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Does health literacy affect patients' receipt of preventative primary care? A multilevel analysis

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Abstract

Background: People with limited health literacy are more likely to be socioeconomically disadvantaged and have risk factors for preventable chronic diseases. General practice is the ideal setting to address these inequalities however these patients engage less in preventive activities and experience difficulties navigating health services. This study aimed to compare primary care patients with and without sufficient health literacy in terms of their lifestyle risk factors, and explore factors associated with receiving advice and referral for these risk factors from their GPs.

Methods: A mailed survey of 739 patients from 30 general practices across four Australian states was conducted in 2012. Health literacy was measured using the Health Literacy Management Scale. Patients with a mean score of <4 within any domain were defined as having insufficient health literacy. Multilevel logistic regression was used to adjust for clustering of patients within practices.

Results: Patients with insufficient health literacy (n = 351; 48%) were more likely to report being overweight or obese, and less likely to exercise adequately. Having insufficient health literacy increased a patient's chance of receiving advice on diet, physical activity or weight management, and referral to and attendance at lifestyle modification programs. Not speaking English at home; being overweight or obese; and attending a small sized practice also increased patients' chances of receiving advice on these lifestyle risks. Few (5%, n = 37) of all patients reported being referred to lifestyle modification program and of those around three-quarters had insufficient health literacy. Overweight or obese patients were more likely to be referred to lifestyle modification programs and patients not in paid employment were more likely to be referred to and attend lifestyle programs.

Conclusion: Patients with insufficient health literacy were more likely to report receiving advice and being referred by GPs to attend lifestyle modification. Although the number of patients referred from this sample was very low, these findings are positive in that they indicate that GPs are identifying patients with low health literacy and appropriately referring them for assistance with lifestyle modification. Future research should measure the effectiveness of these lifestyle programs for patients with low health literacy.

Keywords: Health literacy, Obesity, Nutrition, Physical activity, Weight, Primary health care, Behavioural risk factors

Background

Health literacy is defined by the Institute of Medicine as 'the degree to which individuals have the capacity to obtain, process and understand basic health information and services needed to make appropriate health decisions' [1]. Health literacy assessment is frequently based on functional measures that determine basic reading skills, skills for discussing and understanding text, and being able to do numerical calculations [2]. Levels of health literacy in a population will therefore be dependent on the type of measurement used. For example, the 2006 Adult Literacy and Life Skills Survey (Australia) found 60% of adults to be performing at the lowest levels of health literacy when assessed for prose literacy, document literacy, numeracy and problem solving [2]. In contrast, the National Assessment of Adult Literacy (NAAL USA

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2003) used the same methods of measurement and determined the majority of adults (53%) to have intermediate health literacy when classified as proficient, intermediate, basic and below basic [3].

There is consistent evidence of an association between an individual's level of health literacy and their health behaviours most notably decisions and actions about their lifestyle behaviour [4]. People with insufficient health literacy engage less in health promoting behaviours and are more likely to smoke especially in adolescence and as young adults [5], are less likely to eat the recommended portions of fruit and vegetables a day [4], and are more likely to report having diabetes, cardiac disease or stroke [6], lower socioeconomic status [7] and cultural and linguistic diversity [8].

People with insufficient health literacy also commonly experience difficulties navigating health services, they delay accessing health services and tend not to seek preventive health care [4]. They also tend to limit their conversational engagement with health care providers to cover up their low literacy [9]. Even when they do seek preventive care, these patients often do not receive or are not referred to interventions of sufficient intensity and duration to achieve physiological changes, and fail to maintain changes due to lack of follow up and support [10]. This may be partly due to provider factors, because providers communicate less well with people with low health literacy, do not fully explain conditions or processes related to care and incorrectly assume these patients are either not interested, or desire a less active role in their health care [11,12].

