



MELBOURNE HEALTH

**CLINICAL EPIDEMIOLOGY & HEALTH
SERVICE EVALUATION UNIT**

**A Literature review of public health
interventions for
Rheumatoid Arthritis, Osteoarthritis
&
Osteoporosis**

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GLOSSARY

ABS	Australian Bureau of Statistics
ADL	Activities of Daily Living
AFA	Arthritis Foundation of Australia
AIHW	Australian Institute of Health and Welfare
ASMC	Arthritis Self-Management Course
BMD	Bone Mineral Density
CBT	Cognitive Behavioural Therapy
CDSMC	Chronic Disease Self-Management Course
CEHSEU	Clinical Epidemiology and Health Service Evaluation Unit
DALYs	Disability Adjusted Life Years
DHS	Department of Human Services
DSM-IV-TR	Diagnostic and Statistical Manual of Mental Disorders- Text Version, IV edition
GP	General Practitioner
NHMRC	National Health and Medical Research Council
OA	Osteoarthritis
OP	OP
OPSMC	OP Self-Management Course
RCT	Randomised Controlled Trials
RA	Rheumatoid Arthritis
WHO	World Health Organisation
YLD	Years Lived with Disability
25-OHD	25 Hydroxy Vitamin D

1. EXECUTIVE SUMMARY

In 2000, the Bone and Joint Decade was proclaimed by the World Health Organization (WHO) in recognition of the significant impact of arthritis and musculoskeletal conditions on population health worldwide (1). This proclamation aimed to raise awareness, promote effective management, empower consumers and encourage research into these important conditions. In response to this, in 2002, arthritis and musculoskeletal conditions became Australia's seventh National Health Priority Area.

As an international and national priority, arthritis and musculoskeletal conditions has attracted renewed interest in terms of the information available to support their management and services. Policy and decision makers, service providers, public health physicians and other public health practitioners need access to the best contemporary evidence to make a decision about the appropriate healthcare and to plan and deliver the appropriate public health services. This report will enable the Department of Human Services and decision makers to undertake informed planning and development of services to optimise arthritis and musculoskeletal disorder prevention, education and management in the Victorian community.

1.1 Purpose and Scope

The purpose of this review is to (1) summarise the evidence regarding the effectiveness of public health interventions for arthritis and musculoskeletal conditions, (2) document which interventions are available within Victoria and, (3) to identify barriers to the implementation of best evidence public health interventions including:

1. Reducing the risk and outcome of falls in persons with arthritis and musculoskeletal conditions.
2. Reducing the risk of joint injury and subsequent development of osteoarthritis (OA)
3. Reducing the risk of further fracture in persons with OP (OP) presenting with first fracture
4. Reducing the risk and management of anxiety and depression in OA, rheumatoid arthritis (RA) and OP.

Comprehensive reporting of this evidence base will:

- Provide a consolidated outline of evaluated public health interventions and models for the care of arthritis and musculoskeletal disorders.
- Assist agencies to systematically plan and develop local community-based arthritis and OP interventions
- Assist agencies to identify and tackle barriers to the provision of comprehensive and integrated patients-centred treatment
- Assist agencies to identify and develop proposals aligned with current priority programs
- Highlight conflicting evidence, gaps in evidence and provide recommendations for future policy, practice and research

The report is devoted into sections addressing the four key areas as described earlier. Each section will contain the following:

- A summary of the key findings, encapsulated in a matrix overview of all interventions with evidence of applicability. Such a matrix allows quick identification of relevant interventions, explored in detail in subsequent sections.
- A synthesised discussion of public health interventions relevant to the specific arthritis and musculoskeletal issue.

In addition to the literature review, Arthritis Victoria conducted a quantitative survey of evidenced-based, public health interventions for rheumatoid arthritis, osteoarthritis and osteoporosis being utilised in the Victorian primary care sector. This survey was created around the evidenced based interventions for the four key areas in this report.

It is anticipated that this report will be used in conjunction with Commonwealth initiatives (National Action Plan and National Strategic Improvement Framework) for OA, RA and OP that are currently in development. The four issues addressed in the current report have been chosen by virtue of their recognised impact at both individual and public health levels. It is acknowledged that many other issues exist for persons with arthritis and musculoskeletal conditions that will also have significant impact at these levels and could be considered for analysis in future reports.

1.2 Method

This report has focussed on issues around public health interventions for arthritis and musculoskeletal conditions, their relation to current practice and their applicability to Victoria. Public Health is viewed as an organised societal approach to population health, where health is understood as defined by WHO to be “a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity.” (2). The public health interventions summarised in this report fulfil inclusion criteria outlined by the Cochrane Health Promotion and Public Health Field (3). This report does is not intended as an exhaustive summary of evidence of effective pharmacological, non-pharmacological or surgical interventions for an individual’s condition. Where no published reports could be identified that fulfilled Cochrane criteria for public health interventions a summary of effective interventions for individual treatment have been included to complement the available information and inform future public health research and planning.

Prevention strategies for arthritis and musculoskeletal conditions can be classified into three levels depending on the stage of disease and severity:

- *Primary prevention* is designed to prevent a disease or condition from occurring in the first place and targets healthy people.
- *Secondary prevention* reduces the impact of a condition. It attempts to identify a disease at its earliest stage before symptoms are exacerbated so that prompt and appropriate management can be initiated.
- *Tertiary prevention* focuses on reducing or minimizing the consequences of a disease once symptoms or other impacts have developed. The goal of tertiary prevention is to prevent disease progression and deterioration, prevent relapse, reduce disease severity, prevent and reduce exacerbations and reduce mortality and permanent disability.

Identification of Public Health Interventions

The public health interventions identified in the report include:

- Interventions designed to support positive health;
- Interventions designed to reduce health-harming behaviours and situations;
- Interventions to improve the health outcomes of those with responsibility for caring for those affected by illness or injury
- Preventive interventions aimed at improving health-protecting factors and reducing health risk factors in whole populations/communities/ demographic target groups;
- Public policies influencing the effectiveness and equitable delivery of health services at a population level

An extensive search of the academic literature was conducted in MEDLINE, CINHALL and PsycINFO for papers regarding investigation of public health interventions relevant to each of the four areas using defined search strategies. Bibliographies of identified articles were scrutinised for additional references.

The search strategies developed for identifying relevant information pertaining to each type of public health intervention are detailed in Appendix 1.

The following abstract inclusion criteria were used for public health intervention studies:

- People of all ages and either sex
- Articles published in the English language
- Human studies
- Studies conducted from 1966 to October, 2004
- Studies conducted in community settings
- Studies relating to organised social interventions
- Systematic reviews
- Controlled clinical trials
- Case series, case reports and narrative reviews where there was no identified controlled clinical trials in the area
- Interventions that specifically addressed one of the three arthritis and musculoskeletal conditions of interest.

The following abstract exclusion criteria were used for public health intervention studies:

- Studies relating to specific pharmacological, non pharmacological and surgical interventions for treating an individual's condition, except where no other defined public health interventions, were identified and the specific interventions were considered to potentially inform public health research and planning.
- Non English language abstracts
- Papers that were irretrievable within the timeframe of the project

Reports of the potentially relevant studies were retrieved in full. Any differences regarding study inclusion were resolved by discussion and consensus agreement.

Where these were available evidence is reported based on peer reviewed high quality systematic reviews or well-designed randomised controlled trials. All retrieved papers were

critically appraised using methods outlined in ‘A Schema for Evaluating Evidence on Public Health Interventions 2002’ (4). Formal levels of evidence were assigned using a standard format defined by National Health and Medical Research Council (NHMRC) and are described in Table 1 (5). Lack of high-level evidence for interventions reflects currently available knowledge but does not necessarily imply lack of efficacy.

Table 1. Levels of Evidence used for Guideline Recommendations	
Level of Evidence	Description
I	Evidence obtained from a systematic review of all relevant randomised controlled trials.
II	Evidence obtained from at least one properly designed randomised controlled trial.
III –1	Evidence obtained from well-designed pseudo-randomised controlled trials (alternate allocation or some other method).
III –2	Evidence obtained from comparative studies with concurrent controls and allocation not randomised (cohort studies), case-control studies, or interrupted time series with a control group.
III –3	Evidence obtained from comparative studies with historical control, two or more single-arm studies, or interrupted time series without a parallel control group.
IV	Evidence obtained from case series, either post-test or pre-test and post-test.

1.3 Acknowledgements

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2. REVIEW PROCESS

2.1 Background

The term arthritis and musculoskeletal disorder refers to a diverse group of conditions that affect muscle, joints, tendons and other parts of the musculoskeletal system. These conditions are commonly associated with pain and impaired physical function and impact on occupational and psychosocial status often resulting in a reduced quality of life or, for some, reduced survival. Amongst the many categories of these disorders, osteoarthritis (OA), rheumatoid arthritis (RA) and OP (OP) represent a significant proportion of these disorders (6-10). Thus these three musculoskeletal conditions will be the focus of this report.

2.2 Burden of arthritis and musculoskeletal conditions

2.2.1 Overall Epidemiology

Information regarding the epidemiology of arthritis and musculoskeletal disease has been obtained from the Australian Institute of Health and welfare (AIHW) and the Arthritis Foundation of Australia (AFA). These organizations collect self-report data using an Australian National Health Survey, which is conducted periodically (every 6 or 7 years) by the Australian Bureau of Statistics (ABS). The latest survey was conducted in 2001. The prevalence and burden of disease of arthritis and musculoskeletal conditions has been estimated in a number of ways and is thought to be much higher than that revealed by the National Health Survey. The National Health Survey is a household survey, collecting information only on reported health conditions. Thus, it is likely that a proportion of people with arthritis is undiagnosed and untreated (9).

Arthritis and musculoskeletal conditions are reported to affect one out of every three persons in Australia (11). Arthritis is the third most common diagnosis made by general practitioners (3.6% of encounters) and the tenth most frequently managed condition by general practitioners (12). In 2000, arthritis was the most common chronic condition in the population, causing severe long-term pain and physical disability in 16.5% of affected Australians that year. This seems to be much higher than the rate predicted by the National Health Survey 1995 (9). In 2004, self-report data from the survey of Disability, Ageing and Carers documented that approximately 1.2 million Australians (about 34% of all persons with disability) had a disability attributable to arthritis and musculoskeletal disorders (13, 14).

Prevalence statistics by sex indicate that 60.4% of patients diagnosed with arthritis are women (12). Age is also a documented risk factor for the development of arthritis. In 2001, 43% people aged 65-74 years group and 52% of people aged 75 years and over suffered from arthritis.

2.2.2 Overall Cost of arthritis and musculoskeletal conditions

The impact of arthritis and musculoskeletal conditions is measured in terms of psychosocial and economic costs.

