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# Understanding patient beliefs regarding the use of imaging in the management of low back pain

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## Abstract

**Background:** Imaging for low back pain (LBP) remains common despite guidelines recommending against routine imaging. Patient beliefs about imaging may contribute to the problem. This study aimed to quantitatively investigate patient beliefs regarding the need for imaging in managing LBP and to investigate whether personal characteristics, pain characteristics or back pain beliefs are associated with imaging beliefs.
**Methods:** A survey was performed of consecutive patients presenting to general medical practitioners in Sydney, Australia. Nine medical clinics were selected across varied socioeconomic regions. Survey questions assessed beliefs about the importance of imaging for LBP, collected demographic information, LBP history and general beliefs about back pain. Descriptive statistics and multivariate logistic regression were used to analyse findings.
**Results:** Three hundred completed surveys were collected with a 79.6% response rate. The mean age was 44 years and 60.7% of respondents were women. Exactly, 54.3% (95%CI: 48.7–58.9%) believed that imaging was necessary for the best medical care for LBP. Exactly, 48.0% (95%CI: 42.4–53.6%) believed that everyone with LBP should obtain imaging. Increased age, lower education level, non-European or non-Anglo-saxon cultural background, history of previous imaging and Back Beliefs Questionnaire scores were associated with beliefs that imaging was necessary.
**Conclusion:** Approximately, half of all patients presenting to a medical doctor consider low back imaging to be necessary. This may have important implications for overutilization of low back imaging investigations. Knowledge of the factors associated with the patient's belief that imaging is necessary may be helpful in designing appropriate interventions to reduce unnecessary imaging for LBP.

## 1. Introduction

International guidelines uniformly recommend against imaging for patients with low back pain (LBP) in the first 4–6 weeks unless serious pathology is suspected (Dagenais et al., 2010; Koes et al., 2010). It is estimated that serious causes of low back pain (e.g. fracture, cancer or infection) occur in less than 1% of primary care low back pain presentations (Henschke et al., 2009). Despite this, imaging rates for people presenting to a general medical practitioner (GP) with LBP are reported to be approximately 17-25% (Gonzalez-Urzelai and Lopez-de-

**What is already known about this topic?**
- Imaging is overused in the management of low back pain and patients' beliefs may contribute to this.
- Little evidence exists on patients beliefs about the importance of imaging for the management of low back pain.

**What does this study add?**
- Approximately half of all patients presenting to primary care believe that imaging is necessary in the management of low back pain.
- Older patients, those with a lower education level, non-European or Anglo-saxon cultural background, history of previous imaging or lower Back Beliefs Questionnaire scores are more likely to believe that imaging is necessary.

Munain, 2003; Williams et al., 2010; Mafi et al., 2013). High imaging rates may expose patients to unnecessary ionizing radiation, higher costs and have been shown to be associated with poorer patient outcomes (Chou et al., 2009).

Interventions aiming to reduce imaging rates have typically been directed at health practitioners with variable but generally poor results (Jenkins et al., 2015). One of the reasons reported by GPs for high diagnostic imaging rates is a belief that patients with LBP expect to be referred for imaging and consider this important to receiving good care (Shye et al., 1998; Buchbinder et al., 2009). It has been shown that patients who believe imaging to be important in the management of LBP are more likely to be referred for imaging (Espeland et al., 2001; Wilson et al., 2001). Despite the importance of patient beliefs about imaging for LBP, surprisingly little is known about how common it is for patients to consider imaging important, and what patient factors may be associated with different beliefs about imaging for LBP.

Few studies have investigated patients' beliefs about imaging. Available quantitative data suggest that approximately two of three people think that imaging is important in the management of LBP (Moffett, 2000; Espeland et al., 2001; Werner et al., 2008). However, data collection in these studies was performed more than 10 years ago, was restricted to beliefs about X-rays, rather than other types of low back imaging (i.e. CT and MRI) and was not performed in the most relevant setting for potential interventions (i.e. GP clinics). Almost nothing is known about patient factors that may be associated with different beliefs regarding imaging for LBP. It is plausible that personal demographic characteristics, pain characteristics or general LBP beliefs may be related to imaging beliefs. Several studies have investigated patient beliefs about LBP using the Back Beliefs Questionnaire (Buchbinder, 2001; Gross, 2006; Bowey-Morris et al., 2011; Bostick et al., 2013); however, the Back Beliefs Questionnaire does not specifically investigate beliefs about imaging. If we better understand the beliefs of people regarding imaging for LBP, including factors associated with these beliefs, then interventions can be developed which target the patient rather than, or as well as, the health practitioner.

