THE UNIVERSITY OF NEW SOUTH WALES
SYDNEY · 2052 · AUSTRALIA

AUSTRALIAN PRIMARY HEALTH CARE RESEARCH INSTITUTE

UNIVERSITY OF NEW SOUTH WALES

EFFECTIVE INTERVENTIONS TO IMPROVE HEALTH LITERACY IN THE MANAGEMENT OF LIFESTYLE RISK FACTORS IN PRIMARY HEALTH CARE

Professor Mark Harris
Ms Jane Taggart
Ms Anna Williams
Dr Sarah Dennis
Dr Anthony T Newall
Dr Tim Shortus
Dr Elizabeth Denney-Wilson
Professor Nicholas Zwar

ACKNOWLEDGMENT

The research reported in this paper is a project of the Australian Primary Health Care Research Institute, which is supported by a grant from the Australian Government Department of Health and Ageing under the Primary Health Care Research, Evaluation and Development Strategy. The information and opinions contained in it do not necessarily reflect the views or policies of the Australian Government Department of Health and Ageing.

The research team would like to thank the following people for their contributions to the review:

REFERENCE GROUP

- Associate Professor Fran Boyle: Head, Health Systems & Policy Academic Discipline Group, School of Population Health, University of Queensland
- Ms Judy Daniel: Assistant Secretary, Primary Care Policy Development Branch, Commonwealth Department of Health and Ageing
- Associate Professor Jeffrey Fuller: Northern Rivers University Dept Rural Health, University of Sydney
- Mr John Kurko: Senior Manager, Active Living, National Heart Foundation (NSW Branch)
- Associate Professor John Litt: Discipline of General Practice, Flinders University
- Mr Andrew Milat: Centre for Health Advancement, NSW Department of Health
- Mr Steve Morris: Senior Policy Adviser, Australian General Practice Network
- Ms Jennie Roe: Assistant Secretary, Primary Care Chronic Disease Branch, Department of Health and Ageing
- Ms Liz Cotton: Vascular Health Section, Chronic Disease Branch, Mental Health and Chronic Disease Division, Department of Health and Ageing
- Ms Balwinder Sidhu: Manager Liverpool Fairfield Multicultural Health Services, Sydney South West Area Health Service

INTERNATIONAL EXPERTS

- Professor Bruce Arroll: Academic Head of Department, School of Population Health, Faculty of Medical and Health Sciences, The University of Auckland
- Professor Don Nutbeam: Provost and Deputy Vice-Chancellor, The University of Sydney
- Professor Anne Rogers: Professor of the Sociology of Health Care, National Primary Care Research and Development Centre, The University of Manchester
- Dr Rima Rudd: Department of Society, Human Development & Health, Harvard School of Public Health
- Associate Professor Grant Russell: Dept of Family Medicine, University of Ottawa
- Dr Annelies Jacobs: Radboud University Medical Centre, The Netherlands

Australian Primary Health Care Research Institute (APHCRI)
ANU College of Medicine, Biology and Environment
Building 62, Corner Mills and Eggleston Roads
The Australian National University
Canberra ACT 0200

T: +61 2 6125 0766
F: +61 2 6125 2254
E: aphcri@anu.edu.au
W: www.anu.edu.au/aphcri

LIST OF ABBREVIATIONS

ABS:	Australian Bureau of Statistics
ALLS:	Adult Literacy and Life Skills Survey
AMI:	Australasian Medical Index
ANU:	Australian National University
APAIS:	Australian Public Affairs Information Service
APHCRI:	Australian Primary Health Care Research Institute
AIHW:	Australian Institute for Health and Welfare
BA:	Before and After
CALD:	Culturally and linguistically diverse
CBA:	Controlled Before and After
CCT:	Controlled Clinical Trial
CCTR:	Cochrane Controlled Trials Register
CDSR:	Cochrane Database of published and ongoing Systematic Reviews
CINAHL:	Cumulative Index to Nursing and Allied Health Literature
COS:	Community of Scholars
DARE:	Database of Abstracts of Reviews of Evidence
EED:	Economic Evaluation Database
EPC:	Enhanced Primary Care
EPOC:	Effective Practice and Organisation of Care
HALS:	Health Activity Literacy Scale
HTA:	Health Technology and Assessment
ITS:	Interrupted Time Series
JBI:	Joanna Briggs Institute
MLP:	Mediterranean Lifestyle Program
NVS:	Newest Vital Sign
NHMRC:	National Health and Medical Research Council
QALY:	Quality Adjusted Life Years
RCT:	Randomised Controlled Trial
RT:	Randomised Trial
REALM:	Rapid Estimate of Adult Literacy in Medicine
SAHLSA:	Short Assessment for Spanish Speaking Adults
SNAPW:	Smoking, Nutrition, Alcohol, Physical activity, Weight
TOFHLA:	Test of Functional Health Literacy in Adults
UNSW:	University of New South Wales
WHO:	World Health Organisation
WRAT:	Wide Range Achievement Test

List of Tables

List of Figures

BACKGROUND

This review focuses on improving health literacy in the management of the SNAPW (Smoking, Nutrition, Alcohol, Physical Activity and Weight) lifestyle risk factors. These lifestyle risk factors make an important contribution to the rising burden of chronic illness in the Australian population. Health literacy and lifestyle risk factors and their management influence the decisions and actions which people make and their resulting health. They also determine the effectiveness of many strategies to prevent and manage chronic illness.

DEFINING HEALTH LITERACY

Health literacy describes the relationship between education and empowerment and encompasses a set of skills that a person needs in order to be able to negotiate the health system and manage their own health. A number of definitions of health literacy have been proposed. The Institute of Medicine in the USA uses the definition of health literacy developed by the National Library of Medicine. [1]

> *The degree to which individuals have the capacity to obtain, process, and understand basic health information and services needed to make appropriate health decisions*.

The World Health Organisation (WHO) uses the definition of health literacy proposed by Nutbeam and Kickbusch. [2]

> *The cognitive and social skills which determine the motivation and the ability of individuals to gain access to, understand, and use information in ways which promote and maintain good health*.

The definition proposed by Nutbeam [3] is the one used to inform the conceptual framework for this review and it describes three levels of health literacy.

> ***Basic or functional health literacy*** is the basic reading and writing skills needed to be able to function in daily life.
>
> ***Communicative or interactive health literacy*** describes more advanced cognitive and literacy skills which combine with social skills to enable someone to participate in a range of activities and apply information to changing situations.
>
> ***Critical health literacy*** describes more advanced cognitive and social skills that a person can use to exert more control over their lives.

MEASURING HEALTH LITERACY

The measurement of health literacy has tended to focus on functional health literacy which is defined above. A number of scales have been developed to assess functional health literacy (Appendix 1, Table A1.1).

In addition to the tools available to assess functional health literacy there are a number of disease specific knowledge based assessments which are frequently used to assess changes in knowledge associated with education programs. Most of these tests are print based tests and therefore assume a basic level of literacy.

Interactive and critical health literacy described by Nutbeam[3] are more complex levels of health literacy that go beyond simply reading and interpreting health related instructions and are associated with development of skills to manage their health. There are no established methods for the assessment of these higher levels of health literacy specifically in the health literacy literature so we looked to the self-management literature for instruments that measure the concepts of self-efficacy, patient motivation, confidence and broader social support (examples in Appendix 1, Table A1.2).

Table 1: Conceptual Framework

					Outcomes		
Patient characteristics	**Intervention**	**Provider**	**Drivers / Barriers**	**Health Literacy**	**Health Literacy Outcome***	**Behaviour Change**	**Cost Outcome**
Note: These are things known to predict level of health literacy	**Note:** Provided in two main settings: PHC (including family practice) Community	**Note:**	**Note:**	**Note:**	**Note:** One of these must be present in addition to SNAPW to prove effect through HL	**Note:** One of these must be present in addition to HL outcome	
Age Gender Ethnicity SES Education level Cognitive ability Cultural factors Medical conditions Lifestyle risks	Information – written, video, oral, pictures, Web based Group self-management support, goal setting or education Individual Motivational interviewing or Coaching Telephone based (eg coaching)	Doctor Nurse Allied health Educator Lay health worker	**Individual** Language Knowledge/beliefs Ideologies Experiences Medical conditions **Social/community** Environment Social support Social norms Networks Culture/Traditions Health system/provider **Accessibility** Interpreters Incentives Continuity of care Time / workload Communication skills **Training** Providers no. Provider types Up-to-date verbal and written information Inter-sectoral	**Functional health literacy** Health related knowledge Understanding **Interactive health literacy** Motivation Behavioural intentions Empowerment **Critical health literacy** Cognitive skills Social skills Personal skills Self-efficacy	Disease knowledge, Health related skills, Health literacy score: TOFLA, REALM, HALS, TVS Change in Readiness to change Attitudes Knowledge Patient activation Measures of self-efficacy Self management score	**S**moking status **N**utrition **A**lcohol use **P**hysical activity **W**eight	Intervention costs, Economic evaluation

*Lack of comprehensive measures of health literacy

The conceptual framework (Table 1) brings together the levels of health literacy as proposed by Nutbeam[3] and the possible outcome measures. The framework also includes characteristics of patients, providers, interventions and possible barriers and drivers that guided the review process.

HEALTH LITERACY AND HEALTH OUTCOMES

People with low levels of health literacy have been shown to have poorer health outcomes than those with higher levels of health literacy.[4 5 6] People with limited health literacy have: less knowledge of diseases and self care[7]; worse self management skills[8]; lower use of screening[9, 10]; lower medication compliance rates[11]; and higher rates of hospitalisation.[12] People with low health literacy also have lower levels of engagement in health promoting behaviours and are more likely to smoke especially in adolescence and as young adults.[12] By contrast the benefits of high levels of health literacy include improved preventive care and early detection of illness and disease, ability to access the most appropriate form of health care and management of chronic disease. [13]

SELF-MANAGEMENT SKILLS

There is a link between health literacy and patient self management skills. Self-management is defined as active participation by people in their own healthcare.[14] Self-management is the term given to the way a person proactively plans and manages their life and lifestyle to optimize their health, well being and quality of life when living with one or more chronic health conditions. Functional health literacy has been shown to be critical to patients acquiring the knowledge required to self manage chronic diseases such as diabetes and cardiovascular disease.[15] More than half of the adult Australian population lack the health literacy skill levels to self-manage their conditions and negotiate the health system effectively.[4] Inadequate health literacy leads to greater use of health services (including hospitals), less involvement in or uptake of prevention and control of chronic illness and poorer health outcomes.[16, 17]

PATIENT ACTIVATION AND HEALTH BEHAVIOUR

In addition to information and knowledge, patients also need motivation and self management skills in order to achieve and maintain lifestyle change.[18] In the Chronic Care Model this is described as an 'activated' patient.[19] An activated patient is one with the skills, knowledge and motivation to participate as effective members of the care team.[20] A measure has been developed of patient activation that describes four stages.[21] These are:

- believing the patient role is important;
- having the confidence and knowledge necessary to take action;
- actually taking action to maintain and improve one's health; and
- staying the course even under stress.

The interaction between health literacy and health behaviour occurs within the context of the person's immediate living and working environment and the society they live in and will be influenced by a number of personal factors such as age, sex, socioeconomic status; immediate environmental factors such family structure, culture, working and living conditions; and broader societal factors such as economics.

HEALTH LITERACY IN THE AUSTRALIAN POPULATION

EXTENT OF THE PROBLEM

The Australian Bureau of Statistics (ABS) published a report in 2006 called Health Literacy in Australia.[4] They used the Adult Literacy and Life Skills Survey (ALLS) to assess five domains of literacy: prose literacy, document literacy, numeracy, problem-solving and health literacy in a sample of 15 to 74 year olds. Health literacy was defined as the knowledge and skills required to understand and use information relating to health issues such as drugs and alcohol, disease prevention and treatment, safety and accident prevention, first aid,

emergencies, and staying healthy. The scores calculated for each individual represent the point at which they have 80% chance of completing all the tasks with a similar level of difficulty and level 3 is regarded as the minimum level required to function on a daily basis in today's society (e.g. be able to integrate and demonstrate their understanding by an appropriate response to text containing first aid advice).[22] In 2006, 48% of females and 43% of males aged 15-44 years achieved level 3 or above, see Figure 1. The proportion of the population achieving level 3 across Australia varies from 37% in the Northern Territory and Tasmania to 56% in the ACT.