Prevention of chronic disease is a top priority in Australia [13,14]. As general practitioners (GPs) provide clinical services to approximately 88% of the population annually [15], a GP consultation provides a good opportunity to provide interventions for patients with physiological and behavioural risk factors for chronic diseases [16]. GPs in Australia are encouraged through funding initiatives provided through Medicare to fully assess behavioural risk factors for patients aged 45 and over. Inherent in this is a clinical judgement to initiate appropriate referrals for the management of these risk factors [17]. Planned health checks in middle-aged adults have been demonstrated to improve the frequency of management of smoking, nutrition, alcohol and physical activity behavioural risk factors and the Royal Australian College of General Practitioners (RACGP) provide recommendations for GPs to optimally address risk factor management [18].

Providing individuals with health information and actively involving them in health decisions are key components of patient centred health care that enhances capability for self-management. Active involvement is however unlikely to be achieved if patients have suboptimal health literacy [19].

There has been relatively little research focused on ways to improve the provision of preventive care in routine primary care practice for patients with insufficient health literacy [20]. There are a number of models and frameworks which attempt to describe the variables that predict health literacy or describe outcomes associated with various levels of health literacy [21]. Traditionally the medical model view has been one where health literacy is a risk factor leading to poor compliance [22] and one that requires management to achieve positive health outcomes [23]. The opposing public health/health promotion perspective is to view health literacy as an asset on which to build and promote an individual's control over their own health care [1,22]. This latter view encompasses the notion that health literate practices involve not only functional literacy skills but communicative and social skills that can be applied to changing circumstances; and higher level cognitive skills and social skills (critical literacy), that supports critical analysis of information, and allows the individual to exert greater control over life events and situations [24].

Recent research suggests that there are several evidence-based strategies that can be beneficial when provided to patients in primary care settings. Brief interventions based on a patient's 'readiness to change' have been shown to be effective especially in relation to smoking [25,26]. Particularly the structured framework of the 5As (assess, advice, agree, assist and arrange), is promoted for use by the RACGP for Australian GPs [18]. Interventions provided at the general practice level may also be supplemented by more intensive programs in lifestyle modification provided by associated community services via referral from the GP [27].

In this study we assessed a group of patients enrolled in the Preventive Evidence into Practice (PEP) study at baseline to determine if there were any differences between patients with and without sufficient health literacy as to their lifestyle risk factors, their receipt of advice on risk factors and the levels of referral to, and attendance at, lifestyle modification programs. We also examined any association between other patient and practice characteristics and these preventive activities. We hypothesize that people with insufficient health literacy would have worse lifestyle risk factors and receive less preventative health care from their GPs, compared to patients with sufficient health literacy.

Methods

We used the Health Literacy Management Scale (HeLMS) to measure health literacy. HeLMS is a patient completed instrument containing 5 point Likert scales assessing the level of 'difficulty' experienced with 29 items across 8 domains (with a range from 1: 'unable to perform at all', to 5 'experiencing no difficulty'). Five of the eight domains

focus on individual abilities: patient's attitude towards health, ability to understand health information, communication skills and pro-activeness, and skills in using health information. The remaining three domains focus on broader factors that influence these abilities: patient's level of social support, socioeconomic status, and access to GP healthcare. A mean score within a domain of less than 4 is regarded as a 'flag' to indicate that an individual may require assistance [28]. The HeLMS was chosen for this study as it is an Australian based tool and it utilises a framework informed by interviews from patients from primary care and other healthcare settings. The tool also assesses knowledge beyond that of functional literacy including where to seek health information, the ability to be proactive in seeking or understanding health information, and the capacity to retain, process and apply information [19].

The PEP study is a cluster randomised controlled trial examining uptake of guidelines for preventive care of vascular disease and diabetes in general practice. The methods have been described elsewhere [29]. It was conducted in four Australian states: New South Wales, Queensland, Victoria and South Australia. Thirty two practices (eight from each state) were recruited to the study but two practices withdrew prior to data collection. A random selection of 160 patients (without known cardiac disease, stroke or diabetes) aged between 40–69 years were invited by mail to participate in the study from each of the 30 general practices (4800 patients in total). Patients self-reported their risk factors (weight, diet, smoking and alcohol status and physical activity), and the support and referral received from their GP in the three months prior via a patient survey.

