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Heuristics and biases in cardiovascular disease prevention: How can we improve communication about risk, benefits and harms?

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ABSTRACT

Objective: Cardiovascular disease (CVD) prevention guidelines recommend medication based on the probability of a heart attack/stroke in the next 5–10 years. However, heuristics and biases make risk communication challenging for doctors. This study explored how patients interpret personalised CVD risk results presented in varying formats and timeframes.
Methods: GPs recruited 25 patients with CVD risk factors and varying medication history. Participants were asked to 'think aloud' while using two CVD risk calculators that present probabilistic risk in different ways, within a semi-structured interview. Transcribed audio-recordings were coded using Framework Analysis.
Results: Key themes were: 1) numbers lack meaning without a reference point; 2) risk results need to be both credible and novel; 3) selective attention to intervention effects. Risk categories (low/moderate/high) provided meaningful context, but short-term risk results were not credible if they didn't match expectations. Colour-coded icon arrays showing the effect of age and interventions were seen as novel and motivating. Those on medication focused on benefits, while others focused on harms.
Conclusion: CVD risk formats need to be tailored to patient expectations and experiences in order to counteract heuristics and biases.
Practice implications: Doctors need access to multiple CVD risk formats to communicate effectively about CVD prevention.

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1. Introduction

1.1. The role of risk in CVD prevention

For cardiovascular disease (CVD) prevention, probabilistic risk is central to clinical guidelines that determine whether medication should be prescribed to a patient [1]. CVD risk calculators based on large cohort studies take modifiable (e.g. blood pressure, cholesterol, smoking) and non-modifiable (e.g. age, sex, diabetes) risk factors into account, to identify patients at highest risk of a heart attack or stroke [2,3]. This is a better way to recommend medication than treating blood pressure or cholesterol as isolated risk factors, because it targets patients at highest risk who are most likely to benefit from taking medication [4]. Different countries use varying 5–10 year risk models with different treatment thresholds [1]. Ten year models include a US calculation with race as a risk factor and a 7.5% threshold for medication; a UK calculation that includes socio-economic area and a 10% threshold; and a European model that differentiates between low and high risk countries with a 10% threshold [5–7]. Five year models include Framingham calculations used in Australia and New Zealand with a 15% medication threshold for general populations and lower thresholds for high risk ethnicities [8–10].

1.2. The importance of communication in CVD risk assessment

Qualitative research has found the meaning of CVD risk can be confused by uncertainty about the role of risk factors in a particular

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model, and conflicting results when different models are used for the same patient [11,12]. Doctors and patients may be unaware of how model assumptions affect the risk result: the specific CVD outcomes (e.g. mortality versus heart attack), timeframes (e.g. 5 versus 10-year risk) and medication thresholds (e.g. prescribe at 10% versus 15% risk) all have a big impact on the final result. Doctors report communication as a key barrier to using risk calculators, as the relationship between CVD risk and prescribed medication can be a challenging concept to convey [13,14]. 'High risk' is easier to explain in relation to blood pressure and cholesterol results [13,15], but it is less obvious that the strongest drivers of CVD risk are non-modifiable: age and sex [1]. Doctor-patient communication is especially challenging in two situations: 1) low risk patients who may progress to high risk unless they make lifestyle changes (e.g. a young overweight smoker with mildly elevated blood pressure), and 2) low risk patients who would be treated for isolated risk factors under previous guidelines (e.g. high cholesterol but no other risk factors), but would actually be classified as low risk if a probabilistic risk calculation was undertaken [13,14,16]. Doctors worry that probabilistic risk estimates may undermine lifestyle change messages if the number is perceived as 'low', or equally it may cause anxiety if perceived to be 'high' [13,14]. Other challenges include explaining risk to patients with low health literacy [17]. Many patients remain unaware of their CVD risk, its meaning and the rationale for medication or lifestyle recommendations [14].

