterol, she said.

A recent study by researchers at the University of Georgia even suggested a PUFA-rich diet may help to control a person's appetite by influencing hormones associated with hunger.

Participants who regularly consumed foods high in PUFAs had a significant decrease in the hormone ghrelin, responsible for increasing hunger.

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They also had a significant increase in peptide YY (PYY) - a hormone that increases fullness or satiety. Participants saw increases in PYY while fasting and after consuming a meal.

Ms Bilinski recommends cooking with either olive oil or vegetable oil.

SBS News is reporting recent research findings about coconut oil that suggest this oil may not have the beneficial health effects that many people believe it does. It is the way in which these findings are reported that suggests they carry probative weight as premises in an argument. Each statement or claim is associated with a source of expertise and authority. We are not just told, for example, that coconut oil raises cholesterol, but that a reputable body, the *American Heart Association*, is warning the public that this is the case based on findings from one of its research studies. American expertise assumes an international dimension when the advice on coconut oil is said to conform to Australian Dietary Guidelines. A spokesperson for the Dietitians Association of Australia, Kellie Bilinski, who is also an accredited practising dietician, adds yet further authority to the claims that coconut oil is a saturated fat and should not be consumed for this reason. These claims from different expert sources form premises in the following argument from authority:

The *American Heart Association* and the *Dietitians Association of Australia* are expert organizations (PREMISE 1)
These organizations assert that coconut oil is a saturated fat that should not be consumed (PREMISE 2)
If the *American Heart Association* and the *Dietitians Association of Australia* are expert organizations, and these organizations assert that coconut oil is a saturated

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fat that should not be consumed, then it is true that coconut oil is a saturated fat that should not be consumed (PREMISE 3)
Coconut oil is a saturated fat that should not be consumed (CONCLUSION)

To this point, we have reconstructed only half of the argumentation used in this health story. The focus of argument then shifts from the negative health effects of coconut oil to the beneficial health effects of polyunsaturated fatty acids in foods like salmon and walnuts. These beneficial effects include a reduction of cholesterol and appetite. Once again, these claims are developed as premises in an argument from authority:

The *University of Georgia* and the *Dietitians Association of Australia* are expert institutions (PREMISE 1)
Individuals affiliated with these institutions assert that polyunsaturated fatty acids reduce cholesterol and appetite (PREMISE 2)
If the *University of Georgia* and the *Dietitians Association of Australia* are expert institutions, and individuals affiliated with these institutions assert that polyunsaturated fatty acids reduce cholesterol and appetite, then it is true that polyunsaturated fatty acids reduce cholesterol and appetite (PREMISE 3)
Polyunsaturated fatty acids reduce cholesterol and appetite (CONCLUSION)

Argumentation in this health story unfolds in two stages, with each stage supporting its respective conclusions about coconut oil and polyunsaturated fatty acids by means of an argument from authority. We will have occasion to examine this particular informal fallacy many times in the chapters that lie ahead. Its dominance in medical and health stories reflects the extent to which we defer to expertise in our reasoning about health.

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CHAPTER SUMMARY: Key points

• Medicine and health have tended to be overlooked in the critical thinking literature. And yet robust critical thinking skills are needed to evaluate the large number and range of health messages that we are exposed to on a daily basis.

• An ability to think critically helps us to make better personal health choices and to uncover biases and errors in health messages and other information. An ability to think critically allows us to make informed decisions about medical treatments and is vital to efforts to reduce medical diagnostic errors.

• A key element in critical thinking is the ability to distinguish strong or valid reasoning from weak or invalid reasoning. When an argument is weak or invalid, it is called a 'fallacy' or a 'fallacious argument'.

• The informal fallacies are so-called on account of the presence of epistemic and dialectical flaws that cannot be captured by formal logic. They have been discussed by many generations of philosophers and logicians, beginning with Aristotle.

• Historically, philosophers and logicians have taken a pejorative view of the informal fallacies. Much of the criticism of these arguments is related to a latent deductivism in logic, the notion that arguments should be evaluated according to deductive standards of validity and soundness. Against deductive standards and norms, many reasonable arguments are judged to be fallacies.

• Developments in logic, particularly the teaching of logic, forced a reconsideration of the prominence afforded to deductive logic in the evaluation of arguments. New criteria based on presumptive reasoning and plausible argument started to emerge. Against this backdrop, non-fallacious variants of most of the informal fallacies began to be described for the first time.

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• Today, some argument analysts characterize non-fallacious variants of the informal fallacies in terms of cognitive heuristics. During reasoning, these heuristics function as mental shortcuts, allowing us to bypass knowledge and come to judgement about complex health problems.

Suggestions for further reading:

(1) Sharples, J.M., Oxman, A.D., Mahtani, K.R., Chalmers, I., Oliver, S., Collins, K., Austvoll-Dahlgren, A. and Hoffmann, T. (2017) 'Critical thinking in healthcare and education', *British Medical Journal*, 357: j2234. Doi: 10.1136/bmj.j2234.

