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Journalists' views on media coverage of medical tests and overdiagnosis: a qualitative study

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ABSTRACT

Objective Promotional media coverage of early detection tests is an important driver of overdiagnosis. Following research evidence that global media coverage presents the benefits of testing healthy people far more frequently than harms, and gives little coverage to overdiagnosis, we sought to examine journalists' views of media reporting of tests, overdiagnosis, and strategies to improve critical reporting on tests.

Design Qualitative study using semi-structured telephone interviews. Interviews were conducted between February and March 2020 and were audio-recorded and transcribed verbatim. Framework thematic analysis was used to analyse the data.

Participants and setting Twenty-two journalists (mainly specialising in health reporting, average 14.5 years' experience) based in Australia.

Results This sample of journalists acknowledged the potential harms of medical tests but felt that knowledge of harms was low among journalists and the public at large. Most were aware of the term overdiagnosis, but commonly felt that it is challenging to both understand and communicate in light of strong beliefs in the benefits of early detection. Journalists felt that newsworthiness in the form of major public health impact was the key ingredient for stories about medical tests. The journalists acknowledged that factors, like the press release and 'click bait culture' in particular, can influence the framing of coverage about tests. Lack of knowledge and training, as well as time pressures, were perceived to be the main barriers to critical reporting on tests. Journalists felt that training and better access to information about potential harms would enable more critical reporting.

Conclusions Effectively communicating overdiagnosis is a challenge in light of common beliefs about the benefits of testing and the culture of current journalism practices. Providing journalists with training, support, and better access to information about potential harms of tests could aid critical reporting of tests.

Strengths and limitations of this study

- This is the first study to explore journalists' views of the reporting of medical tests and overdiagnosis.
- The findings will help inform strategies to improve critical reporting on medical tests and communicate better about overdiagnosis.
- Our sample comprised mainly health-specific journalists with an interest in taking part in the study and may not be representative of all journalists.
- It remains unclear if the journalists' knowledge of how to critically report on tests translates into critical reporting in practice.

BACKGROUND

Advances in early detection testing through diagnostic technology, screening programmes, biomarkers, artificial intelligence and self-tracking technologies such as the Apple Watch are increasingly aimed at healthy people to detect a potential disease prior to the onset of symptoms. [1-5] While early detection tests may have benefits for those with a potentially serious disease, there is considerable evidence that unnecessary testing can harm healthy people through overdiagnosis.[6-8] Overdiagnosis occurs when individuals are labelled with a technically correct diagnosis that does not improve health outcomes.[9 10] It is now widely recognised as a threat to human health and health system sustainability.[9 11-16]

Many possible drivers of overdiagnosis have been documented. The media, through promoting early detection tests to healthy individuals, is considered an important driver.[15] A recent cross-sectional study[17] of global media coverage – including over a thousand media stories about five early detection tests (3D mammography, liquid biopsy, Apple Watch, blood biomarker tests and artificial intelligence technology for dementia) – found that the potential benefits of testing were presented far more frequently than potential harms. The risk of overdiagnosis was mentioned in very few stories. These findings align with published studies of media coverage of health and medicine, which have found that the media emphasise potential benefits more than harms.[18-21] The COVID-19 pandemic – in particular – has brought this problem into sharp focus. Many media outlets have hyped the effect of anti-viral drugs on the basis of small, industry-funded, uncontrolled studies – potentially hampering treatment evaluation efforts and responses to the pandemic.[22]

The media's often unrealistic and over-optimistic expectations about the value of early detection tests is a cause for concern for four main reasons. First, the general public, and patients, already tend to overestimate the benefits of early detection[23-25] and uncritical media coverage can reinforce these perceptions. Second, few individuals seem to be aware of the potential harms of early detection and overdiagnosis.[26 27] Third, there is evidence that tests are already widely overused.[28 29] And fourth, media coverage can influence patterns of healthcare utilisation – with positive coverage of a test or treatment associated with increases in utilisation.[30-32]

Box 1. The power of the media

Media coverage of Kylie Minogue's breast cancer diagnosis in Australia in May 2005 led to a 20-fold increase in media coverage about breast cancer, with a particular emphasis on how young women can get breast cancer and the importance of early detection.[32]

Bookings for mammograms as part of government-sponsored BreastScreen programmes across Australia rose 40% during the 2 weeks of the coverage, and there was a 101% increase in non-screened women in the eligible age group (40-69 years). Six weeks after the coverage, bookings stayed more than a third higher in non-screened women.[32]

Given the powerful role that media can play in perpetuating the present lack of awareness of the downsides of testing, including overdiagnosis, and in shifting public health behaviours, strategies to improve media reporting of tests and overdiagnosis are needed. While there is a considerable scientific literature on how the media frames different health issues, less attention has been given to hearing journalists' perspectives on media coverage of medical tests and overdiagnosis. In particular, no study has examined journalists' perspectives of new tests, and their benefits and risks. This study sought to redress this knowledge gap.

METHODS AND ANALYSIS

Study design

This qualitative study used semi-structured telephone interviews to explore journalists experience of, and attitudes to, reporting on medical testing, overdiagnosis, and strategies to improve media coverage of both tests and overdiagnosis. It was designed and reported according to the Consolidated Criteria for Reporting Qualitative Research (COREQ).[33] The study was approved by The University of Sydney Human Research Ethics Committee (2019/964). See Supplementary File 1 for the study protocol.

Participants and recruitment

Participants were 22 Australia-based journalists. Both health journalists and generalist journalists across any type of media were included. To be eligible, participants needed to be currently working as a journalist in Australia, be able to communicate in English (both orally and in written form) and be able to give informed consent. Ability to read and understand

English were key inclusion criteria for the proposed study because the interview was conducted in English. There were no restrictions on the age or gender of participants.

Journalists were purposively recruited through three different avenues: 1). There was journalism expertise in the author team (RM) and personal contacts played a role in the initial development of a list of potential participants to contact. 2). One author (MOK) performed Google and Twitter searches to locate potentially eligible journalists. If a journalist had publicly available contact information, they were emailed about the study. 3). An active 'snowball' recruitment technique was used by asking participating journalists to suggest other eligible journalists they believed would be interested in being involved.

All potential participants were emailed a Participant Information Sheet outlining aims and important information about the study. Those interested in taking part returned a consent form to researchers through email and were contacted to arrange an interview.

Data collection

An interview schedule (Supplementary file 2) was developed, discussed and piloted by the research team. The research team have expertise across public health (MOK, BN, TD, CM, LA, KM, AB), epidemiology (AB, LA), psychology (KM), health communication (MOK, BN, KM,and AB), overdiagnosis (MOK, BN, TD, LA, CM, KM, AB, RM) and journalism (AB and RM). The telephone interviews were conducted by four researchers (MOK, BN, TD, RM) between February and March 2020. Interviews lasted approximately 45 minutes, and were audio-recorded and transcribed verbatim. The interviewers took notes during the interviews to highlight key themes emerging from the interviews and direct further questioning (e.g. explore a point raised by the journalist). This information enabled the interviewer to summarise back to the journalist at the end of the interview and give them an opportunity to provide further information.

Data analysis

The interview data were analysed using Thematic Framework Analysis. Microsoft Excel was used to organise the data to capture the views expressed by the journalists. The first step was

familiarisation of the data, where one researcher (MOK) independently reviewed the transcripts and developed a list of emerging themes arising from the transcripts. Those themes along with the interview schedule (Supplementary file 1) formed the structure of the coding framework. An additional three researchers (BN, TD, and RM) then read a sub-set of transcripts and reviewed the coding framework and necessary changes or additions to the framework were discussed and made. Once the coding framework was finalised, one researcher (MOK) coded all of the interviews into the coding framework, and an additional researcher (BN) independently double-coded a random 20% of the interviews. Differences in the coding between the two researchers were discussed and resolved.

RESULTS

Journalist characteristics are shown in Table 1.

The results of the analysis of the interview data are organised around seven main themes: 1. Readers' interest in medical tests; 2. Ingredients of a 'good' news story; 3. Journalists' knowledge of potential harms of medical tests; 4. Factors influencing the framing of media coverage on tests; 5. Barriers to critical coverage of medical tests; 6. Enablers of critical coverage of medical tests; and 7. Interest in a training intervention. See Supplementary file 3 for extra journalist quotes relating to each theme.

Table 1. Journalist characteristics

Characteristics	**Number of journalists (n = 22)**
Type of journalist	
Health	14 (63.6%)
Science (including health)	6 (27.3%)
General	2 (9.1%)
Gender	
Male	4 (18.2%)
Female	18 (81.8%)
Years of experience	
<5	3 (13.6%)
5 – 10	9 (40.9%)
11 – 20	2 (9.1%)
21- 25	2 (9.1%)

>30	6 (27.3%)
Workplace setting	
National Broadcaster (ABC)	8 (36.4%)
Freelance	6 (27.3%)
Online and print newspaper (Sydney Morning Herald)	3 (13.6%)
Medical Republic	2 (9.1%)
Not-for-profit media outlet for stories written by academics (The Conversation)	2 (9.1%)
Online newspaper (New Daily)	1 (4.5%)
Peer-reviewed journal (Medical Journal of Australia)	1 (4.5%)
Level of health story reporting	
A lot	18 (81.8%)
Some	2 (9.1%)
Very little	1 (4.5%)
History of reporting on medical tests	
Yes	16 (72.7%)
No	4 (18.2%)
Unsure	2 (9.1%)
History of training in understanding medical evidence	
Yes	7 (31.8%)
No	15 (68.2%)
Approached to report on medical tests	
Yes	15 (68.2%)
No	7 (31.8%)

1. Readers' interest in medical tests

The vast majority of journalists felt that stories about medical tests are popular among readers, particularly where the test relates to a common or serious health condition, like cancer and inheritable conditions.

"the concept of being able to detect disease in someone who might be unknowingly walking around with a ticking time bomb in their chest or blood stream is really compelling" (J7, 6 years' experience)

The public's enthusiasm for technology to catch a health issue early was mentioned by some journalists.

2. Ingredients of a 'good' news story

Public health impact was deemed the most important ingredient for reporting on a test by most journalists. Impact was frequently explained in terms of positive changes in the management of a common condition.

"how big is this step forward or, you know, how soon will it be introduced to patients, or practically speaking what does it change for them … so I guess always having that patient lens in mind." (J22, 3 years' experience)

Peer-reviewed research as a prerequisite for reporting on a medical test was acknowledged by the vast majority of journalists. Very few elaborated on the importance of the quality of the research (e.g. the likelihood of bias). Many journalists said they seek independent comment on tests from trustworthy sources like a university, and some journalists said they would seek clarification on vested interests before reporting on a test.

3. Knowledge of potential harms of medical tests

The vast majority of journalists acknowledged the potential harms of medical tests, and mostly referred to the harms of screening for prostate and breast cancers, such as unnecessary testing, unnecessary treatments, and anxiety. All journalists except one were aware of the term overdiagnosis. A few had a deeper understanding.

"Like my understanding of that is that you often will have people diagnosed with something, and they know they've got it but it's not going to actually affect them. If they'd never had the test they would never have known and they'd have lived a happy healthy life." (J13, 6 years' experience)

Most journalists felt that knowledge of harms was low among the public and journalists in general due to frequent exposure to messaging about the benefits and importance of early testing. Several journalists felt that overdiagnosis was a difficult concept for readers to understand.

"*I think generally there appears to be an attitude, certainly in a country like Australia, that, public health screening is a very important public health measure. And that the more screening you do, the better. You know, I can't remember a campaign ever that was trying to get people to not go to the doctor (laughs)" (J6, 6 years' experience)*

Only a small number of journalists viewed it as important to get information on safety concerns or potential side effects of a test before writing a story.

4. Factors influencing the framing of media coverage

The power of the press release to influence coverage was acknowledged by most journalists. A small number of journalists suggested that a journalist's control over using the press release may be low depending on overall priorities for news content within the organisation.

"It's like here's the story, here's the new product, here's the patient, his life has been saved or changed or altered. You know, here's how many people it's going to be saved, here's our expert. You know, it's a real parcel" (J1, 20 years' experience)

Click bait (sensationalised titles designed to attract readers to click on stories) was mentioned by most journalists and was perceived to have downsides. However, a few journalists acknowledged that click bait can be driven by systemic issues which may be hard to modify. These include attempts to keep content interesting and obtain funding.

"if you can get a big headline out of it, if you can turn it into click bait, all the better. And I think that's the danger. I mean I saw something the other day about some cancer test that's going to be a breakthrough, and it was only just, you know, made it to rat trials." (J8, 32 years' experience)

Most journalists acknowledged the potential for commercial interests to influence the media coverage of tests. About half of the journalists commented on lack of training and experience, particularly among young generalist journalists, as a contributor to the framing of media coverage. A minority of journalists stated that many journalists are tempted to report very good or very bad news as it was felt that extremes in news coverage are more attractive to readers.

5. Barriers to critical coverage of medical tests

Lack of knowledge and experience of the medical evidence and harms was perceived to be the biggest barrier to improving coverage on medical tests by most journalists. Knowledge was generally in relation to reading research, and knowing the right questions to ask (e.g. about commercial interests). Some journalists said that lack of knowledge and experience was compounded by the reduction in the number of specific health journalists.

"When it comes to screening tests, I would say the knowledge around the potential pitfalls of screening or over screening is not well known or understood. I think that applies to the general population but I also think that probably applies to journalists as well." (J6, 6 years' experience)

Most journalists mentioned time pressure as a significant barrier to critical reporting and often stated they themselves were fortunate to have time available to research a story.

Several journalists stated that access to trustworthy experts for independent comment was a real problem for their reporting.

A small number of journalists said the complexity and uncertainty of overdiagnosis was difficult to communicate and may dissuade journalists from reporting.

"I tend to be a bit hesitant to report on the dangers of overtesting and overdiagnosing when the proponents of these tests have such powerful and personal stories to tell." (J7, 6 years' experience)

6. Enablers of critical coverage of medical tests

The provision of journalist training was viewed as important to improve the critical coverage of tests by most journalists. They felt training should mainly focus on learning how to critically appraise research and press releases, understand statistics, and know the questions to ask about a test.

"A basic understanding of what the different levels of evidence are, what kinds of studies there are and why some are better than others about making strong conclusions. I think some statistics would help, if only just the basics of you know, absolute versus relative, and P scores and stuff like that. I think

knowing, if we can train them about the downsides. They need to ask every single time, what are the downsides? And I don't think people do." (J8, 32 years' experience)

Some journalists felt it was important for institutions like universities or government agencies to improve the quality of communication of the evidence. Common suggestions were improving press release quality to include conflict of interests and funding, and avoiding overstatements of findings.

Most journalists felt that researchers and peak bodies need to better communicate the harms of testing to journalists. This includes initiating stories, providing information about harms, as well as listing harms on websites where readers could find out more.

7. Interest in a training intervention

All journalists expressed an interest in training. The journalists were quite evenly split in terms of preferences for face-to-face, online, or combined face-to-face and online training. All journalists highlighted the importance of keeping the training short in duration and most liked the idea of resources and ongoing support. Frequent suggestions were checklists, access to expertise for comment and fact-checking, and reminders.

"And then I also think that a resource that would be useful, something you can take away like an at a glance kind of 'don't forget these five things'. Something that's, they can then sort of stick on their desk…" (J13, 6 years' experience)

DISCUSSION

Summary of key findings

The findings from this interview study suggests that many journalists may be aware of the potential harms of medical tests such as overdiagnosis, but they commonly view information about harms as difficult to access and communicate. Knowledge of harms such as overdiagnosis, however, was perceived to be low among the public and journalists at large yet important and interesting. In particular, overdiagnosis was viewed as a counterintuitive concept for many, given prominent public health efforts to promote the benefits of early detection. The journalists identified a number of factors that influence coverage and present challenges to improving critical reporting on tests. Journalists were engaged by the idea of receiving training and support.

Comparison to existing literature

Our findings align with a number of other qualitative and survey studies of journalists that newsworthiness, time pressures, click bait and lack of medical knowledge are important factors in both influencing media coverage of health topics and attempts to change coverage.[34-37] Views on the power of the press release are supported by quantitative data showing that the quality of the press release is associated with the quality of the subsequent medical news reporting,[38 39] and that journalists frequently rely on press releases for story ideas.[40] The problems with press releases have been highlighted again during the COVID-19 pandemic through the media's reliance on potentially unreliable preprints, or preliminary or partial results promoted before peer review, to communicate treatment effectiveness.[22]

The prevalence of click bait in media coverage fits broadly with cross-sectional studies displaying the media's frequent use of emotive words like 'breakthrough', 'revolutionary' and 'unprecedented' to report new treatments.[41 42] In fact, one randomised trial found that use of words like 'breakthrough' and 'promising' in reference to medicines in media releases increases the public's belief in drug effectiveness compared to facts-only explanations.[43]

The observation that promotion and desire for early detection testing is widespread fits with the considerable literature displaying public, patient, and clinicians' beliefs in the benefits of testing.[22 23 44] Further, there is data showing that medical marketing of tests to persuade

individuals about the importance of early detection is escalating.[45] The journalists' need for access to better information and expertise aligns with previous qualitative work.[34 36]

Strengths and weaknesses of this study

To our knowledge, this is the first study to explore journalists' views of media reporting of medical tests and the problem of overdiagnosis. This study provides useful information about the barriers to critical reporting on tests, and enablers which could improve it. The findings will facilitate the development of strategies to better support journalists to report on the harms of tests, including overdiagnosis.