Therefore, this study aimed to quantitatively investigate beliefs regarding the need for imaging in managing LBP in patients presenting to GPs and to investigate whether personal characteristics, pain characteristics or back pain beliefs may be associated with imaging beliefs.

## 2. Methods

### 2.1 Study design

A survey was performed of patients presenting to general medical practitioners, regardless of the reason for the consultation. The people most likely to potentially benefit from educational information about imaging for LBP are patients presenting to the GP for a current episode of LBP. However, a survey only addressing this group of patients would not allow us to assess whether beliefs were different in people with and without current LBP, or in those who do or do not choose to seek care for their LBP. Therefore, it was determined that the most appropriate group to survey would be patients presenting to the GP with any health complaint. This would include subsets of patients presenting to the GP for LBP; with a history of LBP; and those who had never had LBP and would allow for analysis of the relationship between these factors and imaging beliefs.

Multiple general medical practices across Sydney (New South Wales, Australia) were approached to be involved in the study. These were selected to ensure a spread of different socioeconomic regions, using the Socioeconomic Indexes for Areas data obtained from the Australian Bureau of Statistics (ABS, 2011). Data were collected from each practice on one or two occasions (half day). On these occasions, consecutive patients attending the medical practice were invited to participate. Ethics approval for this

 

research was given by the Macquarie University Human Research and Ethics committee (approval no.: 5201400333).

### 2.2 Procedure

Each medical practice was given the choice whether patients would be approached before or after consultation with the GP. Receptionists were asked to notify the researcher of any patients who should not be invited to participate in the survey (e.g. patient was very unwell). Consecutive patients were approached in the waiting room by a researcher and were given a brief explanation of the survey and consent form. If patients consented to participate, they completed the survey individually. Participants were also given the opportunity to complete the survey at home, in either paper or online format, if they preferred. Data were recorded regarding response rate and reasons for not participating.

### 2.3 Participant inclusion criteria

To be invited to participate in the survey, participants needed to be presenting to a GP for any health reason, be over 18 years of age and be able to understand English sufficiently to understand the consent procedure and to complete the survey.

### 2.4 Survey design

The survey collected information regarding patient demographics, including age, gender, educational level, health insurance status and cultural background. History of LBP was ascertained and further questions regarding the intensity of pain were adapted from the chronic pain grade questionnaire (Smith et al., 1997). Only patients reporting a history of LBP were questioned regarding pain intensity. General beliefs about LBP were assessed using the Back Beliefs Questionnaire (Symonds, 1996). Previously validated questionnaires regarding beliefs about imaging for LBP could not be found. Instead, individual questions from previously published work addressing this issue (Wilson et al., 2001; Werner et al., 2008) were modified for inclusion. The two questions were measured on a 5-point likert scale from strongly disagree to strongly agree. Imaging beliefs question one (Q1) asked respondents to indicate their level of agreement with the statement: 'X-rays or scans are necessary to get the best medical care for low back pain'. Imaging beliefs question two (Q2) asked respondents to indicate their level of agreement with the statement: 'Everyone with low back pain should have spine imaging (e.g. X-ray, CT or MRI)'. A copy of the complete survey is provided in Supporting Information Appendix S1.

### 2.5 Data analysis

Sample size calculations were performed and it was determined that a sample size of 300 would allow sufficient precision to detect differences of 11–15% in response frequencies across strata formed by patient characteristics. These calculations considered plausible prevalence (e.g. one strata contained 80% and the other 20% of participants) and agreement rates (e.g. 55% of one strata agreed vs. 40% in the other strata) likely to be encountered.

Survey responses were independently double-entered and imported into SPSS (IBM SPSS Statistics version 22) for statistical analysis. Background data for prevalence of LBP were calculated and compared to published LBP prevalence data (Walker et al., 2004; Hoy et al., 2010; Williams et al., 2010) to assess for a representative sample. Response rate data were reported as the percentage of patients invited who consented to partake in the survey and the percentage of those invited who returned completed surveys. Reasons for non-consent were assessed to investigate any possible areas of bias.