The authors examine the role of critical thinking in medicine and healthcare, arguing that critical thinking skills are essential for doctors and patients. They describe an international project that involves collaboration between education and health. Its aim is to develop a curriculum and learning resources for critical thinking about any action that is claimed to improve health.

(2) Hitchcock, D. (2017) *On Reasoning and Argument: Essays in Informal Logic and on Critical Thinking*, Cham: Switzerland: Springer.

This collection of essays provides more advanced reading on several of the topics addressed in this chapter, including the fallacies, informal logic, and the teaching of critical thinking. Chapter 25 considers if fallacies have a place in the teaching of critical thinking and reasoning skills.

(3) Hansen, H.V. and Pinto, R.C. (eds.) (1995) *Fallacies: Classical and Contemporary Readings*, University Park, PA: The Pennsylvania State University Press.

This edited collection of 24 chapters contains historical selections on the fallacies, contemporary theory and criticism, and analyses of specific fallacies. It also examines fallacies

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and teaching. There are chapters on four of the fallacies that will be examined in this book: appeal to force; appeal to ignorance; appeal to authority; and *post hoc ergo propter hoc*.

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QUESTIONS

(1) Diagnostic errors are a significant cause of death and serious injury in patients. Many of these errors are related to cognitive factors. Trowbridge (2008) has devised twelve tips to familiarize medical students and physician trainees with the cognitive underpinnings of diagnostic errors. One of these tips is to explicitly describe heuristics and how they affect clinical reasoning. These heuristics include the following:

Representativeness – a patient's presentation is compared to a 'typical' case of specific diagnoses.

Availability – physicians arrive at a diagnosis based on what is easily accessible in their minds, rather than what is actually most probable.

Anchoring – physicians may settle on a diagnosis early in the diagnostic process and subsequently become 'anchored' in that diagnosis.

Confirmation bias – as a result of anchoring, physicians may discount information discordant with the original diagnosis and accept only that which supports the diagnosis.

Using the above information, identify any heuristics and biases that occur in the following scenarios:

Scenario 1: A 60-year-old man has epigastric pain and nausea. He is sitting forward clutching his abdomen. He has a history of several bouts of alcoholic pancreatitis. He states that he felt similar during these bouts to what he is currently feeling. The patient states that he has had no alcohol in many years. He has normal blood levels of pancreatic enzymes. He is given a diagnosis of acute pancreatitis. It is eventually discovered that he has had acute myocardial infarction.

Scenario 2: A 20-year-old, healthy man presents with sudden onset of severe, sharp chest pain and back pain. Based on these symptoms, he is suspected of having a dissecting thoracic aortic aneurysm. (In an aortic dissection, there is a separation of the layers within the wall of the aorta, the large blood vessel branching off the heart.) He is eventually diagnosed with pleuritis (inflammation of the pleura, the thin, transparent, two-layered membrane that covers the lungs).

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(2) Many of the logical terms that were introduced in this chapter also have non-logical uses in everyday language. Below are several examples of the use of these terms. For each example, indicate if the word in italics has a *logical* or a *non-logical* meaning or use:

(a) University 'safe spaces' are a dangerous *fallacy* – they do not exist in the real world (*The Telegraph*, 13 February 2017).
(b) The MRI findings *beg the question* as to whether a careful ultrasound examination might have yielded some of the same information on haemorrhages (*British Medical Journal: Fetal & Neonatal*, 2011).
(c) The youth justice system is a *slippery slope* of failure (*The Sydney Morning Herald*, 26 July 2016).
(d) The EU countered with its own gastronomic *analogy*, saying that "cherry picking" the best bits of the EU would not be tolerated (*BBC News*, 28 July 2017).
(e) As Ebola spreads, so have several *fallacies* (*The New York Times*, 23 October 2014).
(f) Removing the statue of Confederacy Army General Robert E. Lee no more puts us on a *slippery slope* towards ousting far more nuanced figures from the public square than building the statue in the first place put us on a *slippery slope* toward, say, putting up statues of Hitler outside of Holocaust museums or of Ho Chi Minh at Vietnam War memorials (*Chicago Tribune*, 16 August 2017).
(g) We can expand the *analogy* a bit and think of a culture as something akin to a society's immune system – it works best when it is exposed to as many foreign bodies as possible (*New Zealand Herald*, 4 May 2010).
(h) The Josh Norman Bowl *begs the question*: What's an elite cornerback worth? (*The Washington Post*, 17 December 2016).
(i) The intuition behind these *analogies* is simple: As a homeowner, I generally have the right to exclude whoever I want from my property. I don't even have to have a good justification for the exclusion. I can choose to bar you from my home for virtually any reason I want, or even just no reason at all. Similarly, a nation has the right to bar foreigners from its land for almost any reason it wants, or perhaps even no reason at all (*The Washington Post*, 6 August 2017).

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(j) Legalising assisted suicide is a *slippery slope* toward widespread killing of the sick, Members of Parliament and peers were told yesterday (*Mail Online*, 9 July 2014).