The study has some important limitations. A highly selective sample of journalists was included. Only Australia-based journalists were included. Although we approached journalists of various levels of experience and from different types of media outlets, the majority of the sample were experienced health journalists working for well-regarded media outlets. These journalists expressed awareness of overdiagnosis. This may be influenced by our recruitment strategies and journalists' willingness to participate in this specific research. The generalisability of the results may be limited for journalists in different countries with a different media landscape or less experienced reporters who do not specialise in health reporting.

Meaning of the study

The finding that journalists are very interested in receiving research training and support should be welcomed by researchers and organisations interested in improving the critical reporting of tests and knowledge of overdiagnosis. Journalists are well positioned to educate the public about medical tests[31 46] and media coverage of tests can influence healthcare utilisation.[30 32] The media have contributed to improvements in health-related knowledge and behaviours - for example in the areas of low back pain, smoking cessation, and vaccination.[47-49] Improving critical reporting on early detection could encourage more realistic expectations about the benefits of early detection and an awareness of potential harms such as overdiagnosis.[7] Future research should focus on developing training and resources for journalists and examine their impact on journalist knowledge and the quality of media coverage on tests.

Journalists face numerous challenges. First, the public has long received the message that early detection is a good thing. Second, the complexity of overdiagnosis and uncertainty in the evidence base may together make it difficult to communicate the nuances involved. Third, journalists must grab the readers' attention by providing interesting stories within tight deadlines. There are opportunities for academics and organisations to understand these working environments and be available to communicate stories in an engaging but accurate manner. Finally, interventions should not only target journalists, but also the wider levers (e.g. press releases) that all contribute to how information about medical tests is communicated.

CONCLUSION

This sample of Australian journalists seem aware of the potential harms of medical tests such as overdiagnosis, which are often left out of media coverage.[17] But, effectively communicating overdiagnosis is a challenge in light of entrenched beliefs about the benefits of testing and the culture of current journalism practices. Providing journalists with training and support in their efforts to communicate overdiagnosis could aid critical reporting of tests. This may contribute to addressing the wider problem of medical test overuse, which is a major threat to health system sustainability.

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Supplementary File 1 : Study Protocol

Background

Early detection of disease is gaining considerable attention worldwide.[1] Enthusiasm for early detection is displayed by the increasing interest in advances in diagnostic technology, screening programmes, innovations in biomarkers, and "P4 medicine" (predictive, preventive, personalised, and participatory).[1-3] In fact, testing in medicine is increasingly aimed at apparently healthy people to identify those at an increased risk of a disease or disorder.[4] This communicates one message: early detection is a good thing.[1]

However, there is mounting evidence that unnecessary and/or excessive testing can harm healthy people, and the quest for ever-earlier detection of disease can lead to overdiagnosis. Overdiagnosis happens when people are diagnosed in ways that do not benefit them or that can do more harm than good.[5,6] Although an exact definition of overdiagnosis remains the subject of debate, particularly in the context of non-cancer conditions, overdiagnosis can be considered to occur when persons are labelled with a technically correct diagnosis that does not improve health outcomes.[7,8] Overdiagnosis is a major global challenge to health system sustainability and human health and strategies to reduce overdiagnosis are urgently needed.[9]

Many possible drivers of overdiagnosis have been documented.[9] One major driver is the promotion (to clinicians and the public) of increasingly sensitive tests.[9] These can lead to detection of "abnormalities", which may be of uncertain clinical significance. Tests being increasingly promoted to the healthy include the Apple Watch for the early detection of atrial fibrillation, liquid biopsies and artificial intelligence for the early detection of cancer and Alzheimer's disease, and 3D mammography for the early detection of breast cancer.[4] Poor quality media reporting has been highlighted as a strong driver of this promotion.[9] Uncritical media coverage of the benefits and breakthrough of new tests, without consideration of their potential downsides or harms, potentially contributes to a more general lack of awareness about the potential harms of getting tested when healthy. In fact, research has shown that only a small proportion of people are knowledgeable about overdiagnosis.[10] Further, patients (and clinicians) overestimate the benefits of testing, while underestimating the harms.[11,12] Given the powerful role that media can play in influencing public health beliefs and behaviours, strategies to improve media reporting of medicine are needed.[9]

There are concerns that biased media reporting may be exacerbated by the increasingly changing media landscape, such as the rising influence of social media and the decline of the traditional consumption patterns of mainstream news media.[13] With the development of a more fragmented media context there is the increasing diminution of the role of specialist reporters with resulting loss of baseline technical knowledge, gatekeeping and thoughtful, investigative health journalism.[13] This presents a major challenge to the communication of complex concepts like overdiagnosis. Indeed, previous studies on the media have identified evidence of exaggeration,[14,15] inaccurate media coverage of published scientific papers,[16,17] overstating of

benefits of treatments, downplaying of harms[14,18] and failure to report important conflicts of interest of the experts cited in the story.[18]

Poor media coverage of medicine is not an insignificant issue; it can influence how the public perceives the risk of health services and how patients make treatment decisions.[4] For example, media coverage about the celebrity Kylie Minogue's self-referral mammogram bookings led to a 20-fold increase in media coverage about breast cancer and a 40% increase in mammogram bookings during the 2-week peak after the interview. Six weeks later media coverage was still up by 30%.[19]

While much research has examined how the media frames different health issues, very little research has examined the experiences of journalists and attempted to identify obstacles that hinder journalists from higher quality reporting, and elucidate possible strategies for addressing these. Further, no study has yet examined journalists knowledge and views about the increasing problem of overdiagnosis and what this may mean for media reporting of medicine. Also, many media outlets are inundated with sometimes conflicting health information from companies, researchers, institutions, the government and consumers and it would be interesting to explore how they deal with this deluge of information. Furthermore, there is little or no specialised training available for journalists who are expected to interpret often complicated statistics like relative and absolute risks. While there are guidelines available for journalists on how to responsibly report on health matters, journalists have received very little support in the implementation of these guidelines.

It is very important to examine the experiences and perceptions of journalists regarding medical reporting in a time of increasing recognition of the threats from overdiagnosis and too much medicine more generally. Identifying barriers and potential solutions to good medical reporting will help inform the development of an intervention to improve both journalists' confidence and capacity to report more responsibly on medical tests and/or treatments and the problem of overdiagnosis.

This project aims to explore journalists' views on media reporting of medicine (particularly medical tests), and barriers and solutions to improving media reporting in a time of overdiagnosis and too much medicine.

Methods and analysis

Ethical approval

We will seek ethical approval from the University of Sydney Human Research Ethics Committee.

Study design

We will conduct a qualitative study using semi-structured face-to face (or telephone as applicable) interviews. Individual interviews will be conducted to allow participants to speak in confidence about their views and experiences, and to ensure they are not influenced by other journalists with different levels of experience or that work in different settings/specialities. This study will be designed and reported according to the Consolidated Criteria for Reporting Qualitative Research (COREQ).

Participants

We will recruit 15-20 Australia-based journalists. We will purposively recruit journalists with different characteristics (e.g. type of media- TV, print, social media) and levels of experience (e.g. years active, speciality). Both specialist medical journalists and non-medical journalists will be included. Examples of potential media organisations include the Guardian, News Ltd, ABC, Nine-Fairfax, Nine-TV (or 7 TV), and The Conversation.

To be eligible, participants need be currently working as journalist in Australia, be able to communicate in English (both orally and over email), and be able to give informed consent. Ability to read and understand English are key inclusion criteria for the proposed study because the interview will be conducted in English. There will be no restriction on the age or gender of participants.

Recruitment

We will recruit potential participants through a number of different avenues, where needed. There is journalism expertise in the author team (Ray Moynihan) and personal contacts will play a role in the initial development of a list of potential participants to contact. From here we will use an active 'snowball' recruitment technique by asking participating journalists to suggest other eligible journalists they believe would be interested in being involved. We will then access their publicly available contact information to approach them about the study. If needed, the Australian Science Media Centre and Cochrane Australia will be asked to support recruitment working with their networks.

Data collection

Interviews will be conducted face-to-face at Sydney School of Public Health (The University of Sydney), or via Skype/Zoom/telephone if the participant prefers, by a researcher with experience in conducting qualitative interviews. An interview schedule will be developed and discussed among the team members. Interview questions will address the following topics: journalist background, journalist training, interest in reporting on health and medicine, positive and negative experiences of reporting on health and medicine, definition of scientific quality in reporting, views on the changing media landscape, knowledge of overdiagnosis and too

much medicine, barriers to quality reporting of medical tests, solutions for improving media reporting of medical tests, openness to a training intervention and views on the content of an intervention package.

Interviews will last ~60 minutes and will be audio-recorded and transcribed verbatim for analysis. The interviewer will also take notes during the interview to highlight key themes emerging from the interview and direct further questioning (e.g. explore a point raised by the participant). This information will also enable the interviewer to summarise back to the participant at the end of the interview and give them an opportunity to provide further information.

Data analysis

The interview data will be analysed using thematic framework analysis. Framework analysis is a well-accepted method for analysing qualitative data from interviews and is conducted in 5 stages. Stage 1 (familiarisation): the interview will be transcribed verbatim (from audio recordings) by the researcher who conducted the interview. Stage 2 (identifying a thematic framework): transcripts and interview notes will be analysed numerous times to identify codes that could be linked together by related concepts. A second researcher will double code half of the transcripts to check for reliability of the framework. Disagreements will be resolved through discussion. Concepts will then be grouped into broader themes and sub-themes. Stage 3, 4 & 5 (indexing, charting and mapping, interpretation): data will be summarised and charted using Microsoft Excel, and the mapping of themes and sub-themes will be iterative. This analysis will be conducted primarily by one researcher, with input from the research team in the development of the codes and themes.

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Supplementary File 2: Journalist Interview Schedule

Thank you very much for doing this interview. As mentioned in the information sheet I sent you, this interview is to better understand Australian journalists' views towards media reporting of new medical tests. This interview will take between 30 minutes and one hour.

As mentioned in the participant information sheet, this interview will be audio-recorded to make sure we have an accurate record of your responses, and your identity and everything you say will be kept strictly confidential.

Do you have any questions before we begin?
Okay, so I will start the audio-recording now.

Journalist experience

- Who/where are you currently working for and what is your current role?
- Have you worked elsewhere in the past?
  [If yes], could you tell us about your previous experience (e.g. where, main role, etc)
- How long have you been active as a journalist?
- General or specialist?
- Health only or not?
- [If general], could you give us a sense of how often you report on a health-related topic?

Promotion of new tests

Briefly define what we mean by medical tests before we begin questions.
There are different forms of medical tests, and we can put them into two broad categories; diagnostic tests and screening tests. Diagnostic tests are for people with symptoms to diagnose for a specific condition or disease. For example, something like a new heart scan to detect a heart attack, in people reporting symptoms that look like a heart attack.
But then there's also screening tests, which are for people without symptoms to try to detect disease before, it appears symptomatic. For example, the PSA test for healthy men to detect prostate cancer.

- In general, how interested are readers in stories about medical tests?
- Are you approached about studies on new tests?
- Have you even been asked to write a story to promote a new test?
  - Who by?

- What do you see as the key elements of stories on new tests?
- When you write a story about a new medical test – what evidence do you look for?
- What type of information or evidence do companies, health professionals or academics/researchers/scientists bring/may bring to you when they want to promote their new tests?
- What is essential for your story – in your view / experience?

Potential Causes of the promotion of new medical tests

- In your view, what are the **key factors** influencing how new medical tests are reported in the media? *Prompt examples if needed:* press release, lack of time, promote interest/entertainment (click bait)

- What are your views on large **corporate interests** in health and people with various commercial interests?
    - Do you think they can play a role in driving news coverage or influencing news stories? Please expand.

There is a body of literature showing that **press release** content often makes it into the media.

- What are your views on this?
    - Do you think this is a good thing or bad thing?
        - Why? Please expand.

- What are other factors that might directly influence the content of what makes it into the media?
    - How do these compare to something like a press release?

From my understanding, journalists can now easily track number of readers, shares, time spent reading an article. The term **click bait** seems to get mentioned in relation to getting more reads.

- What are your views on this ?
    - *Prompt:* Do you see this a being a positive or negative or both? Please expand.
- Do you feel like you under pressure to produce click bait stories?
    - *Prompt:* Why or why not?

Does this influence the way stories on new tests are written in your view and if yes, how?

Downsides of promotion of medical tests

- In your view, what are the potential downsides or negative effects of promoting new medical tests?
  Prompts if needed: e.g. people overestimating the benefits of new tests, not aware of potential downsides or harms of new tests, enthusiasm for tests before there is evidence to support their use.
  For example, we did a study examining how the global media reports on the benefits and harms of 5 new medical tests for people without symptoms. These were the Apple watch ECG, 3D mammography, and blood biomarker and AI tests for dementia and cancer. We found that less than 20% of the stories mentioned potential harms or downsides of these medical tests.

- There is some concern that uncritical reporting of new medical tests could promote **overdiagnosis and overtreatment**.

- Have you heard of overdiagnosis ?
  - If yes, could you tell me what you understand it to mean?

Prompt example – if needed

- Overdiagnosis happens when someone gets a diagnosis that ends up causing them more harm than good. For example, the apple watch now has an electrocardiogram to track heart rhythms in healthy people. It aims to detect a condition called atrial fibrillation. The difficulty is that healthy people can have seemingly irregular heart rhythms that may never go on to give them any trouble. However, a diagnosis of atrial fibrillation may lead to harms from over testing, anxiety due to have a heart condition, and bleeding from unnecessary blood thinning medicines.

  - Have you reported on it before? What was the context?

- What are your views on overdiagnosis?

- What are your views on how media coverage of new tests, or medicine generally, may help to contribute to overdiagnosis?

Potential Barriers to reporting accurately on new medical tests

- What do you think are/may be the key challenges or barriers for journalists in reporting accurately on new tests?
  Prompts – if needed:
  - Less journalists?
  - Less specialist reporters?
  - Time?

- How to make a story on a new test both accurate (including being critical) and interesting. Reporting on difficult topics may not get lots of readers. e.g. challenges of writing about overdiagnosis and getting interest.
- Researchers trusting journalists?

Training

- Have you received any training to help you better understand or access medical evidence in general?
  - If yes, what was the context?
    - Do you think it improved your reporting?
    - Would you recommend something similar to other journalists?
  - If no, would you be interested in that type of training? Why or why not?

Potential Solutions to improve reporting on medical tests

- Do you think anything can be done to help wind back some of the overly positive reporting about new tests and promote more critical reporting, particularly about the potential downsides or limitations of new tests, such as overdiagnosis?

  Prompts – if needed:
  - Institutional change?
  - Press release – greater transparency in conflicts of interest.
  - Researchers trusting journalists. How?
  - Supporting journalists?
  - Being available to journalists to read a call, interpret a paper, fact check a story/press release?
  - A checklist to guide reporting?

Openness to training

We are interested in developing some kind of training package for journalists to better support their reporting on new tests. How would you feel about this idea?

- What would you like to see included in this?
- Best format? (e.g. face to face, webinars, blended, etc)
- Length of training
- Top up training (e.g. shorter follow-up sessions after a more extensive training package)

We have some training ideas that I would like to run by you, so I am going to put them explicitly to you one by one.

- What do you think of an Australian Science Media Centre workshop on this issue? A short one- running between 60 and 90 minutes?
- What are relative merits of a workshop that comes to your workplace – like the Science Media Centre currently does – compared to a workshop held somewhere- that journalists from different media outlets could attend?
- What do you think of the idea of being offered access to a network of researchers working in this field? to read a paper, fact check a story for example.
- A checklist to guide reporting?

Closing

Now we're coming to the end of the interview, but before we wrap up do you have any questions or is there anything, we didn't discuss that you would like to add in relation to journalists reporting new medical tests or overdiagnosis generally?

Finally, before we finish, I am wondering do you know of any other journalist(s) who may be interested in taking part in this study? We are trying to recruit 10 more journalists. Any suggestions would be great.

Thank you very much for your time.