Of the sample 739 (15%) patients provided consent and completed the baseline survey. A comparison of demographic data of the participants in our survey and those from clinical audit data from 27 of the 30 practices is provided in Table 1. The patients participating in the survey were more likely to be older and female compared to patients from the clinical audit.

Table 1 Age and gender comparison of participating patients

	Clinical audit data N (%)	Consenting patients N (%)
Age group in years		
40-44	6472 (21.1)	92 (12.6)
45-49	6043 (19.7)	102 (13.9)
50-54	5898 (19.2)	127 (17.3)
55-59	5014 (16.3)	140 (19.1)
60-64	4353 (14.2)	156 (21.3)
65-69	2925 (9.5)	112 (15.3)
70	0	3 (0.4)
Mean age (95% CI)	52.50 (52.42-52.60)	55.47 (54.86-56.07)
Sex		
Male	12552 (40.9)	225 (30.6)
Female	18153 (59.1)	509 (69.4)

Data and variables

The independent variables were dichotomous patient and practice characteristics and patient stated risk factors. These fifteen variables (Table 2) were considered for their potential association with obtaining advice, referral to and attendance at lifestyle modification programs focussing on diet, physical activity or weight loss.

Patients who had a mean score of <4 in any of the eight average domain scores of HeLMS were considered as having insufficient health literacy. Any current smoking was defined as a smoking risk; diet risk was defined as eating ≤6 serves of fruits and vegetables daily and alcohol risk was defined as drinking more than two standard drinks in a typical day [30]. Physical activity scores were calculated using the frequency of vigorous and moderate physical activity per week (scored from 0 to 8). A score of less than 4 was considered inadequate activity levels in accordance with Australian guidelines [31]; and weight risk was defined as having a Body Mass Index (BMI) of ≥25 [32]. The practice characteristics consisted of two variables: practice size (<5 GPs or ≥5 GPs) [33] and practice location according to Australian Standard Geographical Classification-Remoteness Areas 2006 (state capital cities compared with inner regional areas) [34]. People not in labour force included full-time students, those looking after their family, unable to work due to sickness or disability, retired and unemployed. The variable 'smoking risk' was not included in the analysis owing to its very low prevalence in the study population.

The dependent variables were also patient reported and they were: receiving advice on diet, physical activity or weight management from their GPs; being referred to lifestyle programs for diet, physical activity or weight and attending such programs, in the three months preceding the survey. These lifestyle programs could include any service, program or referral to a health professional directed at weight management, healthy eating or physical activity.

Any form of verbal or written advice from GPs of the practice from which the patient was recruited was considered as advice and any type of formal or informal referral from GPs from the same practice was considered as referral. Self-referrals were also included in attendance at lifestyle modification programs since this may have been initiated from GP or practice nurse recommendations.

Statistical analysis

After calculating descriptive statistics (frequency, percentage, mean and standard deviation), we conducted

Table 2 Patient and practice characteristics

Variables (N = 739)	Categories	n	%
Patient demographics			
Age (n = 732)	40-54 years	321	43.9
	55-70 years	411	56.1
Sex (n = 734)	Female	509	69.3
	Male	225	30.7
Place of birth (n = 733)	Australia	552	75.3
	Outside Australia	181	24.7
Language (N = 731)	Speaks English at home	704	96.3
	Speaks a language other than English at home	27	3.7
Education (n = 732)	No university degree	478	65.3
	University degree	254	34.7
Employment (n = 725)	In labour force	474	65.4
	Not in labour force	251	34.6
Owner of own accommodation (n = 734)	Yes	661	90.1
	No	73	9.9
Patient risk factors			
Sufficient Health Literacy (n = 726)^	Yes	375	51.7
	No	351	48.3
Smoking risk (n = 734)^^	Yes	63	8.6
	No	671	91.4
Diet risk (n = 724)*	Yes	582	80.4
	No	142	19.6
Alcohol risk (n = 725)**	Yes	190	26.2
	No	535	73.8
Physical activity risk (n = 728)#	Yes	404	55.5
	No	324	44.5
Weight risk (n = 703)##	Yes	415	59.0
	No	288	41.0
Practice characteristics			
Practice size (n = 739)	Less than 5 GPs (17 practices)	403	54.5
	5 or more GPs (13 practices)	336	45.5
Practice location (n = 739)	State capital cities (28 practices)	695	94.0
	Inner regional (2 practices)	44	6.0