Psychosocial Cost

In 1996, arthritis and musculoskeletal disorders were estimated to account for 4% of the burden of disease in Australia. Arthritis and musculoskeletal disorders accounted for 1% of premature mortality and 7% of years of healthy life lost due to poor health or disability (11). The socioeconomic cost is further escalated by the fact that 60% of people with arthritis are of working age (9, 11, 15). In Victoria in 1996, musculoskeletal disease accounted for five percent of the total Victorian disease burden in women, or 15,443 Disability-Adjusted Life Years (DALYs). Osteoarthritis accounted for two thirds of this overall burden. The male burden was three percent lower or 8581 DALYs. Osteoarthritis ranked third in the top 20 causes of Disability Burden in Victoria, for women with 9,785 Years Lived with Disability (YLD) and eighth for men with 5,664 YLD (16). Psychological state and quality of life are also inhibited by the diagnosis of arthritic and musculoskeletal diseases.

Economic Cost

The economic impact of the arthritis and musculoskeletal conditions on society is massive. In 2000, arthritis costs were estimated by Access Economics to total almost \$9 billion or 1.4 per cent of gross domestic product (GDP). Of this total, \$2.2 billion (0.35 per cent of GDP) is made up of direct costs of health services aimed at preventing, diagnosing and treating arthritis, while indirect costs were estimated to be \$6.7 billion (1.06 per cent of GDP). In 2000-01, musculoskeletal conditions accounted for 9.5% of total health expenditure (\$4.7 billion) as compared to 11.2% on cardiovascular disease and 9.9% on diseases of the nervous system [7].

2.2.3 Epidemiology of Osteoarthritis (OA)

Osteoarthritis, the most common form of arthritis is characterised by joint pain and impairment of joint mobility associated with loss of joint cartilage and changes in underlying bone surfaces. Damage to articular cartilage occurs in response to a number of factors including trauma (10).

Incidence and Prevalence

OA is the most common form of musculoskeletal disorder world wide. Epidemiological estimates of OA vary according to the diagnostic tool used. Diagnosis may be made based in self-report, clinical symptomatology or radiology reports.

It is estimated that 9.6% of men and 18% of women aged ≥ 60 years have symptomatic OA world wide (10). In Australia in 1995, 1.2 million persons were estimated to be affected by OA (12). OA accounts for 15% of all self reported arthritis in Australia (approximately 3 million of the total population; (9, 12). Based on international radiological survey data, the Australian Institute of Health and Welfare (AIHW) estimated that there are more than 40,000 new cases of radiological OA diagnosed each year (17). Comparisons by sex, revealed that in 2001 9.2% of females surveyed were diagnosed with

OA as compared to 5.7% of males (11). The incidence and prevalence of OA will continue to grow as the population ages.

Impact

In Australia, OA is the ninth leading precipitant for general practitioner visits and the second for rheumatologist visits (11, 18) as the lead cause of pain and disability in the community. OA is the predominant condition leading to joint replacement surgery of the hip and knee (19). The total number of joint replacements performed in Australian hospitals has increased by almost 30% in the 4 years from 1996 to 2001 and a further 13.4% by June 2002 (20). OA is the third-largest contributor to life-years lost due to disability with the total of 4.8% of total life lost due to disability.(21). The direct medical costs to the Australian HealthCare budget specifically attributed to OA in 2001 were \$1090 million (22).

2.2.4 Epidemiology of RA

RA is an autoimmune disease associated with chronic joint inflammation that leads to progressive joint damage and often severe disability (10). Although RA is primarily considered an articular disease, it can also cause systemic extra-articular manifestation affecting various organs, including the lungs, heart and the eyes (10). RA most commonly develops between the age of 25 and 50 but can begin at any age. The aetiology of RA is unknown.

Incidence and Prevalence

In 2002, the National Health Survey identified the Australian prevalence of RA to be 2.4% (12). This is comparable with the international prevalence of between 1% and 2% (23). As with OA, the prevalence of RA is higher in women than men (11). In 2001, the prevalence of RA was 2.7% in females and 2.0% in males (12).

Impact

RA has a significant impact on patients' physical, social and psychological functioning even at the early stages of disease manifesting as a restriction in activities of daily living (ADL), work and leisure activities. RA is reported to be more disabling than other form of arthritis, with 33% of patients reporting mild to moderate disability and less than 10% having severe disability (24).

Research has estimated that disability associated with RA has been estimated to be 13,023 DALY (9). Years of life lost (YLL) due to premature death attributable to RA are estimated to be much higher than for other forms of arthritis (25). The reduced life expectancy associated with RA is caused by co-morbidities such as infections, cardiovascular, renal disease, respiratory disease and gastrointestinal disease (9). Based on data obtained from Arthritis Foundation of Australia (AFA), the total direct cost of RA for year 1999-2000 was estimated to be almost \$173 million (9).

2.2.5 Epidemiology of OP

OP is a disease where bone density and structural quality deteriorate, leading to weakness and bone fragility of the skeleton and increased risk of fracture. Common sites of fractures are wrist, hip, spine, pelvis and upper arm (26).

Incidence and Prevalence

In 2001, nearly two million Australians were estimated to have OP, of which 75% were women. This burden is predicted to increase to three million people by the year 2013 (9). Amongst females with OP, 10.5% were aged 65-74 years and 12.3% were aged 75 and above. In males with OP, 1.25% were aged 65-74 years and 1.5% were aged 75 and above (11).

Impact

In Australia, OP already poses a major public health problem for individuals and society as a whole. The clinical sequelae of OP are low trauma fractures and their complications. The most common low trauma fractures are: vertebrae, proximal femur and distal forearm. OP related fractures are estimated to be escalating at a rate of 4.0% per annum (9). In 2000-01, 64,514 Australian were hospitalised with osteoporotic fractures, half of these being the hip fractures. These figures equate to 177 fracture-related hospitalisations per day, or one every 8.1 minutes (9). Those who survive from hip fracture have an increased risk of dependence, with almost half requiring help with ADL and 15-25% requiring long term care(27, 28).

Economically, the cost of OP is estimated to be \$1.9 billion per annum in direct health expenditure. Indirect costs such as lost earnings, volunteer carers, modifications and equipment are estimated to be \$5.6 billion per annum. In 2000-2001, total OP cost equated to 1.2% of GDP (9). The economic burden of OP is further escalated by estimates the lost tax revenue due to OP exceeds \$1 billion (9).

2.3 Purpose of this review

Arthritis and musculoskeletal conditions are clearly a significant public health issue for Australia (29). A major challenge exists to provide a coordinated public health approach to ensure the delivery of effective interventions to those at risk of developing arthritis as well as to limit the adverse impact of these conditions following diagnosis. Despite the increasing burden of these disorders, arthritis and musculoskeletal conditions have received little public attention in Australia. This report will supplement commonwealth initiatives aimed at reducing the burden of arthritis and other musculoskeletal conditions and will enable the Department of Human Services Victoria and other decision makers to undertake informed planning, development and provision of appropriate services to reduce the burden of rheumatoid arthritis (RA), osteoarthritis (OA) and OP (OP) in Victoria.

This report focuses on four key areas in which public health initiatives may significantly impact on better health outcomes for persons with arthritis and musculoskeletal conditions. It is acknowledged that there are additional issues that would also benefit from comprehensive review for future public health strategic planning and that this report represents the first step in planning public health interventions for arthritis and musculoskeletal conditions.

The purpose of this review is:

1. To summarise the evidence for effective public health interventions for the following arthritis and musculoskeletal condition issues,

2. To document the extent to which these interventions are available within Victoria and,
3. To document barriers to implementation of currently available effective public health interventions:
 - Reducing the risk and outcome of falls in persons with arthritis and musculoskeletal conditions.
 - Reducing the risk of joint injury that can be associated with subsequent development of OA
 - Reducing the risk of further fracture in persons with OP presenting with first fracture
 - Reducing the risk and management of anxiety and depression in OA, RA and OP.

Accordingly, this review is divided into four sections:

- Falls in persons with arthritis and musculoskeletal conditions.
- Joint injury that can be associated with subsequent development of OA
- Fracture in persons with OP
- Anxiety and depression in OA, RA and OP.

3. KEY FINDINGS AND RECOMMENDATIONS

This review is divided into four sections:

- Falls in persons with arthritis and musculoskeletal conditions.
- Joint injury that can be associated with subsequent development of OA
- Fracture in persons with OP
- Anxiety and depression in OA, RA and OP.

The key findings of each section are summarized in the following matrix for easy reference:

3.1 Falls in persons with arthritis

Intervention	Prevention	Evidence of effectiveness	Evidence of applicability	Issues and possible direction
Falls specific interventions	Secondary/Tertiary	<p>Multifactorial interventions have a range of positive impacts on community dwelling older citizens in reducing falls and fall related consequences. These interventions include:</p> <ul style="list-style-type: none"> ▪ Education and health promotion, ▪ Exercise programs, ▪ Medical management of the underlined diseases, ▪ Medication management, ▪ Environmental home modification, ▪ Use of proper foot wear and aid devices and, ▪ Proper and balance diet <p>The impact of these programs in falls reduction in arthritis population requires further investigation.</p>	Community dwelling older persons who are identified to be at increased risk of falling	<ul style="list-style-type: none"> ▪ Specific targeting and testing of these interventions in Patient populations with arthritis is indicated.

Intervention	Prevention	Evidence of effectiveness	Evidence of applicability	Issues and possible direction
<p>Exercise</p>	<p><i>Primary/Secondary/Tertiary</i></p>	<p>Evidence from a systematic review supports the role of exercise to prevent falls and fall related injuries in older people.</p>	<p>People with high risk of falls.</p>	<ul style="list-style-type: none"> ▪ No evidence to support the exact type and amount of exercise needed. ▪ Exercise compliance is a major challenge particularly long term.
	<p><i>Secondary/Tertiary</i></p>	<p>There is an evidence to support the effectiveness of balance training, including Tai Chi for improving arthritic symptoms, balance, physical function and fear of falling.</p>	<p>Older persons who are able to weight bear. Most studies targeted older women.</p>	<ul style="list-style-type: none"> ▪ Promising approaches exist to improve balance control mechanism and facilitate movement control, which can aid body posturing, physical functioning, and reduce falls risk. ▪ Further research is needed to identify the most effective form/s of physical intervention to reduce risk of falls for patients with arthritis.
<p>Patient Education</p>	<p>Primary/Secondary/Tertiary</p>	<p>A systematic review evaluating patient education for adults with RA demonstrated only small short-term beneficial effects. However, a RCT demonstrated that patient education in addition to a self-help course was cost effective and associated with:</p> <ul style="list-style-type: none"> ▪ reduced pain, ▪ increased self-efficacy, ▪ increased compliance to treatment and exercise programs, ▪ increased understanding about the disease and ▪ Reduced use of health care services. <p>None of the studies investigated falls prevention as an outcome.</p>	<p>Adult RA population</p>	<ul style="list-style-type: none"> ▪ There is a lack of evidence on the effectiveness of education alone in preventing falls associated with arthritis. ▪ The effect of arthritis self management programs that include falls prevention education requires further investigation.