Supplementary File 3: Journalists quotations

Themes	Supporting quotes
1. Readers' interest in tests	*"Readers are really interested in it. It presents I guess hope and different scientific advances that might change outcomes are probably pretty appealing to a general audience." (J19, 7 years' experience)* *"I think they're very interested.'Cause I think health stories in general are quite popular.'Cause they affect everybody." (J20, 33 years' experience)*
2. Ingredients of a 'good' news story	
Newsworthiness	*"Well for starters it needs to, to be a useful test. Like there needs to be a need for it." (J7, 6 years' experience)* *"Is this delivering something that's going to be genuinely helpful to people." (J11, 4 years' experience)*
Research Evidence	*"Um… well it's rarely a randomised trial. The evidence is usually… um… pretty lousy. More often than not I won't do the story." (J9, 36 years' experience)* *"I mean reviews are the best but that's probably, they probably don't exist for newish testing. yeah, I mean I, I guess peer review research, published research" (J19, 7 years' experience)*
Obtain Independent Opinion	*"Oh, I'd probably be happy if I'd spoken to a radiologist or a radiation oncologist and a urologist, I suppose. It's a bit of a vexed area where like, you know, it's been under battle for quite a while. So I'd be careful about who I was speaking to I suppose." (J16, 9 years' experience)* *"We would go to get some independent comment from someone else not affiliated with the study" (J12, 30 years experience)*

Awareness of Vested interests	*"We want to know where any funding has come from." (J17, 12 years experience)* *"Who is promoting it? if there's invested interest, that's the main thing I can think of." (J21, 4 years' experience)*
Clarify Safety information	*"And then you would have a reasonable idea of what, of its efficacy and of course of its safety. And they're the, they're the two questions that you're kind of obliged to ask really, you know? Does it work? And to what extent does it work? And, is it safe?" (J11, 4 years' experience)*
3. Journalists' knowledge of potential harms of medical tests	
General knowledge of harms	*"It can lead to inappropriate, um, healthcare, inappropriate use of resources or just public resources generally. You know, it can lead to over-medicalisation for things." (J20, 33 years' experience)* *"All that's screening. And, um, there are harms as well as benefits. You know, not many harms, but… they've, they've not been well documented." (J9, 36 years' experience)*
Knowledge of overdiagnosis	*"Back pain's a great example of this, right? If the more people you test, the more abnormalities you will find but those abnormalities are actually perfectly natural and aren't linked to back pain. But once you start finding them then it gets into people's heads that, oh my God their spine's falling to bits and they should be treated and we should do something about it. And so you end up with over treatment as well." (J15, 5 years' experience)* *"My understanding is that it's basically, the idea that people are being told that they have illnesses or they're falling into the classification of having a disease or illness, which would otherwise not affect their quality of life. And then they may be offered or sold, treatments that aren't going to make a difference because the illness was never going to affect their quality of life in the first place. And then the negative obviously of that is that some of these invasive tests and treatments could actually damage*

	their quality of life" (J10, 4 years' experience)
Public and other journalists' knowledge of harms	*"The understanding within general society and within the media of overdiagnosis is, I would think, low to non-existent." (J15, 5 years' experience)* *"I think there definitely needs to be more awareness of the issues around over diagnosis in the broader media community, cause I don't think it's a very well known issue. And if people don't know about it they're not going to include it in their stories." (J2, 6 years' experience)*
4. Factors influencing the framing of media coverage	
Press releases	*"They can be good in terms of directing you or tipping you off about new research or a certain expert in the area. But I usually take the, whatever comes out of a PR agency with a grain of salt" (J10, 4 years' experience)* *"Press releases, even sort of the Universities (laughs) and researchers are still making, you know, these massive mistakes and over-blowing research." (J3, 9 years' experience)*
Click-bait	*"You know, 'breakthrough' and 'cure' and those kind of very emotive words… people might want to click on those." (J5, 22 years' experience)* *"It doesn't effect me at all. Because don't write for the outlets where that may, you know, my salary or my pay is conditional on clicks or click-throughs. But I think, yeah, click bait is a problem in all media, not just in health and medical." (J1, 20 years' experience)*
Commercial interests	*"Commercial partners that may be interested in getting the test out there, people who stand to benefit financially. So that's a pressure out there. There are also maybe patient groups. I don't know whether the patient groups share an agenda with people who are making a financial gain from the test or not?" (J4, 30 years' experience)*

	"I think if I was approached by a pharmaceutical company with a new test they've developed I'd be very hesitant to write a story about it." (J2, 6 years' experience)
Focus or good or bad news	*"Especially when it's diseases that are, you know, really intractable or that people are really afraid of. I think it's very easy to oversell things. It's all about having a good story." (J1, 20 years' experience)*
Lack of training and experience	*"generalists don't really have a background in health or science that are covering these things, not really getting to the bottom of where the money's coming from?" (J3, 9 years' experience)* *"I think especially beginner journalists or journalists who are just starting in the health round can approach topics uncritically" (J16, 9 years' experience)*
5. Barriers to critical coverage of medical tests	
Journalist knowledge and experience	*"I think first and foremost when it comes to screening tests, I would say the knowledge around the potential pitfalls of screening or over screening is not well know or understood. I think that applies to the general population but I also think that probably applies to journalists as well." (J6, 6 years' experience)* *"I feel the core challenge is lack of knowledge. Like.. you know, I think you could speak to lots of health and science and just general news journalists and they would just have no idea that that was even a problem.You know, so I, I… and I, I reckon that their idea of it would probably as a percentage, you know, be in line with the general publics…… percentage of people who understood that there's a problem. Like there just isn't the literacy about this topic in the community or in the media." (J15, 5 years' experience)*
Time pressures	*"I think a really key barrier for most journalists is time. You're often making decisions about coverage in that split second moment between like deleting or not deleting an email." (J13, 6 years' experience)*

	"The main thing is time. You can't overstate it. And, and, yeah, the pressures of deadlines are just… constant and sometimes, yeah, unmanageable." (J21, 4 years' experience)
Lack of access to experts	*"I didn't end up covering it. But it was, it was a major issue because I spent at least a day trying to find someone, like a whole day trying to find someone to, who had the time, and, and the expertise, and I just couldn't find them." (J17, 12 years' experience)* *"Just not perhaps having ready access to perhaps a group of reliable experts that can comment either on or off the record" (J18, 25 years' experience)*
Complexity of overdiagnosis	*"So in a lot of ways that's a message that's been drummed into people for the last 30 years. You know, go and get, get a pap smear, go and get a mammogram, you know, go and get a bowel cancer test, and it comes in the mail. So that message of you need to be screened, you need to be getting a regular test has been something that's been embedded in people's minds. So it's almost counterintuitive for them to think there's a test there, why wouldn't I have it?" (J12, 30 years' experience)* *"Overdiagnosis sounds like a contradiction… because everybody wants a diagnosis. So how could having a diagnosis possibly be bad? Um… but yeah, we're not very good at explaining it" (J8, 32 years' experience)*
6. Enablers of critical coverage of medical tests	
Journalist training	*"Teach us how to read medical research, you know, how to tell if a publication is good or not." (J2, 6 years' experience)* *"More journalism education in relation to evidence, types of evidence, statistics, all that kind of thing" (J4, 30 years' experience)*
Training for academics and peak bodies	*'There's work to do in educating some other sectors as well, like, you know, some of the, um… the medical colleges and the AMA and some of the other… medical and health groups that are called on to*

	comment on these stories" (J3, 9 years' experience) *"I think the onus is partly on… whoever is, um, providing recommendations around screening, whether that's research institutes or not-for-profits advocacies, the health, government departments and so on.. that, you know, it would be pretty unusually I think to go on a website where there's recommendations to screening that has a section about, um, when screening is not appropriate or, or the kind of pitfalls of over screening. I think that's probably something that's overlooked" (J6, 6 years' experience)*
Better attempts to communicate harms	*"It would be worth groups like the group at Bond University, perhaps if they know research is coming out, or if they seen research is coming out, being a little bit reactive and putting out a media release of their own… yeah, I think, I think that a louder voice in the over diagnosis area would be, be fantastic." (J2, 6 years' experience)* *"There are powerful stories to be told about… people… the harms that are done…... from over testing and over treatments, and putting those stories out there would be, yeah, finding the stories and putting them out there would be… a good way to help bring some of those story tropes to the fore to make them more accessible to journalists." (J4, 30 years' experience)*
7. Interest in a training intervention	*"Yeah, I, I think it's an excellent idea. And I think we should do it."* (J15, 5 years' experience) *"Yeah, look I think it would be great. Um, my favourite type of training personally is the ones where you do a lot of work shopping on stories." (J4, 30 years' experience)*

COREQ checklist

No. Item	Guide questions/description	Reported on Page #
Domain 1: Research team and reflexivity		
Personal Characteristics		
1. Inter viewer/facilitator	Which author/s conducted the inter view or focus group?	Page 6
2. Credentials	What were the researcher's credentials? E.g. PhD, MD	Page 1
3. Occupation	What was their occupation at the time of the study?	Page 6
4. Gender	Was the researcher male or female?	N/A
5. Experience and training	What experience or training did the researcher have?	Page 6
Relationship with participants		
6. Relationship established	Was a relationship established prior to study commencement?	N/A
7. Participant knowledge of the interviewer	What did the participants know about the researcher? e.g. personal goals, reasons for doing the research	N/A
8. Interviewer characteristics	What characteristics were reported about the inter viewer/facilitator? e.g. Bias, assumptions, reasons and interests in the research topic	Page 6 and 16
Domain 2: study design		
Theoretical framework		
9. Methodological orientation and Theory	What methodological orientation was stated to underpin the study? e.g. grounded theory, discourse analysis, ethnography, phenomenology, content analysis	Page 6
Participant selection		
10. Sampling	How were participants selected? e.g. purposive, convenience, consecutive, snowball	Page 6
11. Method of approach	How were participants approached? e.g. face-to-face, telephone, mail, email	Page 5
12. Sample size	How many participants were in the study?	Page 5
13. Non-participation	How many people refused to participate or dropped out? Reasons?	N/A
Setting		
14. Setting of data collection	Where was the data collected? e.g. home, clinic, workplace	Page 5
15. Presence of non-participants	Was anyone else present besides the participants and researchers?	N/A

16. Description of sample	What are the important characteristics of the sample? e.g. demographic data, date	Page 7 and 8
Data collection		
17. Interview guide	Were questions, prompts, guides provided by the authors? Was it pilot tested?	Supplementary file 2
18. Repeat interviews	Were repeat inter views carried out? If yes, how many?	N/A
19. Audio/visual recording	Did the research use audio or visual recording to collect the data?	Page 6
20. Field notes	Were field notes made during and/or after the inter view or focus group?	Page 6
21. Duration	What was the duration of the inter views or focus group?	Page 6
22. Data saturation	Was data saturation discussed?	N/A
23. Transcripts returned	Were transcripts returned to participants for comment and/or correction?	N/A
Domain 3: analysis and findings		
Data analysis		
24. Number of data coders	How many data coders coded the data?	Page 6
25. Description of the coding tree	Did authors provide a description of the coding tree?	N/A
26. Derivation of themes	Were themes identified in advance or derived from the data?	Page 6
27. Software	What software, if applicable, was used to manage the data?	N/A
28. Participant checking	Did participants provide feedback on the findings?	N/A
Reporting		
29. Quotations presented	Were participant quotations presented to illustrate the themes/findings? Was each quotation identified? e.g. participant number	Page 8 - 12
30. Data and findings consistent	Was there consistency between the data presented and the findings?	Page 13 - 14
31. Clarity of major themes	Were major themes clearly presented in the findings?	Page 8 - 12
32. Clarity of minor themes	Is there a description of diverse cases or discussion of minor themes?	Page 8 - 12

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Journalists' views on media coverage of medical tests and overdiagnosis: a qualitative study

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Journalists' views on media coverage of medical tests and overdiagnosis: a qualitative study

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ABSTRACT

Objective Promotional media coverage of early detection tests is an important driver of overdiagnosis. Following research evidence that global media coverage presents the benefits of testing healthy people far more frequently than harms, and gives little coverage to overdiagnosis, we sought to examine journalists' views of media reporting of tests, overdiagnosis, and strategies to improve critical reporting on tests.

Design Qualitative study using semi-structured telephone interviews. Interviews were conducted between February and March 2020 and were audio-recorded and transcribed verbatim. Framework thematic analysis was used to analyse the data.

Participants and setting Twenty-two journalists (mainly specialising in health reporting, average 14.5 years' experience) based in Australia.

Results This sample of journalists acknowledged the potential harms of medical tests but felt that knowledge of harms was low among journalists and the public at large. Most were aware of the term overdiagnosis, but commonly felt that it is challenging to both understand and communicate in light of strong beliefs in the benefits of early detection. Journalists felt that newsworthiness in the form of major public health impact was the key ingredient for stories about medical tests. The journalists acknowledged that factors, like the press release and 'click bait culture' in particular, can influence the framing of coverage about tests. Lack of knowledge and training, as well as time pressures, were perceived to be the main barriers to critical reporting on tests. Journalists felt that training and better access to information about potential harms would enable more critical reporting.

Conclusions Effectively communicating overdiagnosis is a challenge in light of common beliefs about the benefits of testing and the culture of current journalism practices. Providing journalists with training, support, and better access to information about potential harms of tests could aid critical reporting of tests.

Strengths and limitations of this study

- This is the first study to explore Australian journalists' views of the reporting of medical tests and overdiagnosis.
- The findings will help inform strategies to improve critical reporting on medical tests and communicate better about overdiagnosis.
- Our sample comprised mainly health-specific journalists with an interest in taking part in the study and may not be representative of all journalists.
- It remains unclear if the journalists' knowledge of how to critically report on tests translates into critical reporting in practice.

BACKGROUND

Advances in early detection testing through diagnostic technology, screening programmes, biomarkers, artificial intelligence and self-tracking technologies such as the Apple Watch are increasingly aimed at healthy people to detect a potential disease prior to the onset of symptoms. [1-5] While early detection tests may have benefits for those with a potentially serious disease, there is considerable evidence that unnecessary testing can harm healthy people through overdiagnosis.[6-8] Overdiagnosis occurs when individuals are labelled with a technically correct diagnosis that does not improve health outcomes.[9 10] It is now widely recognised as a threat to human health and health system sustainability.[9 11-16]

Many possible drivers of overdiagnosis have been documented. The media, through promoting early detection tests to healthy individuals, is considered an important driver.[15] A recent cross-sectional study[17] of global media coverage – including over a thousand media stories about five early detection tests (3D mammography, liquid biopsy, Apple Watch, blood biomarker tests and artificial intelligence technology for dementia) – found that the potential benefits of testing were presented far more frequently than potential harms. The risk of overdiagnosis was mentioned in very few stories. These findings align with published studies of media coverage of health and medicine, which have found that the media emphasise potential benefits more than harms.[18-21] The COVID-19 pandemic – in particular – has brought this problem into sharp focus. Many media outlets have hyped the effect of anti-viral drugs on the basis of small, industry-funded, uncontrolled studies – potentially hampering treatment evaluation efforts and responses to the pandemic.[22]

The media's often unrealistic and over-optimistic expectations about the value of early detection tests is a cause for concern for four main reasons. First, the general public, and patients, already tend to overestimate the benefits of early detection[23-25] and uncritical media coverage can reinforce these perceptions. Second, few individuals seem to be aware of the potential harms of early detection and overdiagnosis.[26 27] Third, there is evidence that tests are already widely overused.[28 29] And fourth, media coverage can influence patterns of healthcare utilisation – with positive coverage of a test or treatment associated with increases in utilisation.[30-32] (See Box 1 for example)

Box 1. The power of the media

Media coverage of Kylie Minogue's breast cancer diagnosis in Australia in May 2005 led to a 20-fold increase in media coverage about breast cancer, with a particular emphasis on how young women can get breast cancer and the importance of early detection.[32]

Bookings for mammograms as part of government-sponsored BreastScreen programmes across Australia rose 40% during the 2 weeks of the coverage, and there was a 101% increase in non-screened women in the eligible age group (40-69 years). Six weeks after the coverage, bookings stayed more than a third higher in non-screened women.[32]

Given the powerful role that media can play in perpetuating the present lack of awareness of the downsides of testing, including overdiagnosis, and in shifting public health behaviours, strategies to improve media reporting of tests and overdiagnosis are needed. While there is a considerable scientific literature on how the media frames different health issues, less attention has been given to hearing journalists' perspectives on media coverage of medical tests and overdiagnosis. To our knowledge, one qualitative study[33] has previously examined US journalists views of media coverage of overtreatment. The sample of journalists in this study nominated overtesting (e.g. cancer screening) as an important driver of overtreatment. However, no study has examined journalists' specific perspectives of new tests, and their benefits and risks. This study sought to redress this knowledge gap.

METHODS AND ANALYSIS

Study design

This qualitative study used semi-structured telephone interviews to explore journalists experience of, and attitudes to, reporting on medical testing, overdiagnosis, and strategies to improve media coverage of both tests and overdiagnosis. It was designed and reported according to the Consolidated Criteria for Reporting Qualitative Research (COREQ).[34] The study was approved by The University of Sydney Human Research Ethics Committee (2019/964). See Supplementary File 1 for the study protocol.

Participants and recruitment

Participants were 22 Australia-based journalists. Both health journalists and generalist journalists across any type of media were included. To be eligible, participants needed to be currently working as a journalist in Australia, be able to communicate in English (both orally and in written form) and be able to give informed consent. Ability to read and understand English were key inclusion criteria for the proposed study because the interview was conducted in English. There were no restrictions on the age or gender of participants.

Journalists were purposively recruited through three different avenues: 1). There was journalism expertise in the author team (RM) and personal contacts played a role in the initial development of a list of potential participants to contact. 2). One author (MOK) performed Google and Twitter searches to locate potentially eligible journalists. If a journalist had publicly available contact information, they were emailed about the study. 3). An active 'snowball' recruitment technique was used by asking participating journalists to suggest other eligible journalists they believed would be interested in being involved.

All potential participants were emailed a Participant Information Sheet outlining aims and important information about the study. Those interested in taking part returned a consent form to researchers through email and were contacted to arrange an interview.