^A mean score of <4 in any of the eight average domain scores of HeLMS as having insufficient health literacy.
^^Current smokers as having risk.
*Eating ≤6 serves of fruits and vegetables daily as having risk.
**Drinking >2 standard drinks in a day as having risk.
#A score of <4 in the sum of vigorous and moderate physical activity as having risk.
##A BMI of ≥25 as having weight risk.

multilevel analysis to determine the differences between patients with and without sufficient health literacy regarding their lifestyle risk factors; advice on management of risk factors; referral to lifestyle modification programs; and attending such programs after adjusting for clustering. We also calculated unadjusted odds ratio and 95% confidence intervals using standard logistic regression models to examine the association between the independent variables and 1) advice on diet, physical activity or weight 2) referral to lifestyle programs and 3) attendance at lifestyle programs.

Initially, we fitted a baseline variance component or empty multilevel model (no independent variables) for each of the dependent variables followed by the multilevel model with independent variables. The significance of the fixed and random parameter variance estimates

(practice variance) was assessed using the Wald joint $\chi 2$ test statistic [20]. The proportion of the practice level variance explained for each model was estimated as the difference in practice variance between baseline model (empty model) and each model with independent variables divided by the practice variance for the baseline model. All multi-level models were performed using MLwiN version 2.25 [35].

The study was approved by the National Research and Evaluation Ethics Committee of the Royal Australian College of General Practitioners (NREEC 10–002), and ratified by the Institutional Ethics Committees of participating universities. The study was registered with the Australian New Zealand Clinical Trials Registry (ACTRN: ACTRN12612000578808) (http://www.ANZCTR.org.au/ACTRN12612000578808.aspx).

Results

Patient and practice characteristics

Of the 739 patients responding to the survey, more than half (56%) were aged 55–70 years. This included three patients who had turned 70 between the time of recruitment and the data collection. Of these 69% were female, 75% were Australian born, the majority were English speaking (96%) and owned their homes (90%), 65% were in paid employment and 35% had a university degree. Of the 30 practices recruited, 17 practices had <5 GPs and 28 practices were located in the state capital cities. The median number of patients per practice was 25.5 (IQR = 13.8-35.0) (Table 2).

Patient reported health literacy and lifestyle risks and their association with obtaining advice, referral and attendance at diet, physical activity or weight programs

Overall, 48% of the patients had insufficient health literacy in at least one of the eight domains of HELMS (Tables 2 and 3). Forty-one percent of the patients had low scores in attitudes towards improving their health and lifestyle; 14% did not have social support for maintaining and improving their health; and 10% were not proactive concerning their health care (Table 4).

Table 3 Multiplicity distribution of HeLMS domains with insufficient health literacy

Number of domains with insufficient health literacy	% of patients with this count
0	51.9
1	31.5
2	10.2
3	4.8
4	1.8
More than 4 domains	0.8

Table 4 Baseline health literacy

Health literacy domain	Mean (SD)	% with insufficient HL (<4, that is, having moderate, or extreme difficulty, or completely unable)
Patient attitudes towards health	3.97 (0.78)	41.0
Understanding health information	4.91 (0.33)	1.4
Social Support	4.58 (0.80)	13.8
Socioeconomic considerations	4.78 (0.53)	5.9
Accessing general practitioner healthcare services	4.99 (0.11)	0.3
Communication with health professionals	4.87 (0.39)	2.7
Being proactive	4.64 (0.72)	10.3
Using health information	4.87 (0.34)	2.3

Regarding patient reported lifestyle risks, 80% of the patients reported not consuming sufficient fruit and vegetables, 59% were overweight or obese, 55% did not exercise adequately, 26% consumed alcohol at a risky level and 9% smoked (Table 2). Sixteen percent of patients (n = 115) said they had received advice on nutrition, physical activity and/or weight in the previous 3 months, 5% (n = 37) reported having been referred to lifestyle management programs or services on diet, weight management or physical activity and a further 2% of patients (n = 13) reported self-initiated attendance. Overall 7% (n = 48) attended such programs following referrals, including self-referrals.