Descriptive statistics were used to assess the frequency of response to each of the five likert scale categories for the two primary questions regarding beliefs about imaging for LBP (Q1 and Q2). Results were also divided into those that either agreed or strongly agreed, compared to all other responses, and reported as percentages with 95% confidence intervals (95% CI).

Multivariate logistic regression analysis was used to assess for any association between 10 preselected predictor variables and beliefs about imaging for LBP and to adjust for possible confounders. The predictor variables were: age, gender, education level, health insurance status, cultural background, history of LBP, severity of LBP, presentation to the GP for LBP, previous imaging for LBP and the Back Beliefs Questionnaire score. Education level was dichotomized to those with tertiary level education and those below. Health insurance status was dichotomized to those covered by private health insurance and those only covered by public health insurance (Medicare). Cultural background was dichotomized to those from a European or Anglo-Saxon cultural background and those with a different cultural background. The Back Beliefs Questionnaire score was calculated as per standardized methods (Symonds, 1996) to give a

score between 9 and 45. A lower Back Beliefs Questionnaire score indicates poorer beliefs about LBP. Separate models were run using the two questions assessing beliefs about imaging (Q1 and Q2) as the dependent variables. The responses for Q1 and Q2 were dichotomized into strongly agree and agree (responses 4 and 5 on the likert scale) versus strongly disagree, disagree and neither agree nor disagree (responses 1–3 on the likert scale). Two separate models were built for each of the outcome questions by entering all 10 predictor variables into each model. Multicollinearity of the 10 predictor variables was assessed using a correlation matrix.

## 3. Results

### 3.1 Recruiting practices and participants

The surveys were conducted at nine different GP practices containing a total of 36 GPs across five New South Wales local health districts. Based upon 2011 Australian census data (ABS, 2011), two of the GP practices were in low socioeconomic areas, four were in middle socioeconomic areas and three were in high socioeconomic areas.

Survey responses were collected between June and October 2014. Data collection occurred on 15 separate days, with six clinics collecting data on two occasions, and the others on just one occasion. No more than 30 responses were collected on any one session. Only one of the nine clinics requested that patients were approached after the GP consult, with 7% of total respondents completing the survey after their consult; all of the other clinics preferred the researcher to approach patients in the reception area prior to the GP consultation.

Fig. 1 depicts the recruitment of patients into the survey; 93.8% of patients presenting to the GP clinics during periods of data collection were approached and invited to participate. Of the patients approached that met the study inclusion criteria, 79.6% consented to participate in the survey and 76.3% returned completed surveys. Only 7.5% of non-respondents declined to partake due to a lack of interest in the specific research topic.

The demographic and clinical characteristics of the survey respondents are shown in Table 1. Female respondents accounted for 60.7% of survey responses and the mean age of respondents was 44 years. Current LBP was reported in 18.7% of survey respondents and 79% reported a history of LBP. Current consultation with the GP for LBP was reported in 5.7% (95% CI 3.6–8.9) of respondents.