Levels of literacy and health literacy are worse among people from low socioeconomic backgrounds[23] which in turn compound their degree of disadvantage by reducing their participation in employment and access to services. Less than a third of people without a school qualification achieved a literacy level of 3 or above. In those who had completed year 12, the proportion of people achieving level 3 or above increased to 58%. Only 25% of unemployed people achieved level 3 or above compared to 47% of those who were employed. People who were born overseas in a non-English speaking country were less likely to achieve level 3 (26% compared with 46% of those from English speaking countries). Results were not reported separately for Indigenous populations.[4] The results are similar to those from the USA where 53% of the population achieved level 3 or above[24] and the UK where the Skills for Life Survey identified that 46% of the population did not have the literacy skills to achieve their full potential. [25]

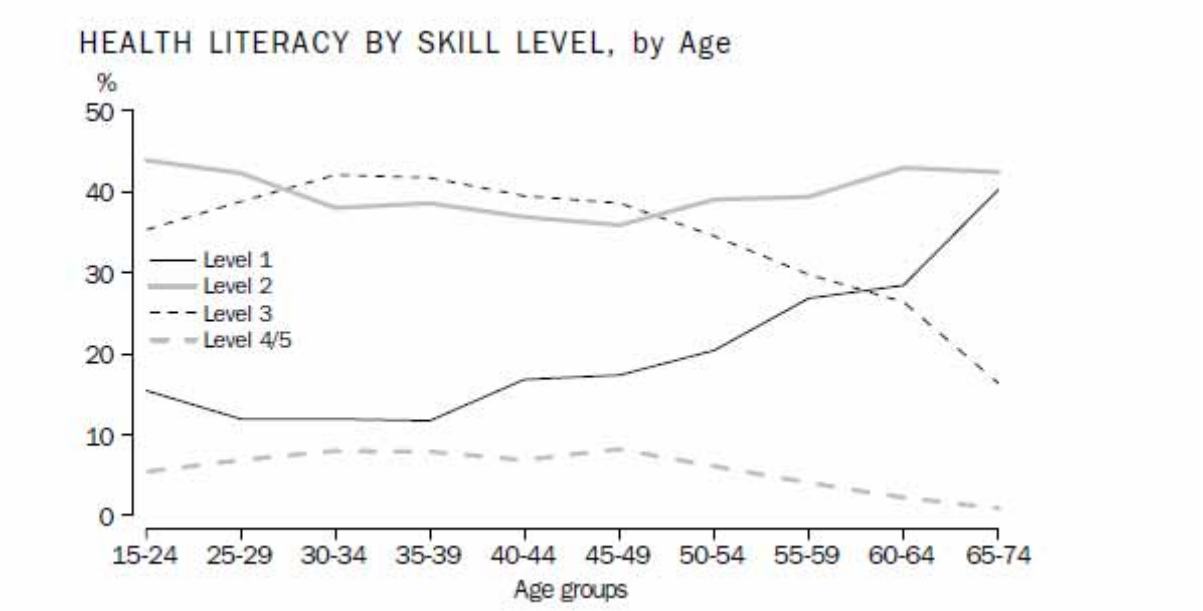

Figure 1: Results of the ALLS in the Australian population, level of health literacy in the population by age group[4]

A recent population survey in South Australia found that people with inadequate or at-risk functional health literacy were significantly more likely to report having diabetes, cardiac disease or stroke, and significantly less likely to have recently attended a doctor. [26]

SNAPW RISK FACTORS

Smoking, poor nutrition, hazardous or harmful use of alcohol, declining levels of physical activity and overweight and obesity are major contributors to the burden of chronic disease in Australia.[27] There is a clear association between the prevalence of SNAP-related risk factors and the risks of developing disease. In 2001, 70% of Australians reported low usual vegetable consumption, 48% reported low usual fruit consumption, 32% were physically inactive, 22% were smokers and 16% were obese.[28] In addition, 64% of male drinkers and 44% of female

drinkers consume more than five standard drinks on one occasion in the last twelve months.[29] Multiple risk factors are associated with being from a low socioeconomic background and increase the likelihood of hospital admission.

Literacy levels are associated with these risk factors, with them being generally worse in those with lower levels of literacy.[5] Health literacy levels are also associated with the SNAP behaviours. In a survey conducted in the UK higher levels of health literacy were associated with specific health behaviours including the likelihood of eating at least five portions of fruit and vegetables a day or being a non-smoker independently of age, education, gender, ethnicity and income.[30] There may also be variations in health literacy in relation to each of the specific health behaviours (i.e. the same person may not have different levels of health literacy in relation of smoking and diet).

HEALTH POLICY IN AUSTRALIA

In Australia health literacy figures prominently in an increasing range of policy documents at National and State levels. The National Health and Hospital Reform Commission has recently made a number of recommendations to "build" health literacy in the community.[31] They are:

- including health literacy as a core element of the National Curriculum for schools;
- providing access to evidence-based, consumer-friendly information that supports people in making healthy choices and in better understanding and making decisions about their use of health services; and
- a sustained national community awareness campaign to increase mental health literacy and reduce the stigma attached to mental illness.
- Similarly the Draft National Primary Health Care Strategy[32] has identified the need for:
- enhanced skills in supporting individuals in health literacy and self-management, including changing risky lifestyle behaviours, particularly those with low health literacy through more appropriate information, self-management programs and other supports; and
- a focus on improving health literacy in local communities and with disadvantaged and marginalized groups.

Health literacy is recognised in the work of the Preventative Task Force[32] which has called for a multi-layered approach of social marketing, community-level initiatives and formal education in health literacy involving local government.

Commonwealth policy on health literacy has also been reflected in programs run by the State governments to promote mental health literacy (New South Wales, Victoria, Queensland, Western Australia, Australian Capital Territory), oral health literacy (Victoria), better use of health services (NSW, Victoria, Western Australia, Australian Capital Territory) and lifestyle (Tasmania) with programs focusing on building health literacy among specific groups including young people, rural communities, migrants, refugees and Aboriginal people.

RESEARCH QUESTIONS

This review addresses the following research questions:

- What have been the major interventions nationally and internationally which have aimed to improve the health literacy and motivation of people to manage their own lifestyle risk factors?
    - Which of these interventions have been found to be effective in changing health literacy and the SNAPW lifestyle risk factors?
    - Evidence for the cost and/or cost-effectiveness of these interventions?
    - Which have been effective in different settings, with different providers, with different population groups?
    - Evidence for similarities and differences in low socio-economic groups and people with cultural or linguistic disadvantages?
- What were the known effective drivers and barriers to the uptake and sustaining of the policy initiatives and interventions
    - Evidence for the cost-effectiveness of drivers to influence their uptake?
    - Evidence for similarities and differences in low socio-economic groups and people with cultural or linguistic disadvantages
    - What barriers influenced the uptake of these interventions in health services and health services providers
    - What barriers influenced the receptivity of patients to these interventions in primary health care?
- What are the policy options to support the implementation of effective interventions to improve the knowledge, skills and motivation (health literacy) of people to manage their own lifestyle risk factors in Australian primary health care?

METHODS FOR REVIEW

This section provides an overview of the key methods undertaken as part of the review process. Key definitions used are found in Appendix 2.

SCOPING THE REVIEW

Three main activities were undertaken to scope the focus and scale of the review including: (1) Scoping searches; (2) Development of definitions; (3) Consultation with members of the review reference group and identified international key experts; and (3) Consultations with a UNSW biomedical librarian. Scoping activities resulted in the development of a conceptual framework (Table 1), refinement of the original research questions and the development of a search strategy and study verification assessment for inclusion or exclusion in the review.

DEVELOPMENT OF A CONCEPTUAL FRAMEWORK

A conceptual framework (Table 1) was developed to support the search strategy, analysis and discussion components of the review. The framework was informed by the work of Nutbeam[33] and also draws from Keleher[17] and Manganello[34] and it provides an overview of the key constructs related to the three levels of health literacy (functional, interactive and critical) as well as describing the types of interventions, drivers/barriers and possible outcome measures on which the review will report evidence of effectiveness. The conceptual framework provides some examples of instruments that were sought and used generally in the search strategy to target studies interested in health literacy in primary care, the concepts more generally and associated outcomes. For purposes of the review studies that reported any measure or outcome of the concepts were included. That is, the measures used to report health literacy were not limited to the examples provided (Appendix 1).

SEARCH STRATEGY

A search strategy was developed to target a broad range of study design and other published material to support the development of a typology of interventions and ascertain their effectiveness. Study types included: experimental and quasi-experimental studies, controlled before and after studies, interrupted time series studies with and without a control group and historical control studies. In addition, evaluation, pilot, non controlled before and after, qualitative studies and discussion/opinion papers were also included in the search strategy.

Five main sources were used to gather evidence and information to answer the research questions targeting both peer reviewed (black) and non-peer reviewed (grey) publications including: (1) electronic database searching; (2) targeted journal hand-searching; (3) snowballing; (4) grey literature collation; and (5) a review of existing systematic reviews. All information gathered was stored in an Endnote database.

ELECTRONIC DATABASE SEARCHING

Search strategies were developed specifically for each electronic database (Appendix 3) using the methodological component of EPOC combined with strategies to identify the interventions to address health literacy and lifestyle risk factors delivered by health professionals working in the primary health care setting. A broad number of terms were initially developed related to primary health care, self-management, SNAPW and known health literacy interventions (e.g. group education, motivational interviewing, coaching etc) and health literacy measures and outcomes (generic and condition specific tools).

Potential search terms were tested in each of the databases to identify subject headings and relevant text word searches appropriate to each database. Databases searched included: the Cochrane Library, Johanna Briggs Institute (JBI), Medline, Embase, CINAHL, Psychinfo, Web of Science, Scopus, APAIS, Australasian Medical Index, Community of Science and Google

Scholar. The following limits were applied: English language, published from 1985 to 2009, human adults from age 18 or above. A filter for primary health care was applied.

TARGETED JOURNAL, SNOWBALLING AND GREY LITERATURE SEARCHING

Using the same limits, an electronic hand search of the following four targeted journals was undertaken by one researcher (JT): (1) Patient Education and Counselling; (2) Health Education and Behaviour; (3) American Journal of Preventive Medicine; and (4) Preventive Medicine.

One researcher performed the snowballing exercise (JT) by searching sentinel papers identified during the scoping phase and reference lists of the intervention studies included in the primary dataset and relevant existing systematic reviews with the aim of comprehensive exhaustion of the literature. A second researcher (SD) snowballed the reference lists from the systematic reviews.

Grey literature was sourced using three methods: (1) consultation with the national reference group members; (2) consultation with key international experts via telephone interviews (TS); and (3) searching web sites of state, national and international department of health and other related organisations (MH, SD, JT, TS, EDW) .

INCLUSION AND EXCLUSION CRITERIA

Studies were included in the review if they addressed the following:

- Intervention studies: experimental and quasi-experimental studies, cohort, observational, controlled and non-controlled before and after studies, interrupted time series studies with and without a control group, descriptive studies, historical control studies, evaluation and pilot studies.
- Adult males and females aged 18 years and over with at least one SNAPW risk factor for the development of a chronic disease.
- Interventions were included if they were implemented within the targeted primary health care services and aimed to influence the knowledge, skills and motivation of consumers and providers of PHC services to make SNAPW lifestyle changes.
- To be included the study had to have reported an intervention or outcome measure associated with health literacy. The review was inclusive of all health literacy and intervention measures reported – that is the review did not just limit the findings to the various well reported measures used to develop the search strategy (Appendix 3). The search strategy was confined to primary research published from 1 January 1985 until April 30 2009.

The primary research material underwent two major assessment phases to determine whether they were included or excluded from the review: (1) screening and (2) verification.

SCREENING

Two researchers (JT and AW) reviewed the title and abstracts of all studies resulting from the electronic database search based on the inclusion criteria. One researcher (JT) reviewed studies resulting from the snowballing, targeted journal and grey literature searching. A second researcher reviewed the existing systematic reviews and meta-analysis (SD).

Studies were excluded during this process if (a) the title / abstract of the article indicated no direct relevance to the subject of the review; (b) it was found to be a duplicate. Unsure studies were reviewed by a third researcher (MH) and a team discussion where necessary. A 10% sample of all excluded studies was reviewed by a researcher (MH) for accuracy and where discrepancies were found they were discussed by the team and excluded or re-included in the primary dataset.

VERIFICATION

The verification stage focused on the intervention studies and involved two researchers (JT and AW) re-applying the original screening assessment then assessing the content of the papers based on a set criteria. Studies were excluded if they did not meet the original inclusion criteria or involved an intervention outside primary health care that could not be applied in primary health care. To be included studies had to implement an intervention which aimed to influence the knowledge, skills and motivation of consumers to make smoking, nutrition, alcohol, physical activity or weight lifestyle changes. In addition, the papers had to report an outcome measure associated with health literacy. Key outcome measures targeted included patient knowledge, stage of change, self-efficacy, shared decision-making, patient activation. A third researcher (MH) reviewed all studies excluded during this process for accuracy and assessed unsure studies for inclusion/exclusion. Where discrepancies were found a team discussion resolved the issue. Verification of the remaining studies/material in the primary dataset was undertaken by one researcher (SD).

DATA EXTRACTION

Two researchers (JT and AW) extracted information from half the studies each (except the descriptive studies) and then reviewed the entire set together to check reliability and resolve any queries. Where more than one paper was found to report the same study, the main paper was used as the basis for data extraction of reported interventions and outcomes. A cross check of 20% of the extracted studies was undertaken by a third researcher (MH) for accuracy. One researcher (JT) extracted data from the descriptive studies and this was cross checked by a second researcher (MH) for accuracy. One researcher (SD) extracted barrier and driver information from the qualitative studies, grey literature papers/reports and discussion/opinion papers.

QUALITY ASSESSMENT OF THE INTERVENTION STUDIES

A published quality checklist, was used to assess the methodological rigor of the intervention studies[35] (Appendix 4). One researcher (SD) performed quality assessments on all the intervention studies. A second researcher (AW) assessed an overlapping sample (20%) of the studies to establish reliability. An intra-cluster correlation test was calculated giving a coefficient score of 0.72. This established the reliability of the quality assessments on all the intervention studies undertaken by the first researcher. Thus those scores were used to group the studies into low (<2.0), medium (2.0 – 2.5) and high (>2.5) methodological quality. Studies were not excluded from the review based on quality scores.

DEVELOPING A TYPOLOGY OF THE INTERVENTIONS

A typology of interventions (Appendix 5) was developed from the intervention studies that reported a SNAPW intervention and a health literacy outcome by one researcher (AW) and checked by two researchers (MH & JT). A manual content analysis was undertaken to isolate the components of the interventions that related to health literacy and group them into categories defined in the conceptual framework.