Compared to patients with sufficient health literacy, patients with insufficient health literacy were two times less likely to exercise adequately (OR = 1.81; 95% CI 1.34 to 2.43; $P < 0.001$) and two times more likely to be overweight or obese (OR = 1.86; 95% CI 1.36 to 2.54; $P < 0.001$). They were twice as likely to be given information on lifestyle risk factors by their GPs (OR = 1.98; 95% CI 1.32 to 2.98; P =0.002), and three times more likely to be referred to lifestyle programs by their GPs (OR = 2.86; 95% CI 1.36 to 6.04; P =0.006) and to attend such referrals (OR = 2.93; 95% CI 1.51 to 5.69; P = 0.002) (Table 5). The results were reported after adjustment for clustering effect.

Six variables showed statistically significant association with receipt of advice on diet, physical activity or weight in the univariate analysis: health literacy, gender of patients, non-English speaking at home, weight risk, practice size and practice location. However, only four of these variables retained their significance in the multilevel analysis after adjustment for confounding and cluster effects (Table 6). In the multilevel analysis, patients with insufficient health literacy had more than one and a half times greater odds of reporting that they

Table 5 Health literacy status of patients and their risk factors after adjustment for cluster effect

	Physical activity risk; n = 715	Diet risk; n = 711	Alcohol risk; n = 712	Weight risk; n = 690	Given advice on lifestyle changes; n = 726	Referred to lifestyle programs; n = 726	Attended referral to lifestyle programs; n = 726
	n (%)	n (%)	n (%)	n (%)	n (%)	n (%)	n (%)
Patients with insufficient health literacy; n = 351	218 (63.0)	284 (82.8)	100 (28.9)	222 (67.1)	71 (20.2)	27 (7.7)	35 (10.0)
Patients with sufficient health literacy; n = 375	179 (48.5)	286 (77.7)	85 (23.2)	185 (51.5)	43 (11.5)	10 (2.7)	13 (3.5)
Odds Ratio (Patients with sufficient health literacy as reference category)	1.81 (1.34 to 2.43)	1.38 (0.95 to 2.01)	1.61 (0.84 to 3.09)	1.86 (1.36 to 2.54)	1.98 (1.32 to 2.98)	2.86 (1.36 to 6.04)	2.93 (1.51 to 5.69)
P-value	<0.001	0.088	0.150	< 0.001	0.002	0.006	0.002

P-values after adjustment for clustering using multilevel analysis.
% was reported for patients with insufficient and sufficient health literacy.

received advice on diet, physical activity or weight from their GPs than patients with sufficient health literacy (OR = 1.71; 95% CI 1.10 to 2.65). Similarly, patients who did not speak English at home had around five times the odds of receiving such advice compared to those who spoke English at home (OR = 4.79; 95% CI 1.99 to 11.55), and overweight or obese patients had two and a half times greater odds of receiving such advice than patients with normal range BMI (OR = 2.53; 95% CI 1.52 to 4.22). Also, patients attending a practice with 5 or more GPs had 43% lower odds of receiving advice compared to the patients attending a practice with fewer than 5 GPs (OR = 0.57; 95% CI 0.35 to 0.93).