Intervention	Prevention	Evidence of effectiveness	Evidence of applicability	Issues and possible direction
Occupational therapy (OT)	<i>Secondary/Tertiary</i>	<p>Environmental Home Hazard assessment is useful as part of a multifaceted and targeted intervention strategy for falls prevention.</p> <p>Occupational therapy instruction for RA is effective for joint protection but has limited benefit for improving functional ability and has not been tested for effect on falls prevention.</p>	Broad range of settings and population sub-groups	<ul style="list-style-type: none"> Insufficient evidence exists regarding the effectiveness of OT or social support interventions in the prevention of falls in patients with arthritis beyond home hazard assessment.
Social support	<i>Primary/Secondary/Tertiary</i>	<p>Telephone Support. A small controlled trial demonstrated that monthly telephone support for patients with knee OA was cost effective in reducing pain and utilisation of health care facilities and improving function. There is no evidence to support the impact of these programs in reducing</p>	Older community dwelling persons who are identified as being at high risk of falls.	<ul style="list-style-type: none"> Appropriate targeting of interventions may be informed by patient population demographic factors
Intervention for fear of falling	<i>Secondary/Tertiary</i>	<p>Tai- Chi and patient education are effective in reducing fear of falling and increasing patient self-efficacy. There are limited studies that report interventions to reduce the fear of falling.</p>	Community dwelling elderly persons who have a past history of falls.	<ul style="list-style-type: none"> Fear of falling is a serious consequence of falls and may become a risk factor for falls. Improving access to community based Tai Chi. Further research into effective interventions for reducing fear of falling is needed.
Vitamin D supplementation	<i>Primary/Secondary/Tertiary</i>	There is substantial evidence to support the effectiveness of vitamin D supplementation in reducing falls in the general population of elderly people.	Institutionalised and community dwelling elderly people who are susceptible for vitamin D deficiency.	<ul style="list-style-type: none"> Patients with arthritis, especially older persons with limited exposure to sunlight are at risk of vitamin D deficiency.

Intervention	Prevention	Evidence of effectiveness	Evidence of applicability	Issues and possible direction
		<p>There is lack of information regarding effectiveness of Vitamin D supplementation in reducing falls, within the arthritis population.</p>		<ul style="list-style-type: none"> ▪ Increased awareness of Vitamin D deficiency and supplementation is needed, especially in those with a history of falls. ▪ Specific targeting and testing of vitamin D in patient populations with arthritis and high falls risk is indicated.

3.1.1 Recommendations

Based on this literature review, it is recommended that public health initiatives be undertaken to;

- Increase awareness of falls in people with arthritis and musculoskeletal disorders by targeting consumers and health professionals.
- Increase uptake of effective strategies for falls and fall-related injury prevention
- Increase research relating to epidemiology and aetiology of falls and fear of falling in people with arthritis and musculoskeletal conditions.
- Increase research to identify arthritis specific interventions to reduce the risk of falls and fall related injury.

3.2 Joint injury and OA

Intervention	Prevention	Evidence of effectiveness	Evidence of applicability	Issues and possible direction
Community based injury prevention programs	Primary	Evaluation of community based programs developed using health promotion design methods for general injury prevention in sport and recreational activity have yielded mixed results.	People associated with high injury risk sporting and recreational activity with high levels of repetitive low-grade impact and/or direct joint impact from contact with players, equipment or playing surfaces.	<ul style="list-style-type: none"> There is a lack of high quality evidence of the benefit of community based injury prevention programs in Australia. Program specific elements may be of benefit but further research and evaluation is indicated. Knowledge of local epidemiology of injury aetiology underpins injury prevention program design, implementation and evaluation processes. An improved surveillance system is required to enable high quality epidemiological research.
Occupational joint injury prevention programs	Primary	<p>There is evidence that primary prevention programs reduce musculoskeletal injuries in the workplace.</p> <p>The impact on workplace injury on the development of OA is unknown.</p>	People are involved in workplace activities involving heavy lifting, climbing stairs, frequent kneeling and squatting, bending. For example, floor layers, construction workers, forestry workers and farmers.	<ul style="list-style-type: none"> The association between OA and workplace injury is unknown. Modifying or minimizing occupational mechanical risk factors may serve to reduce the risk of joint injury and OA. Further research relating on the epidemiology of occupational associated joint injuries is indicated.

Intervention	Prevention	Evidence of effectiveness	Evidence of applicability	Issues and possible direction
<p>individuals/groups: -Promoting general health -Promoting safe behaviours -Stretching, Warm-ups -Rehabilitation -Protective equipment -Safe equipment and surface</p>	<p><i>Primary/Secondary</i></p>	<p>Observational data exists to support the effect of health promotion on changing general lifestyle behaviours and in turn reducing the risk of OA.</p> <p>Promoting safe play through fair rules may reduce sports injuries. However, the impact on the different types and sites of injuries has not been adequately evaluated.</p> <p>There is a lack of evidence relating to specific interventions targeted to reduce risk through use of protective equipments.</p>	<p>People associated with high injury risk due to sporting and recreational activity that involves high levels of repetitive low-grade impact and/or direct joint impact.</p>	<ul style="list-style-type: none"> ▪ Further research is needed to target public health initiatives aimed at reducing the burden of OA through joint injury prevention. ▪ There is an opportunity to support health promotion for improving general lifestyle behaviours that may decrease risk of spot related injury.

3.2.1 Recommendations

Based on this review, it is recommended that Public health initiatives be undertaken to;

- Promote healthy lifestyle behaviors
- Review and improve injury surveillance methods in elite and community-based sports.
- Support epidemiological research into:
 - The association between occupational activity and OA in the Victorian/Australian context
 - The aetiology of joint injury in elite and community based sports
- Evaluate focussed public health interventions based on local epidemiology knowledge for prevention of exercise associated joint injuries

3.3 Risk of Osteoporotic Fracture

Intervention	Prevention	Evidence of effectiveness	Evidence of applicability	Issues and possible direction
<p>Promoting Healthy life style: -Community based programs for the improvement of bone health; -Exercise programs -Fall prevention strategies</p>	<p>Primary/Secondary</p>	<p>There is evidence that community based self-management courses that promote better knowledge and self-efficacy influence OP lifestyle behaviors.</p> <p>Exercise programs such as aerobics, weight bearing resistant training and walking are effective in increasing bone strength in postmenopausal women.</p> <p>Targeted falls prevention programs are found to be effective in reducing falls.</p> <p>Injury prevention strategies such as hip-protectors reduce hip fractures in the institutionalized elderly.</p>	<p>Health promotion interventions applicable for all ages.</p>	<ul style="list-style-type: none"> ▪ Public awareness and understanding of OP should be raised and target specific populations. ▪ There is an opportunity to increase uptake of evidence based on guideline recommendations for the treatment of fragility fractures.
<p>Model of care for management of people with fragility fracture: -Multidisciplinary care program; -Specialist model of care</p>	<p>Secondary</p>	<p>There is evidence that a multidisciplinary approach to identification and treatment of high-risk patients has been demonstrated to improve fragility fracture management.</p> <p>Evidence regarding the most appropriate model/s of care is inadequate.</p>	<p>People who have suffered fragility fractures.</p>	<ul style="list-style-type: none"> ▪ Further research regarding the appropriate model of care for management of fragility fractures within different settings is indicated. ▪ Timely access to up-to-date evidence based information about fracture risk and management is required for health professionals in a user friendly format.

Intervention	Prevention	Evidence of effectiveness	Evidence of applicability	Issues and possible direction
<p>Strategies to prevent vitamin D deficiency and related consequences:</p> <ul style="list-style-type: none"> -Vitamin D supplementation -General awareness; -Fortification of food -Recognition of high-risk groups 	<p><i>Primary/secondary/Tertiary</i></p>	<p>There is evidence to support the association between Vitamin D supplementation and reduction of OP fracture</p> <p>There is a lack of public health interventions that target increasing population awareness of Vitamin D deficiency.</p> <p>There is evidence for the effectiveness of Vitamin D fortification of nutrients such as milk, fruit juice in reducing hypovitaminosis D in high-risk groups.</p>	<p>High risk patient populations. In Australia, these populations include</p> <ul style="list-style-type: none"> ▪ Elderly institutionalised people ▪ Women that are veiled ▪ People with dark skin pigmentation ▪ Infants of mothers who have migrated from Africa and the Indian sub-continent. 	<ul style="list-style-type: none"> ▪ There is an opportunity to increase awareness of the general population regarding the risk of vitamin D deficiency. High risk populations should be considered for targeting. ▪ There is a need for access to increased daily intake of vitamin D for high risk populations.

3.3.1 Recommendations:

Based on this review, it is recommended that Public health initiatives be undertaken to;

- Promote increased public and health provider understanding and awareness of OP and that this public health promotion target high risk groups (e.g. men)
- Promote healthy lifestyle behaviors that improve bone health
- Support consumer and carer and health professional access to information about OP and vitamin D Deficiency.
- Support research for the development of models of care and their implementation as best practice.
- Promote Public health initiatives that reduce the risk of vitamin D deficiency in high risk groups in the community

3.4 Depression, Anxiety and Arthritis (OA, RA and OP)

Intervention	Prevention	Evidence of effectiveness	Evidence of applicability	Issues and possible direction
Patient education	<i>Primary/Secondary/Tertiary</i>	<p>There is evidence to support the effectiveness of educational programs to minimize depression and anxiety in the general population.</p> <p>There is insufficient evidence to support the impact of these programs in the arthritis population.</p>	Broad range of settings and population sub-groups	<p>There is an opportunity to increase education strategies for people who have arthritis regarding the risk of anxiety and depression</p> <p>Patient access to consistent evidence-based information about the anxiety and depression is required.</p> <p>There is a need for research and evaluation of patient education strategies to minimize anxiety and depression in populations with arthritis.</p>
Health professionals education	<i>Primary/secondary/Tertiary</i>	Educational interventions aimed at improving clinician knowledge and attitudes (eg. guideline implementation strategies) to enable the recognition and management of depression have little impact on clinical practice or depression outcomes.	Primary care physicians and other health care professionals	<p>There is need for accessible, up to date evidence based information for health professionals regarding risk of depression in the arthritis population.</p> <p>Further research is needed to investigate the most effective educational strategies for health professionals to facilitate their treatment and management of depression and anxiety in arthritis patients.</p>
Collaborative care	<i>Primary/Secondary</i>	A multi-component collaborative approach involving combinations of patient and physician education, shared care between primary and tertiary clinicians is associated with improved treatment adherence and patient recovery.	People at high risk of depression and anxiety	The best model of care for reducing the risk of anxiety and depression requires further research and evaluation in Australia for populations with arthritis.

Intervention	Prevention	Evidence of effectiveness	Evidence of applicability	Issues and possible direction
Promoting Healthy life-style: -Community based health promotion programs; -Social support	<i>Primary/Secondary/Tertiary</i>	Community based health promotion programs (eg. self-management programs) are effective in assisting the patient with problem solving and improving coping skills towards better self- management of symptoms, although this evidence is sparse.	Populations with arthritis and OP.	Further evaluation of health promotion programs for people with arthritis who are at high risk of anxiety and depression is indicated.
Psychologica I interventions	<i>Secondary/tertiary</i>	The effectiveness of psychological interventions such as cognitive behavioural therapy, relaxation, and stress management is well documented in the general population but remains unclear in patients with arthritis.	People with depression and anxiety	Further research is needed to clarify the effectiveness of psychological therapies in patient with arthritis and OP.