Secondary analysis was undertaken by two researchers (JT & AW) to develop a scale of intensity of the interventions. The allocation of intensity was checked by a third researcher (MH). The scale of intensity focused on the frequency or number of contacts associated with an intervention. The scale consisted of three levels:

(1) Low intensity: less than or equal to 3 hours of contact or 3 points of contact associated with the health literacy intervention;

(2) Medium intensity: greater than 3 hours of contact and less than 8 hours of contact or 8 points of contact associated with the health literacy intervention;

(3) High intensity: greater than 8 hours of contact or 8 points of contact associated with the health literacy intervention.

DEVELOPING A TYPOLOGY OF DRIVERS AND BARRIERS

The typology of barriers and drivers was developed by two researchers (MH & SD). A content analysis was undertaken of all studies/papers within the primary dataset to develop a typology of barriers and drivers. The emerging barriers were then grouped into five main categories: patient and patient context, provider and provider context and interaction between these levels.

DATA ANALYSIS AND SYNTHESIS

Studies were analysed in terms of their intervention group within the typology and whether SNAPW and health literacy outcomes were reported. For each study it was recorded which type of SNAPW and health literacy outcomes were reported and whether there were any significant findings. Secondary analysis was then undertaken for the significant outcomes for each intervention group by setting, participant and provider characteristics. Quality scores and intensity ratings of the intervention were used to provide further description of the effectiveness studies. Synthesis occurred through a face to face consultation with the Reference Group.

REVIEWING THE COSTS

All studies that reported any costs were identified as part of data extraction. These studies were then separated into two groups: those that conducted some form of economic evaluation and those that reported intervention costs only. Information on interventions costs and cost-effectiveness ratios were then extracted by one researcher (ATN) where available.

RESULTS

Over 4200 studies were collated and assessed for inclusion in the review. Three hundred and forty five studies formed the final primary dataset for data extraction (Appendix 6). This included: (1) 175 intervention studies; (2) 42 descriptive studies; (3) 128 qualitative studies, editorial/opinion papers and grey literature (Appendix 7).

During the data extraction process a further 121 intervention studies were excluded because they did not have health literacy interventions or outcomes related to health literacy to leave 54 studies that reported health literacy and/or SNAPW outcomes associated with a health literacy intervention (Appendix 8).

CHARACTERISTICS OF THE INCLUDED INTERVENTION STUDIES

The majority of included intervention studies (N=54) originated from the USA and UK. Only 4 studies were from Australia or New Zealand. The studies were mostly implemented in a primary health care setting (including general practice, primary care and community health) or in the community in general with the majority published after the year 2000. (Table 2)

Table 2: Characteristics of the Included Intervention Studies

Intervention Studies with Significant HL & SNAPW findings (N=54)	**N**	**%**		**N**	**%**
Publication Year			**Setting**		
1988 -1999	20	37.0	Community (General)	21	38.9
2000 – 2009	34	63.0	General Practice / Primary Care/ Community Health	29	53.7
Total	100	100	Other (hospital, not PHC)	4	7.4
Countries			**Total**	**54**	**100**
USA	31	57.4			
UK	8	15.0			
Australian/New Zealand	4	7.4			
Sweden/Switzerland/Netherlands	9	17.0			
Canada	1	1.9			
Japan	1	1.9			
Total	**54**	**100**			

Footnote: Studies originating from Denmark, France, Belgium, Germany, Italy were not included in the analysis of the intervention studies as they did not report significant health literacy and SNAPW findings.

MAJOR FINDINGS

THE MAJOR INTERVENTIONS NATIONALLY AND INTERNATIONALLY WHICH HAVE AIMED TO IMPROVE THE HEALTH LITERACY AND MOTIVATION OF PEOPLE TO MANAGE THEIR OWN LIFESTYLE RISK FACTORS?

The following main types of interventions were identified from studies which evaluated their effectiveness in improving health literacy:

- Individual motivation interviewing and counselling interventions delivered face to face
- Group education programs
- Multiple interventions (includes both individual counselling and group education)
- Written materials

- Telephone coaching or counselling
- Web or computer based programs
- Other community education.

WHICH OF THESE INTERVENTIONS HAVE BEEN FOUND TO BE EFFECTIVE IN CHANGING HEALTH LITERACY AND SNAPW RISK FACTORS?

Most intervention studies demonstrated an improvement in health literacy (74%). The largest number of studies evaluated group education, individual counselling, multiple interventions and written materials (Table 3). The three group education intervention studies which did not demonstrate an improvement in health literacy were conducted in the USA based in the community and involved low socioeconomic or low educational status background patients.[36-38] One of these was a low quality before and after study with a low intensity intervention that included three one hour group education sessions targeting Mexican, American or Chicano populations delivered by lay worker.[36] This study did not find a significant outcome for SNAPW but reported significant findings related to the development of patient skills. The other two unsuccessful intervention studies were of a high intensity and both studies were ranked medium in quality. One included ten group education sessions[37] and the other six classes over 20 weeks with a graduation session.[38] The three individual motivational interviewing or counselling studies which did not demonstrate an improvement in health literacy all involved brief advice by doctors[39, 40] with one also including extended counselling by a nurse for 6 weeks.[41] The four multiple intervention studies which failed to demonstrate change in health literacy included a study evaluating individual counselling, feedback on stage of change, leaflets, a follow up session plus telephone reminders;[42] one using a series of tailored feedback, brief telephone counselling and booklets[43] and two studies evaluating group education delivered in the community[44] or a hospital.[45] Three mailed written materials studies also failed to improve health literacy. These were all low intensity interventions including one-time nutrition information,[46] one off risk information sheet and tailored behaviour change information[47] and healthy weight pamphlets mailed over 8 weeks.[48]

Table 3: Studies by intervention type by change in SNAPW and health literacy

Intervention type (number of studies)	**Study Quality#**			**SNAPW* outcome (No. sig. studies/ No. studies measuring SNAPW)**					**Health literacy outcome (No. studies sig. outcome/ No. studies measuring change in HL)**
	H	M	L	S	N	A	P	W	
Group education (16)	3	12	1	0/3	7/14	0/1	6/10	1/1	12/15 (80%)
Individual motivational interviewing or counselling (10)	2	7	1	3/4	0/3	0	5/7	0/1	7/10 (70%)
Multiple interventions (12)	2	9	1	1/3	5/8	0/1	3/8	2/4	7/11 (64%)
Web / Computer (2)	0	2	0	0/1	2/2	0	1/1	0	1/2 (50%)
Telephone (2)	1	0	1	0	0/1	0	0/1	0	2/2 (100%)
Written material (12)	3	8	1	3/6	7/8	0	4/6	0/1	8/11 (73%)
TOTAL (54)	11	38	5	8/17	20/36	0/2	19/33	3/7	37/51 (74%)

#Note: H=High, M=Medium, L=Low

*Note: S = Smoking, N=Nutrition and diet behaviours, A = Alcohol consumptions, P = Physical activity, W = Weight.

Table 4: Studies by intervention type and change in health literacy component (table shows number of studies with significant outcome/number of studies measuring change in health literacy)

	Functional or basic Health literacy		Interactive or critical health literacy		
	Knowledge	**Skills**	**Self efficacy**	**Stage of change**	**Other health literacy***
Group education (15)	6/7	0	6/10	4/4	2/4
Individual motivational interviewing and counselling (10)	1/2	1/1	1/4	5/8	0/5
Multiple interventions (11)	3/6	0	2/4	5/6	0/1
Web/computer (2)	0	0	0	1/2	0
Telephone (2)	1/1	0	1/1	1/2	0
Written material (11)	1/1	0/1	2/3	6/9	1/1
Total (51)	12/17	1/2	12/22	22/31	3/11

Note: * Includes social support, awareness, attitudes

There was variation across the intervention types in outcomes for health literacy (Table 4). More studies reported outcomes for stage of change followed by self efficacy and knowledge. No studies reported outcomes for patient activation. Studies evaluating group education interventions and written materials reported health literacy improvements more often than the other intervention types.

There was more variation in the effectiveness of interventions in changing SNAPW behaviours (Table 3). There were only 2 studies reporting alcohol consumption as an outcome in association with a health literacy intervention and neither of those demonstrated a change following the intervention. Half of the studies which evaluated smoking behaviour showed changes in this outcome with studies evaluating individual motivational counselling being most likely to report a significant outcome. There was a slightly higher rate of success in studies evaluating nutrition and physical activity behaviours. For nutrition, written materials were most likely to show a change in this behaviour. Both the two web/computer interventions demonstrated change in nutrition behaviours. For physical activity, more than half of studies evaluating group education, written materials or individual motivational interventions showed change in this behaviour. Overall there were 18/23 studies with interventions targeting multiple risk factors which demonstrated significant change in at least one risk factor. Three of the studies that did not demonstrate significant change were group education interventions in the community,[36, 49, 50] one used written materials and the other was a multiple intervention that included the doctor seeing patients regularly (about every 2 weeks) until they had lost 10% or their body weight.[51] .

Of the 54 studies, 36 examined the effects of the interventions at more than 6 months (18 at < 6months, 26 at 6-12 months and 10 at more than 12 months - see Table 5). If studies with less than 6 months follow up are excluded from the analysis, individual motivational counselling and written materials were most effective for smoking cessation; group, multiple and written interventions for nutrition and weight. For physical activity group and individual interventions were of comparable effectiveness.

Table 5: Significant outcomes in SNAPW by intervention type and follow-up time

Intervention type (number of studies)	Number significant outcomes / Number of studies outcome reported by period of follow up (< 6 months, 6-12 months or >12 months)														
	Smoking			Nutrition			Alcohol			Physical activity			Weight		
	<6	6-12	>12	<6	6-12	>12	<6	6-12	>12	<6	6-12	>12	<6	6-12	>12
Group education (16)		0/2	0/1	4/7	2/5	1/2		0/1		1/3	3/5	1/2	1/1		1/1
Individual motivational interviewing or counselling (10)	1/1	2/3		0/1	0/1					2/2	2/3	1/2		0/1	
Multiple interventions (12)		1/1	0/2	2/2	2/3	2/3			0/1	1/1	2/3	1/4	0/1	1/2	0/1
Web / Computer (2)	0/1			2/2						1/1					
Telephone (2)					0/1						0/1				
Written material (12)		2/4	2/2	3/3	2/3	2/2				2/3	2/3		0/1		
TOTAL (54)	1/2	5/10	2/5	11/15	6/13	5/7		0/1	0/1	7/10	9/15	3/8	1/3	1/3	1/2
TOTAL %	50	50	40	73	46	71		0	0	70	60	37	33	33	50

We conducted analysis to determine the influence of the intensity of the interventions (High - 8 or more hours or points of contact; Moderate - >3 and < 8 hours or points of contact; Low – 3 or less hours or points of contact). There were roughly equal proportions of intervention that were of high (37%), medium (26%) or low intensity (37%). Group education interventions were mostly intensive and the individual counselling and written materials tended to be of low intensity. There was no clear evidence that more intense interventions were more effective.

There were five low quality studies. Excluding these low quality studies made little difference to inferences about effectiveness of the types of intervention on health literacy or behavioural outcomes (Tables 6 and 7).

Table 6: Studies by intervention type showing intensity of intervention and change in SNAPW and health literacy (low quality studies excluded n=5)

Intervention type (number of studies)	Intervention intensity#			SNAPW* outcome (No. sig. studies/ No. studies measuring SNAPW outcome)					Health literacy outcome (No. studies sig. outcome/ No. studies HL outcome reported)
	H	M	L	S	N	A	P	W	
Group education (15)	12	2	1	0/3	7/13	0/1	6/9	2/2	12/15 (80%)
Individual motivational interviewing or counselling (9)	0	2	7	2/3	0/1	0	4/6	0/1	6/9 (67%)
Multiple interventions (11)	5	5	1	1/3	5/8	0/1	2/7	2/4	6/10 (60%)
Web / Computer (2)	0	2	0	0/1	2/2	0	1/1	0	1/2 (50%)
Telephone (1)	1	0	0	0	0/1	0	0/0	0	1/1 (100%)
Written material (11)	0	2	9	4/6	7/8	0	4/6	0/1	7/11 (64%)
TOTAL (49)	18	13	18	7/16	21/33	0/2	17/29	4/8	33/48 (69%)

#Note: H=High, M=Moderate, L=Low

*Note: S = Smoking, N=Nutrition and diet behaviours, A = Alcohol consumptions, P = Physical activity,
W = Weight.

Table 7: Significant outcomes in SNAPW by intervention type and intensity (low quality studies excluded n=5)

Intervention type (number of studies)	Number significant outcomes / Number of studies reporting outcome														
	Smoking			Nutrition			Alcohol			Physical activity			Weight		
	H	M	L	H	M	L	H	M	L	H	M	L	H	M	L
Group education (15)	0/3			6/10	1/2	0/1	0/1			6/8		0/1	1/1		1/1
Individual motivational interviewing or counselling (9)		1/1	1/2			0/1					1/1	3/5			0/1
Multiple interventions (11)	0/2	1/1		2/5	3/3		0/1			1/5		1/2	2/3	0/1	
Web / Computer (2)			0/1			2/2						1/1			
Telephone (1)					0/1										
Written material (11)			4/6		1/1	5/6					2/2	1/3		0/1	
TOTALS (49)	0/5	2/2	5/9	8/15	5/7	7/10	0/2			7/13	3/3	6/12	3/4	0/2	1/2

EVIDENCE FOR THE COST AND/OR COST-EFFECTIVENESS OF THESE INTERVENTIONS?

