Patient Perception and Physician Communication of Cardiovascular Disease Risk

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On my honor as a University Student, I have neither given nor received unauthorized aid on this assignment as defined by the Honor Guidelines for Thesis-Related Assignments

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Introduction

Most of us know what it is like to receive words of caution from a doctor, whether it be to floss more to prevent cavities or to wear sunscreen to prevent skin cancer. And it is easy to dismiss these warnings, at least until you get your first cavity or wrinkles start to show. But what if it is a more deadly consequence, like a heart attack? In today's western society, it is exceptionally easy to eat too much processed food and not get enough exercise, and it is just as easy to dismiss medical advice to make lifestyle changes in order to improve cardiovascular health, especially for those who are uneducated in the first place. However, without making this lifestyle change, many people will and do suffer from heart disease, and once it is found it can be too late to make changes. Therefore, I want to know, why are people unwilling or unable to make lifestyle changes to improve their heart health? If it is common knowledge that eating a diet high in fat and processed sugar is unhealthy, why do people still do it? Is it always common knowledge? In this paper, I will investigate the different psychological and social factors that affect how patients perceive their cardiovascular disease risk, and if there are other factors other than risk perception that prevent lifestyle changes. Understanding this will ultimately help to guide the development of technologies that can aid physician communication and patient perception of risk. An example of this is my Capstone project, which is a diagnosis tool that can accurately and convincingly display cardiovascular disease risk. With this tool, the goal is to unambiguously and easily determine cardiovascular health and disease risk, and this paper may guide how best to measure and display the risk so that patients are more likely to maintain necessary lifestyle changes.

I will be using the framework of "risks and standards" from Hess and Sovacool's "Sociotechnical Matters" (Hess & Sovacool, 2020). This outline involves examining the

difference between expert and public understanding. In this case, the expert would be the physician, whether it be primary care or cardiologist, and the public would be the patients. In general, there is a widespread tendency of patients to underestimate the results of CVD risk screenings (Webster & Heeley, 2010), while the experts, the physicians, often underutilize current tools for predicting risk. Even if they did use these tools, they have certain limitations. The framework also involves investigating the process of social negotiation, which is critical for properly communicating risk to the patient and negotiating an achievable treatment plan.

Methods

To ensure a thorough review, I looked at studies and papers from various scopes: from the very broad field of risk perception as a whole, risk perception of health, and then risk perception of specifically cardiovascular diseases. I sourced my material from either primary sources or reliable review articles, and all of the data was supported by multiple sources unless otherwise stated.

Context/Background

Today, 35% of cardiovascular disease (CVD) mortality is caused by a lack of physical inactivity alone, and out of all 18 million cases of CVD around the world, an estimated 90% of it is preventable with lifestyle changes such as diet, smoking, and alcohol consumption("90 Percent of Heart Disease is Preventable through Healthier Diet, Regular Exercise, and Not Smoking", 2022). The pathology is complex, but often the underlying cause for these diseases is atherosclerosis, where plaques form in the blood vessel due to a build-up of cholesterol, caused by excess fat. Another underlying cause is hypertension, which is caused by an excess of sodium (Getz & Reardon, 2007).

The current tools available to determine risk involve formulas that require input on age, gender, cholesterol levels, blood pressure, and smoking status, and use equations to estimate risk, such as 10-year absolute risk. These tools include printable risk charts, personal digital assistants, and web-based calculators (Sheridan et al., 2003). However, according to a study of a large sample of physicians in the United States, physicians do not often use these tools in their daily practice. This is because they were deemed not accurate or useful enough to warrant the extra time needed to use them (Shillinglaw et al., 2012). This statement implies two key issues; first, since the current tools are admittedly not accurate, how can doctors expect their patients to take the calculated risk seriously, even if they used these tools? The uncertainty of the risk assessment gives patients all the more reason to dismiss the warning and assume that they will be fine. A second key issue is the lack of time with the doctor during an appointment, which implies a deeper-rooted issue within our healthcare system. While these deeper-rooted issues are outside of the scope of this paper, the ultimate goal is to explore ways to allow adequate patient-physician communication given these limited appointment times. To do this, I will explore the three main factors that affect risk perception: psychological factors of the patient, sociological factors of the patient, and how the physician measures and communicates this risk.