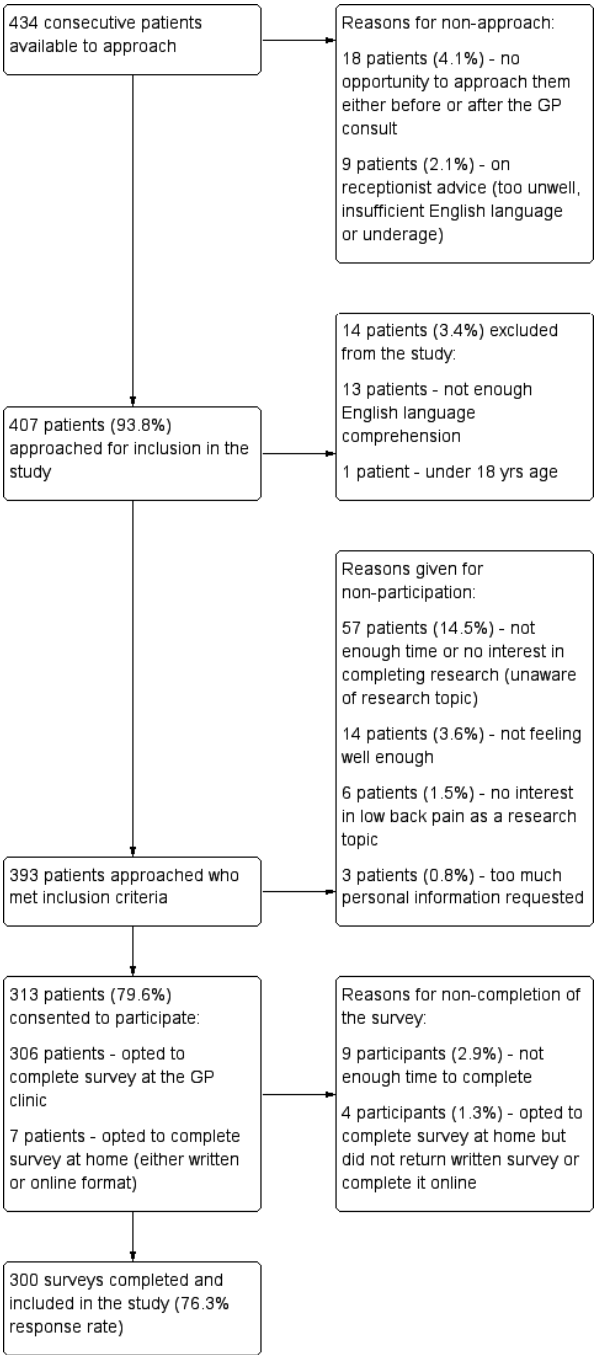


**Figure 1** Flow diagram of participant recruitment.

### 3.2 Beliefs about importance of imaging for LBP

The responses to the two questions regarding beliefs about imaging for LBP are depicted in Fig. 2. Exactly, 54.3% (95% CI: 48.7, 58.9) of respondents agreed or strongly agreed that X-rays or scans are

**Table 1** Demographics and low back pain characteristics of survey respondents.

| | |
|---|---|
| Age (mean, SD) | 44 (18.9) |
| Female (*N*, %) | 182 (60.7) |
| Secondary school not completed (*N*, %) | 19 (6.3) |
| Secondary school or trade completed (*N*, %) | 117 (39.0) |
| Tertiary qualification completed (*N*, %) | 164 (54.7) |
| Private health insurance (*N*, %) | 177 (58.9) |
| Anglo-Saxon or European cultural background (*N*, %) | 201 (67.0) |
| Currently experiencing low back pain (*N*, %) | 56 (18.7) |
| History of low back pain (*N*, %) | 237 (79.0) |
| Presenting at the GP for low back pain (*N*, %) | 17 (5.7) |
| Worst low back pain on a 10-point scale (median, IQR) | 6.0 (5) |
| Previous imaging for low back pain (*N*, %) | 98 (32.7) |
| Back beliefs score on scale from 9 to 45 (mean, SD) | 28.1 (6.8) |

SD: standard deviation; GP: general medical practitioner; IQR: interquartile range.

necessary to get the best medical care for low back pain and 48.0% (95% CI: 42.4, 53.6) of respondents agreed or strongly agreed that everyone with low back pain should have spine imaging. The distribution of responses to Q1 and Q2 was similar across the five response categories (Fig. 2).

### 3.3 Factors associated with beliefs about imaging for LBP

Analysis of associations with beliefs about imaging in LBP is shown in Table 2. Cultural background, previous imaging for LBP and the Back Beliefs Questionnaire score showed a statistically significant association with beliefs about imaging for LBP, regardless of which question was used as the outcome. Age demonstrated a statistically significant association for Q1 and was of borderline significance for Q2. Education level showed a statistically significant change for Q2 but did not reach statistical significance for Q1. Increased age, a lower education level, a non-European or Anglo-Saxon cultural background, history of previous imaging for LBP and a lower Back Beliefs Questionnaire score were associated with an increased belief in the need for LBP imaging for both Q1 and Q2. Gender, health insurance status, current LBP, presenting to the GP for LBP and level of worst LBP on a 10-point scale did not have meaningful effect sizes or reach statistical significance for an association with beliefs about imaging for LBP. The correlation coefficients of the independent variables were assessed. The highest correlation coefficient found was 0.39 between the level of LBP at worst and previous imaging for LBP, indicating that multicollinearity is not significant for this analysis.