The assessment of health literacy intervention costs and cost-effectiveness was limited by the scarcity of studies which met the inclusion criteria. Those studies that did include quantitative information on costs were targeted at either nutrition or smoking cessation. Intervention costs varied widely depending on the method of delivery and the intensity of the intervention. For example, some mail-based programs had minimal intervention costs per participant,[52] while other programs which involved multiple visits with healthcare staff had relatively high intervention costs.[53] Cost-effectiveness analyses were conducted for only three interventions. Two of the interventions were targeted at smoking cessation,[54] [52] the other was a nutrition intervention.[53] The nutrition intervention was a clinical trial of the Mediterranean Lifestyle Program (MLP) targeted women with type 2 diabetes with a 24 month follow-up.[53] This study reported the cost per unit change in various intermediate outcomes, such as the cost per unit change in calories derived from saturated fat. A prior study had detailed outcomes of the MLP trial at 6 months.[55]

A recent modelling study[56] has attempted to estimate the cost per quality-adjusted life-year (QALY) based upon the outcomes reported in the MLP trial. This study used an existing chronic disease model to extrapolate the findings from various lifestyle programs targeted at individuals with diabetes. The model integrated trial data with assumptions about the maintenance of behaviour change and the likely flow on effects in terms of health states, resource use, and survival. This study found that the MLP had a base-case cost of £33,000 per QALY gained. However, several of the alternative lifestyle programs evaluated offered better value for money than the MLP.

One study compared motivational consulting for smoking cessation with brief clinician advice. [54] The authors reported an incremental cost per quitter (self-reported abstaining 24 hours) of £450.65 (or £265.00, consultation time only) for motivational consulting. However, the study did not collect data on biochemically confirmed sustained abstinence 6 months post intervention (the standard measure for smoking cessation). Furthermore, the effectiveness of motivational consulting when evaluated using the longer term measures collected by the study (self-reported abstaining>1 month) were not significant.

Another study compared computer generated tailored letter on smoking cessation with non-tailored letters. [52] They found non-tailored letters to be more effective than the tailored letter and restricted cost-effectiveness analysis to non-tailored letter compared with no letter. The study estimated cost per quitter (6 months biochemically confirmed) of between £37 and £89 for the non-tailored letter. However, as with Butler et al. study, the results of the cost-effectiveness analysis were based upon an intervention which did not show a statistically significant effectiveness (adjusted, P = 0.07) for long-term measures of abstinence (6 months biochemically confirmed). In both studies the trends in effectiveness for long-term outcomes were in the right direction.

WHICH HAVE BEEN EFFECTIVE IN DIFFERENT SETTINGS, WITH DIFFERENT PROVIDERS, WITH DIFFERENT POPULATION GROUPS?

Effectiveness by setting

Twenty nine of the studies were based in primary health care settings (Table 8). A breakdown of type of setting in primary health care that the studies were undertaken included: general primary health care (n=10); general practice (n=11); primary care including health maintenance organisation (n=3); primary care clinic (n=3) and community health (n=2). Of the studies undertaken in general practice five were from the US, four UK, one Switzerland, one Netherlands and one from Australia. All primary care clinic studies and those including HMOs were undertaken in the US.

Table 8: Studies in Primary Health Care Settings

Intervention type (number of studies)	Study Quality			SNAP outcome (No. sig. studies/ No. studies measuring SNAPW outcome)					Health literacy outcome No. studies sig. outcome/ No. studies HL outcome reported
	H	M	L	S	N	A	P	W	
Individual motivational interviewing or counselling (10)	2	7	1	2/4	0/3	0	5/7	0	7/10 (70%)
Group Education (4)	1	3	0	0/2	3/4	0/1	1/1	0	4/4 (100%)
Multiple interventions (9)	1	7	1	1/2	3/5	0/1	1/6	1/2	6/8 (75%)
Written materials (6)	3	3	0	3/4	3/4	0	0/1	0	4/6 (67%)
TOTAL (29)	7	20	2	6/12	9/16	0/2	7/15	1/2	21/27 (78%)

Note: H=High, M=Medium, L=Low

Twenty one studies demonstrated at least one positive health literacy outcome (78%).

Written materials were least successful in changing health literacy. Two of these studies that reported no significant change in health literacy were high quality studies of low intensity interventions. Both studies were undertaken in the US in primary care clinics within health maintenance organisations. In one study a doctor provided self help materials targeting nutrition to participants resulting in improved nutrition but no significant change in patient skills or stage of change.[46] The other study involved a doctor providing one counselling session, a physical activity prescription and one follow up call. This study reported improved physical activity but no significant change in self-efficacy. [40]

Only four studies evaluated group education but all of these demonstrated change in health literacy. These interventions were medium to high intensity with group sessions ranging from 3 x 2 hour sessions to weekly meetings over 6 months. One also included an individual education session. The first study was a randomised controlled trial within a HMO over a six month period involving group education and one additional individual session delivered by a diabetes educator, psychologist, nutritionist and pharmacist within a HMO. The group education program included smoking, nutrition and alcohol interventions and reported change in nutrition, knowledge and self-efficacy.[57] The second study was a randomised controlled trial within a primary care clinic of a 2.5 day non-residential education and weekly meetings for six months with small group support provided by a dietician, exercise physiologist, stress management instructor and lay workers. The empowerment program included smoking, nutrition and physical activity interventions and reported statistically significant findings for nutrition, physical activity, self-efficacy and social support.[53] The third study was randomised controlled trial undertaken in a Swedish community health setting and involved 4-5 group empowerment sessions over a seven month period provided by a doctor and diabetes educator. The intervention targeted nutrition but this behaviour did not change. Knowledge did improve but not self-efficacy. [58] The fourth study was a randomised controlled trial undertaken within a general practice setting in the Netherlands. The group education program targeted nutrition and entailed three sessions of two hour duration, reporting changes in both nutrition and stage of change.[59]

Ten of the studies used individual motivational interviewing or counselling. The interventions in these studies varied. One study with individual brief counselling by a nurse (1-3 sessions) reported physical activity changes but no changes in smoking and nutrition.[60] A more intensive intervention with education and counselling by a nurse over 12 to 20 weeks changed smoking and physical activity but not nutrition.[61] A higher proportion of these studies were effective in changing smoking and physical activity behaviours than nutrition and reported statistically significant health literacy findings associated with stage of change (n=5). This was a randomised controlled trial that targeted physical activity and involved a doctor delivering a brief intervention involving motivational counselling, patient setting goals and keeping an activity log over a six week period. Significant findings were found for physical activity and

stage of change.[62] Three of the UK studies reported significant findings. The first study was a before and after study conducted in a Family Health Service Authority that involved a nurse providing individual nutrition advice during one consultation which reported change in nutrition behaviours and patient skills.[63] The second UK study was a randomised controlled trial targeting smoking, nutrition and physical activity by a nurse providing between 1-3 individual brief counselling sessions. The study reported significant findings associated with physical activity, self-efficacy and stage of change.[60] The third UK study was a medium quality randomised trial targeting smoking where a GP registrar provided motivational counselling and the patient set targets. There was a significant shift in participants stage of change.[54] A randomised controlled trial conducted in the Netherlands targeting physical activity by a doctor or nurse practitioner providing individual tailored counselling and follow up calls by a counsellor reported significant findings for both physical activity and stage of change.[64] The only Australian study was a trial involving three groups of practices with a doctor providing lifestyle counselling. There was no change in physical activity, but there was a significant shift in patients stage of change.[65]

Two of the ten studies did not find a SNAPW or health literacy significant outcome. One study was a randomised controlled trial conducted in general practice in the US that involved a doctor providing brief 5 minutes individualised motivational counselling targeting physical activity, patient goal setting, a physical activity prescription and mailed monthly materials.[39] The other study was a randomised trial conducted in general practice in the UK and compared a doctor providing brief smoking advice with extended counselling from a nurse over six weeks.[41]

Nine studies evaluated multiple interventions and these were more successful in demonstrating change in nutrition than physical activity and significant findings related to stage of change. A quasi-experimental study conducted in a community health setting in the Netherlands targeted smoking, nutrition, alcohol and physical activity through inter-sectoral neighbourhood coalitions. The study found significant change in nutrition behaviours, knowledge, self-efficacy and stage of change.[66] Two of the nine studies did not demonstrate a change in either SNAPW or health literacy outcomes. The first study was a randomised trial in general practice in Switzerland where the first intervention group received individualised counselling and feedback tailored to their current stage of change, take home leaflets tailored to stage of change and were offered counselling with a physical activity specialist at a quarter of the actual cost. In addition a follow up session with a practice assistant using computer assisted tool to assess physical activity and motivation was also received and participants were given phone reminders at 3,6 and 12 months. The second intervention group received feedback about their current stage of change related to the international recommendations of health enhancing physical activity. Plus a stage specific leaflet to take home and individualised counselling.[42] The second study was a clustered randomised controlled trial conducted in a general practice setting in the UK where doctors were trained in effective treatment options, including reduction of dietary energy intake, increased physical activity, and pharmaceutical intervention targeting weight loss.[51]

Overall interventions based in primary health care appear relatively more successful with nutrition than with physical activity. There were no computer based interventions.

Approximately half of the community based studies were conducted in the US (n=16), two studies from the Netherlands and one study each from New Zealand, Canada and Australia. Studies conducted in a community setting were successful in changing health literacy outcomes (75%). Most studies involve interventions focused on nutrition and physical activity and about two thirds of these were successful in changing these behaviours (Table 9).

Table 9: Studies in Community settings

Intervention type (number of studies)	Study Quality			SNAP outcome (No. sig. studies/ No. studies measuring SNAPW outcome)					Health literacy outcome No. studies sig. outcome/ No. studies HL outcome reported
	H	M	L	S	N	A	P	W	
Group Education (11)	1	9	1	0/1	4/9	0	5/10	1/1	7/10 (70%)
Multiple interventions (2)	1	1	0	0/1	2/2	0	1/1	0	2/2 (100%)
Computer (1)	0	1	0	0/1	1/1	0	1/1	0	0/1 (0%)
Written materials (5)	0	4	1	1/2	4/4	0	3/5	0/1	4/5 (80%)
Telephone (2)	1	0	1	0	0/1	0	1/1	0	2/2 (100%)
TOTAL (21)	3	15	3	1/5	11/17	0	10/16	1/2	15/20 (75%)

Eleven of the 21 studies based in the community evaluated group education interventions. Nine of those were conducted in the US with only four studies reporting significant findings for both SNAPW (more commonly nutrition and physical activity) and health literacy (more commonly stage of change). The first study was before and after study of a group education program targeting nutrition and physical activity in a low education and socio-economic status population and delivered by a lay worker. The study reported significant findings related to nutrition, physical activity and self-efficacy. [67] The second study was a medium quality before and after study of a group education program targeting physical activity and implemented by bilingual ethnically matched health educators. The study reported significant findings related to physical activity, participant knowledge, stage of change and social support.[68] The third study was a before and after trial. The intervention included 2.5 hour sessions over 6 weeks provided by a lay worker. There were significant outcomes for nutrition and physical activity and self efficacy.[67] The fourth study involved the use of cognitive and motivational techniques in a small group situation. There was a significant increase in cardio respiratory fitness.[69]

Two studies reported SNAPW significant outcomes but no significant health literacy related findings. The first study was a medium quality randomised trial of a group education program targeting nutrition and delivered by lay workers or nutrition education assistants. The study reported significant change in nutrition behaviours but not in self-efficacy.[37] The second study was a before and after study of a group education program targeting nutrition and delivered by a dietician which reported significant change in nutrition behaviours but not health literacy.[38] A further two studies reported significant health literacy related outcomes but no SNAPW findings. The first of these was a medium quality randomised trial of a group education program targeting smoking, nutrition and physical activity and lead by a health educator. The study did not find any SNAPW outcomes but reported significant change in self-efficacy.[49] The second study was a before and after study of a group education program targeting nutrition and physical activity delivered by 'Reach 2010 team" in the first year and then a community lay worker. The study only reported significant findings related to stage of change.[50] One US study did not find significant outcomes related to either SNAPW or health literacy. This study was a low quality before and after study of a group education program targeting nutrition and physical activity and delivered by a lay worker. Both the New Zealand and Australian studies targeted physical activity and nutrition and found significant SNAPW and health literacy outcomes. The New Zealand study was a non-randomised controlled trial of a group education program targeting nutrition and physical activity delivered by a lay worker. The study reported significant findings for weight, patient knowledge and stage of change.[70] The Australian study was a medium quality randomised controlled trial of a group education program targeting nutrition and physical activity also delivered by a lay worker. The study reported significant physical activity and self-efficacy findings.[71]

Of the five studies that evaluated written materials four reported both SNAPW and health literacy significant outcomes. The first study was a low quality before and after study

conducted in the US of a nutrition and physical activity focused self-help program run by the American Heart Association. The study reported significant outcomes for nutrition, physical activity and patient knowledge.[72] The second study was a randomised controlled trial of tailored feedback letters conducted in the Netherlands. The trial found significant outcomes related to nutrition, physical activity and self-efficacy.[73] A similar intervention included reports based on stage of change that were generated through an 'expert computer' system and mailed to participants. Significant outcomes were reported for physical activity, self efficacy and stage of change.[74] Another study included three mailed computer generated reports with a self help manual. This study reported significant changes in smoking and nutrition.[75] A Canadian randomised controlled trial that evaluated an 8 week mailed healthy weight intervention reported significant findings related to nutrition but no change in health literacy.[48] Two US studies evaluated telephone interventions. The first study was a low quality randomised trial that delivered telephone counselling based on cognitive therapy and trans-theoretical stages of change and compared it to a general telephone exercise counselling intervention. The study reported significant outcomes for both physical activity and self-efficacy.[76] The second study was a randomised controlled trial targeting black American men where the intervention group received fruit and vegetable education compared to the control group who received prostate education. The study reported significant change in patient knowledge and stage of change but no SNAPW outcome.[77]