(3) In the Special Topic 'What's in a name?', an example of a question-begging argument from the author's recent personal experience was used. How would you reconstruct the argument in this case to illustrate the presence of a fallacy?

(4) On 9 July 2017, the effect of coconut oil on health was also discussed in an article in *The Guardian* entitled 'Coconut oil: Are the health benefits a big fat lie?' The following extract is taken from that article. (a) What type of reasoning is the author using in this extract? In your response, you should reconstruct the argument by presenting its premises and conclusion. Also, is this argument valid or fallacious in this particular context?

> "When it comes to superfoods, coconut oil presses all the buttons: it's natural, it's enticingly exotic, it's surrounded by health claims and at up to £8 for a 500ml pot at Tesco, it's suitably pricey. But where this latest superfood differs from benign rivals such as blueberries, goji berries, kale and avocado is that a diet rich in coconut oil may actually be bad for us."

The article in *The Guardian* also makes extensive use of expert opinion. Two such opinions are shown below. (b) What *three* linguistic devices does the author use to confer expertise or authority on the individuals who advance these opinions?

Christine Williams, professor of human nutrition at the University of Reading, states: "There is very limited evidence of beneficial health effects of this oil".

Tom Sanders, emeritus professor of nutrition and dietetics at King's College London, says: "It is a poor source of vitamin E compared with other vegetable oils".

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The author of the article in *The Guardian* went on to summarize the findings of a study by two researchers that was published in the British Nutrition Foundation's Nutrition Bulletin. The author's summary included the following statement: *There is no good evidence that coconut oil helps boost mental performance or prevent Alzheimer's disease*. (c) In what type of informal fallacy might this statement be a premise?

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ANSWERS

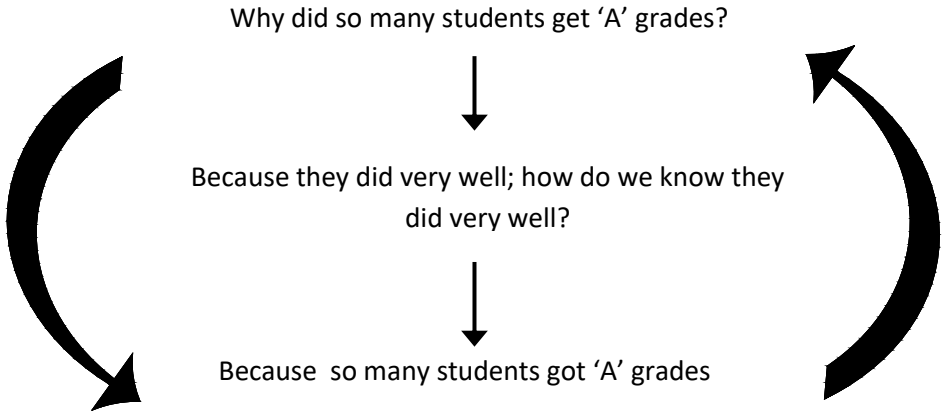
(1)

Scenario 1: An anchoring error has occurred in which the patient is given a diagnosis of acute pancreatitis early in the diagnostic process. The clinician becomes anchored in this diagnosis, with the result that he overlooks two pieces of information that would have allowed this diagnosis to be disconfirmed – the fact that the patient has reported no alcohol use in many years and the presence of normal blood levels of pancreatic enzymes. By dismissing this information, the clinician is also showing a confirmation bias – he attends only to information that confirms his original diagnosis.

Scenario 2: A representativeness error has occurred. The patient's presentation is typical of aortic dissection. However, this condition can be dismissed in favour of conditions like pleuritis or pneumothorax on account of the fact that aortic dissection is exceptionally rare in 20-year-olds.

(2) (a) non-logical; (b) non-logical; (c) non-logical; (d) non-logical; (e) non-logical; (f) logical; (g) logical; (h) non-logical; (i) logical; (j) logical

(3) The fallacy can be illustrated as follows. The head of department asks the question 'Why did so many of these students get 'A' grades'? He receives the reply 'Because they did very well'. But someone might reasonably ask 'How do we know that they did very well?' To which the reply is 'Because so many students got 'A' grades'. The reasoning can be reconstructed in diagram form as follows:



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(4) (a) The author is using an analogical argument, which has the following form:

P1: Blueberries, goji berries, kale, avocado and coconut oil are natural, exotic, pricey and surrounded by health claims.
P2: Blueberries, goji berries, kale and avocado have health benefits.
C: Coconut oil has health benefits.

This is a false analogy, or a fallacious analogical argument, because coconut oil does not share with these other superfoods the property or attribute <*has health benefits*>.

(b) The author uses academic rank, field of specialization, and university affiliation to confer authority or expertise on individuals who advance expert opinions.

(c) This statement could be a premise in an argument from ignorance.

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NOTES

1. The use of formal education as a proxy measure for critical thinking skills is problematic in a number of respects. It assumes, for example, that formal education aims to develop critical thinking skills and that these skills are directly taught in schools when in fact neither may be the case.

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