Psychological Factors of Risk Perception

Even if physicians could accurately screen for cardiovascular disease (CVD) risk, there are psychological reasons that patients will have a bias against these risks. According to one meta-analysis exploring this issue, there are multiple theories to explain how people make decisions based on the information they are given (Webster & Heeley, 2010). One of the first models used to explain risk perception is the Health Belief Model (HBM), which says that a person will make a risk judgment based on four factors: perceived susceptibility of the disease,

severity of the disease, benefits of the preventative action , and barriers to the preventative action. This model assumes that decision is a purely cognitive, almost mathematical process of weighing risks and benefits.

A second model, the Protection Motivation Theory (PMT), is similar to the HBM but adds the components of fear and the perceived ability to carry out the preventative action. The ultimate decision depends on the balance between the perceived threat of the disease and the perceived efficacy and doability of the preventative measure.

A more recent model, the Risk as Feelings theory, hypothesizes that the risk response is mainly driven by emotional influences, rather than a purely cognitive process. For example, other models might say that if someone is very fearful of a certain outcome, they would be more likely to embrace preventative action; however, it may actually be more likely that they avoid the action as a defensive mechanism. Their risk response also can depend on how the person feels about the preventative measure. Overall, this model is a much more realistic view of how humans really react, as this mode of thinking is shown to be faster, more intuitive, and require much less effort than strictly analytical thinking. However it is not necessarily irrational, as this mode of thinking compromises many subconscious associations which are used to make quick judgements. Though analytic thinking can be a valuable tool as well, the risks-as-feelings model is essential to take into account when analyzing how people perceive risks (Slovic et al., 2004).

A final model is the Unrealistic Optimism model, which focuses on specifically the risk perception part of the equation, rather than all of the factors that drive the decision making process. This refers to the well-known bias that people tend to overestimate their control of an issue, causing them to underestimate the risk. Weinstein, who first initiated this theory, said that this bias is for the purpose of “self-esteem enhancement,” as we want to believe we are

inherently healthier than others, and the biased is magnified with perceived preventability of the condition, if the symptoms of the condition hadn't yet appeared, or if there was embarrassment surrounding the condition. It was also found that this bias is relatively universal, and not limited to any age, gender, educational, or occupational group. It was also shown that being adequately worried decreases this bias, which slightly contradicts the Risk as Feelings model, which says that fear can prevent action. There is obviously a balance to how much fear is beneficial, and the challenge is to find what point that is.

Looking at these models together can give valuable insight as to why people tend to avoid preventative measures, which is especially relevant for cardiovascular disease. It is clear that the psychology is complex, as humans are not completely logical beings as some of the early models would suggest, and we tend to underestimate risk when we are in control. Further, while it is beneficial to worry about disease risk to encourage proactive behavior, too much anxiety can lead to avoidant behavior as well. Perhaps with a better understanding of these psychological factors, doctors and engineers could create a better system of communication that maximizes a patient's understanding of risk and willingness to change. However, psychology is not the only factor of patient risk perception, as social factors play a significant role as well, which will be discussed in the next section.

Social Factors

In addition to psychological factors that affect risk perception, there are social factors that are heavily influential, and are important to address to avoid harmful stigmas around heart disease. Among these social factors are socioeconomic status, race and ethnicity, culture and language, access to care, and residential environment, which often overlap (Havranek et al., 2015). When it comes to risk perception, educational status is extremely relevant; this is because

a lack of education, specifically below high school level, causes low health literacy and therefore low risk perception, ultimately causing poor health outcomes. Along with this, there has been generally little effort in the US health system to improve self-care behavior or implement preventative measures for these people.

Another very relevant social factor that contributes to risk perception is race. Black people are 2-3 times more likely to die of heart disease compared to white people and black and people of color have higher CVD risk factors, and although CVD mortality has steadily declined since the 1970s for the overall population, it has remained constant for these racial minority groups. There are many complex factors that contribute to this, one being historically biased medical treatment. Though improved, this biased treatment continues even today, causing deep-rooted mistrust. This mistrust is present even if the physician is not biased, causing a skewed risk perception, and it is associated with lower health, lower self-care adherence, and underuse of available services (Havranek et al., 2015).

One research article studied the effect of socioeconomic disparities on CVD knowledge, risk perception, and intention to make lifestyle changes such as physical activity and a healthy diet in various communities in England (Hassen et al., 2022). This study found that level of education, income, and gender were all factors that contributed to risk knowledge and intention toward a healthy lifestyle. In terms of gender, females have a higher intention to have a healthy diet but a lower intention to be physically active compared to men, which may be indicative of limited safe access to equipment or social motivation. They also showed that education is strongly correlated to both CVD risk knowledge and a healthier diet, and that lower incomes strongly correlate with dietary habits. This is likely due to the high cost of healthier foods and poor access, causing their intention to change dietary habits to be lower.