Two studies evaluated mixed interventions. The US study was a high quality randomised controlled trial and the Japanese study was a medium quality quasi-experimental study. Both studies reported significant findings for both SNAPW and health literacy related outcomes.[44, 78]

One US medium quality randomised controlled trial evaluated a motivational interviewing and counselling intervention that targeted physical activity in the community setting. The study did not find significant outcomes related to physical activity but reported change in patient knowledge and self-efficacy.[69]

There was only one computer intervention that was conducted in the US in a randomised trial. It included a self guided interactive computer program with goal setting plus two reminder phone calls. Significant outcomes were reported for nutrition and stage of change.[79]

Effectiveness by Providers

In the majority of studies the intervention was delivered by doctors (Table 10). These were the largest proportion of high quality studies. However these were the lowest proportion of studies demonstrating improvements in health literacy (57%). By contrast studies involving educators and nurses had the highest success in relation to health literacy (100 and 86% respectively). However some of the differences between providers may be attributable to differences in the intensity of the interventions. Those interventions that involved an educator were all high intensity interventions, ranging from 6 or 7 x 60 minute classes[78] to 12 month interventions of group education sessions[49] or an intervention that included exercise prescription, telephone exercise counselling and two assessment visits[76]. The role of the nurse in the interventions was either providing brief counselling or one counselling session and advice,[60, 63, 80, 81] extended counselling over 6 weeks [41] more intensive disease education and counselling on risk factors[61] or involvement in group education with individual sessions.[82] In one study a nurse practitioner or doctor provided two consultations with follow-up phone calls between and after the consultations.[64]

There were no major differences in behavioural outcomes between studies involving the various providers. Studies evaluating interventions involving doctors were more likely to report change in smoking [41, 54, 83] and nutrition outcomes.[43, 46, 82, 84, 85] Those involving nurses[60, 61, 64, 80, 81] or educators[68, 69] were more likely to report change in physical activity. The studies in the 'other providers' list were likely to report changing nutrition behaviour.[66, 72, 73, 75, 79, 86-88] The majority of these studies were of low intensity and provided indirectly to participants via mail or a computer interface. Two of the written materials interventions that were successful in changing nutrition delivered by 'other providers' included mailed computer generated profile reports relevant to stage of change and change processes plus strategies on

how to progress and a self help manual.[75, 88] Another study using a similar intervention and delivered by 'other providers' reported significant changes in physical activity.[74] The two interventions involving a computer were an internet delivered computer-tailored lifestyle intervention[86] and a self guided interactive CD.[79]

Table 10: Studies by provider

Provider (number of studies)	Intervention type (number of studies)	Study Quality			SNAP outcome (No. sig. studies /No. studies measuring SNAPW outcome)					Health literacy outcome No. studies sig. outcome/ No. studies HL outcome reported
		H	M	L	S	N	A	P	W	
Doctor (16)	Group education (2)	2	0	0	0	2/2	0	1/1	2/2	2/2
	Individual motivational interviewing or counselling (7)	2	5	0	2/2	0	0	3/5	0	4/7
	Written material (2)	1	1	0	1/1	1/1	0	0	0	0/1
	Multiple interventions (5)	1	3	1	0	2/3	0	1/3	0/1	2/4
	Total	**6**	**9**	**1**	**3/3**	**5/6**	**0**	**4/9**	**2/3**	**8/14 (57%)**
Nurse (8)	Group education (1)	0	1	0	0	1/1	0	0	1/1	1/1
	Individual motivational interviewing or counselling (5)	0	4	1	2/3	0/3	0	3/3	0/1	3/4
	Multiple interventions (2)	1	0	1	0	0	0	2/2	0	2/2
	Total	**1**	**5**	**2**	**2/3**	**1/3**	**0**	**5/5**	**1/2**	**6/7 (86%)**
Allied health (9)	Group education (5)	1	4	0	0/2	3/5	0/1	1/1	0	3/4
	Multiple interventions (23	0	3	0	0	1/3	0	0/2	2/2	2/3
	Individual motivational interviewing or counselling (1)	0	1	0	0	0	0	1/1	0	1/1
	Total	**1**	**8**	**0**	**0/2**	**4/8**	**0/1**	**2/4**	**2/2**	**6/8 (75%)**
Educator (6)	Group education (4)	1	3	0	0/1	1/2	0	3/4	1/1	4/4
	Telephone (1)	0	0	1	0	0	0	0/1	0	1/1
	Mixed intervention (1)	1	0	0	0	1/1	0	0	0/1	1/1
	Total	**2**	**3**	**1**	**0/1**	**2/3**	**0**	**3/4**	**1/2**	**6/6 (100%)**
Lay worker (8)	Group education (7)	1	5	1	0/1	3/7	0	3/6	1/1	5/7
	Multiple interventions (1)	0	1	0	0/1	1/1	0	1/1	0	1/1
	Total	**1**	**6**	**1**	**0/2**	**4/8**	**0**	**4/7**	**1/1**	**6/8 (75%)**
Other providers not included above (15)*	Group education (1)	0	1	0	0	1/1	0	0	0	1/1
	Written materials (10)	2	7	1	3/5	6/7	0	3/6	0/1	8/10
	Computer (2)	0	2	0	0/1	2/2	0	1/1	0	1/2
	Multiple interventions (2)	0	2	0	1/2	1/1	0/1	0/1	0	2/2
	Total	**2**	**12**	**1**	**4/8**	**10/11**	**0/1**	**4/8**	**0/1**	**12/15 (80%)**

Note: NR=not reported, Two of the studies provided by doctors and two provided by lay workers are Aust/NZ studies

* This includes researchers, American Heart Assoc., neighbourhood coalitions and studies where the provider was not reported.

Please note: Table 10 reports findings related to providers. The total number of studies shown in the provider column (N=62) is due to the fact that some studies reported more than one type of a provider, therefore studies are duplicated in the total number reported.

a) Evidence for similarities & differences in low socio-economic groups & people with cultural or linguistic disadvantages?

Table 11: Studies targeting low socio-economic groups

Intervention type (number of studies)	Study Quality			Setting			SNAP outcome (No. sig. studies/ No. studies measuring SNAPW outcome)					Health literacy outcome No. studies sig. outcome/ No. studies HL outcome reported
	H	M	L	PHC	Com	Other	S	N	A	P	W	
Group education (8)	0	7	1	1	7	0	0	4/6	0	3/5	0	5/7
Multiple interventions (4)	1	3	0	2	1	1	0/1	3/4	0/1	0/2	2/2	3/4
Individual motivational interviewing and counselling (1)	0	1	0	1	0	0	0/1	0	0	1/1	0	1/1
Computer (1)	0	1	0	0	1	0	0	1/1	0	0	0	1/1
TOTAL (14)	1	12	1	4	9	1	0/2	8/11	0/1	4/8	2/2	10/13 (77%)

Note: One Group Education study is Aust/NZ

There were 14 studies of interventions targeting low income socioeconomic groups (Table 11). These were predominantly group education programs of a high intensity, focused on nutrition or physical activity. Three of the multiple intervention studies included group education.[45, 66, 78] The other multiple intervention consisted of a series of tailored feedback, brief telephone counselling by a nurse and a booklet.[43] The studies targeting the low socio-economic groups were most successful in improving health literacy (77%) and relatively successful in achieving changes in nutrition behaviours (73%). All the group education and multiple interventions that included group education and targeted nutrition were successful in either changing nutrition or weight.

Table 12: Studies targeting people with low education

Intervention type (number of studies)	Study Quality			Setting			SNAP outcome (No. sig. studies/ No. studies measuring SNAPW outcome)					Health literacy outcome No. studies sig. outcome / No. studies HL outcome reported
	H	M	L	PHC	Com	Other	S	N	A	P	W	
Group education (7)	0	6	1	1	6	0	0	3/5	0	3/5	0	5/7
Multiple interventions (4)	1	3	0	3	1	0	0/1	2/4	0/1	0/1	2/2	4/4
Individual motivational interviewing or counselling (1)	0	1	0	1	0	0	0/1	0	0	1/1	0	1/1
TOTAL (12)	1	10	1	5	7	0	0/2	5/9	0/1	4/7	2/2	10/12 (83%)

Note: One Group Education study is an Aust/NZ study

There were 12 studies of interventions targeting people with low educational attainment (Table 12). These were predominantly group education programs focused on nutrition or physical activity and were effective in improving health literacy but were less successful in

achieving behavioural change. Most of the interventions were of high intensity (8/12). The two studies that did not improve health literacy included one of 10 group sessions provided by a lay worker[37] and a series of tailored feedback, brief telephone counselling and booklets provided by a doctor.[43]

Table 13: Studies targeting people from ethnic groups

Intervention type (number of studies)	Study Quality			Setting			SNAP outcome (No. sig. studies/ No. studies measuring SNAPW outcome)					Health literacy outcome No. studies sig. outcome/ No. studies HL outcome reported
	H	M	L	PHC	Com	Other	S	N	A	P	W	
Group Education (7)	1	5	1	1	6	0	0	2/5	0	3/5	1/1	5/7
Telephone (1)	1	0	0	0	1	0	0	0	0	1/1	0	1/1
Computer (1)	0	1	0	0	1	0	0	1/1	0	0	0	1/1
Multiple interventions (3)	1	2	0	1	1	1	1/1	0/2	0	0/1	2/2	2/3
Total (12)	3	8	1	2	9	1	1/1	3/8	0	4/8	3/3	9/12 (75%)

There were 12 studies of interventions targeting minority ethnic groups (Table 13). These were predominantly group education programs with 75% achieving a change in health literacy. Most interventions focused on nutrition or physical activity but were less successful in achieving behaviour change. The majority of the studies (n=10) were conducted in the US and were largely medium quality randomised trials/randomised controlled trials or before and after studies. Two studies were conducted in New Zealand and Australia.

Four of the US studies evaluating group education targeted Mexican American or Latino populations and implemented medium quality before and after studies. The studies had mixed findings. Two Studies targeting African American women appeared to be less successful in achieving health literacy related outcomes. [38] [50] Two out of the four studies had positive findings. One study aimed to increase physical activity to 30 minutes per day in Latino women through group education led by bilingual ethnically matched health educators and reported improved physical activity, participant knowledge, stage of change and social support .[68] A second study recruited Mexicans to attend a chronic disease self management program targeting nutrition and physical activity and reported change in nutrition and physical activity behaviours and self-efficacy. [67] Another low quality before and after study aimed to improve nutrition and physical activity in Mexican, American or Chicano populations. This reported increased participant skills but no other health literacy or SNAPW outcomes.[36] A New Zealand high quality non-randomised controlled study targeted Samoan and Tongan populations in a culturally appropriate group education program targeting nutrition and physical activity. The study reported significant findings related to weight, knowledge and stage of change.[70]

Two of the three US studies that evaluated mixed interventions with ethnic minority groups (Hispanic and African American) reported significant SNAPW and health literacy outcomes [78, 89]. However one US study that targeted overweight older African Americans with a mixed intervention focusing on nutrition, physical activity and weight delivered by a dietician and exercise physiologist reported significant findings related to weight, but no significant change in heath literacy.[45]

KNOWN DRIVERS AND BARRIERS TO THE UPTAKE AND SUSTAINABILITY OF INITIATIVES AND INTERVENTIONS

Barriers to health literacy in Canada have been identified in a systematic review conducted by the Canadian Public Health Association.[90] These include barriers at the individual and system levels. Individual barriers include: low levels of formal education; mother tongue; cultural

beliefs; and disability. These may be compounded by social stigma and exclusion. System barriers include poor school educational experience and attainment; barriers to participation in literacy programs; poor availability of and access to workplace health programs; quality and reading age of health information; variable access to and quality of internet information; complexity of decision making and navigation in health care; low levels of provider awareness of health literacy levels of patients; low levels of awareness of health policy makers. A number of strategies were suggested including; improving community and workplace literacy and health programs; greater use of interpreters and culturally appropriate health services and programs; improving the awareness and skills of health workers in managing patients with low health literacy; improving the quality and readability of health information. The investigators found few rigorous evaluations of the effectiveness of health literacy interventions. However community based and participatory approaches showed some promise. The report recommended focusing on particular population groups at risk of low health literacy including: the aged, recent immigrants, those with low levels of educational attainment or on low income and Aboriginal people.

There were six groups of barriers and drivers to health literacy identified from the qualitative, descriptive and interventions papers (See Table 14):

- Patient factors (35 papers)
- Patient context (26 papers)
- Socioeconomic Environment (6 papers)
- Provider factors (32 papers)
- Provider and Service context (27 papers)
- Patient-provider interface (20 papers)

The importance of these barriers and facilitators varied across the SNAPW behavioural risk factors. In relation to smoking cessation, patient psychological state especially stress was an important barriers especially when compounded by poverty and cultural barriers. Conversely improved knowledge about preventive interventions, media and family and social support were important facilitators. The use of culturally appropriate and tailored patient education materials and the relationship with provider, continuity of care and follow up were also important facilitators. For example a review article reported in 1994 on the effectiveness of tailored materials for older adults.[91] For providers, lack of knowledge, confidence, motivational interviewing skills were important barriers which could be addressed by appropriate training (including funding for training) and information systems.