Participation in the labour force, patients' level of health literacy and weight risk were associated with patients being referred to lifestyle modification programs in both the univariate and multilevel analysis (Tables 6). Patients with insufficient health literacy had three times greater odds of being referred compared to those having sufficient health literacy (OR = 3.09; 95% CI 1.38 to 6.91). In addition, the likelihood of patients not involved in the labour force or having weight risk being referred were also greater (OR = 2.99; 95% CI 1.43 to 6.22 and OR = 2.96; 95% CI 1.13 to 7.79 respectively) than those in the labour force or with normal range BMI.

Five variables showed an association that was statistically significant with the attendance at lifestyle modification programs in the univariate analysis: age of patients, employment, health literacy, weight risk and practice size. Of these, only health literacy and not being in the labour force remained significant in the multilevel analysis. Patients with insufficient health literacy had 3.4 times greater odds of attending lifestyle modification programs than patients who had sufficient health literacy (OR = 3.44; 95% CI 1.69 to 7.00). Patients not involved in the labour force had twice the odds of attending such programs following referral compared to their counterparts (OR = 2.04; 95% CI 1.04 to 4.02). Overall patient and practice variables explained 43% of the practice variance of the attending referrals to lifestyle programs (Table 6).

Discussion

People with socioeconomic disadvantage experience higher mortality, suffer more ill health and are less likely to prevent disease or detect it at an asymptomatic stage [36]. The optimal model of primary care is one in which opportunistic preventive care is provided to all patients with targeted preventive health checks at particular life stages and for higher risk individuals [37]. Being able to recognise low health literacy is important in general practice as there is good evidence that tailoring health related communication to those with low health literacy can improve health outcomes [38].

We found that almost half the patients in this study met the criteria for insufficient health literacy. This is consistent with studies in primary care in other developed countries [39] and the prevalence reported in the Australian community [40]. We found that those with insufficient health literacy were more likely to report being overweight or obese and have inadequate levels of physical activity, which is also consistent with current evidence and supports our study hypothesis. Incongruously for this sample the level of social disadvantage was relatively low.

Although our participants reported very similar lifestyle risk levels to previous Australian general practice studies (just over 50%), advice concerning these risk factors was offered to only 16% of the cases. Moreover the overall level of reported referral by the GP to address risk factors was particularly low (5%). Only 48 people reported attending lifestyle modification programs for weight, physical activity and nutrition and of these 13 initiated this referral themselves.

As this sample came from general practices in four Australian states, this result indicates there is still considerable scope on their part for improved identification

Table 6 Factors associated with obtaining advice, being referred and attending referral using unadjusted univariate and adjusted multilevel analysis