Overall, there are many social factors with complex interactions that affect risk perception and willingness to change behavior. Perhaps the most influential factors are education levels, due to lower health literacy, race, due to historical mistreatment and lack of trust, and income, due to lack of access to healthy foods. It also may be important to take gender into account, as women have different social motivations and may have limited access to safe workout spaces.

Healthcare/Physician factors

Currently, certain guidelines are in place for physicians in how to communicate cardiovascular risk (Navar et al., 2016). According to these guidelines, it is first essential to understand the patient's priorities and preferences; this involves asking questions about how the patient personally views this risk and their perceived control of the issue, which may shed light on what biases they have. Then, the physician should formulate the options and recommendations for CVD risk reduction. Third, and a critical step, is communicating these risks and benefits to the patient. The current standard is to use the 10-year risk model for people between 40-75, which inputs gender, age, smoking status, diabetes status, cholesterol levels, and systolic blood pressure to estimate the percent likelihood of developing cardiovascular disease within 10 years (Samaniyan Bavarsad et al., 2020). These guidelines encourage using round numbers and small percentages, limiting the number of statistics and graphics but using simple decision aids, and providing context with risk estimation. They also suggest using relative risk compared to absolute risk.

However, although these are the general guidelines, they are imperfect and not always used in practice. In addition, the current tools and calculators to estimate cardiovascular disease

risk have flawed accuracy and often are not even used. The following studies give us a glimpse of what really happens in hospitals in a variety of settings.

One study was done in England, where 15 practitioners were interviewed to analyze how CVD risk is communicated in the primary care settings (Gidlow et al., 2021). The standard in England is to use a 10-year heart attack or stroke risk calculator (the QRISK2), which inputs a variety of risk factors to estimate the percent chance of having a heart attack or stroke within 10 years; however, this calculator was developed to guide physician decision making, not to facilitate patient communication. More recently, alternative calculators, such as the JBS5, have been developed that communicate risk in the form of heart age, which estimates the age your heart is equivalent to compared to someone with optimal risk factors of the same age, gender, and ethnicity; event-free survival age, which is the age at which the patient may expect to have their first cardiovascular disease event; chance of survival free of CVD, which is a curve that shows the decreasing chance, at each age point, to be free of heart attack or stroke for that year; or risk score manipulation, which displays how certain interventions can change these aforementioned risk scores, as well as other visual displays. Through the interviews, the researchers found that the practitioners generally felt confident using the 10-year risk score for their own analysis, but ultimately lacked proper understanding of how to communicate it to the patient. The interviews showed that the patients were more responsive to risk scores from the JBS5 calculator, however the practitioners had not been adequately trained to understand what the scores meant, and none of them had received specific training in risk communication.

Another study was conducted in Australia, where 25 general practitioners were interviewed in order to determine what methods were being used to communicate CVD risk (Bonner et al., 2014). In Australia, the standard is to use the Frimingham risk equation, which

inputs age, gender, smoking, diabetes, systolic blood pressure, and cholesterol ratio to estimate the 5-year absolute risk of a cardiovascular event. Depending on the percent risk, it is defined as low, medium, or high risk. Previous to this study, it was found that a quantitative risk assessment, with percentages and frequencies, were more effective for patient understanding compared to only qualitative assessments. However, it was also found that 73% of GPs exclusively used qualitative formats. This study investigated why that is, and why practitioners do not use quantitative tools to communicate risk.

As a result, it was found that the practitioners used three different communication styles, depending both on the attitudes of the patients and the severity of the risk. These communication strategies were "positive," "scare tactic," and "indirect." Positive was used for patients with relatively lower risk who were more receptive to making changes. Scare tactic was used with higher-risk patients who were more dismissive about their health, and unmotivated to make changes. Finally, the indirect method is used when the patient is very resistant to the topic and perhaps has other issues in their life, so the physician withholds the absolute risk to avoid overwhelming the patient and make sure they come back. Generally, quantitative risk assessments would be beneficial for the positive and scare tactics, but not for the indirect method or with less educated patients with high anxiety or low motivation. Overall, this study showed the nuances of risk communication depending on the risk, motivation, and anxieties of the patient, and emphasizes the need for alternative risk assessment and communication tools, which can improve understanding of CVD risk for all three groups of patients.