There were a larger number of patient barriers cited in papers addressing improvement in health literacy about nutrition. These included the patient's psychological state, perception of risk associated with poor diet, expectations about the benefit from interventions, co-morbidity from other conditions. For example a randomised controlled trial observed that patients who perceived greater benefits and fewer barriers were likely to achieve greater improvements.[60] Conversely another randomised controlled trial observed that negative expectations were associated with greater difficulty achieving change.[92] Knowledge about diet, the availability and quality of information, individualised versus group format to education, and all aspects of cost, accessibility and availability of services were all identified as factors influencing the uptake of nutrition education interventions. Provider barriers were similar to smoking (especially time and skills). However facilitators included not only knowledge, confidence and training underpinned by information systems but also in particular knowledge about referral services, evidence based guidelines and nutrition information. The providers own diet was an important barrier.

Patient barriers and facilitators to the uptake of health education about physical activity were broadly similar to nutrition. A randomised controlled trial observed that reduced cost of visits improved uptake.[42] However physical impairment and lack of environmental safety were also important barriers. For example another randomised controlled trial found that having a

secure place to exercise was an important facilitator for maintaining physical activity outside the intervention sessions.[45] Provider barriers were also similar to those for nutrition. However, expectations of providers related to the efficacy of the interventions, including referral services was an important barrier. Facilitators included standardised assessments, links with community services and other referral networks.

a) Evidence for the cost-effectiveness of drivers to influence their uptake.

We found no studies meeting our inclusion criteria which assessed the cost-effectiveness of drivers aimed at influencing the uptake of health literacy interventions. To be included the studies had to report an outcome measure associated with health literacy.

b) Evidence for similarities & differences in low socio-economic groups & people with cultural or linguistic disadvantages

Approaches are more effective if they are tailored to the needs of disadvantaged groups.[93] Overall there were 18 papers which described socio-economic or cultural or linguistic disadvantage as a barrier to health literacy for behavioural risk factor management. Among the intervention studies only 2 papers [38, 45] specifically described poverty as a barrier. A before and after study found an interaction between obesity and poverty affecting patients' motivation to change their diet.[38] A randomised controlled trial described financial concerns competing with a weight reduction intervention for priority among overweight Afro-Americans.[45] Another study found that reducing the cost of allied health care improved consumer uptake.[42] Among the descriptive studies only one Australian survey of GPs specifically described ethnic background as a barrier to health literacy.[94]

c) Receptivity of providers to interventions

The uptake of these interventions and their impact on health literacy, self management skills and motivation may be influenced by the organization of health care including continuity of care and health professional roles[95, 96], funding and incentives[97, 98], and the availability of a well trained health workforce.[99] There were 6 studies with interventions which targeted providers. Two of these studies reported barriers, both found that the time required to offer individual counselling was longer than for normal consultations. In an Australian study the total time to offer a smoking intervention was 8-7 minutes more than a standard general practice consultation.[100] Among the 54 consumer intervention studies, few identified barriers and/or drivers related to providers or services. A randomised controlled trial identified the time and practice required for providers to develop skills meant that training needed to be provided over time (rather than once off).[58] Standard protocols were important in improving the success of individual counselling.[80]

d) Receptivity of patients to interventions

Some of the intervention studies identified barriers to the receptivity of consumers to interventions in primary health care. Design of education curricula based on adult learning, social learning theory and recognition of low reading ability was important in improving the effectiveness and uptake of a community based group education program.[78] Three studies identified the importance of patient outcome expectations in their receptivity to motivational interviewing interventions with patients who perceived greater benefits and fewer barriers to physical activity were likely to increase their activity levels. [70, 60, 101] A randomised controlled trial made similar observations following a community based group intervention.[92]

Table 14: Drivers and Barriers

Barriers and Drivers (Number of Papers citing)	Driver	Barrier
Patient factors		
Psychological state (Confidence, self esteem, self efficacy, mood, stress) (9)	✓	✓
Beliefs and values(9)	✓	✓
Knowledge (9)	✓	
Physical impairment/co morbidity (5)		✓
Outcome expectations/ perception of benefit (5)	✓	
Perception of risk (4)	✓	
Learning skills (4)	✓	
Literacy levels(4)	✓	✓
Gender (3) and age (1)		✓
Patient context		
Family & social support (26)	✓	
Poverty / income / low SES (8)		✓
Culture / ethnicity (10)		✓
Availability & quality of information (10	✓	
Time / other commitments (4)		✓
Socioeconomic Environment		
Media (4)	✓	✓
Environment (safety) (3)		✓
Education system (1)	✓	
Provider factors		
Time (16)		✓
Preventive skills (12)	✓	
Knowledge of guidelines, information (11)	✓	
Attitudes and beliefs (10)		✓
Teamwork Other providers (6)	✓	
Knowledge of referral services (3)	✓	
Confidence (2)	✓	
Communication skills (2)	✓	
Outcome expectations (2)		✓
Provider and Service Context		
Training (duration, MI, communication), CPD, funding time, organization) (7)	✓	
Funding for health education (4)	✓	
Community links / community oriented services (2)	✓	
Availability of referral services/networks (2)	✓	✓
Information systems (2)	✓	
Availability of space (1)		✓
Supportive public health policy (1)	✓	

Table 14 Continued:

Barriers and Drivers (Number of Papers citing)	Driver	Barrier
Patient provider interface		
Access of health education / lifestyle modification		
Cost (6)		✓
Transport (1)		✓
Availability (3)		✓
Physical access (1)		✓
Trust of information (6)	✓	
Continuity of care (7)	✓	
Patient provider relationship (6)	✓	
Proactive follow up (4)	✓	
Aids (e.g. Pedometer) (4)	✓	
Reading age of materials (3)		✓
Patient education materials tailored (2)	✓	
Cultural materials / translation (2)	✓	
Individualised format (2)	✓	
Health seeking behaviour (2)		✓
Group format (1)	✓	
Goal setting (1)	✓	
Decision support (1)	✓	
Standardised assessment questions/protocols (1)	✓	

DISCUSSION

EFFECTIVENESS OF INTERVENTIONS

There were relatively few studies (n=54) that evaluated the impact of interventions on patients' health literacy and motivation to manage their own lifestyle risk factors. Only two included studies evaluated interventions to modify alcohol consumption. Other alcohol intervention studies were excluded because they did not explicitly evaluate a health literacy outcome. In almost three quarters of these studies, there was a positive change in at least one measure of health literacy. Reasons for lack of effect on health literacy were mostly related to the intensity of intervention.

Somewhat surprisingly, a third of studies evaluating a multiple range of interventions failed to demonstrate changes in health literacy. These studies were also less likely to demonstrate change in SNAPW behaviours than those interventions which were less complex. These unsuccessful interventions included both individual and group interventions with additional written interventions, reminders and follow up. This suggests that simply adding different types of interventions together may not necessarily enhance their effectiveness in improving health literacy. Successful interventions need a coherent theoretical framework and need to make sense to both providers and patients. Somewhat surprisingly We also found that interventions of greater intensity were not more likely to report impacts on lifestyle behaviours than those of lower intensity.

Some interventions appeared more suited to particular behavioural risk factors. Studies evaluating individual motivational counselling were more likely to report change in smoking and physical activity. There was more evidence for the success using written interventions with nutrition behaviours and possibly web/computer interventions but there were only two of these studies. However, targeting multiple risk behaviours did not appear to reduce the effectiveness of interventions especially in changing nutrition and physical activity.

There was a scarcity of studies which assessed the costs or cost-effectiveness of health literacy interventions, with the majority of those identified focused on smoking cessation. A number of brief interventions involving consultation or computer generated tailored letters for smoking were low cost (compared with other interventions for the same risk factors)[102] but there were no statistically significant changes in measures of behaviour change in the long term in these studies. The cost-effectiveness results for these interventions must be interpreted with appropriate caution. The evaluation of cost-effectiveness is often seen as a final hurdle to implementation of interventions that have already proven effectiveness .[103]

Cost-effectiveness analysis is increasingly being used by decision makers as a tool to help inform allocative efficiency within the healthcare sector.[104] By using standardised methods and valuing outcomes in comparable units, such as quality-adjusted life-years (QALYs), cost-effectiveness analyses help decision makers compare the value that is offered by alternative healthcare spending options.[105] However, a limitation of many of the cost-effectiveness studies identified was the focus on intermediate outcomes, such as the cost per quitter, resulting in a reduced utility to decision makers.[106]

Most interventions were either based in primary health care services or the community and there appeared to be little influence of these settings on their success in changing health literacy or risk behaviours. In primary health care settings the majority of individual and group interventions produced changes to health literacy and risk behaviours. The majority of community based studies involved group interventions or the use of written materials. While there were only half as many studies using written materials as used group education they seemed more successful in improving health literacy, nutrition and physical activity compared with group education interventions. It is not possible to determine if there were differences in effectiveness between individual interviewing and counselling and multiple interventions as there were so few of these studies.

The type of provider was associated with effectiveness of interventions. Nurse or educators were more likely to be involved in successful interventions to change health literacy. They were also somewhat more effective in changing physical activity behaviours but less so with smoking compared with other providers. Lay workers were of comparable effectiveness with medical or nursing providers in changing health literacy and diet and physical activity behaviours but not smoking. All this has positive implications for the involvement of a range of well trained providers including lay workers in interventions to enhance the lifestyle risk factors. This substitution or enhancement of roles is likely to be more effective where providers are co-located.[107]

BARRIERS AND DRIVERS

There were a wide range of barriers related to patients, providers and the way in which services and programs were delivered to consumers. These varied according the particular risk behaviours for both patients and providers. Few of these had been subjected to evaluation or examined for their influence in intervention trials and were obtained from the descriptive or qualitative literature.

The 12-14 studies which focused on patients of low socioeconomic status or educational attainment or from ethnic minorities mostly involved group interventions targeting nutrition and physical activity. These were successful in changing health literacy and moderately effective in changing these behaviours (half to two thirds of studies). Patient psychological status, beliefs and outcome expectations were identified as important barriers which were in turn influenced by family and social support, poverty, culture ethnicity and the availability of information. Financial barriers (such as the cost of healthy food) and the cost of interventions were important determinants of uptake of health literacy interventions by disadvantaged groups.

The most important barrier to the provision health literacy interventions by providers was the availability of time and their range of preventive skills which were in turn influenced by the quality and availability of training. This was observed in a wide range of interventions as well as descriptive studies. Providing individual interventions took between 5 and 15 minutes in consultations. Most group intervention sessions lasted 1-2.5 hours for a total of 6-10 or more (up to 25) sessions. Both approaches have to deal with significant capacity constraints within primary health care due to problems of workforce supply and/or other demands.

In providing health literacy interventions, the strength and continuity of the provider-patient relationship was identified as important in many studies. This provides an opportunity to build trust in the information provided, skills for greater engagement of patients and attitudes and beliefs to be addressed over time. The design of health literacy materials and patient outcome expectations also influenced their receptiveness of patients to health literacy interventions.

THE POLICY OPTIONS TO SUPPORT THE IMPLEMENTATION OF EFFECTIVE INTERVENTIONS

This review suggests that both group and individual interventions are useful in supporting health literacy for change in behavioural risk factors, as each approach may suit different groups of providers or patients. This is particularly so when trying to reach people with socioeconomic or educational disadvantage.

The intensity of group education and motivational interviewing and counselling interventions needs to be balanced against the capacity of providers and the value in increasing the reach of interventions to the largest number of patients. Somewhat surprisingly, increasing the intensity of the intervention did not necessarily increase its effectiveness. Indeed a number of studies that evaluated lower intensity interventions (such as the use of written materials tailored to the stage of change) were effective in changing both health literacy and behavioural outcomes.

Effective interventions may target multiple behaviours (such as both physical activity and diet) without compromising their effectiveness. However, simply combining more intervention types into a large complex program without a coherent framework may not be effective.

We found evidence that interventions could be delivered effectively by a range of providers either in primary health care or in other community settings. Providers need training to give them the skills to conduct motivational counselling or group education based on adult education principles. While interventions may be relatively brief they are constrained by the time and capacity of primary health care providers. Existing programs to support preventive health checks and lifestyle interventions may need to be extended to provide more capacity for the range of primary health care providers to offer educational interventions to a broader range of patients. There may also need to be funding mechanisms for GPs, nurses and allied health providers or support to develop a lay workforce capable of contributing to group educational interventions based in the community.

Patient barriers need to be addressed by broader changes within the health system. These include literacy and economic barriers especially the cost of interventions for people with low income, low education or those from CALD backgrounds. Consumers have strong attitudes, beliefs and expectations relating to the behavioural risk factors. A trusting continuous relationship over time with their provider and/or provider team can help to address these attitudes and beliefs and provide patients with the opportunity and confidence to actively engage in decisions about their health. Culturally and language appropriate patient education resources (including Life-scripts) provide important tools for developing health literacy. These need to be made more available to all providers in a form which can be readily used in individual consultations as well as in group programs.

Interventions can be effective with various disadvantaged groups including minority groups and those of low socioeconomic status and educational achievement. It is important, however, that such health literacy interventions are provided at low or no cost to patients if it is not to deter their uptake and potential effectiveness. Engagement of other family and community members may enhance their effectiveness.