3.4.1 Recommendations:

Based on this review, it is recommended that Public Health Initiatives be undertaken to;

- Promote awareness of health care professionals and consumers of the risk of anxiety and depression in patients with arthritis.
- Promote access to high quality evidence based information for health professionals, consumers and carers regarding the risk of anxiety and depression in populations with arthritis.
- Promote awareness and uptake of self-management programs among patients with arthritis.
- Promote research into effective models of care for patients with arthritis experiencing depression and anxiety.
- Promote further research into community based interventions for anxiety and depression in populations with arthritis.

4. THE ASSOCIATION BETWEEN ARTHRITIS (RA, OA AND OP) AND FALLS

There have been a number of definitions of fall. The definition of fall adopted by the Victorian Quality Council for the recently developed Guidelines for the prevention of falls is;

“a sudden unintentional change in position causing an individual to land at a lower level, on an object, the floor, the ground or other surface (30).

4.1 Burden of Falls

Falls are a leading cause of mortality and morbidity in persons aged 65 years and over worldwide (31). The incidence of falls in the elderly people is difficult to estimate, however, it has been reported that about one-third of people aged over 65 years experience a fall once or more per year in industrialised countries (32). In Australia, falls are the leading cause of injury-related hospitalisation, accounting for 4% of all hospital admissions in the 65 years and over age group (33). According to the Victorian Emergency Minimum Dataset (VEMD) of January 1997-December 2000, fracture is the most common injury resulting from falls and constitutes 50.2% of all fall-related injuries. In persons aged 65 years and over, 40% of injury related deaths are contributed directly or indirectly by falls. Falls account for 1% of total deaths (33).

From an economic perspective, in n 1998, the Australian lifetime cost directly related to falls in older people was estimated to be in excess of AUD \$1080 million (34). In 2001, the management of injurious falls was estimated to cost AUD\$ 498.2 million per year (35).

4.2 Association between Falls and Arthritis

There are numerous conditions and factors (intrinsic and extrinsic) that contribute to the risk of falling in community dwelling elderly persons. Studies have indicated that falls usually result from an interaction between multiple factors. Evidence from prospective population-based studies reporting the risk factors for falls in the community dwelling elderly suggest a positive association between musculoskeletal conditions and increased risk of falls (36-43).

The population-attributed risk of having at least one fall in patients with arthritis in 12 months was found by one study to be 17.4% (10.4% to 23.9%). This risk was significantly higher than calculated for patients with coronary heart disease, circulatory disease, chronic pulmonary disease or depression. In a cross sectional study, Patel et al investigated the fall-related risk factors in women aged between 65 and 93 years with OP. They found that the fall risk for the younger women within this age group was 37%. This risk increased to 63% in the women with OP of the femoral neck (44). Similar results have also been reported in a case control study of women with RA in the UK (45)-(46).

Australian data available on falls risk relies on retrospective patient self report of falls. An evaluation study of Falls Clinics in Victoria revealed that musculoskeletal conditions were major risk factors in 60% of clinic patients (47). A further Victorian based study of 155 ambulatory patients attending a metropolitan teaching hospital with rheumatic conditions, reported that 49% patients had had a fall in the previous 12 months. Of these, 76.4% reported an adverse outcome as a result of the fall including 26.8% whose fall resulted in hospital attendance or admission (45). These results should, however, be accepted with caution as the rate of fall may have been overestimated due to patient selection bias. Nevertheless, a Sydney based self-report study of physiological risk factors for falls in 684 community dwelling elderly men and women with lower extremity arthritis revealed significantly more falls (Relative Risk RR, 1.22, 95% CI 1.03 – 1.46) and injurious falls (RR, 1.27, 95% CI 1.01 – 1.6) over a 12 month period as compared with an elderly non-arthritis group (48).

4.3 Physical Factors associated with arthritis contributing in increasing risk of falls

Arthritis is associated with altered function of different components of the musculoskeletal and sensory systems (48-51).

Impaired strength

Lower limb arthritis experience is associated with reduced muscle strength (52-56), an important risk factor for falls (57-59). Fisher et al conducted a case control study of patients with and without arthritis. They found a significantly lower strength for extension (72%) and flexion (56%), endurance of the quadriceps (203%) and hamstrings (214%) and velocity (128%) in the arthritis group as compared with the non-arthritis groups (52). Similar results were demonstrated in two other case control studies (54, 56).

Impaired proprioception and balance

Proprioceptive deficits are an important risk factor for falls and have been reported in patients with arthritis(60, 61). Hurley et al investigated sensorimotor changes and functional performance in patients with knee arthritis (61). They found significantly poorer proprioceptive acuity of the knee joint along with significantly weaker quadriceps muscle strength in patients with OA as compared with patients without OA. Similar results were demonstrated in another cross sectional study. (60).

Increase level of pain

Pain, a common feature of arthritis, affects muscle function and can contribute to falls risk. Leville et al found that women with widespread musculoskeletal pain had a 60% higher risk of fall than women with no or mild pain (50). Similarly, Nahit et al in a case control study of patients with a new episode of hip pain in women with hip OA reported that the risk of having fallen in the previous 12 months increased three fold (41%) as compared to controls (16%) (49).

4.4 Psychological Factors associated with arthritis and risk of falls

The psychological impact of arthritis and falls is also a major concern. Fear of falling is a major outcome of falls and may become a risk factor for further falls. Fear of falling has been examined in several studies (62-66). Several studies have reported higher prevalence of fear of falling among populations with arthritis and RA in particular (63-66). A Victorian retrospective cohort study examined the prevalence, outcome and risk factors for falling in 155 ambulatory patients with rheumatic conditions(67). Over half of these patients (52.3%) reported a fear of falling. This fear ranged from being moderate to severe in 16.8% of patients. This finding is consistent with the findings of other research (65, 68). In the non-falls group, 8 of 78 patients (10.3%) reported moderate to severe fear of falling. Other studies have also demonstrated high levels of psychological symptoms including depression and anxiety in the arthritis population (69-71). These psychological symptoms have been related to the levels of pain resulting from arthritis and falls hazard (36). The psychological impact of arthritis and fall will be discussed in more detail in a later section of the report.

4.5 Prevention and Minimizing Falls in persons with arthritis

Interventions aimed at minimizing the risk of falls in community dwelling older patients have been shown to reduce falls and fall-related injuries when targeted at high risk groups (72). There is limited information available, however, on the effectiveness of falls prevention interventions specific to the arthritis population.

4.6 Public health interventions

4.6.1 Consider patient education

Patient education is a behavioural technique, which provides positive reinforcement and is usually used in combination with the other interventions. An underlying assumption of these programs is that increased awareness/knowledge of the relevant condition will translate into behaviour modification (35). To date, few studies have comprehensively examined the effect of patient education in preventing or minimizing falls in the arthritis population.

A systematic review evaluating patient education for adults with RA, which included 50 studies, demonstrated only small short-term effects of patient education on disability, joint counts, patient global assessment, psychological status and depression (73). No evidence of long-term benefits was found. One factor that may explain this result is the fact that many patient education programmes included in these studies were not specific to arthritis or RA, rather providing only general patient information (73). Moreover, none, of these studies included falls statistics as outcome measures associated with patient education.

In Victoria, Psycho-educational programs such as the Arthritis Self-Management Course (ASMC) or the more generic Chronic Disease Self-Management Course (CDSMC) are provided by consumer organizations such as Arthritis Victoria. The focus of these programs is on improving self-efficacy and providing practical ways of coping with symptoms of the disease. A RCT evaluated these patient education programs and found them to be cost effective and associated with reduced pain, increased well-being, increased compliance with treatment and exercise, reduced health care utilisation and increased understanding of the disease (74). This finding is consistent with research suggesting that education and health promotion are important components of multi-factorial falls prevention programs (72, 75-77). There remains, however a lack of evidence to support a beneficial effect of these interventions on fall risk and reduction for people with arthritis (35).

- ❖ **Patient education within arthritis self management programs can be beneficial in improving self-efficacy, reducing pain, increase well being and coping with the signs and symptoms of the disease.**
- ❖ **There have been no studies of the effect of these programs on falls risk and fall related injuries for patients with arthritis.**

4.6.2 Consider Falls Prevention Clinics {Level I (+) – II (+) Evidence}

Specialist Falls Prevention Clinics promote an individual approach to falls prevention that is based on comprehensive assessment and targeted interventions for those with established high risk of recurrent falls. This approach is supported by evidence from RCTs (47). A study of falls in high-risk community dwelling elderly people presenting to an accident and emergency department with a fall examined the risk of falls following a targeted comprehensive multidisciplinary (medical and occupational therapy) assessment. Patients receiving the assessment were found to experience a significant reduction in risk of falls (Odd Ratio, 0.39; 95% CI 0.23-0.66) and risk of recurrent falls (Odd Ratio, 0.33; 95% CI 0.16-0.68) as compared to the control group, which did not receive the assessment (78).

The National Ageing Research Institute (NARI) recently conducted an evaluation of the Victorian Falls Clinics (47). Results revealed that patients who received a Falls Clinic intervention in a pre-intervention/ post-intervention designed study experienced an average reduction in falls of over 50%. This finding was supported by an analysis of data from three Victorian Falls Clinics, which reported an overall reduction of 39% in the proportion of clients falling once or more after they were assigned to the falls clinic intervention. There was also improved performance on a number of physical and functional measures (79). The NARI report also documented that although all 14 Victorian Falls Clinics reported musculoskeletal conditions as major risk factors, only nine used medical investigation and treatment of the underlying disease as common interventions. Falls assessments in these clinics also did not include musculoskeletal investigation or management (47). Patient compliance, staffing, unstructured systems

and lack of coordination were raised as major barriers to the implementation of such targeted clinics (47, 80).

- ❖ **Comprehensive individually targeted assessment and intervention programs provided within a specialist model of care reduce risk of falls for high risk groups**
- ❖ **There has been little evaluation of the physical and functional outcomes of these programs for people with arthritis and musculoskeletal disorders.**

4.6.3 Consider Exercise Interventions {Level II (+) evidence}

Exercise has been shown to result in a range of health benefits for older people living in community including increasing strength, functional capacity, balance, mobility and general health (physical and psychological). Numerous exercise programs have been implemented and evaluated in the general population. There is limited evidence, however, regarding the specific effectiveness of exercise programs in reducing falls in arthritis population.

A systematic review of RCTs conducted in the general population has supported the use of exercise based interventions to prevent falls and fall related injuries in older people (81). Of 11 RCTs reviewed, with accumulated data from 4933 men and women aged 60 years and over, five demonstrated a significant reduction in the rate of falls or the risk of falling following the introduction of an exercise intervention. The authors concluded that exercise is effective in lowering falls risk in selected groups and thus should be included in falls prevention programs. Similarly, a Cochrane systematic review reported that progressive strength training programs led to improved muscle strength and other functional activities (82). Despite the findings of such positive outcomes brought about by exercise programs, few studies have specifically investigated the effects of such interventions in the arthritis population.