Data collection

An interview schedule (Supplementary file 2) was developed, discussed and piloted by the research team. The research team have expertise across public health (MOK, BN, TD, CM, LA, KM, AB), epidemiology (AB, LA), psychology (KM), health communication (MOK, BN, KM,and AB), overdiagnosis (MOK, BN, TD, LA, CM, KM, AB, RM) and journalism (AB and RM). The telephone interviews were conducted by four researchers (MOK, BN, TD, RM) between February and March 2020. Interviews lasted approximately 45 minutes, and were audio-recorded and transcribed verbatim. The interviewers took notes during the interviews to highlight key themes emerging from the interviews and direct further questioning (e.g. explore a point raised by the journalist). This information enabled the interviewer to summarise back to the journalist at the end of the interview and give them an opportunity to provide further information.

Data analysis

The interview data were analysed using Thematic Framework Analysis. Microsoft Excel was used to organise the data to capture the views expressed by the journalists. The first step was familiarisation of the data, where one researcher (MOK) independently reviewed the transcripts and developed a list of emerging themes arising from the transcripts. Those themes along with the interview schedule (Supplementary file **2**) formed the structure of the coding framework. An additional three researchers (BN, TD, and RM) then read a sub-set of transcripts and reviewed the coding framework and necessary changes or additions to the framework were discussed and made. Once the coding framework was finalised, one researcher (MOK) coded all of the interviews into the coding framework, and an additional researcher (BN) independently double-coded a random 20% of the interviews. Differences in the coding between the two researchers were discussed and resolved.

Patient or public involvement

Patients or the public were not involved in the design, or conduct, or reporting, or dissemination plans of our research.

RESULTS

Journalist characteristics are shown in Table 1.

The results of the analysis of the interview data are organised around seven main themes: 1. Readers' interest in medical tests; 2. Ingredients of a 'good' news story; 3. Journalists' knowledge of potential harms of medical tests; 4. Factors influencing the framing of media coverage on tests; 5. Barriers to critical coverage of medical tests; 6. Enablers of critical coverage of medical tests; and 7. Interest in a training intervention. See Supplementary file 3 for extra journalist quotes relating to each theme.

Table 1. Journalist characteristics

Characteristics	**Number of journalists (n = 22)**
Type of journalist	

Health	14 (63.6%)
Science (including health)	6 (27.3%)
General	2 (9.1%)
Gender	
Male	4 (18.2%)
Female	18 (81.8%)
Years of experience	
<5	3 (13.6%)
5 – 10	9 (40.9%)
11 – 20	2 (9.1%)
21- 25	2 (9.1%)
>30	6 (27.3%)
Workplace setting	
National Broadcaster (ABC)	8 (36.4%)
Freelance	6 (27.3%)
Online and print newspaper (Sydney Morning Herald)	3 (13.6%)
Health website (Medical Republic)	2 (9.1%)
Not-for-profit media outlet accepting stories from academics (The Conversation)	2 (9.1%)
Online newspaper (New Daily)	1 (4.5%)
Peer-reviewed journal (Medical Journal of Australia)	1 (4.5%)
Level of health story reporting	
A lot (writes health articles on most days)	18 (81.8%)
Some (every second week)	2 (9.1%)
Very little (less than once a month)	1 (4.5%)
History of reporting on medical tests	
Yes	16 (72.7%)
No	4 (18.2%)
Unsure	2 (9.1%)
History of training in understanding medical evidence	
Yes	7 (31.8%)
No	15 (68.2%)
Approached to report on medical tests	
Yes	15 (68.2%)
No	7 (31.8%)

Note: The ABC provides radio, television, and online services. The majority of ABC employed journalists in this study perform online and radio roles.
The participants from The Conversation and The Medical Journal of Australia are journalists/editors who select, steer and edit news stories and submitted articles. They have former roles in mainstream media.

1. Readers' interest in medical tests

The vast majority of journalists felt that stories about medical tests are popular among readers, particularly where the test relates to a common or serious health condition, like cancer and inheritable conditions.

"the concept of being able to detect disease in someone who might be unknowingly walking around with a ticking time bomb in their chest or blood stream is really compelling" (J7, 6 years' experience)

The public's enthusiasm for technology to catch a health issue early was mentioned by some journalists.

2. Ingredients of a 'good' news story

Public health impact was deemed the most important ingredient for reporting on a test by most journalists. Impact was frequently explained in terms of positive changes in the management of a common condition.

"how big is this step forward or, you know, how soon will it be introduced to patients, or practically speaking what does it change for them … so I guess always having that patient lens in mind." (J22, 3 years' experience)

Peer-reviewed research as a prerequisite for reporting on a medical test was acknowledged by the vast majority of journalists. Very few elaborated on the importance of the quality of the research (e.g. the likelihood of bias). Many journalists said they seek independent comment on tests from trustworthy sources like a university, and some journalists said they would seek clarification on vested interests before reporting on a test. Four journalists explicitly said they would ask about vested interests, including financial gain from promoting and/or selling the test.

3. Knowledge of potential harms of medical tests

The vast majority of journalists acknowledged the potential harms of medical tests, and mostly referred to the harms of screening for prostate and breast cancers, such as unnecessary testing, unnecessary treatments, and anxiety. All journalists except one were aware of the term overdiagnosis. A few had a deeper understanding.

"Like my understanding of that is that you often will have people diagnosed with something, and they know they've got it but it's not going to actually affect them. If they'd never had the test they would never have known and they'd have lived a happy healthy life." (J13, 6 years' experience)

Most journalists felt that knowledge of harms was low among the public and journalists in general due to frequent exposure to messaging about the benefits and importance of early testing. Several journalists felt that overdiagnosis was a difficult concept for readers to understand.

"*I think generally there appears to be an attitude, certainly in a country like Australia, that, public health screening is a very important public health measure. And that the more screening you do, the better. You know, I can't remember a campaign ever that was trying to get people to not go to the doctor (laughs) " (J6, 6 years' experience)*

Only a small number of journalists viewed it as important to get information on safety concerns or potential side effects of a test before writing a story.

4. Factors influencing the framing of media coverage

The power of the press release to influence coverage was acknowledged by most journalists. A small number of journalists suggested that a journalist's control over using the press release may be low depending on overall priorities for news content within the organisation.

"It's like here's the story, here's the new product, here's the patient, his life has been saved or changed or altered. You know, here's how many people it's going to be saved, here's our expert. You know, it's a real parcel" (J1, 20 years' experience)

Click bait (sensationalised titles designed to attract readers to click on stories) was mentioned by most journalists and was perceived to have downsides. However, a few journalists

acknowledged that click bait can be driven by systemic issues which may be hard to modify. These include attempts to keep content interesting and obtain funding.

"if you can get a big headline out of it, if you can turn it into click bait, all the better. And I think that's the danger. I mean I saw something the other day about some cancer test that's going to be a breakthrough, and it was only just, you know, made it to rat trials." (J8, 32 years' experience)

Most journalists acknowledged the potential for commercial interests to influence the media coverage of tests. About half of the journalists commented on lack of training and experience, particularly among young generalist journalists, as a contributor to the framing of media coverage. A minority of journalists stated that many journalists are tempted to report very good or very bad news as it was felt that extremes in news coverage are more attractive to readers.

5. Barriers to critical coverage of medical tests

Lack of knowledge and experience of the medical evidence and harms was perceived to be the biggest barrier to improving coverage on medical tests by most journalists. Knowledge was generally in relation to reading research, and knowing the right questions to ask (e.g. about commercial interests). Some journalists said that lack of knowledge and experience was compounded by the reduction in the number of specific health journalists.

"When it comes to screening tests, I would say the knowledge around the potential pitfalls of screening or over screening is not well known or understood. I think that applies to the general population but I also think that probably applies to journalists as well." (J6, 6 years' experience)

Most journalists mentioned time pressure as a significant barrier to critical reporting and often stated they themselves were fortunate to have time available to research a story.

Several journalists stated that access to trustworthy experts for independent comment was a real problem for their reporting. If a press release did not come with an independent comment, journalists often lacked the time to find one. Some felt it was difficult to access experts on certain health topics. Researcher availability was also mentioned as an issue. Specifically, it was difficult to speak with certain researchers as they may not answer calls/emails.

A small number of journalists said they tended to feel uncomfortable talking about harms including overdiagnosis as they can be difficult to communicate, and have potential to provoke unpleasant emotions in people who may be affected by a health condition (e.g. cancer).

"I tend to be a bit hesitant to report on the dangers of overtesting and overdiagnosing when the proponents of these tests have such powerful and personal stories to tell." (J7, 6 years' experience)

6. Enablers of critical coverage of medical tests

The provision of journalist training was viewed as important to improve the critical coverage of tests by most journalists. They felt training should mainly focus on learning how to critically appraise research and press releases, understand statistics, and know the questions to ask about a test.

"A basic understanding of what the different levels of evidence are, what kinds of studies there are and why some are better than others about making strong conclusions. I think some statistics would help, if only just the basics of you know, absolute versus relative, and P scores and stuff like that. I think knowing, if we can train them about the downsides. They need to ask every single time, what are the downsides? And I don't think people do." (J8, 32 years' experience)

Some journalists felt it was important for institutions like universities or government agencies to improve the quality of communication of the evidence. Common suggestions were improving press release quality to include conflict of interests and funding, and avoiding overstatements of findings.

Most journalists felt that researchers and national bodies (e.g. Cancer Council) need to better communicate the harms of testing to journalists. This includes initiating stories, providing information about harms, as well as listing harms on websites where readers could find out more.

7. Interest in a training intervention

All journalists expressed an interest in training. The journalists were quite evenly split in terms of preferences for face-to-face, online, or combined face-to-face and online training. All journalists highlighted the importance of keeping the training short in duration and most liked the idea of resources and ongoing support. Frequent suggestions were checklists, access to expertise for comment and fact-checking, and reminders.

"And then I also think that a resource that would be useful, something you can take away like an at a glance kind of 'don't forget these five things'. Something that's, they can then sort of stick on their desk…" (J13, 6 years' experience)

DISCUSSION

Summary of key findings

The findings from this interview study suggests that many journalists may be aware of the potential harms of medical tests such as overdiagnosis, but they commonly view information about harms as difficult to access and communicate. Knowledge of harms such as overdiagnosis, however, was perceived to be low among the public and journalists at large yet important and interesting. In particular, overdiagnosis was viewed as a counterintuitive concept for many, given prominent public health efforts to promote the benefits of early detection. The journalists identified a number of factors that influence coverage and present challenges to improving critical reporting on tests. Journalists were engaged by the idea of receiving training and support.

Comparison to existing literature

Our findings align with a number of other qualitative and survey studies of journalists that newsworthiness, time pressures, click bait and lack of medical knowledge are important factors in both influencing media coverage of health topics and attempts to change coverage.[35-38] Views on the power of the press release are supported by quantitative data showing that the quality of the press release is associated with the quality of the subsequent medical news reporting,[39 40] and that journalists frequently rely on press releases for story ideas.[41] The problems with press releases have been highlighted again during the COVID-19 pandemic through the media's reliance on potentially unreliable preprints, or preliminary or partial results promoted before peer review, to communicate treatment effectiveness.[22]

The prevalence of click bait in media coverage fits broadly with cross-sectional studies displaying the media's frequent use of emotive words like 'breakthrough', 'revolutionary' and 'unprecedented' to report new treatments.[42 43] In fact, one randomised trial found that use of words like 'breakthrough' and 'promising' in reference to medicines in media releases increases the public's belief in drug effectiveness compared to facts-only explanations.[44]

The observation that promotion and desire for early detection testing is widespread fits with the considerable literature displaying public, patient, and clinicians' beliefs in the benefits of testing.[22 23 45] In a qualitative study[33] examining US journalists views of media coverage of overtreatment, the sample of journalists viewed the issue of overtreatment – together with overtesting – as a complex matter driven by strong public faith in healthcare and societal norms that make medical uncertainty difficult to accept. Further, there is data showing that medical marketing of tests to persuade individuals about the importance of early detection is escalating.[46] The journalists' need for access to better information and expertise aligns with previous qualitative work.[35 37]

Strengths and weaknesses of this study

To our knowledge, this is the first study to explore journalists' views of media reporting of medical tests and the problem of overdiagnosis. This study provides useful information about the barriers to critical reporting on tests, and enablers which could improve it. The findings will facilitate the development of strategies to better support journalists to report on the harms of tests, including overdiagnosis.

The study has some important limitations. A highly selective sample of journalists was included. Only Australia-based journalists were included. Although we approached journalists of various levels of experience and from different types of media outlets, the majority of the sample were experienced health journalists working for well-regarded media outlets. These journalists expressed awareness of overdiagnosis. This may be influenced by our recruitment strategies and journalists' willingness to participate in this specific research. The generalisability of the results may be limited for journalists in different countries with a different media landscape or less experienced reporters who do not specialise in health reporting.

Meaning of the study

The finding that journalists are very interested in receiving research training and support should be welcomed by researchers and organisations interested in improving the critical reporting of tests and knowledge of overdiagnosis. Journalists are well positioned to educate the public about medical tests[31 47] and media coverage of tests can influence healthcare utilisation.[30 32] The media have contributed to improvements in health-related knowledge and behaviours - for example in the areas of low back pain, smoking cessation, and vaccination.[48-50] Improving critical reporting on early detection could encourage more realistic expectations about the benefits of early detection and an awareness of potential harms such as overdiagnosis.[7] Future research should focus on developing training and resources for journalists and examine their impact on journalist knowledge and the quality of media coverage on tests.

Journalists face numerous challenges. First, the public has long received the message that early detection is a good thing. Second, the complexity of overdiagnosis and uncertainty in the evidence base may together make it difficult to communicate the nuances involved. Third, journalists must grab the readers' attention by providing interesting stories within tight deadlines. There are opportunities for academics and organisations to understand these working environments and be available to communicate stories in an engaging but accurate manner. Finally, interventions should not only target journalists, but also the wider levers (e.g. press releases) that all contribute to how information about medical tests is communicated.

CONCLUSION

This sample of Australian journalists seem aware of the potential harms of medical tests such as overdiagnosis, which are often left out of media coverage.[17] But, effectively communicating overdiagnosis is a challenge in light of entrenched beliefs about the benefits of testing and the culture of current journalism practices. Providing journalists with training and support in their efforts to communicate overdiagnosis could aid critical reporting of tests. This may contribute to addressing the wider problem of medical test overuse, which is a major threat to health system sustainability.

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Supplementary File 1 : Study Protocol

Background

Early detection of disease is gaining considerable attention worldwide.[1] Enthusiasm for early detection is displayed by the increasing interest in advances in diagnostic technology, screening programmes, innovations in biomarkers, and "P4 medicine" (predictive, preventive, personalised, and participatory).[1-3] In fact, testing in medicine is increasingly aimed at apparently healthy people to identify those at an increased risk of a disease or disorder.[4] This communicates one message: early detection is a good thing.[1]

However, there is mounting evidence that unnecessary and/or excessive testing can harm healthy people, and the quest for ever-earlier detection of disease can lead to overdiagnosis. Overdiagnosis happens when people are diagnosed in ways that do not benefit them or that can do more harm than good.[5,6] Although an exact definition of overdiagnosis remains the subject of debate, particularly in the context of non-cancer conditions, overdiagnosis can be considered to occur when persons are labelled with a technically correct diagnosis that does not improve health outcomes.[7,8] Overdiagnosis is a major global challenge to health system sustainability and human health and strategies to reduce overdiagnosis are urgently needed.[9]

Many possible drivers of overdiagnosis have been documented.[9] One major driver is the promotion (to clinicians and the public) of increasingly sensitive tests.[9] These can lead to detection of "abnormalities", which may be of uncertain clinical significance. Tests being increasingly promoted to the healthy include the Apple Watch for the early detection of atrial fibrillation, liquid biopsies and artificial intelligence for the early detection of cancer and Alzheimer's disease, and 3D mammography for the early detection of breast cancer.[4] Poor quality media reporting has been highlighted as a strong driver of this promotion.[9] Uncritical media coverage of the benefits and breakthrough of new tests, without consideration of their potential downsides or harms, potentially contributes to a more general lack of awareness about the potential harms of getting tested when healthy. In fact, research has shown that only a small proportion of people are knowledgeable about overdiagnosis.[10] Further, patients (and clinicians) overestimate the benefits of testing, while underestimating the harms.[11,12] Given the powerful role that media can play in influencing public health beliefs and behaviours, strategies to improve media reporting of medicine are needed.[9]

There are concerns that biased media reporting may be exacerbated by the increasingly changing media landscape, such as the rising influence of social media and the decline of the traditional consumption patterns of mainstream news media.[13] With the development of a more fragmented media context there is the increasing diminution of the role of specialist reporters with resulting loss of baseline technical knowledge, gatekeeping and thoughtful, investigative health journalism.[13] This presents a major challenge to the communication of complex concepts like overdiagnosis. Indeed, previous studies on the media have identified evidence of exaggeration,[14,15] inaccurate media coverage of published scientific papers,[16,17] overstating of

benefits of treatments, downplaying of harms[14,18] and failure to report important conflicts of interest of the experts cited in the story.[18]

Poor media coverage of medicine is not an insignificant issue; it can influence how the public perceives the risk of health services and how patients make treatment decisions.[4] For example, media coverage about the celebrity Kylie Minogue's self-referral mammogram bookings led to a 20-fold increase in media coverage about breast cancer and a 40% increase in mammogram bookings during the 2-week peak after the interview. Six weeks later media coverage was still up by 30%.[19]

While much research has examined how the media frames different health issues, very little research has examined the experiences of journalists and attempted to identify obstacles that hinder journalists from higher quality reporting, and elucidate possible strategies for addressing these. Further, no study has yet examined journalists knowledge and views about the increasing problem of overdiagnosis and what this may mean for media reporting of medicine. Also, many media outlets are inundated with sometimes conflicting health information from companies, researchers, institutions, the government and consumers and it would be interesting to explore how they deal with this deluge of information. Furthermore, there is little or no specialised training available for journalists who are expected to interpret often complicated statistics like relative and absolute risks. While there are guidelines available for journalists on how to responsibly report on health matters, journalists have received very little support in the implementation of these guidelines.