The relative cost effectiveness of drivers to influence uptake of health literacy interventions will depend on the nature of intervention and those involved, as well the wider context (organisational, political, economic and social).[108] We did not identify any cost-effectiveness studies on drivers which met the inclusion criteria; however we did locate some research on the cost-effectiveness of drivers for SWAPW interventions, which did not explicitly measure health literacy. One noteworthy Australian study[109] compared the relative cost-effectiveness of alternative drivers to increase GP uptake of screening and brief intervention for risky alcohol consumption. They found that GP financial incentives for screening were less cost-effective than other interventions such as computerised reminders and educational outreach. One of the limitations of this study was that they did not value screening time costs for non-incentive interventions. While the allocation of GP time may not always have budgetary implications, it may still present an opportunity cost when determining cost-effectiveness, being a scare resource with alternative uses. Clearly this is an area that requires further research.

Our analysis of the barriers and drivers suggests that there needs to be greater emphasis on educating providers about the importance of health literacy and implications for their practice. Training for providers in the skills they require to support health literacy is important especially techniques such as motivational interviewing which address patient attitudes as well as their knowledge. Policies which enhance the accessibility, personal continuity and length of consultations in primary health care are likely to be important to enable the provider to provide interventions of sufficient intensity to achieve positive results. Those with socioeconomic or educational disadvantage may require more intensive interventions to achieve change in health literacy or lifestyle risk factors. For patients from other cultures the availability of interpreters may be especially important. These imply organisational and structural changes within primary health care such as the development of more integrated and engaged primary health care teams.

WHAT REMAINS UNRESOLVED?

There is a need for the development of more specific measures of critical and interactive health literacy and of studies which rigorously evaluate interventions to enhance these. There is a particular need for rigorous studies which evaluate health literacy and behavioural outcomes for interventions to improve alcohol, diet and physical activity in primary health care. These are also important precursors for rigorous cost effectiveness studies.

While we found some papers, there were relatively few studies evaluating telephone and web/computer based interventions over longer periods of time. Given their adoption by many governments this deserves further study. There were also few studies evaluating health literacy interventions for alcohol or weight behaviours.

STRENGTHS AND LIMITATIONS

In this study we used a broad definition of health literacy [110] which included not only functional health literacy but also more advanced skills including cognitive, literacy and social skills which enable a person to participate and exert control over his or her health, health care and lives. This in turn led us to include research which used as their outcomes not only functional measures but also broader measures of motivation and self efficacy. Thus the review used changes in disease knowledge and other proxy measures including readiness to change, attitudes, self-efficacy, patient activation and shared decision making as a way of reporting outcomes of a health literacy intervention. All studies included in the efficacy analysis measured health literacy and this restricted the number of studies available for review. However comparisons between included studies need to be interpreted with caution as included studies in the review may have used different measures for health literacy.

The majority of the studies were of high or medium quality – only five studies were of low quality and these were evenly spread over studies evaluating the various types of intervention. The included studies were predominantly in primary health care or in the community in community organisations of various types but which were relevant to primary health care in its broad sense. Over half the included studies were from the US and only four studies with significant health literacy and SNAPW findings were from Australia or New Zealand. Differences between the health systems in these countries need to be considered in interpreting the findings.

Health literacy was poorly indexed as a term in the electronic databases. This resulted in the search being highly sensitive with poor specificity. There were relatively few empirical studies identified and few of these which specifically assessed change in health literacy and SNAPW behaviours. In particular there were few economic or costing evaluation studies that met the inclusion criteria.

Although the majority of studies were found to be reasonably methodologically sound when subjected to the quality appraisal, there was a large variation in the reporting of the education attainment, socio-economic status and ethnicity of participants. In many cases the characteristics were not reported. Therefore the review was limited in its ability to fully answer the research questions related to CALD communities and lower socio-economic groups.

REFERENCES

1. Ratzan S, Parker R. Introduction. In: Selden C, Zorn M, Ratzan S, Parker R, editors. National Library of Medicine Current Bibliographies in Medicine: Health Literacy. Bethesda, MD: National Institutes of Health, U.S. Department of Health and Human Services; 2000.
2. Nutbeam D, Kickbusch I. Advancing health literacy: a global challenge for the 21st century. Health Promotion International. 2000;15(3).
3. Nutbeam D. Health literacy as a public health goal: A challenge for contemporary health education and communication strategies into the 21st century. Health Promotion International. 2000;15(3):259-67.
4. Australian Bureau of Statistics. Health Literacy, Australia. Canberra: Australian Bureau of Statistics; 2006.
5. Darren A. DeWalt, Nancy D. Berkman, Stacey Sheridan, Kathleen N. Lohr, Michael P. Pignone. Literacy and Health Outcomes A Systematic Review of the Literature. J GEN INTERN MED. 2004;19:1228-39.
6. Berkman Nancy D. DDA, Pignone Michael P, Sheridan Stacey L, Lohr Kathleen N, Lux Linda, Sutton Sonya F, Swinson Tammeka , Bonito Arthur J.,. Literacy and Health Outcomes. Evidence Report/Technology Assessment. Rockville: Agency for Healthcare Research and Quality; 2004.
7. Rudd RE. Health literacy skills of U.S. adults. . Am J Health Behav, . 2007;31 Suppl S8-18.
8. Sarkar U, L. Fisher, and D. Schillinger, . Is self-efficacy associated with diabetes self-management across race/ethnicity and health literacy? . Diabetes Care. 2006;29(4):823-9.
9. Miller DP, Jr., et al., . The effect of health literacy on knowledge and receipt of colorectal cancer screening: a survey study. BMC Fam Pract, . 2007;8:16.
10. Scott T, G. JA, and M. Williams, . Health Literacy and preventive health care use among Medicare enrollees in a managed care organization. . Med Care. 2002:395-404.
11. Keller DL, J. Wright, and H.A. Pace,. Impact of health literacy on health outcomes in ambulatory care patients: a systematic review. . Ann Pharmacother, . 2008;42(9):1272-81.
12. RTI International–University of North Carolina Evidence-Based Practice Center Research Triangle Park N. Literacy and Health Outcomes, Evidence Report/Technology Assessment: Agency for Healthcare Research and Quality, U.S. Department of Health and Human Services; January 2004.
13. Nutbeam D. The evolving concept of health literacy. Social Science & Medicine. 2008;67(12):2072-8.
14. National Health Priority Action Council (NHPAC). National Chronic Disease Strategy: Australian Government Department of Health and Ageing, Canberra; 2006.
15. Mark V. Williams M, David W. Baker M, MPH, Ruth M. Parker M, Joanne R. Nurss P. Relationship of Functional Health Literacy to Patients' Knowledge of Their Chronic Disease. A Study of Patients With Hypertension and Diabetes. Arch Intern Med. 1998;158:166-72.
16. Dean Schillinger M, Kevin Grumbach M, John Piette P, Frances Wang M, Dennis Osmond P, Carolyn Daher M, et al. Association of Health Literacy With Diabetes Outcomes. JAMA. 2002;288:475-82.
17. Keleher H, Hagger V. Health literacy in primary health care. Australian Journal of Primary Health. [Article]. 2007 Aug;13(2):24-30.
18. Harris MF HC, Powell Davies G, Simpson S, Bernard D, Stubbs A.,. Implementation of a SNAP intervention in two divisions of general practice: a feasibility study. . MJA. 2005(183: s54-s58).
19. Von Korff M GJ, Schaefer J, Curry SJ, Wagner EH. Collaborative management of chronic illness. Ann Intern Med 1997 December;15(127 (12)):1097-102.
20. Lipkin M. Patient education and counseling in the context of modern patient-physician-family communication. . Patient Educ Couns. 1996;27(1):5-11.
21. Hibbard JH SJ, Mahoney ER, and Tusler M. . Development of the Patient Activation Measure (PAM): Conceptualizing and Measuring Activation in Patient and Consumers. . Health Services Research 2004;39 (4):1005-26.
22. Australian Bureau of Statistics. ADULT LITERACY AND LIFE SKILLS SURVEY: USER GUIDE. Canberra: Australian Bureau of Statistics; 2006.
23. Australian Institute of Health and Welfare. Australia's Health 2008. 2008.
24. Institute of Medicine. Health Literacy: A Prescription to End Confusion. Washington, DC: National Academies Press; 2004.
25. Williams J, Clemens S, Oleinikova K, Tarvin K. The skills for life survey. A national needs and impact survey of literacy, numeracy and ICT skills. London: Department for Education and Skills; 2003.
26. Adams RJ AS, Hill CL, Dodd M, Finlay C, Wilson DH. . Risks associoated with low functional health literacy in an Australian Population. . Med J Aus. 2009;191:530-4.
27. Australian Institute of Health and Welfare. The Burden of Disease and Injury in Australia. 2000.
28. Australian Institute of Health and Welfare: O'Brien K. Living dangerously: Australians with multiple risk factors for cardiovascular disease. In: AIHW C, editor.; 2005.
29. National Health and Medical Research Council. Australian alcohol guidelines for low-risk drinking. . In: Canberra N, editor.; 2009.
30. von Wagner C. Knight K. Steptoe A. Wardle J. . Functional health literacy and health-promoting behaviour in a national sample of British adults. . Journal of Epidemiology & Community Health 2007;61:1086-90.

31. National Health and Hospitals Reform Commission. A healthier future for all Australians - Final Report June Canberra: Australian Government Department of Health and Ageing 2009.
32. National Preventative Health Taskforce. Australia:The Healthiest Country by 2020 - National Preventative Health Strategy - the roadmap for action. Canberra: Australian Government Department of Health and Ageing 2009.
33. Nutbeam DKI. Advancing health literacy: a global challenge for the 21st century. Health Promotion International. 2000;15(3).
34. Manganello JA. Health literacy and adolescents: a framework and agenda for future research. Health Education Research 2008;2008 Oct 23 (5): :840-7
35. Effective Public Health Practice Project. Quality Assessment Tool For Quantitative Studies. Retrieved October 2008 from above web address. Corresponding article of interest: Thomas, B.H., Ciliska, D., Dobbins, M., & Micucci, S. (2004). A process for systematically reviewing the literature: Providing the research evidence for public health nursing interventions. Worldviews on Evidence-Based Nursing, 1(3), 176-184.; 1998.
36. Nies MA, Artinian NT, Schim SM, Vander Wal JS, Sherrick-Escamilla S. Effects of lay health educator interventions on activity, diet, and health risks in an urban Mexican American community. Journal of Primary Prevention. 2004;25(4):441-55.
37. Hartman TJ, McCarthy PR, Park RJ, Schuster E, Kushi LH. Results of a community-based low-literacy nutrition education program. Journal of Community Health. 1997;22(5):325-41.
38. Klassen AC, Garrett-Mayer E, Houts PS, Shankar S, Torio CM. The relationship of body size to participation and success in a fruits and vegetables intervention among low-income women. Journal of Community Health. 2008;33(2):78-89.
39. Goldstein MG, Pinto BM, Marcus BH, Lynn H, Jette AM, Rakowski W, et al. Physician-based physical activity counseling for middle-aged and older adults: a randomized trial. Annals of Behavioral Medicine. 1999;21(1):40-7.
40. Norris SL, Grothaus LC, Buchner DM, Pratt M. Effectiveness of physician-based assessment and counseling for exercise in a staff model HMO. Preventive Medicine. 2000 Jun;30(6):513-23.
41. Lancaster T, Dobbie W, Vos K, al e. Randomized trial of nurse-assisted strategies for smoking cessation in primary care. Br J Gen Pract 1999;49:191-4.
42. Jimmy G, Martin BW. Implementation and effectiveness of a primary care based physical activity counselling scheme. Patient Education and Counseling. 2005;56(3):323-31.
43. Fries E, Edinboro P, McClish D, Manion L, Bowen D, Beresford S, et al. Randomized trial of a low-intensity dietary intervention in rural residents: the Rural Physician Cancer Prevention Project. . Am J Prev Med. 2005;28:162-8.
44. Yajima S, Takano T, Nakamura K, Watanabe M. Effectiveness of a community leaders' programme to promote healthy lifestyles in Tokyo, Japan. Journal.
45. Agurs-Collins T, Kumanyika S, Ten Have T, Adams-Campbell L. A randomised controlled trial of weight reduction and exercise for diabetes management in older African-American subjects. Diabetes Care 1997;20(10).
46. Beresford SA SJC, A R Kristal, D Lazovich, Z Feng and E H Wagner. A dietary intervention in primary care practice: the Eating Patterns Study. . American Journal of Public Health. 1997;87(4):610-6.
47. Kreuter MW, Strecher VJ. Do tailored behavior change messages enhance the effectiveness of health risk appraisal? Results from a randomized trial. Health Education Research. 1996;11(1):97-105.
48. O'Loughlin J, Paradis G, Meshefedjian G, Kishchuk N. Evaluation of an 8-Week Mailed Healthy-Weight Intervention. Preventive Medicine. 1998;27(2):288-95.
49. Boylan MJ, Renier CM, Knuths JS, Haller IV. Preventing cardiovascular disease in women: an intervention-control randomized study. Minnesota medicine. 2003;86(5):52-6.
50. Ryan A, Smith C. Change for Life/Cambia tu vida: a health promotion program based on the stages of change model for African descendent and Latino adults in New Hampshire. Preventing chronic disease. 2006;3(3).
51. Moore H, Summerbell CD, Greenwood DC, Tovey P, Griffiths J, Henderson M, et al. Improving management of obesity in primary care: Cluster randomised trial. British Medical Journal. 2003;327(7423):1085-8.
52. Lennox AS OL, Reiter E, Robertson R, Friend J, McCann I,, Skatun D DP. Cost effectiveness of computer tailored and non-tailored smoking cessation letters in general practice: randomised controlled. BMJ. 2001 9th June;322.
53. Toobert DJ, Glasgow RE, Strycker LA, Barrera M, Ritzwoller DP, Weidner G. Long-term effects of the Mediterranean lifestyle program: a randomized clinical trial for postmenopausal women with type 2 diabetes (Provisional abstract). International Journal of Behavioural Nutrition and Physical Activity; 4 (1):.
54. Butler C, Rollnick S, Cohen D, et al. Motivational consulting versus brief advice for smokers in general practice: a randomized trial. Br J Gen Pract 1999;49:611-6.
55. Ritzwoller DP, Toobert D, Sukhanova A, Glasgow RE. Economic analysis of the Mediterranean Lifestyle Program for postmenopausal women with diabetes (Brief record). Diabetes Educator 2006:32 (5):761-769
56. Jacobs-Van der Bruggen M VBP, Hoogenveen R, Feenstra T, Briggs A, Lawson K, Feskens E, Baan C,. Cost-effectiveness of lifestyle modification in diabetic patients. Diabetic Care. 2009 August 2009;32(8).