In a narrative review, Hurley et al investigated the effects of strength training on risk factors for age-related diseases (83). The authors hypothesized that strength training exercise programs may reduce functional instability, disability and pain in patients with knee OA and therefore reduce the risk of falling. A RCT by Carter et al supported this contention. They conducted a trial to test the efficacy of a community based 20-week exercise intervention provided to 93 women with OP by certified fitness instructors on falls risk. Results revealed that after adjusting for confounding covariates, women in the exercise group experienced a 4.9% improvement in dynamic balance ($p = 0.044$) and a 12.8% improvement in knee extension strength ($p = 0.047$) as compared with women in the control group (84). The authors concluded that community based exercise incorporating dynamic balance and strength (important determinants of falls in older women with OP), reduces fall risk (85).

Tai Chi, an ancient Chinese martial art and exercise, which includes isometric exercise and relaxation combined with stretching and correct body posturing, is an increasingly popular method of exercise in arthritic patients (86). Research has shown that Tai Chi improves balance and control in the community-dwelling persons (87, 88). Tai Chi has also been found to reduce fear of falling (88). A recent systematic review of 4 controlled clinical trials examined the effect of Tai Chi as a treatment for

RA in 206 patients. It was found that Tai Chi significantly improved range of motion in the lower extremities (89). It was not clear, however, whether this affected participants' risk of falls and quality of life. Another RCT examined the effect of Tai Chi in older women with OA. This study also revealed an improvement in arthritic symptoms, balance, and physical functioning (90).

- ❖ **Strength and balance exercise have been found to be effective in reducing falls in the general population.**
- ❖ **Exercise programs incorporating balance and strength training can reduce functional instability, disability and symptoms in patients with arthritis which may in turn aid in the prevention of falls.**

4.6.4 Consider environmental home fall hazard modification

Environmental hazard (particularly home hazard) assessment and modification programs are an important component of falls prevention strategies. Although a number of studies have evaluated the effect of home hazard modification/occupational interventions for patients with arthritis and particularly RA, none of these studies have assessed falls prevention as an outcome associated with environmental home hazard assessment (91).

Home hazard assessment has been shown to be useful in the general population as a multi faceted and targeted strategy. Peel et al conducted a RCT to evaluate the effectiveness and sustainability of home assessment and modification (92). The authors found that the home assessment group was significantly more likely to modify their home environment than controls ($p < 0.0001$). During the intervention, the home assessment group demonstrated a trend towards lower fall rates and falls injuries as compared to the control group, although this difference did not reach significance. Also, participants, regardless of group allocation expressed a significant reduction in their concern about falling ($p < 0.0001$). In a further multi-component intervention study that targeted major fall risk factors there was a 29% reduction in the probability of falls of 29% (95% Confidence Interval 22- 36%) one year after intervention (93).

A systematic review of the effectiveness of occupational therapy in RA has also been conducted, which included 38 trials, six of which were high quality RCTs (91). Occupational therapy interventions were grouped into six categories: (1) training of motor function; (2) training of skills; (3) instruction on joint protection; (4) counselling; (5) advice and instruction in the use of assistive devices; and (6) provision of splints were reviewed. Outcome measures included pain, fatigue, functional abilities (including dexterity), physical independence, quality of life, knowledge about disease management, compliance, self-efficacy, range of motion, muscle strength. The reviewers found that occupational therapy concerning "instruction on joint protection" produced beneficial effects (an absolute benefit of 17.5 to 22.5, relative benefit of 100%), whilst there was only limited evidence of a beneficial effect of comprehensive occupational therapy on functional ability (an absolute benefit of 8.7, relative benefit of 20%). The impact of these interventions on falls prevention, however, is unknown.

- ❖ **Home hazard assessment and modification programs are an important component of a fall prevention strategy.**
- ❖ **The impact of these interventions on falls prevention for the arthritis population is unknown but may be generalisable from outcomes in a general population.**

4.6.5 Consider multidisciplinary strategy programs

There is substantial evidence of the effectiveness of multifactorial interventions incorporating education and health promotion, exercise programs, medical management of the underlying diseases, medication management, environmental home modification, use of proper foot wear and aides on falls risk, reduction and consequences in the general elderly community (72, 75-77, 94-96). By way of illustration, a meta-analysis of RCTs evaluated the effect of interventions designed to reduce the incidence of falls in elderly people. This included 62 trials involving 21,668 participants (72). Results of this analysis revealed that ‘Multidisciplinary, multifactorial, health/environmental risk factor screening/intervention’ programmes in the community were beneficial for falls reduction in patients with (pooled RR 0.86, 95%CI 0.76 to 0.98) and without (pooled RR 0.73, 95%CI 0.63 to 0.85) a history of falls. Nevertheless, there remains a lack of information regarding the effectiveness of fall prevention programs specifically designed for, and implemented within a population with arthritis.

- ❖ **Evidence supports the effectiveness of individually targeted, multi-component interventions in reducing falls in the elderly community.**
- ❖ **The impact of these programs in the arthritis population is yet to be evaluated.**

4.6.6 Consider Vitamin D supplementation {Level I (+) evidence}

Substantial evidence exists to support the use of Vitamin D supplementation to reduce falls among general ambulatory and institutionalised older individuals (97, 98). A recently conducted meta-analysis of 5 RCTs (1237 participants) demonstrated that combined Vitamin D and calcium supplementation was associated with a 22% reduction in falls as compared to calcium supplementation alone (97). One possible explanation for this finding may relate to recent reports that vitamin D deficiency affects muscle groups, which are necessary for postural balance and walking (99). In a controlled trial Pfeifer et al reported that elderly women who received vitamin D supplementation for 8 weeks with calcium demonstrated a 9% decrease in body sway ($p < 0.05$) and significant reduction in falls rate per subject over 1 year ($p = 0.034$) as compared with women who received only calcium (100). The authors concluded that short-term supplementation with vitamin D and calcium improves body sway and in turn may prevent falls in elderly women. There remains however, a lack of information regarding the effectiveness of vitamin D supplementation in reducing falls amongst the arthritis population. The effect of vitamin D in patients with arthritis will be discussed in more detail in a later section of the report.

- ❖ **Vitamin D supplementation is effective in reducing falls in elderly people.**
- ❖ **The impact of these programs in persons with arthritis has not been studied.**

4.6.7 Guidelines for public health interventions for prevention of falls

A number of guidelines for the prevention of falls have been developed in Australia. These are:

- The Victorian Quality Council guidelines "Minimising the risk of falls and falls injuries: Guidelines for acute, sub-acute and residential care settings" to provide a framework (model) and supporting resources to support falls prevention activity in hospital and residential care settings
- Queensland Health (2001). Falls prevention best practice guidelines for public hospitals and State Government residential aged care facilities. Brisbane (updated in 2003 with a community supplement).
- Clinical Practice Guidelines: The assessment, management and prevention of falls in the elderly in South Western Sydney Area Health Service. Injury Advisory Committee

These guidelines target acute, sub-acute and residential aged care facilities. Guidelines remain to be developed for addressing falls in community-dwelling older people.

Specific evidence based recommendations have also been developed in Australia for the management of RA (101) and OA (102), OP (103). These guidelines, however, focus on general therapeutic and non-therapeutic management each disease and do not consider falls prevention.

4.6.8 Organizational delivery of fall prevention component in for arthritis patients

Several major Commonwealth and State government initiatives have been introduced to address musculoskeletal health in recent times.

Commonwealth Initiatives

In July 2002, the Australian Health Minister announced arthritis and musculoskeletal disorders as a new National Health Priority Area in recognition of the major health and economical burden these conditions place on our community. Funding of \$11.5 million for four years has been committed by the Commonwealth Government for better arthritis(29).

Regarding falls prevention, reducing falls related hospitalization and deaths for older people has been regarded as a National Health Priority Area (Injury Prevention) program since 1986 (35). In 2001, National Falls Prevention for Older People Initiative: "Step out with confidence" was developed by the Commonwealth Government (34).

State Initiatives

The Victorian Department of Human Services (DHS) has developed a whole of community approach to falls prevention since 1990 (34). Falls Clinics are one example of this initiative. Since 1998, 14 Falls Clinics funded by DHS have been established(47). DHS has also funded a series of programs aimed at reducing falls among older people in community (Foothold on Safety), residential aged care persons and people in hospitals (through Quality Improvement Funding, and Aged Care Division).

4.7 Recommendations

It is recommended that public health initiatives be undertaken to;

- ❖ Increase awareness of falls in people with arthritis and musculoskeletal disorders by targeting consumers and health professionals
- ❖ Increase uptake of effective strategies for falls and fall-related injury prevention
- ❖ Increase research relating to epidemiology and aetiology of falls and fear of falling in people with arthritis and musculoskeletal conditions.

5. JOINT INJURY AND OSTEOARTHRITIS

Injury prevention and control is one of Australia's six national health priority areas (104). Injuries are the leading cause of mortality and large contributor to illness and disability in Australia. (11). In 2000-2001 injuries accounted for \$4.2 billion ie.8.2% of total allocated health expenditure (11). In 2002, injuries accounted for 5.8% of deaths and 6.8% of all hospital admissions. The present chapter discusses the association between joint injury and osteoarthritis.

Joint injury occurs as a result of a sudden major injurious episode or a repetitive activity that exceeds the protective capacity periarticular muscle and tendon leading to transmission of force to cartilage(105). The definition of joint injury and classification of disease widely varies between studies - a factor which may contribute to differences in reported disease prevalence and incidence as well as observed associations between risk factors and disease.

5.1 Types of Joint Injury

Sports and Recreational Joint Injury

Data regarding sporting and recreational injury is limited due to reporting and data collection issues. General injury surveillance systems rely on data gathered from hospital emergency departments. The National Injury Surveillance Unit (NISU) has provided National data since 1986 and comparative data analysis is facilitated by use of a standardised data collection form. A description of sports injury based on these data was published in 1998 (106). Between 1989 and 1993 20% of all child and 18% of all adult Emergency Department presentations were the result of an injury sustained during sport or active recreation. These figures are considered an underestimation of all sport and recreation related injury as they do not include those people who were injured and did not seek emergency department attention. Additional data from the National Health Survey 1995, showed that 38% of injury incurred in the month prior to the survey or during the previous year were associated with sport or recreational activities (107). Specific injury surveillance systems are used in specific sports such as Australian Rules Football (AFL). The AFL report from 2003 indicates an overall injury prevalence of 13.5% a figure that has reduced from 17.2% in 1999 (108).

At a State level, Victorian data is available from the Monash University Accident Research centre (MUARC). Other data sources include death data from the Australian Bureau of Statistics, the National Coronial Information System, as well as hospital admissions data from emergency departments.

Sporting injuries are also associated with a significant cost to the health expenditure in Australia. The Independent research commissioned by Medibank Private reported that overall 5.2 million sports injuries occur every year in Australian community and overall estimated cost to the Australian community is between \$1.65 - \$1.83 billion annually (109).