It is very important to examine the experiences and perceptions of journalists regarding medical reporting in a time of increasing recognition of the threats from overdiagnosis and too much medicine more generally. Identifying barriers and potential solutions to good medical reporting will help inform the development of an intervention to improve both journalists' confidence and capacity to report more responsibly on medical tests and/or treatments and the problem of overdiagnosis.

This project aims to explore journalists' views on media reporting of medicine (particularly medical tests), and barriers and solutions to improving media reporting in a time of overdiagnosis and too much medicine.

Methods and analysis

Ethical approval

We will seek ethical approval from the University of Sydney Human Research Ethics Committee.

Study design

We will conduct a qualitative study using semi-structured face-to face (or telephone as applicable) interviews. Individual interviews will be conducted to allow participants to speak in confidence about their views and experiences, and to ensure they are not influenced by other journalists with different levels of experience or that work in different settings/specialities. This study will be designed and reported according to the Consolidated Criteria for Reporting Qualitative Research (COREQ).

Participants

We will recruit 15-20 Australia-based journalists. We will purposively recruit journalists with different characteristics (e.g. type of media- TV, print, social media) and levels of experience (e.g. years active, speciality). Both specialist medical journalists and non-medical journalists will be included. Examples of potential media organisations include the Guardian, News Ltd, ABC, Nine-Fairfax, Nine-TV (or 7 TV), and The Conversation.

To be eligible, participants need be currently working as journalist in Australia, be able to communicate in English (both orally and over email), and be able to give informed consent. Ability to read and understand English are key inclusion criteria for the proposed study because the interview will be conducted in English. There will be no restriction on the age or gender of participants.

Recruitment

We will recruit potential participants through a number of different avenues, where needed. There is journalism expertise in the author team (Ray Moynihan) and personal contacts will play a role in the initial development of a list of potential participants to contact. From here we will use an active 'snowball' recruitment technique by asking participating journalists to suggest other eligible journalists they believe would be interested in being involved. We will then access their publicly available contact information to approach them about the study. If needed, the Australian Science Media Centre and Cochrane Australia will be asked to support recruitment working with their networks.

Data collection

Interviews will be conducted face-to-face at Sydney School of Public Health (The University of Sydney), or via Skype/Zoom/telephone if the participant prefers, by a researcher with experience in conducting qualitative interviews. An interview schedule will be developed and discussed among the team members. Interview questions will address the following topics: journalist background, journalist training, interest in reporting on health and medicine, positive and negative experiences of reporting on health and medicine, definition of scientific quality in reporting, views on the changing media landscape, knowledge of overdiagnosis and too

much medicine, barriers to quality reporting of medical tests, solutions for improving media reporting of medical tests, openness to a training intervention and views on the content of an intervention package.

Interviews will last ~60 minutes and will be audio-recorded and transcribed verbatim for analysis. The interviewer will also take notes during the interview to highlight key themes emerging from the interview and direct further questioning (e.g. explore a point raised by the participant). This information will also enable the interviewer to summarise back to the participant at the end of the interview and give them an opportunity to provide further information.

Data analysis

The interview data will be analysed using thematic framework analysis. Framework analysis is a well-accepted method for analysing qualitative data from interviews and is conducted in 5 stages. Stage 1 (familiarisation): the interview will be transcribed verbatim (from audio recordings) by the researcher who conducted the interview. Stage 2 (identifying a thematic framework): transcripts and interview notes will be analysed numerous times to identify codes that could be linked together by related concepts. A second researcher will double code half of the transcripts to check for reliability of the framework. Disagreements will be resolved through discussion. Concepts will then be grouped into broader themes and sub-themes. Stage 3, 4 & 5 (indexing, charting and mapping, interpretation): data will be summarised and charted using Microsoft Excel, and the mapping of themes and sub-themes will be iterative. This analysis will be conducted primarily by one researcher, with input from the research team in the development of the codes and themes.

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Supplementary File 2: Journalist Interview Schedule

Thank you very much for doing this interview. As mentioned in the information sheet I sent you, this interview is to better understand Australian journalists' views towards media reporting of new medical tests. This interview will take between 30 minutes and one hour.

As mentioned in the participant information sheet, this interview will be audio-recorded to make sure we have an accurate record of your responses, and your identity and everything you say will be kept strictly confidential.

Do you have any questions before we begin?
Okay, so I will start the audio-recording now.

Journalist experience

- Who/where are you currently working for and what is your current role?
- Have you worked elsewhere in the past?
  [If yes], could you tell us about your previous experience (e.g. where, main role, etc)
- How long have you been active as a journalist?
- General or specialist?
- Health only or not?
- [If general], could you give us a sense of how often you report on a health-related topic?

Promotion of new tests

Briefly define what we mean by medical tests before we begin questions.
There are different forms of medical tests, and we can put them into two broad categories; diagnostic tests and screening tests. Diagnostic tests are for people with symptoms to diagnose for a specific condition or disease. For example, something like a new heart scan to detect a heart attack, in people reporting symptoms that look like a heart attack.
But then there's also screening tests, which are for people without symptoms to try to detect disease before, it appears symptomatic. For example, the PSA test for healthy men to detect prostate cancer.

- In general, how interested are readers in stories about medical tests?
- Are you approached about studies on new tests?
- Have you even been asked to write a story to promote a new test?
  - Who by?

- What do you see as the key elements of stories on new tests?
- When you write a story about a new medical test – what evidence do you look for?
- What type of information or evidence do companies, health professionals or academics/researchers/scientists bring/may bring to you when they want to promote their new tests?
- What is essential for your story – in your view / experience?

Potential Causes of the promotion of new medical tests

- In your view, what are the **key factors** influencing how new medical tests are reported in the media? *Prompt examples if needed:* press release, lack of time, promote interest/entertainment (click bait)

- What are your views on large **corporate interests** in health and people with various commercial interests?
    - Do you think they can play a role in driving news coverage or influencing news stories? Please expand.

There is a body of literature showing that **press release** content often makes it into the media.

- What are your views on this?
    - Do you think this is a good thing or bad thing?
        - Why? Please expand.

- What are other factors that might directly influence the content of what makes it into the media?
    - How do these compare to something like a press release?

From my understanding, journalists can now easily track number of readers, shares, time spent reading an article. The term **click bait** seems to get mentioned in relation to getting more reads.

- What are your views on this ?
    - *Prompt:* Do you see this a being a positive or negative or both? Please expand.
- Do you feel like you under pressure to produce click bait stories?
    - *Prompt:* Why or why not?

Does this influence the way stories on new tests are written in your view and if yes, how?

Downsides of promotion of medical tests

- In your view, what are the potential downsides or negative effects of promoting new medical tests?
  Prompts if needed: e.g. people overestimating the benefits of new tests, not aware of potential downsides or harms of new tests, enthusiasm for tests before there is evidence to support their use.
  For example, we did a study examining how the global media reports on the benefits and harms of 5 new medical tests for people without symptoms. These were the Apple watch ECG, 3D mammography, and blood biomarker and AI tests for dementia and cancer. We found that less than 20% of the stories mentioned potential harms or downsides of these medical tests.

- There is some concern that uncritical reporting of new medical tests could promote **overdiagnosis and overtreatment**.

- Have you heard of overdiagnosis ?
  - If yes, could you tell me what you understand it to mean?

Prompt example – if needed

- Overdiagnosis happens when someone gets a diagnosis that ends up causing them more harm than good. For example, the apple watch now has an electrocardiogram to track heart rhythms in healthy people. It aims to detect a condition called atrial fibrillation. The difficulty is that healthy people can have seemingly irregular heart rhythms that may never go on to give them any trouble. However, a diagnosis of atrial fibrillation may lead to harms from over testing, anxiety due to have a heart condition, and bleeding from unnecessary blood thinning medicines.

  - Have you reported on it before? What was the context?

- What are your views on overdiagnosis?

- What are your views on how media coverage of new tests, or medicine generally, may help to contribute to overdiagnosis?

Potential Barriers to reporting accurately on new medical tests

- What do you think are/may be the key challenges or barriers for journalists in reporting accurately on new tests?
  Prompts – if needed:
  - Less journalists?
  - Less specialist reporters?
  - Time?

- How to make a story on a new test both accurate (including being critical) and interesting. Reporting on difficult topics may not get lots of readers. e.g. challenges of writing about overdiagnosis and getting interest.
- Researchers trusting journalists?

Training

- Have you received any training to help you better understand or access medical evidence in general?
  - If yes, what was the context?
    - Do you think it improved your reporting?
    - Would you recommend something similar to other journalists?
  - If no, would you be interested in that type of training? Why or why not?

Potential Solutions to improve reporting on medical tests

- Do you think anything can be done to help wind back some of the overly positive reporting about new tests and promote more critical reporting, particularly about the potential downsides or limitations of new tests, such as overdiagnosis?

  Prompts – if needed:
  - Institutional change?
  - Press release – greater transparency in conflicts of interest.
  - Researchers trusting journalists. How?
  - Supporting journalists?
  - Being available to journalists to read a call, interpret a paper, fact check a story/press release?
  - A checklist to guide reporting?

Openness to training

We are interested in developing some kind of training package for journalists to better support their reporting on new tests. How would you feel about this idea?

- What would you like to see included in this?
- Best format? (e.g. face to face, webinars, blended, etc)
- Length of training
- Top up training (e.g. shorter follow-up sessions after a more extensive training package)

We have some training ideas that I would like to run by you, so I am going to put them explicitly to you one by one.

- What do you think of an Australian Science Media Centre workshop on this issue? A short one- running between 60 and 90 minutes?

- What are relative merits of a workshop that comes to your workplace – like the Science Media Centre currently does – compared to a workshop held somewhere- that journalists from different media outlets could attend?

- What do you think of the idea of being offered access to a network of researchers working in this field? to read a paper, fact check a story for example.

- A checklist to guide reporting?

Closing

Now we're coming to the end of the interview, but before we wrap up do you have any questions or is there anything, we didn't discuss that you would like to add in relation to journalists reporting new medical tests or overdiagnosis generally?

Finally, before we finish, I am wondering do you know of any other journalist(s) who may be interested in taking part in this study? We are trying to recruit 10 more journalists. Any suggestions would be great.

Thank you very much for your time.

Supplementary File 3: Journalists quotations

Themes	Supporting quotes
1. Readers' interest in tests	*"Readers are really interested in it. It presents I guess hope and different scientific advances that might change outcomes are probably pretty appealing to a general audience." (J19, 7 years' experience)* *"I think they're very interested.'Cause I think health stories in general are quite popular.'Cause they affect everybody." (J20, 33 years' experience)*
2. Ingredients of a 'good' news story	
Newsworthiness	*"Well for starters it needs to, to be a useful test. Like there needs to be a need for it." (J7, 6 years' experience)* *"Is this delivering something that's going to be genuinely helpful to people." (J11, 4 years' experience)*
Research Evidence	*"Um… well it's rarely a randomised trial. The evidence is usually… um… pretty lousy. More often than not I won't do the story." (J9, 36 years' experience)* *"I mean reviews are the best but that's probably, they probably don't exist for newish testing. yeah, I mean I, I guess peer review research, published research" (J19, 7 years' experience)*
Obtain Independent Opinion	*"Oh, I'd probably be happy if I'd spoken to a radiologist or a radiation oncologist and a urologist, I suppose. It's a bit of a vexed area where like, you know, it's been under battle for quite a while. So I'd be careful about who I was speaking to I suppose." (J16, 9 years' experience)* *"We would go to get some independent comment from someone else not affiliated with the study" (J12, 30 years experience)*

Awareness of Vested interests	*"We want to know where any funding has come from." (J17, 12 years experience)* *"Who is promoting it? if there's invested interest, that's the main thing I can think of." (J21, 4 years' experience)*
Clarify Safety information	*"And then you would have a reasonable idea of what, of its efficacy and of course of its safety. And they're the, they're the two questions that you're kind of obliged to ask really, you know? Does it work? And to what extent does it work? And, is it safe?" (J11, 4 years' experience)*
3. Journalists' knowledge of potential harms of medical tests	
General knowledge of harms	*"It can lead to inappropriate, um, healthcare, inappropriate use of resources or just public resources generally. You know, it can lead to over-medicalisation for things." (J20, 33 years' experience)* *"All that's screening. And, um, there are harms as well as benefits. You know, not many harms, but… they've, they've not been well documented." (J9, 36 years' experience)*
Knowledge of overdiagnosis	*"Back pain's a great example of this, right? If the more people you test, the more abnormalities you will find but those abnormalities are actually perfectly natural and aren't linked to back pain. But once you start finding them then it gets into people's heads that, oh my God their spine's falling to bits and they should be treated and we should do something about it. And so you end up with over treatment as well." (J15, 5 years' experience)* *"My understanding is that it's basically, the idea that people are being told that they have illnesses or they're falling into the classification of having a disease or illness, which would otherwise not affect their quality of life. And then they may be offered or sold, treatments that aren't going to make a difference because the illness was never going to affect their quality of life in the first place. And then the negative obviously of that is that some of these invasive tests and treatments could actually damage*

	their quality of life" (J10, 4 years' experience)
Public and other journalists' knowledge of harms	*"The understanding within general society and within the media of overdiagnosis is, I would think, low to non-existent." (J15, 5 years' experience)* *"I think there definitely needs to be more awareness of the issues around over diagnosis in the broader media community, cause I don't think it's a very well known issue. And if people don't know about it they're not going to include it in their stories." (J2, 6 years' experience)*
4. Factors influencing the framing of media coverage	
Press releases	*"They can be good in terms of directing you or tipping you off about new research or a certain expert in the area. But I usually take the, whatever comes out of a PR agency with a grain of salt" (J10, 4 years' experience)* *"Press releases, even sort of the Universities (laughs) and researchers are still making, you know, these massive mistakes and over-blowing research." (J3, 9 years' experience)*
Click-bait	*"You know, 'breakthrough' and 'cure' and those kind of very emotive words… people might want to click on those." (J5, 22 years' experience)* *"It doesn't effect me at all. Because don't write for the outlets where that may, you know, my salary or my pay is conditional on clicks or click-throughs. But I think, yeah, click bait is a problem in all media, not just in health and medical." (J1, 20 years' experience)*
Commercial interests	*"Commercial partners that may be interested in getting the test out there, people who stand to benefit financially. So that's a pressure out there. There are also maybe patient groups. I don't know whether the patient groups share an agenda with people who are making a financial gain from the test or not?" (J4, 30 years' experience)*

	"I think if I was approached by a pharmaceutical company with a new test they've developed I'd be very hesitant to write a story about it." (J2, 6 years' experience)
Focus or good or bad news	*"Especially when it's diseases that are, you know, really intractable or that people are really afraid of. I think it's very easy to oversell things. It's all about having a good story." (J1, 20 years' experience)*
Lack of training and experience	*"generalists don't really have a background in health or science that are covering these things, not really getting to the bottom of where the money's coming from?" (J3, 9 years' experience)* *"I think especially beginner journalists or journalists who are just starting in the health round can approach topics uncritically" (J16, 9 years' experience)*
5. Barriers to critical coverage of medical tests	
Journalist knowledge and experience	*"I think first and foremost when it comes to screening tests, I would say the knowledge around the potential pitfalls of screening or over screening is not well known or understood. I think that applies to the general population but I also think that probably applies to journalists as well." (J6, 6 years' experience)* *"I feel the core challenge is lack of knowledge. Like.. you know, I think you could speak to lots of health and science and just general news journalists and they would just have no idea that that was even a problem.You know, so I, I… and I, I reckon that their idea of it would probably as a percentage, you know, be in line with the general publics…… percentage of people who understood that there's a problem. Like there just isn't the literacy about this topic in the community or in the media." (J15, 5 years' experience)*
Time pressures	*"I think a really key barrier for most journalists is time. You're often making decisions about coverage in that split second moment between like deleting or not deleting an email." (J13, 6 years' experience)*