Parameters (reference category)	Advice on lifestyle changes			Referral to lifestyle programs			Attendance at referral to lifestyle programs		
	% getting advice (ref cat)	Unadjusted OR (95% CI)	#Adjusted OR (95% CI)	% being referred (ref cat)	Unadjusted OR (95% CI)	#Adjusted OR (95% CI)	% attending (ref cat)	Unadjusted OR (95% CI)	#Adjusted OR (95% CI)
Demographics									
Age, years 55–70 (40–54)	13.9 (18.1)	0.73 (0.49 to 1.09)	-	6.1 (3.7)	1.67 (0.83 to 3.37)	-	8.5 (4.0)	2.21 (1.15 to 4.24)	1.92 (0.91 to 4.30)
Male patients (female)	21.8 (13.0)	1.87 (1.24 to 2.81)	1.36 (0.86 to 2.14)	5.8 (4.7)	1.24 (0.62 to 2.48)	-	7.6 (6.1)	1.26 (0.68 to 2.33)	-
Born outside Australia (Australian born)	15.5 (15.8)	0.98 (0.62 to 1.56)	-	5.5 (4.9)	1.14 (0.54 to 2.40)	-	9.4 (5.6)	1.74 (0.94 to 3.23)	-
Non-English speaking at home (English speaking at home)	37.0 (14.8)	3.40 (1.51 to 7.62)	4.79 (1.99 to 11.55)	7.4 (5.0)	1.53 (0.35 to 6.72)	-	14.8 (6.0)	2.74 (0.91 to 8.29)	-
No university education (having university education)	15.9 (15.4)	1.04 (0.69 to 1.59)	-	5.2 (4.3)	1.22 (0.59 to 2.52)	-	7.3 (4.7)	1.59 (0.81 to 3.13)	-
Non-participation in labour force (in labour force)	17.9 (14.3)	1.30 (0.86 to 1.97)	-	8.8 (3.2)	2.90 (1.50 to 5.78)	2.99 (1.43 to 6.22)	10.4 (4.6)	2.37 (1.32 to 4.28)	2.04 (1.04 to 4.02)
Home owner (not owning their home)	16.0 (12.3)	1.36 (0.66 to 2.81)	-	4.7 (8.2)	0.55 (0.22 to 1.37)	-	6.2 (9.6)	0.62 (0.27 to 1.45)	-
Patient risk factors									
Insufficient health literacy (sufficient health literacy)	20.2 (11.5)	1.96 (1.30 to 2.95)	1.71 (1.10 to 2.65)	7.7 (2.7)	3.04 (1.45 to 6.38)	3.09 (1.38 to 6.91)	10.0 (3.5)	3.08 (1.60 to 5.93)	3.44 (1.69 to 7.00)
Diet risk (having adequate fruits and vegetables intake)	16.3 (11.3)	1.54 (0.87 to 2.70)	-	4.8 (5.6)	0.85 (0.38 to 1.90)	-	6.2 (7.7)	0.79 (0.39 to 1.58)	-
Alcohol risk (drinking ≤2 standards drinks in a day)	16.8 (15.3)	1.12 (0.72 to 1.75)	-	4.7 (5.0)	0.94 (0.43 to 2.03)	-	5.3 (6.9)	0.75 (0.36 to 1.54)	-
Physical activity risk (doing adequate physical activity)	16.8 (13.3)	1.32 (0.88 to 2.00)	-	5.0 (4.6)	1.07 (0.54 to 2.13)	-	6.7 (5.6)	1.22 (0.66 to 2.25)	-
Weight risk (having normal range BMI)	20.0 (8.3)	2.75 (1.70 to 4.45)	2.53 (1.52 to 4.22)	7.2 (1.7)	4.41 (1.69 to 11.51)	2.96 (1.13 to 7.79)	8.7 (3.5)	2.64 (1.29 to 5.41)	1.87 (0.89 to 3.95)
Practice characteristics									
5+ GPs (<5 GPs)	11.3 (19.1)	0.54 (0.36 to 0.82)	0.57 (0.35 to 0.93)	3.3 (6.5)	0.49 (0.24 to 1.01)	-	4.2 (8.4)	0.47 (0.25 to 0.90)	0.42 (0.16 to 1.07)
State capital cities (inner regional)	14.8 (27.3)	0.46 (0.23 to 0.93)	0.63 (0.28 to 1.41)	5.0 (4.5)	1.11 (0.26 to 4.79)	-	6.3 (9.1)	0.68 (0.23 to 1.98)	-
Between provider variance (SE*)		-	0.022 (0.092)		-	0.781 (0.464)		-	0.645 (0.375)
Explained variance** (%)		-	19.1		-	13.2		-	43.3

#Adjusted for significant confounding factors including practice characteristics and cluster effect using multilevel analysis.
*Standard error.
**Explained between practice variance using the variance in the empty model as reference.

of patients at risk, and for the provision of well-designed individually tailored patient advice. What is interesting is that 27% of those attending lifestyle modification programs showed self-initiative in seeking out these programs which was perhaps a lost opportunity on behalf of the GPs. It is possible however that for some of these the initiating factor may have been information or recommendation received more informally than a referral from their GP or practice nurse.

We have no information regarding the scope of the interaction that occurred between this group of patients and their GPs and this would be a valuable option for further research. It is also possible that our participants may have had a higher level of motivation generally as this was not measured in this study.