57. Sadur CN, Moline N, Costa M, Michalik D, Mendlowitz D, Roller S, et al. Diabetes management in a health maintenance organization. Efficacy of care management using cluster visits. Diabetes Care. 1999 Dec;22(12):2011-7.
58. Adolfsson ET, Walker-EngstrÃ¶m ML, Smide B, Wikblad K. Patient education in type 2 diabetes-A randomized controlled 1-year follow-up study. Diabetes Research and Clinical Practice. 2007;76(3):341-50.
59. Siero F, Broer, J, Bemelmans, WJ, Meyboom-de Jong, BM. Impact of group nutrition education and surplus value of Prochaska-based stage-matched information on health-related cognitions and on Mediterranean nutrition behavior. . Health Educ Res 2000;15:635-47.
60. Steptoe A, Rink E, Kerry S. Psychosocial predictors of changes in physical activity in overweight sedentary adults following counseling in primary care. Preventive Medicine. 2000;31(2 I):183-94.
61. Efraimsson EÃ, Hillervik C, Ehrenberg A. Effects of COPD self-care management education at a nurse-led primary health care clinic. Scandinavian Journal of Caring Sciences. 2008;22(2):178-85.
62. Calfas K, Sallis J, Oldenburg B, et al. Mediators of change in physical activity following an intervention in primary care: PACE. Prev Med. 1997;26:297-304.
63. Ogden J, Hoppe R. The relative effectiveness of two styles of educational package to change practice nurses' management of obesity. International Journal of Obesity. 1997;21(11):963-71.
64. Van Sluijs EMF, Van Poppel MNM, Twisk JWR, Van Mechelen W. Physical activity measurements affected participants' behavior in a randomized controlled trial. Journal of Clinical Epidemiology. 2006;59(4):404-11.
65. Graham-Clarke P, Oldenburg B. The effectiveness of a general-practice-based physical activity intervention on patient physical activity status. Behaviour Change. 1994;11(3):132-44.
66. Kloek GC, van Lenthe FJ, van Nierop PWM, Koelen MA, Mackenbach JP. Impact evaluation of a Dutch community intervention to improve health-related behaviour in deprived neighbourhoods. Health and Place. 2006;12(4):665-77.
67. Lorig KR, Ritter PL, Jacquez A. Outcomes of border health Spanish/English Chronic Disease Self-management Programs. Diabetes Educator. 2005;31(3):401-9.
68. Collins R, Lee RE, Albright CL, King AC. Ready to be Physically Active? The Effects of a Course Preparing Low-Income Multiethnic Women to be more Physically Active. Health Educ Behav. 2004 February 1, 2004;31(1):47-64.
69. Dunn AL, Marcus BH, Kampert JB, Garcia ME, Kohl HW, Blair SN. Reduction in cardiovascular disease risk factors: 6-month results from Project Active. Preventive Medicine 1999 (1): 101-3.
70. Simmons D, Voyle JA, Fout F, Feot S, Leakehe L. Tale of two churches: Differential impact of a church-based diabetes control programme among Pacific Islands people in New Zealand. Diabetic Medicine. 2004;21(2):122-8.
71. Swerissen H, Belfrage J, Weeks A, Jordan L, Walker C, Furler J, et al. A randomised control trial of a self-management program for people with a chronic illness from Vietnamese, Chinese, Italian and Greek backgrounds. Patient Education and Counseling. 2006;64(1-3):360-8.
72. Koffman DM BT, Mosca L, Redberg R, Schmid T, Wattigney WA. An evaluation of Choose to Move 1999: an American Heart Association physical activity program for women. Arch Intern Med 2001 October 8th 2001;161(18):2193-9.
73. de Vries H, Kremers SP, Smeets T, Brug J, Eijmael K. The effectiveness of tailored feedback and action plans in an intervention addressing multiple health behaviors. American Journal of Health Promotion 2008; 6: 417-25..
74. Marcus BH BB, Pinto BM, Forsyth LH, Roberts MB, Traficante RM. Efficacy of an individualized, motivationally-tailored physical activity intervention. Ann Behav Med 1998;20(3):174-80.
75. Prochaska JO, Velicer WF, Rossi JS, Redding CA, Greene GW, Rossi SR, et al. Multiple Risk Expert Systems Interventions: Impact of Simultaneous Stage-Matched Expert System Interventions for Smoking, High-Fat Diet, and Sun Exposure in a Population of Parents. Health Psychology. 2004;23(5):503-16.
76. Brassington GS, Atienza AA, Perczek RE, DiLorenzo TM, King AC. Intervention-related cognitive versus social mediators of exercise adherence in the elderly. American Journal of Preventive Medicine. 2002 Aug;23(2 Suppl):80-6.
77. Wolf RL, Lepore SJ, Vandergrift JL, Basch CE, Yaroch AL. Tailored telephone education to promote awareness and adoption of fruit and vegetable recommendations among urban and mostly immigrant black men: A randomized controlled trial. Preventive Medicine. 2009;48(1):32-8.
78. Winkleby MA, Howard-Pitney B, Albright CA, Bruce B, Kraemer HC, Fortmann SP. Predicting achievement of a low-fat diet: a nutrition intervention for adults with low literacy skills. Preventive Medicine. 1997;26(6):874-82.
79. Block Gladys WP, Mandel Rochelle , Metz Diane , Fujii Mary, Feldman Nancy , and Sutherland Barbara '. A Randomized Trial of the Little by Little CD-ROM: Demonstrated Effectiveness in Increasing Fruit and Vegetable Intake in a Low-income Population. Preventing Chronic Disease. 2004;1(3).
80. Naylor P, Simmonds, G, Riddoch, C et al. . Comparison of stage-matched and unmatched interventions to promote exercise behaviour in the primary care setting. Health Educ Res. 1999;14:653-66.

81. Little P, Dorward M, Gralton S, Hammerton L, Pillinger J, White P, et al. A randomised controlled trial of three pragmatic approaches to initiate increased physical activity in sedentary patients with risk factors for cardiovascular disease. Br J Gen Pract. 2004;54(500):189-95.
82. Ridgeway NA, Harvill DR, Harvill LM, Falin TM, Forester GM, Gose OD. Improved control of type 2 diabetes mellitus: A practical education/behavior modification program in a primary care clinic. Southern Medical Journal. 1999;92(7):667-72.
83. Slama K, Karsenty S, Hirsch A. French general practitioners' attitudes and reported practices in relation to their participation and effectiveness in a minimal smoking cessation programme for patients. Addiction. 1999;94(1):125-32.
84. Delichatsios H, Hunt M, Lobb R, et al. EatSmart: efficacy of a multifaceted preventive nutrition intervention in clinical practice. Prev Med. 2001;33:91-8.
85. Aldana SG, Greenlaw RL, Diehl HA, Salberg A, Merrill RM, Ohmine S, et al. Effects of an intensive diet and physical activity modification program on the health risks of adults. Journal of American Dietetics Association 2005 ; 3: 371-81.
86. Oenema A, Brug J, Dijkstra A, de Weerdt I, de Vries H. Efficacy and use of an internet-delivered computer-tailored lifestyle intervention, targeting saturated fat intake, physical activity and smoking cessation: a randomized controlled trial. Annals of Behavioural Medicine 2008; 2: 125-35.
87. Campbell MK, DeVellis BM, Strecher VJ, Ammerman AS, DeVellis RF, Sandler RS. Improving dietary behavior: the effectiveness of tailored messages in primary care settings. Am J Public Health. 1994 May 1, 1994;84(5):783-7.
88. Prochaska JO, Velicer WF, Redding C, Rossi JS, Goldstein M, DePue J, et al. Stage-based expert systems to guide a population of primary care patients to quit smoking, eat healthier, prevent skin cancer, and receive regular mammograms. Preventive Medicine. 2005;41(2):406-16.
89. Hoffman AM, Redding CA, Goldberg D, Añel D, Prochaska JO, Meyer PM, et al. Computer expert systems for African-American smokers in physicians offices: A feasibility study. Preventive Medicine. 2006;43(3):204-11.
90. Irving Rootman, Deborah Gordon-El-Bihbety. A Vision for a Health Literate Canada Report of the Expert Panel on Health Literacy. Ottawa: Canadian Public Health Association; 2008. Report No.: ISBN: 978-1-897485-00-2.
91. Rimer BK, Orleans CT. Tailoring smoking cessation for older adults. Cancer. 1994 Oct 1;74(7 Suppl):2051-4.
92. Miller CK, Edwards L, Kissling G, Sanville L. Evaluation of a theory-based nutrition intervention for older adults with diabetes mellitus. Journal of the American Dietetic Association. 2002 Aug;102(8):1069-81.
93. Carroll JK. Fiscella K. Epstein RM. Jean-Pierre P. Figueroa-Moseley C. Williams GC. Mustian KM. Morrow GR. Getting patients to exercise more: a systematic review of underserved populations. . Journal of Family Practice. 2008;57(3):170-6.
94. Bull FCL, Schipper ECC, Jamrozik K, Blanksby BA. How can and do australian doctors promote physical activity? Preventive Medicine. 1997;26(6):866-73.
95. Hopkins SC LE. 2005. Preventive Medicine. Pontes NM, Lin SZ, Mundinger MO.;40:718-24.
96. Menec VH SM AD. Does continuity of care matter in a universally insured population? Health Services Research. 2005;40(2):389-400.
97. Fernandez LA. Martin JM. del Castillo JD. Gaspar OS. Millan JI. Lozano MJ. Keenoy ED. . Sources of influence on medical practice. . Journal of Epidemiology & Community Health. 2000;54(8):623-30.
98. Volpp KG TA, Pauly MV, Glick HA, Puig A, Asch DA, Galvin R, Zhu J, Wan F, DeGuzman J, Corbett E, Weiner J, Audrain-McGovern J. A Randomized Controlled Trial of Financial Incentives for Smoking Cessation. . . The New England Journal of Medicine. 2009;360:699-709.
99. Scott LA. Black DR. . Health communication and professional preparation: health educator credibility, message learning, and behavior change. Health Education & Behavior. 1999;26(5):609-20.
100. Slama K, Redman S, Perkins J, al E. The effectiveness of two smoking cessation programmes for use in general practice: a randomised controlled trial. BMJ. 1990;300:1707-9.
101. Steptoe A, Kerry S, Rink E, Hilton S. The impact of behavioral counseling on stage of change in fat intake, physical activity, and cigarette smoking in adults at increased risk of coronary heart disease. American Journal of Public Health. 2001;91(2):265-9.
102. Song F RJ, Aveyard P, Hyde C, Barton P, Woolacott N., . Cost-effectiveness of pharmacological interventions for smoking cessation: a literature review and a decision analytic analysis. . Med Decis Making 2002;22(5 (suppl):S26-S37).
103. Taylor RS DM, Salkeld G, Sullivan SD. . Inclusion of cost effectiveness in licensing requirements of new drugs: the fourth hurdle. . BMJ. 2004;329:972-5.
104. Harris A HS, Chin G, et al. . The role of value for money in public insurance coverage decisions for drugs in Australia: a retrospective analysis 1994–2004. . Med Decis Making 2008;28:713–22.
105. Gold MR SJ, Russell LB, Weinstein MC. . Cost-effectiveness in health and medicine. . New York: Oxford University Press; 1996.
106. Malley P. Invited commentary on : Salize HJ, Merkel S, Reinhard I, Twardella D, Mann K, Brenner H. Cost-effective primary care-based strategies to improve smoking cessation. . Arch Intern Med 2009;169(3):230-6.

107. Russell GM DS, Hogg W, Geneau R, Muldoon L, Tuna M. . Managing Chronic Disease in Ontario Primary Care: The Impact of Organizational Factors. . Annals of Family Medicine. 2009;7:309-18.
108. Grol R aWM. What drives change? Barriers to and incentives for achieving evidence-based practice. MJA 2004; . BMJ. 2004;180 (6 Suppl): S57-S60.
109. Shanahan M SAaMR. Modelling the Costs and Outcomes of Changing Rates of Screening for Alcohol Misuse by GPs in the Australian Context. Appl Health Econ Health Policy 2006; 5 (3): 155-166. 2006. 2006.
110. Nutbeam D. Health literacy as a public health goal: A challenge for contemporary health education and communication strategies into the 21st century.