1.3. What we already know about CVD risk communication

We know from the broader risk communication literature that absolute probabilities and natural frequencies are better understood than relative risk formats, and that visual aids can be helpful especially when combined with verbal descriptions [18]. A review of CVD risk format studies recommended probabilities, frequencies, graphs and shorter time frames, but most of the included studies were based on hypothetical risk over 10 years or longer [19]. Cognitive psychology research shows that decision making based on probabilistic risk is also influenced by many heuristics and biases, including three key phenomena that may influence CVD risk perception: availability, representativeness, and anchoring and adjustment [20,21]. For availability, people will judge risk based on how easily they can access the mental image of a CVD event. For representativeness, they will judge how likely a risk profile matches their perception of a typical "high risk" person. For anchoring and adjustment, people will pay most attention to the salient risk number with insufficient adjustment for contextual information such as the timeframe for the risk (e.g. 20% risk over 10 years seems higher than 10% risk over 5 years). Since previous research has focused on hypothetical 10 year risk, we sought to address a gap in the literature by exploring patients' personalised risk in both 5 and 10 year timeframes, to better reflect current CVD prevention guidelines and clinical practice.

1.4. Aim

The aim of this study was to explore how patients make sense of and interpret CVD risk results presented in a variety of numerical, verbal and graphical formats, including both shorter (5 year) and longer (10 year) timeframes.

2. Methods

2.1. Recruitment

General Practitioners (GPs) in New South Wales, Australia invited patients aged 35–74 years with CVD risk factors. From returned expression of interest forms, purposive sampling was used to recruit 25 participants. In line with the qualitative approach, we aimed to recruit a diverse rather than representative sample [22], by selecting patients with varying CVD risk factors (e.g. age, gender), medication use and experience of CVD events, ranging from low to high risk [3]. Analyses of 25 interviews suggested theoretical saturation with adequate explanation of meaningful formats for probabilistic risk, so no further recruitment was conducted [23]. Table 1 shows participants were most likely to be female (60%), aged 65–74 (13%), were currently taking at least one CVD-related medication (56%), and their pre-medication risk was estimated to be low (<10% over 5 years) under current Australian guidelines (84%). However, there was a wide range in each of these factors. The average risk result was 5.8% for 5 year risk (range 0–16%), and 15.1% for 10-year risk (range 0–37%). Ethics approval was obtained through the Sydney Local Health District.

2.2. Materials

Two CVD risk calculators were used to explore a wide range of personalised risk formats (see Table 2 for key features, and Figs. 1 and 2 for examples). Interface 1 was developed by the authors to explore new 5-year risk formats that were not available in existing online calculators, including an analogy (i.e. imagining 100 people sitting in a cinema) and a bar graph comparing 5-year risk to target and average risk. This was embedded in the existing Healthy.me app, a personal health management system. The authors added the 5-year Australian risk calculator to the app for this study, with changes made after the first 10 interviews to adapt useful features from Interface 2 into a 5-year risk format. Interface 2 was a publicly available website that allows comparison of different CVD risk models and the estimated effect of medicine/lifestyle interventions on CVD risk using icon arrays. This calculator provides more detailed information in "enhanced results", but we changed this to "basic results" after the first 10 interviews to simplify the content.

2.3. Process

The participant experience of the two interfaces was very similar, using a tablet to explore the risk calculator component (see Figs. 1 and 2 for example results). A protocol including think aloud

Table 1
Participant characteristics.

Participant characteristics	Number (%)
Sex	
Female	15 (60)
Male	10 (40)
Age	
35–44	2 (8)
45–54	1 (4)
55–64	9 (36)
65–74	13 (52)
5-year probabilistic risk result (estimated pre-medication risk)	
Low (<10%)	21 (84)
Moderate (10–15%)	3 (12)
High (>15%)	1 (8)
CVD prevention medication	
Never prescribed	8 (32)
Ceased taking medication	3 (12)
Cholesterol medication only	5 (20)
Blood pressure medication only	2 (8)
Diabetes medication only	2 (8)
Cholesterol and BP medication	5 (20)
Established CVD	
No	21 (84)
Yes	4 (16)

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