	"The main thing is time. You can't overstate it. And, and, yeah, the pressures of deadlines are just… constant and sometimes, yeah, unmanageable." (J21, 4 years' experience)
Lack of access to experts	*"I didn't end up covering it. But it was, it was a major issue because I spent at least a day trying to find someone, like a whole day trying to find someone to, who had the time, and, and the expertise, and I just couldn't find them." (J17, 12 years' experience)* *"Just not perhaps having ready access to perhaps a group of reliable experts that can comment either on or off the record" (J18, 25 years' experience)*
Complexity of overdiagnosis	*"So in a lot of ways that's a message that's been drummed into people for the last 30 years. You know, go and get, get a pap smear, go and get a mammogram, you know, go and get a bowel cancer test, and it comes in the mail. So that message of you need to be screened, you need to be getting a regular test has been something that's been embedded in people's minds. So it's almost counterintuitive for them to think there's a test there, why wouldn't I have it?" (J12, 30 years' experience)* *"Overdiagnosis sounds like a contradiction… because everybody wants a diagnosis. So how could having a diagnosis possibly be bad? Um… but yeah, we're not very good at explaining it" (J8, 32 years' experience)*
6. Enablers of critical coverage of medical tests	
Journalist training	*"Teach us how to read medical research, you know, how to tell if a publication is good or not." (J2, 6 years' experience)* *"More journalism education in relation to evidence, types of evidence, statistics, all that kind of thing" (J4, 30 years' experience)*
Training for academics and peak bodies	*'There's work to do in educating some other sectors as well, like, you know, some of the, um… the medical colleges and the AMA and some of the other… medical and health groups that are called on to*

	comment on these stories" (J3, 9 years' experience) *"I think the onus is partly on… whoever is, um, providing recommendations around screening, whether that's research institutes or not-for-profits advocacies, the health, government departments and so on.. that, you know, it would be pretty unusually I think to go on a website where there's recommendations to screening that has a section about, um, when screening is not appropriate or, or the kind of pitfalls of over screening. I think that's probably something that's overlooked" (J6, 6 years' experience)*
Better attempts to communicate harms	*"It would be worth groups like the group at Bond University, perhaps if they know research is coming out, or if they seen research is coming out, being a little bit reactive and putting out a media release of their own… yeah, I think, I think that a louder voice in the over diagnosis area would be, be fantastic." (J2, 6 years' experience)* *"There are powerful stories to be told about… people… the harms that are done…… from over testing and over treatments, and putting those stories out there would be, yeah, finding the stories and putting them out there would be… a good way to help bring some of those story tropes to the fore to make them more accessible to journalists." (J4, 30 years' experience)*
7. Interest in a training intervention	*"Yeah, I, I think it's an excellent idea. And I think we should do it."* (J15, 5 years' experience) *"Yeah, look I think it would be great. Um, my favourite type of training personally is the ones where you do a lot of work shopping on stories." (J4, 30 years' experience)*

COREQ checklist

No. Item	Guide questions/description	Reported on Page #
Domain 1: Research team and reflexivity		
Personal Characteristics		
1. Inter viewer/facilitator	Which author/s conducted the inter view or focus group?	Page 6
2. Credentials	What were the researcher's credentials? E.g. PhD, MD	Page 1
3. Occupation	What was their occupation at the time of the study?	Page 6
4. Gender	Was the researcher male or female?	N/A
5. Experience and training	What experience or training did the researcher have?	Page 6
Relationship with participants		
6. Relationship established	Was a relationship established prior to study commencement?	N/A
7. Participant knowledge of the interviewer	What did the participants know about the researcher? e.g. personal goals, reasons for doing the research	N/A
8. Interviewer characteristics	What characteristics were reported about the inter viewer/facilitator? e.g. Bias, assumptions, reasons and interests in the research topic	Page 6 and 16
Domain 2: study design		
Theoretical framework		
9. Methodological orientation and Theory	What methodological orientation was stated to underpin the study? e.g. grounded theory, discourse analysis, ethnography, phenomenology, content analysis	Page 6
Participant selection		
10. Sampling	How were participants selected? e.g. purposive, convenience, consecutive, snowball	Page 6
11. Method of approach	How were participants approached? e.g. face-to-face, telephone, mail, email	Page 5
12. Sample size	How many participants were in the study?	Page 5
13. Non-participation	How many people refused to participate or dropped out? Reasons?	N/A
Setting		
14. Setting of data collection	Where was the data collected? e.g. home, clinic, workplace	Page 5
15. Presence of non-participants	Was anyone else present besides the participants and researchers?	N/A

16. Description of sample	What are the important characteristics of the sample? e.g. demographic data, date	Page 7 and 8
Data collection		
17. Interview guide	Were questions, prompts, guides provided by the authors? Was it pilot tested?	Supplementary file 2
18. Repeat interviews	Were repeat inter views carried out? If yes, how many?	N/A
19. Audio/visual recording	Did the research use audio or visual recording to collect the data?	Page 6
20. Field notes	Were field notes made during and/or after the inter view or focus group?	Page 6
21. Duration	What was the duration of the inter views or focus group?	Page 6
22. Data saturation	Was data saturation discussed?	N/A
23. Transcripts returned	Were transcripts returned to participants for comment and/or correction?	N/A
Domain 3: analysis and findings		
Data analysis		
24. Number of data coders	How many data coders coded the data?	Page 6
25. Description of the coding tree	Did authors provide a description of the coding tree?	N/A
26. Derivation of themes	Were themes identified in advance or derived from the data?	Page 6
27. Software	What software, if applicable, was used to manage the data?	N/A
28. Participant checking	Did participants provide feedback on the findings?	N/A
Reporting		
29. Quotations presented	Were participant quotations presented to illustrate the themes/findings? Was each quotation identified? e.g. participant number	Page 8 - 12
30. Data and findings consistent	Was there consistency between the data presented and the findings?	Page 13 - 14
31. Clarity of major themes	Were major themes clearly presented in the findings?	Page 8 - 12
32. Clarity of minor themes	Is there a description of diverse cases or discussion of minor themes?	Page 8 - 12

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Journalists' views on media coverage of medical tests and overdiagnosis: a qualitative study

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ABSTRACT

Objective Promotional media coverage of early detection tests is an important driver of overdiagnosis. Following research evidence that global media coverage presents the benefits of testing healthy people far more frequently than harms, and gives little coverage to overdiagnosis, we sought to examine journalists' views of media reporting of tests, overdiagnosis, and strategies to improve critical reporting on tests.

Design Qualitative study using semi-structured telephone interviews. Interviews were conducted between February and March 2020 and were audio-recorded and transcribed verbatim. Framework thematic analysis was used to analyse the data.

Participants and setting Twenty-two journalists (mainly specialising in health reporting, average 14.5 years' experience) based in Australia.

Results This sample of journalists acknowledged the potential harms of medical tests but felt that knowledge of harms was low among journalists and the public at large. Most were aware of the term overdiagnosis, but commonly felt that it is challenging to both understand and communicate in light of strong beliefs in the benefits of early detection. Journalists felt that newsworthiness in the form of major public health impact was the key ingredient for stories about medical tests. The journalists acknowledged that factors, like the press release and 'click bait culture' in particular, can influence the framing of coverage about tests. Lack of knowledge and training, as well as time pressures, were perceived to be the main barriers to critical reporting on tests. Journalists felt that training and better access to information about potential harms would enable more critical reporting.

Conclusions Effectively communicating overdiagnosis is a challenge in light of common beliefs about the benefits of testing and the culture of current journalism practices. Providing journalists with training, support, and better access to information about potential harms of tests could aid critical reporting of tests.

Strengths and limitations of this study

- This is the first study to explore Australian journalists' views of the reporting of medical tests and overdiagnosis.
- The findings will help inform strategies to improve critical reporting on medical tests and communicate better about overdiagnosis.
- Our sample comprised mainly health-specific journalists with an interest in taking part in the study and may not be representative of all journalists.
- It remains unclear if the journalists' knowledge of how to critically report on tests translates into critical reporting in practice.

BACKGROUND

Advances in early detection testing through diagnostic technology, screening programmes, biomarkers, artificial intelligence and self-tracking technologies such as the Apple Watch are increasingly aimed at healthy people to detect a potential disease prior to the onset of symptoms. [1-5] While early detection tests may have benefits for those with a potentially serious disease, there is considerable evidence that unnecessary testing can harm healthy people through overdiagnosis.[6-8] Overdiagnosis occurs when individuals are labelled with a technically correct diagnosis that does not improve health outcomes.[9 10] It is now widely recognised as a threat to human health and health system sustainability.[9 11-16]

Many possible drivers of overdiagnosis have been documented. The media, through promoting early detection tests to healthy individuals, is considered an important driver.[15] A recent cross-sectional study[17] of global media coverage – including over a thousand media stories about five early detection tests (3D mammography, liquid biopsy, Apple Watch, blood biomarker tests and artificial intelligence technology for dementia) – found that the potential benefits of testing were presented far more frequently than potential harms. The risk of overdiagnosis was mentioned in very few stories. These findings align with published studies of media coverage of health and medicine, which have found that the media emphasise potential benefits more than harms.[18-21] The COVID-19 pandemic – in particular – has brought this problem into sharp focus. Many media outlets have hyped the effect of anti-viral drugs on the basis of small, industry-funded, uncontrolled studies – potentially hampering treatment evaluation efforts and responses to the pandemic.[22]

The media's often unrealistic and over-optimistic expectations about the value of early detection tests is a cause for concern for four main reasons. First, the general public, and patients, already tend to overestimate the benefits of early detection[23-25] and uncritical media coverage can reinforce these perceptions. Second, few individuals seem to be aware of the potential harms of early detection and overdiagnosis.[26 27] Third, there is evidence that tests are already widely overused.[28 29] And fourth, media coverage can influence patterns of healthcare utilisation – with positive coverage of a test or treatment associated with increases in utilisation.[30-32] (See Box 1 for example)

Box 1. The power of the media

Media coverage of Kylie Minogue's breast cancer diagnosis in Australia in May 2005 led to a 20-fold increase in media coverage about breast cancer, with a particular emphasis on how young women can get breast cancer and the importance of early detection.[32]

Bookings for mammograms as part of government-sponsored BreastScreen programmes across Australia rose 40% during the 2 weeks of the coverage, and there was a 101% increase in non-screened women in the eligible age group (40-69 years). Six weeks after the coverage, bookings stayed more than a third higher in non-screened women.[32]

Given the powerful role that media can play in perpetuating the present lack of awareness of the downsides of testing, including overdiagnosis, and in shifting public health behaviours, strategies to improve media reporting of tests and overdiagnosis are needed. While there is a considerable scientific literature on how the media frames different health issues, less attention has been given to hearing journalists' perspectives on media coverage of medical tests and overdiagnosis. To our knowledge, one qualitative study[33] has previously examined US journalists views of media coverage of overtreatment. The sample of journalists in this study nominated overtesting (e.g. cancer screening) as an important driver of overtreatment. However, no study has examined journalists' specific perspectives of new tests, and their benefits and risks. This study sought to redress this knowledge gap.

METHODS AND ANALYSIS

Study design

This qualitative study used semi-structured telephone interviews to explore journalists experience of, and attitudes to, reporting on medical testing, overdiagnosis, and strategies to improve media coverage of both tests and overdiagnosis. It was designed and reported according to the Consolidated Criteria for Reporting Qualitative Research (COREQ).[34] See Supplementary File 1 for the study protocol.

Participants and recruitment

Participants were 22 Australia-based journalists. Both health journalists and generalist journalists across any type of media were included. To be eligible, participants needed to be currently working as a journalist in Australia, be able to communicate in English (both orally

and in written form) and be able to give informed consent. Ability to read and understand English were key inclusion criteria for the proposed study because the interview was conducted in English. There were no restrictions on the age or gender of participants.

Journalists were purposively recruited through three different avenues: 1). There was journalism expertise in the author team (RM) and personal contacts played a role in the initial development of a list of potential participants to contact. 2). One author (MOK) performed Google and Twitter searches to locate potentially eligible journalists. If a journalist had publicly available contact information, they were emailed about the study. 3). An active 'snowball' recruitment technique was used by asking participating journalists to suggest other eligible journalists they believed would be interested in being involved.

All potential participants were emailed a Participant Information Sheet outlining aims and important information about the study. Those interested in taking part returned a consent form to researchers through email and were contacted to arrange an interview.

Data collection

An interview schedule (Supplementary file 2) was developed, discussed and piloted by the research team. The research team have expertise across public health (MOK, BN, TD, CM, LA, KM, AB), epidemiology (AB, LA), psychology (KM), health communication (MOK, BN, KM,and AB), overdiagnosis (MOK, BN, TD, LA, CM, KM, AB, RM) and journalism (AB and RM). The telephone interviews were conducted by four researchers (MOK, BN, TD, RM) between February and March 2020. Interviews lasted approximately 45 minutes, and were audio-recorded and transcribed verbatim. The interviewers took notes during the interviews to highlight key themes emerging from the interviews and direct further questioning (e.g. explore a point raised by the journalist). This information enabled the interviewer to summarise back to the journalist at the end of the interview and give them an opportunity to provide further information.

Data analysis

The interview data were analysed using Thematic Framework Analysis. Microsoft Excel was used to organise the data to capture the views expressed by the journalists. The first step was familiarisation of the data, where one researcher (MOK) independently reviewed the transcripts and developed a list of emerging themes arising from the transcripts. Those themes along with the interview schedule (Supplementary file **2**) formed the structure of the coding framework. An additional three researchers (BN, TD, and RM) then read a sub-set of transcripts and reviewed the coding framework and necessary changes or additions to the framework were discussed and made. Once the coding framework was finalised, one researcher (MOK) coded all of the interviews into the coding framework, and an additional researcher (BN) independently double-coded a random 20% of the interviews. Differences in the coding between the two researchers were discussed and resolved.

Patient or public involvement

Patients or the public were not involved in the design, or conduct, or reporting, or dissemination plans of our research.

RESULTS

Journalist characteristics are shown in Table 1.

The results of the analysis of the interview data are organised around seven main themes: 1. Readers' interest in medical tests; 2. Ingredients of a 'good' news story; 3. Journalists' knowledge of potential harms of medical tests; 4. Factors influencing the framing of media coverage on tests; 5. Barriers to critical coverage of medical tests; 6. Enablers of critical coverage of medical tests; and 7. Interest in a training intervention. See Supplementary file 3 for extra journalist quotes relating to each theme.

Table 1. Journalist characteristics

Characteristics	Number of journalists (n = 22)
Type of journalist	
Health	14 (63.6%)
Science (including health)	6 (27.3%)
General	2 (9.1%)
Gender	
Male	4 (18.2%)
Female	18 (81.8%)
Years of experience	
<5	3 (13.6%)
5 – 10	9 (40.9%)
11 – 20	2 (9.1%)
21- 25	2 (9.1%)
>30	6 (27.3%)
Workplace setting	
National Broadcaster (ABC)	8 (36.4%)
Freelance	6 (27.3%)
Online and print newspaper (Sydney Morning Herald)	3 (13.6%)
Health website (Medical Republic)	2 (9.1%)
Not-for-profit media outlet accepting stories from academics (The Conversation)	2 (9.1%)
Online newspaper (New Daily)	1 (4.5%)
Peer-reviewed journal (Medical Journal of Australia)	1 (4.5%)
Level of health story reporting	
A lot (writes health articles on most days)	18 (81.8%)
Some (every second week)	2 (9.1%)
Very little (less than once a month)	1 (4.5%)
History of reporting on medical tests	
Yes	16 (72.7%)
No	4 (18.2%)
Unsure	2 (9.1%)
History of training in understanding medical evidence	
Yes	7 (31.8%)
No	15 (68.2%)
Approached to report on medical tests	
Yes	15 (68.2%)
No	7 (31.8%)

Note: The ABC provides radio, television, and online services. The majority of ABC employed journalists in this study perform online and radio roles. The participants from The Conversation and The Medical Journal of Australia are journalists/editors who select, steer and edit news stories and submitted articles. They have former roles in mainstream media.

Most of the journalists were based in major population regions such as Sydney, Melbourne, Gold Coast, and Perth.

1. Readers' interest in medical tests

The vast majority of journalists felt that stories about medical tests are popular among readers, particularly where the test relates to a common or serious health condition, like cancer and inheritable conditions.

"the concept of being able to detect disease in someone who might be unknowingly walking around with a ticking time bomb in their chest or blood stream is really compelling" (J7, 6 years' experience)

The public's enthusiasm for technology to catch a health issue early was mentioned by some journalists.

2. Ingredients of a 'good' news story

Public health impact was deemed the most important ingredient for reporting on a test by most journalists. Impact was frequently explained in terms of positive changes in the management of a common condition.

"how big is this step forward or, you know, how soon will it be introduced to patients, or practically speaking what does it change for them … so I guess always having that patient lens in mind." (J22, 3 years' experience)

Peer-reviewed research as a prerequisite for reporting on a medical test was acknowledged by the vast majority of journalists. Very few elaborated on the importance of the quality of the research (e.g. the likelihood of bias). Many journalists said they seek independent comment on tests from trustworthy sources like a university, and some journalists said they would seek clarification on vested interests before reporting on a test. Four journalists explicitly said they would ask about vested interests, including financial gain from promoting and/or selling the test.

3. Knowledge of potential harms of medical tests

The vast majority of journalists acknowledged the potential harms of medical tests, and mostly referred to the harms of screening for prostate and breast cancers, such as unnecessary testing, unnecessary treatments, and anxiety. All journalists except one were aware of the term overdiagnosis. A few had a deeper understanding.

"Like my understanding of that is that you often will have people diagnosed with something, and they know they've got it but it's not going to actually affect them. If they'd never had the test they would never have known and they'd have lived a happy healthy life." (J13, 6 years' experience)

Most journalists felt that knowledge of harms was low among the public and journalists in general due to frequent exposure to messaging about the benefits and importance of early testing. Several journalists felt that overdiagnosis was a difficult concept for readers to understand.