## 4. Discussion

The primary finding of this study was that approximately half [Q1: 54.3% (95% CI: 48.7, 58.9); Q2: 48.0% (95% CI: 42.4, 53.6)] of patients presenting to a GP believed that imaging was necessary in the management of LBP. Current imaging guidelines recommend that imaging is unnecessary for initial presentations of non-specific LBP (Dagenais et al., 2010; Koes et al., 2010) and that serious causes of LBP are present in less than 1% of LBP presentations to primary care (Henschke et al., 2009). Less than a quarter of patients had beliefs consistent with these guidelines, disagreeing or strongly disagreeing that imaging is important for the management of LBP [Q1: 15.7% (95% CI: 12.0, 20.2); Q2: 23.4% (95% CI: 18.9, 28.4)]. Belief of increased need for imaging was seen in patients who: were older; had a lower educational background; had a non-European or non-Anglo-Saxon cultural background; had received previous imaging for LBP; and had a lower Back Beliefs Questionnaire score.

Key strengths of this study include high survey response rate and sampling of a variety of GP clinics and socioeconomic backgrounds. To our knowledge, this is the first study to look at beliefs regarding imaging for LBP in patients presenting to the GP. Invitation to participate in the survey was performed by a researcher, therefore, response rate could be accurately calculated and reasons for non-response could be assessed. Prevalence of low back pain in survey respondents was consistent with published data of an 18.1–25.6% point prevalence of LBP (Walker et al., 2004; Hoy et al., 2010) and a 79.2% lifetime prevalence of LBP (Walker et al., 2004).

Limitations of the study include the small number of patients presenting with current LBP or patients presenting to the GP for their back pain. Because of these small sample sizes, corresponding confidence intervals were wide, however, small effect sizes in these groups means it is unlikely that these factors are significantly associated with an increased belief in the importance of imaging. The questions regarding imaging for LBP were adapted from previous research questions (Wilson et al., 2001; Werner et al., 2008) but have not been formally validated. We included two slightly different questions as it was not clear from previous work which question was optimal. As expected results were similar for both questions, suggesting they measure a similar construct. Only for the variable of educational level were the results statistically significant for one question and not the other. We performed informal piloting of