A third study was done in the US and surveyed 2708 patients from various hospitals in the settings of primary care, cardiology, and endocrinology, in order to investigate how presentation methods for atherosclerotic CVD (ASCVD) risk affected patient perceptions and

treatment preference (Navar et al., 2018). These participants were presented with three different hypothetical scenarios and were asked to rate their perceived risk and willingness to undergo treatment; these scenarios were being presented with 1) a 15% chance of a 10-year ASCVD event, 2) a 4% chance of a 10-year CVD death, and 3) a 50% change of a lifetime ASCVD event. They also investigated the effect of different formats of risk communication, which were text only, bar graphs, and face pictograms. As a result, they found that the severity of risk perception and willingness to undergo therapy were highest when the patients were presented with a lifetime risk of an ASCVD event of 50%, and lowest when shown a 10-year risk of a CVD death of 4%. Further, patients had significantly lower risk perception when shown a face pictogram, compared to a bar graph or just text. The study also looked at how age, education, and numeracy affected risk perception, and found that willingness to take therapy was greater in people with more education and better numeracy, supporting what was previously stated in this paper.

Discussion

Looking at these factors that affect risk perception, there are common themes and also some contradictions and points of unclarity. A recurring theme in psychological factors is optimism bias, where humans think we are more in control of a situation than we actually are, and tend to underestimate the risk when we are the ones in control of the risky action. However, there is inconsistency in the literature as to whether an increased risk perception will actually increase the likelihood of action; on one hand, an increased risk perception will serve as a scare tactic to change harmful behaviors, but on the other hand, being overly anxious about the risk will cause people to avoid changing behavior, possibly because they associate it with the risk, or because a high risk perception can activate fatalist beliefs of having no control of the outcome (Ferrer & Klein, 2015).

When exploring the social and healthcare factors, a very common theme amongst literature was education level and numeracy. While many doctors in the studies acknowledge differences in literacy and change their communication styles accordingly, there are still limitations in both the tools to measure CVD risk and the physician communication styles, caused by a lack of adequate training and knowledge. This, along with many other factors outside of the scope of healthcare, causes a significant correlation between low education levels and CVD morbidity and mortality.

To synthesize the findings of the three studies done in England, Australia, and the US, it was fairly consistently found that the 10-year absolute risk measurement was not sufficient for adequate risk understanding by the patient, and that its main use is to guide the treatment plan for the physician. However, alternative methods are not straight-forward either, as it is necessary for the physician to alter their communication styles depending on the patient's anxieties, motivations, and understanding, so it is difficult to find a singular tool that would work best for everyone. These methods include communicating risk via heart age, visual displays, or tools that show how risk changes with behavioral changes, although there is currently limited specific training on how to use these tools. There is also some conflicting data, for example some studies say that face pictograms are helpful to improve understanding, while others show that they are less effective compared to words alone.

It is clear that future study is needed to find out which tools and communication methods are the most effective at communicating risk in a way that will encourage understanding and action. There is also the potential for engineers to develop novel diagnostic tools which facilitate the measurement and communication of risk, along with changes made by physicians. Limitations of this synthesis include the use of studies from varying regions and cultural

environments, which could limit how much they could realistically be compared and applied to one another. Because there is so much social and cultural variability, it will be difficult to obtain cohesive results in the future, even within a single country; however, with further study, hopefully more concrete trends will emerge.

Conclusion

In this paper, I investigated the many different factors involved in how patients perceive their CVD risk, and how that ultimately translates to lifestyle change. First, there are many psychological factors that contribute to risk perception, such as optimism bias, among other cognitive and emotional processes. Second, there are social factors, such as education level, race, and income level, all of which are intertwined. Finally, there are factors on the end of the physician and the healthcare system, such as standards of communication and risk-calculating tools, which are often limited and underutilized. The purpose of this paper is to highlight the current status of risk communication practices and how effective they are in order to ultimately guide future improvements in the areas of medicine and engineering. From the insights from this paper, we are in need of a comprehensive and easy-to-use method of risk analysis as well as a specific training protocol for physicians, that takes both the psychological and social factors into account to maximize risk understanding. If patients properly understand risk, they are much more likely to make critical lifestyle changes that will greatly improve their quality of life and life expectancy in the future.

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