Occupational Joint Injury

Occupational injury is a significant health and social burden on our community. Between 1999 and 2002 over 82,000 adults were treated in Victorian hospitals for unintentional occupational injury. There were 4,375 hospital admissions and 16,256 hospital emergency department presentations for unintentional occupational injuries (110). In 1997 the National Occupational Health and Safety Commission estimated that the total cost of work related injury/disease to the Australian community was \$27 billion each year (111). In the period between 2001-2002, there was 17 workers' compensation claims per 1000 employees, which included fatalities, permanent disability and temporary disability resulting in being out of work for one or more working weeks (112).

- ❖ **The burden of sport and recreational injury is underestimated due to limitations in injury surveillance methods.**
- ❖ **Injury, including sport, recreational injury and occupational injury contributes a significant morbidity and cost burden to Australian society.**

5.2 The association between joint injuries and OA

The aetiology and pathogenesis of OA is poorly understood. Multiple systemic and local biomechanical factors, some of which are modifiable, may contribute to the onset of disease (Table 1; (113)). Early epidemiological studies of OA have identified joint injury as an important and potentially modifiable risk factor (105). Joint injury has been implicated in the development of OA due to its adverse impact on joint laxity, proprioception and alignment (114, 115). Exacerbating this risk is the poor management and/or rehabilitation which ensues a joint injury (116).

Table 1. Risk factors for Osteoarthritis

Potentially Modifiable Influence	Non Modifiable Influences
<ul style="list-style-type: none"> ▪ Nutritional factors ▪ <i>Occupational injuries</i> ▪ <i>Sports and recreational injury</i> ▪ Obesity ▪ Physical inactivity ▪ Quadriceps strength ▪ Joint deformity 	<ul style="list-style-type: none"> ▪ Age ▪ Gender ▪ Heredity/Genetic factor ▪ Socio-economic status

The following sections summarise current knowledge regarding the association between joint injury in sporting and recreational activities and occupational settings and subsequent development of OA.

The majority of studies examining the association between OA and joint injury have adopted a cross-sectional or retrospective cohort design. Few studies have adopted a prospective cohort design. Evidence from two prospective (124, 125) and five retrospective cohort studies (126-130) have found a positive association between OA of the hip, hand and knee and injuries of the meniscus and cruciate ligament tear, joint dysplasia, fractures of articular. Case controlled studies have also demonstrated similar findings (115, 131-134).

In a prospective cohort study Gelber et al recruited 1321 former medical students and prospectively examined the relationship between joint injury and incident knee and hip OA. Over a median follow up of 36 years, the cumulative incidence of knee OA by age 65 years was 13.9% in participants with a previous history of knee injury as compared to 6.0% in those without a past history of injury (p value = 0.0045, Relative Risk = 2.95 {95% Confidence interval, 1.35 to 6.45}). The authors concluded that joint injury substantially increased the risk of subsequent OA at that site (124). A population based prospective radiographic cohort study also investigated the association between baseline risk factors and incident and progressive knee OA. They reported that risk of knee OA was significantly increased in subjects with previous knee injury (Odds Ratio 4.8, 95% confidence interval, 1.0 to 24.1; (125). Moreover, whilst there was no clear association between acute major joint injury and immediate development of post-traumatic OA, these injuries increased the risk of OA later in life (116, 135, 136).

Observational studies have also reported that meniscus and cruciate ligament tears increased the risk of subsequent development of OA by 5-10 times. The authors found, between 40-60% of patients demonstrated OA changes by 20 years (137, 138). Surgical meniscectomy following knee injury in particular has also been associated with increased risk for knee OA (126, 129, 139-141). A further study demonstrated a high prevalence of radiographic knee OA, pain and functional limitation in female soccer players 12 years after an anterior cruciate ligament injury (129). Epidemiological studies have also supported the association between hip injury and OA (134, 142).

Support for an association between sports injury and OA does not, however generalise to injury brought about by moderate recreational activities. To date, there is no evidence to support a causal relationship between general moderate recreational activities and OA of the joints. Rather, physical activities that include regular, moderate exercise have been found to offer benefits including strong muscle development around joints and increased flexibility and endurance (29). Conversely, low levels of physical activity and a sedentary life style have been associated with increased risk of OA (143).

Occupational Injury

Occupational activities that require repetitious tasks involving joints have also been recognized as risk factors for the development of OA (115, 134, 136, 142, 144). Research has demonstrated that repeated squatting, kneeling, heavy lifting, climbing stairs are all associated with the increase risk of hip and knee OA (115, 145-147). A review of studies published between 2000-2001, which included 5 case-control studies and one cross sectional study revealed that OA was associated with a multitude of occupational activities (146). Two studies confirmed that kneeling and

squatting were risk factors for knee OA. Climbing a ladder or stairs were also found to be risk factors for OA by two studies of men and three studies of women. Similarly, lifting heavy objects was also found to be positively associated with knee OA in two studies involving both men and women although this association did not reach statistical significance. Studies of OA by occupation have revealed that knee OA is most prevalent amongst floor layers, construction workers, forestry workers and farmers whilst hip OA was found to be most prevalent in occupations involving heavy lifting and climbing stairs. Consistent with these findings are the results of a study by Felson et al. In this longitudinal population cohort study, men working in occupations involving constant knee bending had higher rates of radiographic OA as compared to men working in occupations without such movement demands (Odds ratio 2.22, CI 1.38, 3.58; (145). Other well designed epidemiological studies have documented an association between radiographic hand OA and cotton mill workers (148) as well as repetitive pincer grip activity (149).

Several authors have identified injury prevention strategies to reduce occupational injury induced OA. In their narrative review of OA epidemiology, Felson and Zhang reported that preventing knee injury could prevent incident knee OA by approximately 14% in women and 25% in men (142). It has also been estimated that occupational modification of tasks that involve heavy lifting, carrying and repeated squatting in men could decrease the incidence of knee OA by 15% to 30%(145, 150).

- ❖ **Available data supports an association between sporting, recreational and occupations injuries and OA of the knee, hip and hand.**
- ❖ **There is no data specific to the Australian context.**
- ❖ **There is a potential to reduce occupational joint injury**

5.2.1 Reducing the risk of joint injury and subsequent development of OA

Limited information is available regarding the prevention of sport, recreational and occupational joint injuries within the peer reviewed literature. This lack of evidence-based data has been attributed to:

- Sparse evaluation of injury prevention initiatives.
- A focus on injury prevention arising from other causes including road traffic accidents and accidental injury in childhood, which are not generalisable to sporting or recreational injury.
- A focus on injury prevention in areas where data is readily available for evaluation such as emergency department attendances, hospitalisation or fatality.
- A lack of adequate data regarding the incidence and prevalence of sporting and recreational joint injury due to limited surveillance systems the elite sporting arena.

- Limited knowledge and understanding of risk related to specific sporting and recreational activities, creating barriers to targeting high-risk populations with joint injury prevention programs.
- A focus on musculoskeletal pain rather than joint injury due to the associated psychosocial and economic cost.
- The lag time between joint injury and onset symptomatic OA in occupational settings inhibiting the evaluation of injury prevention programs.

5.3 Public Health Interventions

5.3.1 Health-education and health-promotion activities

Community based injury prevention programs

Public health interventions for injury prevention may include:

- Policy development
- National and State organisational governance frameworks
- Environmental modification
- Promotion of safe behaviours

Community based programs developed using health promotion design methods have been applied to general injury prevention including sport and recreational injury prevention. Evaluation has provided conflicting data relating to the effectiveness of community based injury prevention programs.

A Swedish quasi-experimental study of a prevention program based on promotion of fair play, supervision of novices and compulsory use of protective equipment found that the total rate of sports related injuries decreased by 14% (a reduction from 21 to 18 injuries per 1000 population years) (117, 151). This reduction was not found in persons aged 40 years or more for which the rates for severe or fatal injuries (starting from a low baseline level) remained constant. The control group demonstrated no change in injury morbidity although there was a downward trend suggesting a reduction in injuries over time. Differences in injury rate reduction were also noted according to injury site, with a greater reduction in upper limb injuries sustained during horse riding. Based on these findings, the authors suggested that the mechanism of severe injuries was unlikely to be influenced by strategies directed towards prevention of more common and less severe injuries. This observation highlights the importance of understanding the local epidemiology of injury and designing an intervention and evaluation framework to suit each context. It was also noted that the pattern of joint injuries differs between children and adults. Children sustain more upper limb injuries that are rapidly reduced by the introduction of 'fair play rules', whilst adults are more likely to sustain lower limb injuries. The lesser effect of the program on lower limb injuries and older adults is yet to be explained and warrants further research. Possible explanations may include the influence of external factors such as the introduction of protective equipment.

In Australia, two community based injury prevention programs have been evaluated: "The Safe Living Program" and "The Latrobe Better Health injury prevention

program (LVBH)” (152, 153). Evaluation of the Safe Living Program revealed that although there was increased program awareness, there were no significant changes in overall rates of injury deaths, hospitalizations or emergency department presentations. Notwithstanding, this finding may be attributed to two factors. First, the program addressed a very broad range of injury prevention areas comprising 113 activities in the first three years. Second, there was limited program reach and insufficient recruitment and training for its implementation. In light of these complications, fewer, well developed and more targeted, efficacious interventions involving greater community reach, organizational change, and enhanced evaluation design including cost/benefit analyses are needed.

The LVBH injury prevention program was also a community-based approach to “all age all injury prevention” and was evaluated within a pre- and post- design but no control population. Evaluation of this program relied on self-reported changes in injury risk and protective factors. Data was collected using a random telephone survey. Results revealed that the program resulted in increased community awareness. It was also found that the age standardized rate per 100,000 persons for emergency department presentations for all targeted injury fell from 6594 to 4821 over a 5 year period until 1995/1996 ($p=0.017$). The demand for and availability of protective equipment for sport increased, whilst the number of emergency department presentations for sport related injury among 15-24 year olds decreased significantly. The absence of a control group in this evaluation, however, limited the extent to which the observed change could be directly attributed to the program. Nevertheless, the authors noted that the majority of program objectives were met and that collaborative relationships developed between local organizational groups such that the program became part of the local government structure.

- ❖ **Knowledge of local epidemiology of injury aetiology is needed to design and implement the appropriate injury prevention program.**
- ❖ **Improved sports surveillance systems are required to enable high quality epidemiological research**
- ❖ **Further research is needed to investigate the benefit of community based injury prevention programs in an Australian context.**
- ❖ **Injury prevention programs need to target specific high risk sporting activities.**

5.3.2 Consider primary public health prevention strategies targeting high-risk individuals/groups

Promoting general health

The promotion of healthy lifestyles, including regular exercise and maintenance of ideal weight has become Commonwealth and State priorities. The influence of health promotion interventions on the development of OA was demonstrated by the Framingham study in which the risk of developing the knee OA was halved in women who lost an average of 11 lbs (5kg) (154).