"*I think generally there appears to be an attitude, certainly in a country like Australia, that, public health screening is a very important public health measure. And that the more screening you do, the better. You know, I can't remember a campaign ever that was trying to get people to not go to the doctor (laughs) " (J6, 6 years' experience)*

Only a small number of journalists viewed it as important to get information on safety concerns or potential side effects of a test before writing a story.

4. Factors influencing the framing of media coverage

The power of the press release to influence coverage was acknowledged by most journalists. A small number of journalists suggested that a journalist's control over using the press release may be low depending on overall priorities for news content within the organisation.

"It's like here's the story, here's the new product, here's the patient, his life has been saved or changed or altered. You know, here's how many people it's going to be saved, here's our expert. You know, it's a real parcel" (J1, 20 years' experience)

Click bait (sensationalised titles designed to attract readers to click on stories) was mentioned by most journalists and was perceived to have downsides. However, a few journalists acknowledged that click bait can be driven by systemic issues which may be hard to modify. These include attempts to keep content interesting and obtain funding.

"if you can get a big headline out of it, if you can turn it into click bait, all the better. And I think that's the danger. I mean I saw something the other day about some cancer test that's going to be a breakthrough, and it was only just, you know, made it to rat trials." (J8, 32 years' experience)

Most journalists acknowledged the potential for commercial interests to influence the media coverage of tests. About half of the journalists commented on lack of training and experience, particularly among young generalist journalists, as a contributor to the framing of media coverage. A minority of journalists stated that many journalists are tempted to report very good or very bad news as it was felt that extremes in news coverage are more attractive to readers.

5. Barriers to critical coverage of medical tests

Lack of knowledge and experience of the medical evidence and harms was perceived to be the biggest barrier to improving coverage on medical tests by most journalists. Knowledge was generally in relation to reading research, and knowing the right questions to ask (e.g. about commercial interests). Some journalists said that lack of knowledge and experience was compounded by the reduction in the number of specific health journalists.

"When it comes to screening tests, I would say the knowledge around the potential pitfalls of screening or over screening is not well known or understood. I think that applies to the general population but I also think that probably applies to journalists as well." (J6, 6 years' experience)

Most journalists mentioned time pressure as a significant barrier to critical reporting and often stated they themselves were fortunate to have time available to research a story.

Several journalists stated that access to trustworthy experts for independent comment was a real problem for their reporting. If a press release did not come with an independent comment, journalists often lacked the time to find one. Some felt it was difficult to access experts on

certain health topics. Researcher availability was also mentioned as an issue. Specifically, it was difficult to speak with certain researchers as they may not answer calls/emails.

A small number of journalists said they tended to feel uncomfortable talking about harms including overdiagnosis as they can be difficult to communicate, and have potential to provoke unpleasant emotions in people who may be affected by a health condition (e.g. cancer).

"I tend to be a bit hesitant to report on the dangers of overtesting and overdiagnosing when the proponents of these tests have such powerful and personal stories to tell." (J7, 6 years' experience)

6. Enablers of critical coverage of medical tests

The provision of journalist training was viewed as important to improve the critical coverage of tests by most journalists. They felt training should mainly focus on learning how to critically appraise research and press releases, understand statistics, and know the questions to ask about a test.

"A basic understanding of what the different levels of evidence are, what kinds of studies there are and why some are better than others about making strong conclusions. I think some statistics would help, if only just the basics of you know, absolute versus relative, and P scores and stuff like that. I think knowing, if we can train them about the downsides. They need to ask every single time, what are the downsides? And I don't think people do." (J8, 32 years' experience)

Some journalists felt it was important for institutions like universities or government agencies to improve the quality of communication of the evidence. Common suggestions were improving press release quality to include conflict of interests and funding, and avoiding overstatements of findings.

Most journalists felt that researchers and national bodies (e.g. Cancer Council) need to better communicate the harms of testing to journalists. This includes initiating stories, providing information about harms, as well as listing harms on websites where readers could find out more.

7. Interest in a training intervention

All journalists expressed an interest in training. The journalists were quite evenly split in terms of preferences for face-to-face, online, or combined face-to-face and online training. All journalists highlighted the importance of keeping the training short in duration and most liked the idea of resources and ongoing support. Frequent suggestions were checklists, access to expertise for comment and fact-checking, and reminders.

"And then I also think that a resource that would be useful, something you can take away like an at a glance kind of 'don't forget these five things'. Something that's, they can then sort of stick on their desk…" (J13, 6 years' experience)

DISCUSSION

Summary of key findings

The findings from this interview study suggests that many journalists may be aware of the potential harms of medical tests such as overdiagnosis, but they commonly view information about harms as difficult to access and communicate. Knowledge of harms such as overdiagnosis, however, was perceived to be low among the public and journalists at large yet important and interesting. In particular, overdiagnosis was viewed as a counterintuitive concept for many, given prominent public health efforts to promote the benefits of early detection. The journalists identified a number of factors that influence coverage and present challenges to improving critical reporting on tests. Journalists were engaged by the idea of receiving training and support.

Comparison to existing literature

Our findings align with a number of other qualitative and survey studies of journalists that newsworthiness, time pressures, click bait and lack of medical knowledge are important factors in both influencing media coverage of health topics and attempts to change coverage.[35-38] Views on the power of the press release are supported by quantitative data showing that the quality of the press release is associated with the quality of the subsequent medical news reporting,[39 40] and that journalists frequently rely on press releases for story ideas.[41] The problems with press releases have been highlighted again during the COVID-19 pandemic

through the media's reliance on potentially unreliable preprints, or preliminary or partial results promoted before peer review, to communicate treatment effectiveness.[22]

The prevalence of click bait in media coverage fits broadly with cross-sectional studies displaying the media's frequent use of emotive words like 'breakthrough', 'revolutionary' and 'unprecedented' to report new treatments.[42 43] In fact, one randomised trial found that use of words like 'breakthrough' and 'promising' in reference to medicines in media releases increases the public's belief in drug effectiveness compared to facts-only explanations.[44]

The observation that promotion and desire for early detection testing is widespread fits with the considerable literature displaying public, patient, and clinicians' beliefs in the benefits of testing.[22 23 45] In a qualitative study[33] examining US journalists views of media coverage of overtreatment, the sample of journalists viewed the issue of overtreatment – together with overtesting – as a complex matter driven by strong public faith in healthcare and societal norms that make medical uncertainty difficult to accept. Further, there is data showing that medical marketing of tests to persuade individuals about the importance of early detection is escalating.[46] The journalists' need for access to better information and expertise aligns with previous qualitative work.[35 37]

Strengths and weaknesses of this study

To our knowledge, this is the first study to explore journalists' views of media reporting of medical tests and the problem of overdiagnosis. This study provides useful information about the barriers to critical reporting on tests, and enablers which could improve it. The findings will facilitate the development of strategies to better support journalists to report on the harms of tests, including overdiagnosis.

The study has some important limitations. A highly selective sample of journalists was included. Only Australia-based journalists were included. Although we approached journalists of various levels of experience and from different types of media outlets, the majority of the sample were experienced health journalists working for well-regarded media outlets. These journalists expressed awareness of overdiagnosis. This may be influenced by our recruitment strategies and journalists' willingness to participate in this specific research. The generalisability of the results may be limited for journalists in different countries with a

different media landscape or less experienced reporters who do not specialise in health reporting.

Meaning of the study

The finding that journalists are very interested in receiving research training and support should be welcomed by researchers and organisations interested in improving the critical reporting of tests and knowledge of overdiagnosis. Journalists are well positioned to educate the public about medical tests[31 47] and media coverage of tests can influence healthcare utilisation.[30 32] The media have contributed to improvements in health-related knowledge and behaviours - for example in the areas of low back pain, smoking cessation, and vaccination.[48-50] Improving critical reporting on early detection could encourage more realistic expectations about the benefits of early detection and an awareness of potential harms such as overdiagnosis.[7] Future research should focus on developing training and resources for journalists and examine their impact on journalist knowledge and the quality of media coverage on tests. This research should build on previous workshops and tipsheets for journalists (e.g. US National Institutes for Health Medicine in the Media workshops by Drs Lisa Schwartz and Steven Woloshin[47,51]), and available checklists of medical reporting criteria for journalists (e.g. those available from Media Doctor Australia and HealthNewsReview.org).

Journalists face numerous challenges. First, the public has long received the message that early detection is a good thing. Second, the complexity of overdiagnosis and uncertainty in the evidence base may together make it difficult to communicate the nuances involved. Third, journalists must grab the readers' attention by providing interesting stories within tight deadlines. There are opportunities for academics and organisations to understand these working environments and be available to communicate stories in an engaging but accurate manner. Finally, interventions should not only target journalists, but also the wider levers (e.g. press releases) that all contribute to how information about medical tests is communicated.

CONCLUSION

This sample of Australian journalists seem aware of the potential harms of medical tests such as overdiagnosis, which are often left out of media coverage.[17] But, effectively communicating overdiagnosis is a challenge in light of entrenched beliefs about the benefits of testing and the culture of current journalism practices. Providing journalists with training and support in their efforts to communicate overdiagnosis could aid critical reporting of tests. This may contribute to addressing the wider problem of medical test overuse, which is a major threat to health system sustainability.

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Supplementary File 1 : Study Protocol

Background

Early detection of disease is gaining considerable attention worldwide.[1] Enthusiasm for early detection is displayed by the increasing interest in advances in diagnostic technology, screening programmes, innovations in biomarkers, and "P4 medicine" (predictive, preventive, personalised, and participatory).[1-3] In fact, testing in medicine is increasingly aimed at apparently healthy people to identify those at an increased risk of a disease or disorder.[4] This communicates one message: early detection is a good thing.[1]

However, there is mounting evidence that unnecessary and/or excessive testing can harm healthy people, and the quest for ever-earlier detection of disease can lead to overdiagnosis. Overdiagnosis happens when people are diagnosed in ways that do not benefit them or that can do more harm than good.[5,6] Although an exact definition of overdiagnosis remains the subject of debate, particularly in the context of non-cancer conditions, overdiagnosis can be considered to occur when persons are labelled with a technically correct diagnosis that does not improve health outcomes.[7,8] Overdiagnosis is a major global challenge to health system sustainability and human health and strategies to reduce overdiagnosis are urgently needed.[9]

Many possible drivers of overdiagnosis have been documented.[9] One major driver is the promotion (to clinicians and the public) of increasingly sensitive tests.[9] These can lead to detection of "abnormalities", which may be of uncertain clinical significance. Tests being increasingly promoted to the healthy include the Apple Watch for the early detection of atrial fibrillation, liquid biopsies and artificial intelligence for the early detection of cancer and Alzheimer's disease, and 3D mammography for the early detection of breast cancer.[4] Poor quality media reporting has been highlighted as a strong driver of this promotion.[9] Uncritical media coverage of the benefits and breakthrough of new tests, without consideration of their potential downsides or harms, potentially contributes to a more general lack of awareness about the potential harms of getting tested when healthy. In fact, research has shown that only a small proportion of people are knowledgeable about overdiagnosis.[10] Further, patients (and clinicians) overestimate the benefits of testing, while underestimating the harms.[11,12] Given the powerful role that media can play in influencing public health beliefs and behaviours, strategies to improve media reporting of medicine are needed.[9]

There are concerns that biased media reporting may be exacerbated by the increasingly changing media landscape, such as the rising influence of social media and the decline of the traditional consumption patterns of mainstream news media.[13] With the development of a more fragmented media context there is the increasing diminution of the role of specialist reporters with resulting loss of baseline technical knowledge, gatekeeping and thoughtful, investigative health journalism.[13] This presents a major challenge to the communication of complex concepts like overdiagnosis. Indeed, previous studies on the media have identified evidence of exaggeration,[14,15] inaccurate media coverage of published scientific papers,[16,17] overstating of

benefits of treatments, downplaying of harms[14,18] and failure to report important conflicts of interest of the experts cited in the story.[18]

Poor media coverage of medicine is not an insignificant issue; it can influence how the public perceives the risk of health services and how patients make treatment decisions.[4] For example, media coverage about the celebrity Kylie Minogue's self-referral mammogram bookings led to a 20-fold increase in media coverage about breast cancer and a 40% increase in mammogram bookings during the 2-week peak after the interview. Six weeks later media coverage was still up by 30%.[19]

While much research has examined how the media frames different health issues, very little research has examined the experiences of journalists and attempted to identify obstacles that hinder journalists from higher quality reporting, and elucidate possible strategies for addressing these. Further, no study has yet examined journalists knowledge and views about the increasing problem of overdiagnosis and what this may mean for media reporting of medicine. Also, many media outlets are inundated with sometimes conflicting health information from companies, researchers, institutions, the government and consumers and it would be interesting to explore how they deal with this deluge of information. Furthermore, there is little or no specialised training available for journalists who are expected to interpret often complicated statistics like relative and absolute risks. While there are guidelines available for journalists on how to responsibly report on health matters, journalists have received very little support in the implementation of these guidelines.

It is very important to examine the experiences and perceptions of journalists regarding medical reporting in a time of increasing recognition of the threats from overdiagnosis and too much medicine more generally. Identifying barriers and potential solutions to good medical reporting will help inform the development of an intervention to improve both journalists' confidence and capacity to report more responsibly on medical tests and/or treatments and the problem of overdiagnosis.

This project aims to explore journalists' views on media reporting of medicine (particularly medical tests), and barriers and solutions to improving media reporting in a time of overdiagnosis and too much medicine.

Methods and analysis

Ethical approval

We will seek ethical approval from the University of Sydney Human Research Ethics Committee.

Study design

We will conduct a qualitative study using semi-structured face-to face (or telephone as applicable) interviews. Individual interviews will be conducted to allow participants to speak in confidence about their views and experiences, and to ensure they are not influenced by other journalists with different levels of experience or that work in different settings/specialities. This study will be designed and reported according to the Consolidated Criteria for Reporting Qualitative Research (COREQ).

Participants

We will recruit 15-20 Australia-based journalists. We will purposively recruit journalists with different characteristics (e.g. type of media- TV, print, social media) and levels of experience (e.g. years active, speciality). Both specialist medical journalists and non-medical journalists will be included. Examples of potential media organisations include the Guardian, News Ltd, ABC, Nine-Fairfax, Nine-TV (or 7 TV), and The Conversation.

To be eligible, participants need be currently working as journalist in Australia, be able to communicate in English (both orally and over email), and be able to give informed consent. Ability to read and understand English are key inclusion criteria for the proposed study because the interview will be conducted in English. There will be no restriction on the age or gender of participants.

Recruitment

We will recruit potential participants through a number of different avenues, where needed. There is journalism expertise in the author team (Ray Moynihan) and personal contacts will play a role in the initial development of a list of potential participants to contact. From here we will use an active 'snowball' recruitment technique by asking participating journalists to suggest other eligible journalists they believe would be interested in being involved. We will then access their publicly available contact information to approach them about the study. If needed, the Australian Science Media Centre and Cochrane Australia will be asked to support recruitment working with their networks.

Data collection

Interviews will be conducted face-to-face at Sydney School of Public Health (The University of Sydney), or via Skype/Zoom/telephone if the participant prefers, by a researcher with experience in conducting qualitative interviews. An interview schedule will be developed and discussed among the team members. Interview questions will address the following topics: journalist background, journalist training, interest in reporting on health and medicine, positive and negative experiences of reporting on health and medicine, definition of scientific quality in reporting, views on the changing media landscape, knowledge of overdiagnosis and too

much medicine, barriers to quality reporting of medical tests, solutions for improving media reporting of medical tests, openness to a training intervention and views on the content of an intervention package.

Interviews will last ~60 minutes and will be audio-recorded and transcribed verbatim for analysis. The interviewer will also take notes during the interview to highlight key themes emerging from the interview and direct further questioning (e.g. explore a point raised by the participant). This information will also enable the interviewer to summarise back to the participant at the end of the interview and give them an opportunity to provide further information.

Data analysis

The interview data will be analysed using thematic framework analysis. Framework analysis is a well-accepted method for analysing qualitative data from interviews and is conducted in 5 stages. Stage 1 (familiarisation): the interview will be transcribed verbatim (from audio recordings) by the researcher who conducted the interview. Stage 2 (identifying a thematic framework): transcripts and interview notes will be analysed numerous times to identify codes that could be linked together by related concepts. A second researcher will double code half of the transcripts to check for reliability of the framework. Disagreements will be resolved through discussion. Concepts will then be grouped into broader themes and sub-themes. Stage 3, 4 & 5 (indexing, charting and mapping, interpretation): data will be summarised and charted using Microsoft Excel, and the mapping of themes and sub-themes will be iterative. This analysis will be conducted primarily by one researcher, with input from the research team in the development of the codes and themes.

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Supplementary File 2: Journalist Interview Schedule

Thank you very much for doing this interview. As mentioned in the information sheet I sent you, this interview is to better understand Australian journalists' views towards media reporting of new medical tests. This interview will take between 30 minutes and one hour.

As mentioned in the participant information sheet, this interview will be audio-recorded to make sure we have an accurate record of your responses, and your identity and everything you say will be kept strictly confidential.

Do you have any questions before we begin?
Okay, so I will start the audio-recording now.

Journalist experience

- Who/where are you currently working for and what is your current role?
- Have you worked elsewhere in the past?
  [If yes], could you tell us about your previous experience (e.g. where, main role, etc)
- How long have you been active as a journalist?
- General or specialist?
- Health only or not?
- [If general], could you give us a sense of how often you report on a health-related topic?