A considerable body of research indicates that the interaction between providers and patients with low health literacy is often poor [9,11,12] but surprisingly those patients in our study with insufficient health literacy were nearly two times more likely to report being given lifestyle advice and over three times more likely to be referred for, and attend lifestyle modification programs. Although contrary to our study hypothesis, this is a positive finding, suggesting that for this group of patients at least there is heightened identification on the part of GPs and recognition that some form of external advice and support may be required. Again we are unable to comment about the quality or degree of the interaction that occurred in these instances and the numbers in this study are too small to generalise. This does to some degree support the notion of an asset based concept in health literacy as these patients indicate an aptitude for self-management and the likelihood that they would further develop capacity given the correct inputs. Prevention generally involves a change in behaviour and assessing a patient's willingness to change is the first part of this process. Assessing the individual's level of motivation in relation to their health care is a valuable way to bring patients into the decision making process.

In addition to patients' health literacy, several other patient and practice factors impacted on the management of lifestyle risk factors. Overweight patients, those not speaking English at home and those attending smaller practices were more likely to be advised on lifestyle change. This is consistent with our previous research in which we found patients attending smaller practices to be more likely to be referred to lifestyle modification programs for prevention of cardiovascular diseases and diabetes [30]. It is also consistent with international evidence which suggests that quality of care (including preventive care) decreases in larger, busier practices [41].

In addition overweight patients and those not in paid employment were more likely to be referred to lifestyle modification programs. The former is possibly the result of higher profile recommendations related to obesity and the latter may relate to access particularly if the lifestyle modification program is conducted in working hours.

There are a number of limitations to the methods of this study. These include primarily the self-reported nature of the outcomes and the reporting and recall bias this introduces, probably in the direction of over-reporting. The response rate was also relatively low and the patients responding to the survey were older and more were female compared to patients from the clinical audit in the same practices. In addition we were not able to determine the health literacy level of the non-responders and it is also possible that those patients with higher health literacy were more likely to respond to the questionnaire.

Participants of this study were predominantly not socially disadvantaged, Australian-born, spoke English at home, had a university degree, were in paid employment, and owned their home. Despite this more than half met the criteria for insufficient health literacy. A very small number of patients (27) didn't speak English at home and a similarly small number (37) were referred to lifestyle modification programs, resulting in large confidence intervals and less precise estimates.

A major strength of our study is the wide sampling across general practices in four states of Australia. Another significant strength is the use of multilevel analysis. This type of analysis has substantive advantages over single level regression modelling in that it is a technically correct method to model patients and practice level associations with response variables, where data sets clearly identify 'patients' and 'practices' in a nested hierarchical structure.

Conclusions

We found that patient-reported GP behavioural risk factor advice and referral was generally sub-optimal. However, although people with insufficient health literacy had worse self-management behaviour, they were more likely to obtain support from their GPs to manage their health compared to the patients with sufficient health literacy. We do not know the level of appropriateness of preventive health advice given by GPs or whether patients attended all the sessions to which they were referred. The impact of the advice or attendance on the subsequent behaviour change or health status of patients with low health literacy will be the focus of further work.

Availability of supporting data

The data set used to generate the results of this paper contains identified patient data. For reasons of privacy we have therefore provided the data on which these results are based within the tables provided. The full data set will be made available for open access after the completion of the project activities in 2015. This will be made available from the UNSWorks and the records are

published on online portal Research Data Australia (RDA). Enquiries related to data acquisition should be directed to Professor Mark Harris m.f.harris@unsw.edu.au.

Abbreviations

BMI: Body Mass Index; GP: General Practitioner; HeLMS: Health Literacy Management Scale; PEP: Preventive Evidence into Practice; RACGP: Royal Australian College of General Practitioners.

Competing interests

The authors declare that they have no competing interests.

Authors' contribution

CJ designed the study, conducted a part of the data analysis and drafted the manuscript. UJ conducted a part of the data analysis and revised the manuscript. SP coordinated the patient survey and collated responses and compiled and cleaned the patient data set. MH supervised each process of the study and revised the manuscript. CDM, GR, JL SP, EDW, RT, MD and DM contributed to the revision of the manuscript. All authors read and approved the final manuscript.

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