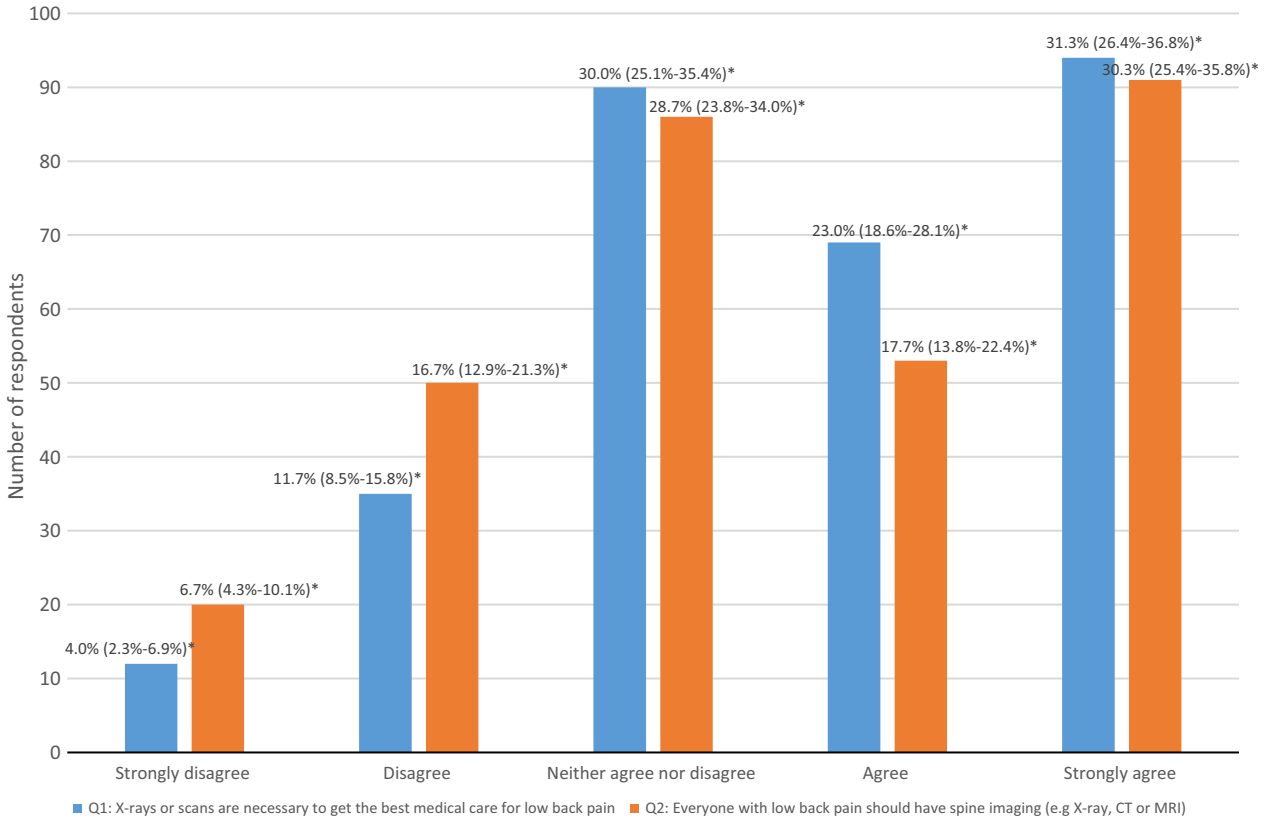


**Figure 2** Survey responses for questions regarding imaging for low back pain.

**Table 2** Factors associated with beliefs about imaging for low back pain.

| | Q1: X-rays or scans are necessary to get the best medical care for low back pain | | Q2: Everyone with low back pain should have spine imaging (e.g. X-ray, CT or MRI) | |
|---|---|---|---|---|
| Independent variable[a] | Odds ratio (95% confidence interval) | Statistical significance (*p*-value) | Odds ratio (95% confidence interval) | Statistical significance (*p*-value) |
| Older age, in decades | 1.30 (1.11, 1.52) | 0.00 | 1.17 (0.99, 1.37) | 0.06 |
| Male gender | 0.82 (0.48, 1.37) | 0.44 | 0.72 (0.41, 1.24) | 0.23 |
| Below tertiary level education | 1.47 (0.84, 2.58) | 0.18 | 2.09 (1.15, 3.80) | 0.02 |
| Public health insurance only (medicare) | 1.31 (0.76, 2.27) | 0.32 | 1.16 (0.66, 2.06) | 0.60 |
| Non-European or non-Anglo-Saxon cultural background | 2.01 (1.07, 3.77) | 0.03 | 2.07 (1.06, 4.05) | 0.03 |
| Current low back pain | 1.19 (0.54, 2.65) | 0.66 | 0.74 (0.32, 1.70) | 0.48 |
| Presenting to GP for low back pain | 1.07 (0.30, 3.82) | 0.91 | 0.98 (0.27, 3.48) | 0.97 |
| Low back pain at worst (10-point scale) | 0.96 (0.88, 1.05) | 0.37 | 0.92 (0.84, 1.01) | 0.07 |
| Previous imaging for low back pain | 2.08 (1.11, 3.91) | 0.02 | 2.81 (1.43,5.51) | 0.00 |
| Higher Back Beliefs Questionnaire score[b] | 0.96 (0.92, 1.00) | 0.04 | 0.90 (0.86, 0.94) | 0.00 |

[a]The tested independent variable is indicated in brackets.

[b]Back beliefs questionnaire score out of 45; the lower the score the poorer the beliefs about low back pain.

the two questions prior to use and study participants did not report difficulties interpreting the simple questions. The study was powered to detect absolute differences in response rate of 11–15% between groups. There is a lack of previous research into this area to help determine a minimum clinically important difference. Our decision was based on the smallest difference we believed is likely to be important given the high prevalence of back pain, frequency of imaging and costs involved. Exclusion of

 

non-English-speaking people may have affected the results of the study; however, only 13 from 407 people (3.2%) were excluded for this reason. Current consultation for LBP in survey respondents (5.7%) was higher than previously reported Australian data of 2.3% of all GP consults being for LBP (Williams et al., 2010). This may suggest that more people completed the survey if they had current LBP; however, the response rate to the survey was high and only 1.5% of patients approached refused to complete the survey due to a lack of interest in the topic. A small number of patients (7%) completed the survey after seeing the GP. While it is possible this may have influenced the results, we believe this is unlikely especially as only 5.7% of patients were attending for current LBP. Patients were asked to recall previous history of LBP and recall bias may have affected these results. No attempt was made to determine whether previous LBP was due to non-specific or serious causes; however, the low prevalence of serious LBP means that it is unlikely that this would have affected the final results. Finally, the study was only performed in one geographic region within Australia and the generalizability to other regions and countries is unclear. Sydney is a geographically large city and is culturally and socioeconomically diverse. GP clinics from different socioeconomic regions were recruited to gain a representative sample of patients presenting to the GP.