Promotion of new tests

Briefly define what we mean by medical tests before we begin questions.
There are different forms of medical tests, and we can put them into two broad categories; diagnostic tests and screening tests. Diagnostic tests are for people with symptoms to diagnose for a specific condition or disease. For example, something like a new heart scan to detect a heart attack, in people reporting symptoms that look like a heart attack.
But then there's also screening tests, which are for people without symptoms to try to detect disease before, it appears symptomatic. For example, the PSA test for healthy men to detect prostate cancer.

- In general, how interested are readers in stories about medical tests?
- Are you approached about studies on new tests?
- Have you even been asked to write a story to promote a new test?
  - Who by?

- What do you see as the key elements of stories on new tests?
- When you write a story about a new medical test – what evidence do you look for?
- What type of information or evidence do companies, health professionals or academics/researchers/scientists bring/may bring to you when they want to promote their new tests?
- What is essential for your story – in your view / experience?

Potential Causes of the promotion of new medical tests

- In your view, what are the **key factors** influencing how new medical tests are reported in the media? *Prompt examples if needed:* press release, lack of time, promote interest/entertainment (click bait)

- What are your views on large **corporate interests** in health and people with various commercial interests?
    - Do you think they can play a role in driving news coverage or influencing news stories? Please expand.

There is a body of literature showing that **press release** content often makes it into the media.

- What are your views on this?
    - Do you think this is a good thing or bad thing?
        - Why? Please expand.

- What are other factors that might directly influence the content of what makes it into the media?
    - How do these compare to something like a press release?

From my understanding, journalists can now easily track number of readers, shares, time spent reading an article. The term **click bait** seems to get mentioned in relation to getting more reads.

- What are your views on this ?
    - *Prompt:* Do you see this a being a positive or negative or both? Please expand.
- Do you feel like you under pressure to produce click bait stories?
    - *Prompt:* Why or why not?

Does this influence the way stories on new tests are written in your view and if yes, how?

Downsides of promotion of medical tests

- In your view, what are the potential downsides or negative effects of promoting new medical tests?
  Prompts if needed: e.g. people overestimating the benefits of new tests, not aware of potential downsides or harms of new tests, enthusiasm for tests before there is evidence to support their use.
  For example, we did a study examining how the global media reports on the benefits and harms of 5 new medical tests for people without symptoms. These were the Apple watch ECG, 3D mammography, and blood biomarker and AI tests for dementia and cancer. We found that less than 20% of the stories mentioned potential harms or downsides of these medical tests.

- There is some concern that uncritical reporting of new medical tests could promote **overdiagnosis and overtreatment**.

- Have you heard of overdiagnosis ?
  - If yes, could you tell me what you understand it to mean?

Prompt example – if needed

- Overdiagnosis happens when someone gets a diagnosis that ends up causing them more harm than good. For example, the apple watch now has an electrocardiogram to track heart rhythms in healthy people. It aims to detect a condition called atrial fibrillation. The difficulty is that healthy people can have seemingly irregular heart rhythms that may never go on to give them any trouble. However, a diagnosis of atrial fibrillation may lead to harms from over testing, anxiety due to have a heart condition, and bleeding from unnecessary blood thinning medicines.

  - Have you reported on it before? What was the context?

- What are your views on overdiagnosis?

- What are your views on how media coverage of new tests, or medicine generally, may help to contribute to overdiagnosis?

Potential Barriers to reporting accurately on new medical tests

- What do you think are/may be the key challenges or barriers for journalists in reporting accurately on new tests?
  Prompts – if needed:
  - Less journalists?
  - Less specialist reporters?
  - Time?

- How to make a story on a new test both accurate (including being critical) and interesting. Reporting on difficult topics may not get lots of readers. e.g. challenges of writing about overdiagnosis and getting interest.
- Researchers trusting journalists?

Training

- Have you received any training to help you better understand or access medical evidence in general?
  - If yes, what was the context?
    - Do you think it improved your reporting?
    - Would you recommend something similar to other journalists?
  - If no, would you be interested in that type of training? Why or why not?

Potential Solutions to improve reporting on medical tests

- Do you think anything can be done to help wind back some of the overly positive reporting about new tests and promote more critical reporting, particularly about the potential downsides or limitations of new tests, such as overdiagnosis?

  Prompts – if needed:
  - Institutional change?
  - Press release – greater transparency in conflicts of interest.
  - Researchers trusting journalists. How?
  - Supporting journalists?
  - Being available to journalists to read a call, interpret a paper, fact check a story/press release?
  - A checklist to guide reporting?

Openness to training

We are interested in developing some kind of training package for journalists to better support their reporting on new tests. How would you feel about this idea?

- What would you like to see included in this?
- Best format? (e.g. face to face, webinars, blended, etc)
- Length of training
- Top up training (e.g. shorter follow-up sessions after a more extensive training package)

We have some training ideas that I would like to run by you, so I am going to put them explicitly to you one by one.

- What do you think of an Australian Science Media Centre workshop on this issue? A short one- running between 60 and 90 minutes?

- What are relative merits of a workshop that comes to your workplace – like the Science Media Centre currently does – compared to a workshop held somewhere- that journalists from different media outlets could attend?

- What do you think of the idea of being offered access to a network of researchers working in this field? to read a paper, fact check a story for example.

- A checklist to guide reporting?

Closing

Now we're coming to the end of the interview, but before we wrap up do you have any questions or is there anything, we didn't discuss that you would like to add in relation to journalists reporting new medical tests or overdiagnosis generally?

Finally, before we finish, I am wondering do you know of any other journalist(s) who may be interested in taking part in this study? We are trying to recruit 10 more journalists. Any suggestions would be great.

Thank you very much for your time.

Supplementary File 3: Journalists quotations

Themes	Supporting quotes
1. Readers' interest in tests	*"Readers are really interested in it. It presents I guess hope and different scientific advances that might change outcomes are probably pretty appealing to a general audience." (J19, 7 years' experience)* *"I think they're very interested.'Cause I think health stories in general are quite popular.'Cause they affect everybody." (J20, 33 years' experience)*
2. Ingredients of a 'good' news story	
Newsworthiness	*"Well for starters it needs to, to be a useful test. Like there needs to be a need for it." (J7, 6 years' experience)* *"Is this delivering something that's going to be genuinely helpful to people." (J11, 4 years' experience)*
Research Evidence	*"Um… well it's rarely a randomised trial. The evidence is usually… um… pretty lousy. More often than not I won't do the story." (J9, 36 years' experience)* *"I mean reviews are the best but that's probably, they probably don't exist for newish testing. yeah, I mean I, I guess peer review research, published research" (J19, 7 years' experience)*
Obtain Independent Opinion	*"Oh, I'd probably be happy if I'd spoken to a radiologist or a radiation oncologist and a urologist, I suppose. It's a bit of a vexed area where like, you know, it's been under battle for quite a while. So I'd be careful about who I was speaking to I suppose." (J16, 9 years' experience)* *"We would go to get some independent comment from someone else not affiliated with the study" (J12, 30 years experience)*

Awareness of Vested interests	*"We want to know where any funding has come from." (J17, 12 years experience)* *"Who is promoting it? if there's invested interest, that's the main thing I can think of." (J21, 4 years' experience)*
Clarify Safety information	*"And then you would have a reasonable idea of what, of its efficacy and of course of its safety. And they're the, they're the two questions that you're kind of obliged to ask really, you know? Does it work? And to what extent does it work? And, is it safe?" (J11, 4 years' experience)*
3. Journalists' knowledge of potential harms of medical tests	
General knowledge of harms	*"It can lead to inappropriate, um, healthcare, inappropriate use of resources or just public resources generally. You know, it can lead to over-medicalisation for things." (J20, 33 years' experience)* *"All that's screening. And, um, there are harms as well as benefits. You know, not many harms, but… they've, they've not been well documented." (J9, 36 years' experience)*
Knowledge of overdiagnosis	*"Back pain's a great example of this, right? If the more people you test, the more abnormalities you will find but those abnormalities are actually perfectly natural and aren't linked to back pain. But once you start finding them then it gets into people's heads that, oh my God their spine's falling to bits and they should be treated and we should do something about it. And so you end up with over treatment as well." (J15, 5 years' experience)* *"My understanding is that it's basically, the idea that people are being told that they have illnesses or they're falling into the classification of having a disease or illness, which would otherwise not affect their quality of life. And then they may be offered or sold, treatments that aren't going to make a difference because the illness was never going to affect their quality of life in the first place. And then the negative obviously of that is that some of these invasive tests and treatments could actually damage*

	their quality of life" (J10, 4 years' experience)
Public and other journalists' knowledge of harms	*"The understanding within general society and within the media of overdiagnosis is, I would think, low to non-existent." (J15, 5 years' experience)* *"I think there definitely needs to be more awareness of the issues around over diagnosis in the broader media community, cause I don't think it's a very well known issue. And if people don't know about it they're not going to include it in their stories." (J2, 6 years' experience)*
4. Factors influencing the framing of media coverage	
Press releases	*"They can be good in terms of directing you or tipping you off about new research or a certain expert in the area. But I usually take the, whatever comes out of a PR agency with a grain of salt" (J10, 4 years' experience)* *"Press releases, even sort of the Universities (laughs) and researchers are still making, you know, these massive mistakes and over-blowing research." (J3, 9 years' experience)*
Click-bait	*"You know, 'breakthrough' and 'cure' and those kind of very emotive words… people might want to click on those." (J5, 22 years' experience)* *"It doesn't effect me at all. Because don't write for the outlets where that may, you know, my salary or my pay is conditional on clicks or click-throughs. But I think, yeah, click bait is a problem in all media, not just in health and medical." (J1, 20 years' experience)*
Commercial interests	*"Commercial partners that may be interested in getting the test out there, people who stand to benefit financially. So that's a pressure out there. There are also maybe patient groups. I don't know whether the patient groups share an agenda with people who are making a financial gain from the test or not?" (J4, 30 years' experience)*

	"I think if I was approached by a pharmaceutical company with a new test they've developed I'd be very hesitant to write a story about it." (J2, 6 years' experience)
Focus or good or bad news	*"Especially when it's diseases that are, you know, really intractable or that people are really afraid of. I think it's very easy to oversell things. It's all about having a good story." (J1, 20 years' experience)*
Lack of training and experience	*"generalists don't really have a background in health or science that are covering these things, not really getting to the bottom of where the money's coming from?" (J3, 9 years' experience)* *"I think especially beginner journalists or journalists who are just starting in the health round can approach topics uncritically" (J16, 9 years' experience)*
5. Barriers to critical coverage of medical tests	
Journalist knowledge and experience	*"I think first and foremost when it comes to screening tests, I would say the knowledge around the potential pitfalls of screening or over screening is not well known or understood. I think that applies to the general population but I also think that probably applies to journalists as well." (J6, 6 years' experience)* *"I feel the core challenge is lack of knowledge. Like.. you know, I think you could speak to lots of health and science and just general news journalists and they would just have no idea that that was even a problem.You know, so I, I… and I, I reckon that their idea of it would probably as a percentage, you know, be in line with the general publics…… percentage of people who understood that there's a problem. Like there just isn't the literacy about this topic in the community or in the media." (J15, 5 years' experience)*
Time pressures	*"I think a really key barrier for most journalists is time. You're often making decisions about coverage in that split second moment between like deleting or not deleting an email." (J13, 6 years' experience)*

	"The main thing is time. You can't overstate it. And, and, yeah, the pressures of deadlines are just… constant and sometimes, yeah, unmanageable." (J21, 4 years' experience)
Lack of access to experts	*"I didn't end up covering it. But it was, it was a major issue because I spent at least a day trying to find someone, like a whole day trying to find someone to, who had the time, and, and the expertise, and I just couldn't find them." (J17, 12 years' experience)* *"Just not perhaps having ready access to perhaps a group of reliable experts that can comment either on or off the record" (J18, 25 years' experience)*
Complexity of overdiagnosis	*"So in a lot of ways that's a message that's been drummed into people for the last 30 years. You know, go and get, get a pap smear, go and get a mammogram, you know, go and get a bowel cancer test, and it comes in the mail. So that message of you need to be screened, you need to be getting a regular test has been something that's been embedded in people's minds. So it's almost counterintuitive for them to think there's a test there, why wouldn't I have it?" (J12, 30 years' experience)* *"Overdiagnosis sounds like a contradiction… because everybody wants a diagnosis. So how could having a diagnosis possibly be bad? Um… but yeah, we're not very good at explaining it" (J8, 32 years' experience)*
6. Enablers of critical coverage of medical tests	
Journalist training	*"Teach us how to read medical research, you know, how to tell if a publication is good or not." (J2, 6 years' experience)* *"More journalism education in relation to evidence, types of evidence, statistics, all that kind of thing" (J4, 30 years' experience)*
Training for academics and peak bodies	*'There's work to do in educating some other sectors as well, like, you know, some of the, um… the medical colleges and the AMA and some of the other… medical and health groups that are called on to*

	comment on these stories" (J3, 9 years' experience) *"I think the onus is partly on… whoever is, um, providing recommendations around screening, whether that's research institutes or not-for-profits advocacies, the health, government departments and so on.. that, you know, it would be pretty unusually I think to go on a website where there's recommendations to screening that has a section about, um, when screening is not appropriate or, or the kind of pitfalls of over screening. I think that's probably something that's overlooked" (J6, 6 years' experience)*
Better attempts to communicate harms	*"It would be worth groups like the group at Bond University, perhaps if they know research is coming out, or if they seen research is coming out, being a little bit reactive and putting out a media release of their own… yeah, I think, I think that a louder voice in the over diagnosis area would be, be fantastic." (J2, 6 years' experience)* *"There are powerful stories to be told about… people… the harms that are done…… from over testing and over treatments, and putting those stories out there would be, yeah, finding the stories and putting them out there would be… a good way to help bring some of those story tropes to the fore to make them more accessible to journalists." (J4, 30 years' experience)*
7. Interest in a training intervention	*"Yeah, I, I think it's an excellent idea. And I think we should do it."* (J15, 5 years' experience) *"Yeah, look I think it would be great. Um, my favourite type of training personally is the ones where you do a lot of work shopping on stories." (J4, 30 years' experience)*

COREQ checklist

No. Item	Guide questions/description	Reported on Page #
Domain 1: Research team and reflexivity		
Personal Characteristics		
1. Inter viewer/facilitator	Which author/s conducted the inter view or focus group?	Page 6
2. Credentials	What were the researcher's credentials? E.g. PhD, MD	Page 1
3. Occupation	What was their occupation at the time of the study?	Page 6
4. Gender	Was the researcher male or female?	N/A
5. Experience and training	What experience or training did the researcher have?	Page 6
Relationship with participants		
6. Relationship established	Was a relationship established prior to study commencement?	N/A
7. Participant knowledge of the interviewer	What did the participants know about the researcher? e.g. personal goals, reasons for doing the research	N/A
8. Interviewer characteristics	What characteristics were reported about the inter viewer/facilitator? e.g. Bias, assumptions, reasons and interests in the research topic	Page 6 and 16
Domain 2: study design		
Theoretical framework		
9. Methodological orientation and Theory	What methodological orientation was stated to underpin the study? e.g. grounded theory, discourse analysis, ethnography, phenomenology, content analysis	Page 6
Participant selection		
10. Sampling	How were participants selected? e.g. purposive, convenience, consecutive, snowball	Page 6
11. Method of approach	How were participants approached? e.g. face-to-face, telephone, mail, email	Page 5
12. Sample size	How many participants were in the study?	Page 5
13. Non-participation	How many people refused to participate or dropped out? Reasons?	N/A
Setting		
14. Setting of data collection	Where was the data collected? e.g. home, clinic, workplace	Page 5
15. Presence of non-participants	Was anyone else present besides the participants and researchers?	N/A

16. Description of sample	What are the important characteristics of the sample? e.g. demographic data, date	Page 7 and 8
Data collection		
17. Interview guide	Were questions, prompts, guides provided by the authors? Was it pilot tested?	Supplementary file 2
18. Repeat interviews	Were repeat inter views carried out? If yes, how many?	N/A
19. Audio/visual recording	Did the research use audio or visual recording to collect the data?	Page 6
20. Field notes	Were field notes made during and/or after the inter view or focus group?	Page 6
21. Duration	What was the duration of the inter views or focus group?	Page 6
22. Data saturation	Was data saturation discussed?	N/A
23. Transcripts returned	Were transcripts returned to participants for comment and/or correction?	N/A
Domain 3: analysis and findings		
Data analysis		
24. Number of data coders	How many data coders coded the data?	Page 6
25. Description of the coding tree	Did authors provide a description of the coding tree?	N/A
26. Derivation of themes	Were themes identified in advance or derived from the data?	Page 6
27. Software	What software, if applicable, was used to manage the data?	N/A
28. Participant checking	Did participants provide feedback on the findings?	N/A
Reporting		
29. Quotations presented	Were participant quotations presented to illustrate the themes/findings? Was each quotation identified? e.g. participant number	Page 8 - 12
30. Data and findings consistent	Was there consistency between the data presented and the findings?	Page 13 - 14
31. Clarity of major themes	Were major themes clearly presented in the findings?	Page 8 - 12
32. Clarity of minor themes	Is there a description of diverse cases or discussion of minor themes?	Page 8 - 12