Promoting safe behaviors

In addition to promoting fair play rules in school-aged children, behavioural approaches to encourage the use of protective equipment in sport and preventive activities such as warm ups and stretching may be a useful strategy for preventing joint injury and in turn OA development . Such an effect, however, is inadequately supported by evidence

Stretching, Warm-ups (Pre- and post- activities)

Standard practices like stretching before and after athletic/recreational activities are believed to prevent or reduce musculoskeletal injury. Evidence from two recent systematic reviews, however, have revealed mixed results (155, 156). In a systematic review of five studies, Herbert and Gabriel evaluated the effect of stretching on delayed onset muscle soreness and risk of injury. The authors found no clear benefit of stretching on either delayed onset muscle soreness or on risk of injury (155). A further systematic review of the effect of stretching on sports injury risk that included six controlled trials revealed that stretching was not associated with a significant reduction in total injuries (156). Similarly, a recently conducted RCT of 1800 Australia army recruits investigating the effectiveness of pre-exercise stretching in prevention of lower limb injury was not able to demonstrate the preventive benefit of stretching (157).

In contrast, however, a cluster randomised control trial of the impact of a structured warm up program for handball teams demonstrated a reduced incidence of acute injuries to the knee or ankle (158). A total of 61 clubs (15 members in each club) participated in a 15-20 minute warm up program developed by medical staff. The focus of the exercises was on improving awareness and control of knees and ankles during standing, running, cutting, jumping and landing as well as improving balance and strength. The warm up program was completed at the beginning of each training session for 15 consecutive sessions. Outcome measures were defined as the incidence of acute injury to the knee (primary), injury to the lower limbs (secondary) and injury to the upper limb. Results revealed that sports persons who participated in the warm-up programme experienced significantly fewer acute knee and upper limb injuries when compared with a control group. The magnitude of injury reduction ranged from 45% to 63%. Acute knee injuries also showed a 37% reduction in the intervention group as compared with control group, although this difference did not reach significance. The authors attributed this reduction to the training programme and concluded that structured warm ups could act as a preventative measure against joint injury of the lower and upper limbs.

Rehabilitation

Many current rehabilitation techniques aim to restore muscular strength, power, endurance, flexibility, proprioception and agility (159). Two narrative reviews of physical activity and risk of OA suggested that returning to sporting activity slowly modified the stress placed on the injured joint (121, 160). Further research, however, is needed to evaluate the long term effectiveness of rehabilitation techniques on OA outcomes (161).

Protective equipment

Evidence regarding the effectiveness of protective equipment on risk of injury remains controversial. Studies of anterior cruciate ligament tears were unable to demonstrate conclusively that knee braces resist the high forces placed on the knee during high risk sporting activities. The authors have suggested knee braces may be most effective in low risk sporting games or during the early phase of post-injury rehabilitation (162, 163).

Safe equipment and surface

A systematic review of six studies of soccer epidemiology demonstrated that injury prevention programs that (a) include warm-up/cool-down periods, (b) use of appropriate shin guards to protect the proximal tibia and malleoli (c) using protective gear for winter training, (d) ankle strapping and proper rehabilitation after injury and (e) exclusion from the games after certain high risk injuries resulted in a 75% reduction in the incidence of injury and an ensuing 80% reduction in associated medical costs (164). An observational study also recommended the use of proper sports equipment under safe conditions to prevent joint injuries to minimise the long-term sequelae of joint injury (139). Buckwater tabulated the list of potential interventions that are associated with a reduced risk of joint injuries and further joint degeneration in athletes (118)

Table 2. List of Interventions Associated with Reduced Joint Injury

Interventions
1. Select sports or exercise programs that subjects joints to low levels of impact
2. Use equipment and playing or running surface that decrease joint impact and torsional loading
3. Maintain or improve muscle strength and tone to improve ability of muscles to decrease joint impact loading and protect joint from injury
4. Maintain or improve general conditioning to decrease risk of joint injury due to fatigue
5. Maintain the ideal body weight
6. Change in sports and exercises to decrease repetition of the same patterns of stress in joints
7. Proper management and rehabilitation of the joint after the injury

These measures are yet to be investigated for their effects on injury prevention. Further biomechanical and epidemiological research is needed to address the role of these measures in reducing injury.

❖ **Health promotion for general healthy lifestyles may contribute to reducing the risk of OA.**

❖ **Promoting safe play through fair rules may reduce injuries however the impact on lower limb injuries has not been adequately evaluated.**

❖ **There is insufficient of evidence of the effect of interventions aimed at reducing individual, environmental risk and sports specific risk.**

Occupational joint injury prevention programs

It has been suggested that the lack of prevention models for musculoskeletal disease (MSD) in the workplace is related to (a) limited agreement on the appropriate case definition for MSDs in the workplace (b) a lack of an ergonomic and epidemiological model for MSDs and, (c) a lack of scientific evidence on specific dose and exposure relationships occurring in the workplace, employee and job (165). The time-lag between occupational activity and onset of symptoms necessitates large-scale longitudinal studies to demonstrate the benefit of workplace interventions aimed at preventing and reducing the impact of OA. Preliminary evidence indicates that primary prevention in the workplace can be effective in reducing musculoskeletal problems such as upper extremity pain and discomfort (166). A retrospective study of the effectiveness of a work injury prevention program involving detailed work risk analysis of the work environment, development of job description, identification of injury-related problematic work situations and implementation of job specific supervisor-training program, revealed a significant reduction in total injury claims and other injury related expenses (167). A prospective cohort study conducted amongst cleaners from Western Australia, likewise reported that work place risk assessment was a beneficial approach in reducing the rate and consequences of workplace injury including joint injuries (168). There was a clear association between the intervention with reduction of approximately two third in injury rate.

Educational programs have also been employed as a preventative measure for occupational injuries. Evaluations of these programs have specifically investigated their effect on back injuries (169, 170). A RCT evaluated the effect of an educational program (which included training by physiotherapist) designed to prevent lower back injury in postal workers. Results of this study revealed that the educational program was not effective in reducing the rate of back injuries. Also unaffected by the education program was the median cost per injury in terms of time off from work, the rate of related musculoskeletal injuries and the rate of injury recurrence after return to work. The education program did, however, improve employees knowledge of safe behaviour, when compared to controls (169). Similar findings were also reported following a RCT involving education of lumber support for lower back symptoms (170).

- ❖ **Public awareness of the association between occupational joint injury and osteoarthritis is unknown.**
- ❖ **There is no Australian data available relating to an association between occupational activities and OA.**
- ❖ **There is evidence that primary prevention programs reduce musculoskeletal disease injuries in the workplace however education programs have not been shown to be effective in preventing occupational joint injury.**

5.3.2 Guidelines for public health interventions for prevention of joint injuries

A number of guidelines exist to assist medical practitioners and other health care providers in the management of established OA, however there are no specific guidelines for the primary prevention of OA associated with sport and recreational or occupational joint injury. Notwithstanding, a range of guidelines for general injury

prevention has been identified for sports and occupational health and safety. ‘How to become a SportSafe Club’, was developed jointly by Sports Medicine Australia and Australian Sports Injury Taskforce (ASIPT) (171). The aim of these guidelines is to assist local sporting clubs in the development of a sport safety plan as recommended by ASIPT. However, the implementation and impact of the developed guidelines has not been evaluated.

Work Safe Victoria, in consultation with the unions and federations, has also developed a range of guidelines for employers, workers and service providers of various industries (172). These include the Manual Handling Guidelines that detail risk reduction and management approaches to manual handling injuries.

5.3.3 Organizational and delivery of joint injury prevention component in different health care settings in Australia

Sports specific health promotion programs in Australia

Despite a recent increase in attention to sport injuries from Government and Public sectors, there remains no lead agency to guide injury prevention and safety policy implementation (107). An assessment by NIPAC of the status of sports injury prevention evidence in conjunction with the National Health and Medical Research Council’s (NHMRC) report highlighted the need for a national approach to sports safety which incorporated infrastructure and funding. This report also outlined a requirement for future research in various areas such as aetiology, risk of injury, and injuries across the different settings, epidemiology and costs (107). In 1997, the Commonwealth Government took on a lead role in this area by establishing the National Injury Prevention Advisory Council (NIPAC), and the Australian Sports Injury Taskforce (ASPIIT). The aim of these assemblies was to promote a national perspective on injury prevention. In particular, ASPIIT embarked on implementing various programs including the development of a national sports injury data collection system, the development of a sport safety accreditation system, the promotion, identification and funding of quality sports injury prevention research, the development of protocols and standards for pre-participation screening as well as the identification of existing injury prevention and training programs, organizations, work groups, resources and initiatives. Intended to complement this Commonwealth framework was the 1997 establishment of the Australian Sports Injury Data Working Party. The aim of this group was to develop guidelines for sports injury surveillance, however, the implementation of this work has not been possible within existing frameworks (173). The Australian Sports Commission also established ‘SportSafe Australia’ to further progress national sport safety (107). Limited funding forced the cessation of Sportsafe Australia beyond 2000. More recently, the Commonwealth Government has drafted the “The National Injury Prevention Plan 2004 Onwards”. This initiative, however, does not address joint injury prevention (174).

There are a number of sports injury health promotion programs also operating at the state level such as the ‘Smartplay’ programs in Victoria and South Australia, the ‘SafeSports’ program in New South Wales and the ‘SportSafe’ program in Western Australia (107). These and other similar programs are largely focused on health

education. For example, in Victoria, the Sport and Recreational Victoria, a division of the Department for Victorian Communities, launched free sports injury fact sheets for different sports aimed at providing sporting clubs and players with information regarding how to reduce injuries and promote safe participation in sport (175). VicHealth also established a program of funding targeting local club access to sport safety equipment to enhance safety at local level (107).

The School Sport Unit of the Department of Education and Training is another organisation promoting and implementing sport and sport-focused programs for all students. It encourages sporting participation, skill development and excellence in performance. Consistent with this role, the Unit has developed Guidelines for the Safe Conduct of Sport and Physical Activity in Schools”, to assist schools to promote quality participation in physical activity in a safe and enjoyable manner (176). Despite the numeracy of these state led programs, however, there has been no evaluation of their effectiveness in preventing or reducing sporting injuries (107).

Professional Sporting Bodies

A number of professional sporting bodies are also engaged in sports health promotion.

Sports Medicine Australia (SMA) also contributes to national sporting health promotion (177). Founded in 1963, SMA has a broad membership of sports medicine and health professionals, sports trainers, sporting clubs and community members. The Safer Sport Program is the principal National community education program run by SMA Australia. The aim of this program is to increase the general community’s awareness of the prevention, assessment, management and referral of sporting injuries. SMA is to host a conference on injury prevention in Melbourne in October 2005.

The Australian Council for Health, Physical Education and Recreation (ACHPER) is a national professional association representing people working in the areas of Health Education, Physical Education, Recreation, Sport, Dance, Community Fitness or Movement Sciences. The Mission of the Council is to promote healthy lifestyles for all Australians and to study and promote its areas of focus.

The Australian Institute of Sport leads the specific development of elite sport and is widely acknowledged in Australia and internationally as employing world’s best practice in the development of elite athletes.

Coaching Australia, is Australian Sports Commission funded body, which describes the National Coaching Accreditation Scheme, coaching tips and resources, courses and events.