Three previous studies have quantitatively investigated beliefs regarding the need for imaging in LBP. Espeland et al. (2001) surveyed 93 Norwegian patients who had been referred for radiographs of the lumbosacral spine. The patients were asked to rate whether they thought it was slightly, fairly or very important for them to receive radiographs; 72% of patients rated radiography as very important. While the results are not easily compared to our study, they seem relatively consistent considering all of the patients questioned had been referred for imaging for current LBP. Werner et al. (2008) and Moffett (2000) surveyed the general population in Norway and England, respectively. Werner et al. (2008) surveyed 1506 people across three different time points in 2002, 2004 and 2005 using a likert scale similar to the current survey. They found that an average of 70.5% (range: 67.7–72.7%) of people surveyed believed that everyone with LBP should have a spine X-ray. Moffett (2000) surveyed 507 people in 1996 using a 'yes' or 'no' response to indicate agreement with the test statement. They found that 65.8% of people surveyed would expect their GP to send them for an X-ray for LBP. These findings are higher than the responses in this study. Similar respondent demographics were noted between the studies except for educational background: an average of 34.3% of respondents had tertiary qualifications in Werner et al. (2008), compared to 54.7% in this study. Other factors that may account for the differences in response are the different sample selection (whole population vs. GP population), differences in geographic location (Norway and England vs. Australia) and differences in the year the study was performed (1996 and 2002–2005 vs. 2014). Within the previous decade, strategies have been implemented to try and decrease imaging for LBP (Buchbinder, 2001; Jenkins et al., 2015; Werner et al., 2008); however, public beliefs regarding the importance of imaging still remain high.

The results of the current study indicate that approximately half of patients presenting to a GP clinic believe that imaging is necessary in the management of LBP. It has been previously shown that these beliefs can lead to an increase in utilization of imaging (Espeland et al., 2001; Wilson et al., 2001); therefore, it is likely that this is a factor in the overuse of imaging in the primary care management of LBP. Interventions to decrease imaging for LBP have been largely directed at the GP with variable but generally poor results (Jenkins et al., 2015). Strategies designed to modify imaging behaviour should, therefore, not be aimed solely at GPs but also at patients presenting to the GP for management of LBP. Interventions or resources which help GPs to explain to patients that imaging is not helpful in the management of most LBP may be effective and should be investigated.

A stronger belief in the need for imaging was associated with increasing age, lower educational background and non-European or Anglo-Saxon cultural background. Education interventions designed for patients should take these factors into consideration and ensure that the education strategy appropriately targets these groups. Poor general beliefs about LBP, as measured on the Back Beliefs Questionnaire, were also associated with increased belief in the need for imaging. Therefore, it seems logical that we may need to educate patients about back pain generally (e.g. pain does not mean there is structural damage), as part of the education about imaging not being important in most cases of LBP.

The factor most associated with belief in the need for imaging was previous imaging of the low back. This implies that a negative cycle may develop between these two factors that needs to be considered and addressed. It would be interesting to assess

whether this cycle is simply a result of previous imaging or occurs as a result of the patient's beliefs about LBP being influenced by the GP who had previously ordered imaging. Since current strategies targeting GPs do not seem to be sufficient to reduce overuse of imaging, patient or population education should be further considered to potentially limit the initiation of this negative cycle.

## 5. Conclusion

This study indicates that approximately half of all patients presenting to a GP consider imaging to be necessary in the management of LBP. This may have important implications for overutilization of low back imaging investigations. An increased belief in the need for imaging was associated with older age, lower educational background, non-European or Anglo-Saxon cultural background, previous imaging for LBP and a lower Back Beliefs Questionnaire score. Knowledge of these associations may be helpful in designing appropriate interventions to improve beliefs about imaging.

### Author contributions

All authors contributed to the design of the study, interpretation of the data, revision of the manuscript for content and final approval of the manuscript. Conception of the study was performed by H.J. and M.H. Data collection and analysis was performed by H.J. All authors discussed the results and commented on the manuscript.

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## Supporting Information

Additional Supporting Information may be found in the online version of this article at the publisher's web-site:

**Appendix S1.**Survey questions.