Occupational Health Promotion Programs in Australia

The National Occupational Health and Safety Commission (NOHSC) is Australia’s national body responsible for leading and coordinating national efforts to prevent workplace death, injury and disease. The NOHSC has recently implemented a project “Occupational Health and Safety Management Systems” (OHSMS) (178). This project is likely to be a major contributor to improving Occupational Health and Safety outcomes in the Australian workforce through its promotion of a systematic

approach to managing OHS. This initiative is expected to complement the NOHSC “National Occupational Health and Safety Strategy 2002-2012” (179) as well as the existing National Standard for Manual Handling and the National Code of Practice for Manual Handling. The National Occupational Health and Safety Strategy 2002-2012 aims to provide a framework for injury prevention activities, whilst the National Standard for Manual Handling and the National Code of Practice for Manual Handling provides guidance regarding safe manual handling activities such as positioning and posture, loads, weight and forces etc. The National Standard for Manual Handling and the National Code of Practice for Manual Handling are currently under review by NOHSC (179). To date, there has been no formal evaluation of any components of the “National Occupational Health and Safety Strategy 2002-2012”, the National Standard for Manual Handling or the National Code of Practice for Manual Handling and thus their effectiveness is unknown.

The Work Cover Authorities funded by the relevant state Governments of Australia also play a role in maintaining workplace safety, injury management and workers compensation systems.

- ❖ **Numerous sporting and occupational health promotion programs exist in Australia at national and state levels, although not all of these programs have focused on injury prevention.**
- ❖ **These programs are yet to be evaluated for their effectiveness in preventing or reducing injury**
- ❖ **There is an opportunity for enhancing a coordinated approach to reducing sport and recreational injury prevention in Australia.**

5.4 Recommendations

It is recommended that Public health initiatives be undertaken to;

- Promote healthy lifestyle behaviors
- Review and improve injury surveillance methods in elite and community-based sports.
- Support the following research activity:
 - Epidemiological research into the association between occupational activity and OA in the Victorian/Australian context.
 - Epidemiological research into the aetiology of joint injury in elite and community based sports.
 - Local evaluation of focussed public health interventions based on local epidemiology knowledge for prevention of exercise associated joint injuries.

6. REDUCING THE RISK OF OSTEOPOROTIC FRACTURE

6.1 Reducing the risk of further fracture in persons with established OP (OP)

OP is defined by the National Institute of Health Consensus Conference as a skeletal disorder characterised by compromised bone strength predisposing a person to increased risk of fracture (180). OP is a silent disease with gradual asymptomatic bone loss until it reaches the advanced stages. People often only become aware they have OP when they suffer a fragility fracture(181). The sites most commonly affected by OP are the vertebrae, hips, ribs, and wrist (182). OP fractures are associated with pain, disability, reduced quality of life and can result in reduced life expectancy. OP is diagnosed by bone mineral density (BMD) measurement using World Health Organization (WHO) diagnostic criteria. These criteria are based on the mean BMD of young adult women (6) as follows:

- *OP*: a BMD value more than -2.5 standard deviation (SD) below the mean (BMD T-score <-2.5)
- *Established OP*: a BMD value T score <-2.5 and the presence of one or more fragility fractures
- *Osteopenia (low bone mass)*: a BMD value between -1 and -2.5 SD below the mean

6.2 Burden of OP

OP has been adopted as a national health priority by the Commonwealth Government in 2002. This decision was precipitated by alarming statistics which indicated that self reported OP has increased by 21% since the 1995 National Health Survey (12). Between 2000-1, OP cost 25,000 years of healthy life in Australians, with half of these years lost due to premature death and rest due to the disability burden of the disease (9). In 2001, approximately two million Australians were affected by osteoporotic conditions, a number is expected to climb to 3 million if the current trend continues (9). It is projected that hip fracture rates will increase four to five-fold by 2050 (183, 184). In 2002-2003, OP was the fifth most commonly managed musculoskeletal conditions in general practice (11).

6.2.1 Risk for osteoporotic fracture

OP has many risk factors some of which are modifiable whilst others are not [Table 1; (6, 185)]. A study of OP risk factors reported that 50% of premenopausal women attending a fracture clinic had lifestyle risk factors to OP fracture which were amenable to modification (186). Similarly, a study of patients attending an ambulatory rheumatology clinic revealed that 68% of male patients and 82% of female patients attending this clinic had three or more risk factors for OP and fracture(187)

Table 1: Risk factors for osteoporotic fracture

<i>Non Modifiable risk factors for OP</i>	<i>Potentially modifiable risk factors for OP</i>
<ul style="list-style-type: none"> ▪ Previous fragility fracture ▪ Heredity ▪ Gender female ▪ Age ▪ Thin Body Frame ▪ Early Menopause 	<ul style="list-style-type: none"> ▪ Nutrition: low calcium diet ▪ Sedentary life style and physical inactivity ▪ Cigarette smoking ▪ Excessive alcohol intake ▪ Use of medications: steroids, anticonvulsants, certain cancer medication, excessive thyroid hormones ▪ Vitamin D deficiency ▪ Amenorrhoea secondary to Anorexia Nervosa ▪ Conditions associated with OP such as Rheumatoid Arthritis

The major risk factors for OP are increasing age and female gender, whilst the major risk for OP fracture is a history of a previous fracture and high falls risk (103). High level evidence has demonstrated that previous fracture, in particular, is a strong predictor for further OP fractures. A prospective study demonstrated that women experiencing a first fracture after the age of 50 years had a 50% greater risk of developing a subsequent hip fracture (188). A similar population based cohort study found that the risk of sustaining a hip fracture subsequent to a distal forearm fracture was 1.54 for women and 2.27 for men aged 40 years and over (189). These findings were supported by a further prospective study of 22,060 patients aged 45 years and over. This study revealed an almost fourfold greater risk of further fracture in patients sustaining a low energy fracture of wrist, hip, proximal humerus or ankle as compared with individuals who had not experienced a previous fracture (190). The risk of hip and vertebral fracture was found by this study to increase by between 1.5 to 9.5 after a first fragility fracture(190-193).

6.2.2 Management of OP

The core objectives of OP management are to (1) restore and maintain bone strength to prevent future fracture and, (2) reduce overall morbidity and mortality associated with the condition (194).

Evidence for gaps in management following first fracture

OP can be precisely diagnosed and effectively managed with safe and cost-effective treatment (195-198). Despite this, OP investigation and treatment is often neglected (199-221). Several evidence-based OP clinical practice guidelines recommend either immediate initiation of pharmacological treatment or measurement of Bone Mineral Density following a fragility fracture (103, 194, 222-224). The implementation of these guidelines, however, has been disappointing. Gaps in OP management have

been documented worldwide (219, 220, 225-229) Results of a report examining OP clinical practice by a HMO cohort over a four year period revealed a substantial gap between clinical practice guidelines and current practice, particularly in relation to BMD measurement and pharmacological treatment (230). A review of practice patterns for management of fragility fracture, which summarised 37 papers (15 retrospective cohort, 1 prospective cohort and 11 cross-sectional studies) published between 1997 -2003, also found that investigation and management of OP was low but when evaluation did occur the diagnosis of OP was high (35%-100%, median 53%) (231). Regarding treatment rates, these were found to be highly variable ranging from as low as 2% to 98%. Studies conducted in Australia and Australian context are summarized below.

<i>Author (year)</i>	<i>Study design</i>	<i>Study site</i>	<i>Number of Subjects</i>	<i>Fracture location and aetiology</i>	<i>Description of intervention</i>	<i>Follow-up period and referral rate (RR)</i>	<i>OP investigation & diagnosis</i>	<i>Treatment rate</i>	<i>Total % treated</i>
Diamond T and Lindenberg M (2002) (220)	Prospective cohort	Patients referred to private radiology practice, Sydney, NSW	161 (Male 30, Female 131)	Low trauma fractures of Spine, upper limb, lower limb, and rib.	Patient provided with survey and OP information card	12 months; 51% RR for DXA	82 DXA (M 9, F 73); led to Rx of OP in 51 (M 5, F 46)	46 female, 0 male Rx with anti-osteoporotic medications	35.1% female, 0% male
Davison et al (2001) (225)	Cross-sectional study	Christchurch Hospital, New Zealand.	224 (Male 50, Female 174)	Hip fractures, aetiology not specified		12–24-month follow-up	55/224 (24.6%) investigated {lab tests: 32 (14.3%); DXA: 23 (10.3%)}	At follow-up: 47 were	21.0%
Smith MD et al (2001) (219)	Cross-sectional study	Inpatients university teaching hospital, South Australia	218 (Male 48, Female 170)	Hip and wrist fractures, aetiology not specified.		Up to 2.5 years follow-up	31.7% invest. by DXA; 56.5% (39/69) Dx	81 some form of osteoporotic medication	37.2%
Fisher AA (2004) (226)	Retrospective chart review	5 tertiary university teaching hospitals, Canberra.	1134 (Female 75-76%)	Hip fractures, aetiology not specified.		Charts reviewed for 3 time periods: 1995-1997; 1998-2000; 2001-2003	Not specified	On admission Rx 14%, 13.5% and 15.6% for time period 1, 2 and 3 respectively. Partial anti-resorptive RX in 4.4%, 6.4% and 7.0% respectively for time periods.	14.4%
Wong PKK et al (2003) (228)	Cross-sectional study	Westmead Hospital, Sydney	63 (Female 47, Male 16)	Low trauma fractures, site not specified	DXA assessment and laboratory investigation for OP	12.7 ± 5.4 months	Not specified	7/47 women had some antiresorptive Rx, and none of the men had any Rx.	16%
Myers TA and Briffa NK (2003) (227)	Cross sectional study	Sir Charles Gairdner Hospital, Perth.	111 (Gender not specified)	Wrist (Colles fracture), Low trauma fracture		1-2 years	9% (10/111) BMD assessed	15% received Rx for OP	15%
Port L et al (2003)(229)	Cross sectional study	Two teaching hospitals, University of NSW, Sydney	385 (female 251, male 97)	Hip fracture		1 year	Not specified	17% of women and 3% of men were taking any form of Rx, and 12% of women and 2% of men specific anti-OP Rx.	17% women, 3% men

Barriers to OP investigation and treatment

Consumer Related Barriers

The major consumer-related barrier to OP investigation and treatment is the lack of awareness amongst patients of OP and its consequences. This is in part due to the silent nature of the condition (220, 221). A multinational study conducted by the International OP Foundation, demonstrated that although 93% of the participants were aware of their OP, 80% did not feel personally at risk even though 50% of these patients were high-risk (221). Similarly, a questionnaire-based survey of advice given to patients with fractures revealed that only 41% (34 of 82) of the patients were aware of their OP (205). A further study highlighted the significance of poor patient awareness of OP in their finding that 72% of patients reported that they would have taken preventive therapy earlier if they had known they of the risks associated with their condition. Accordingly, awareness of OP risk is critical to its effective management and treatment.

The lack of patient awareness of OP amongst patients has also been identified by an Australian study. A survey of Australian OP patients revealed that only 50% of patients believed that fragile bones were a normal part of the ageing process. Furthermore, only 15% were aware that they were at risk prior to diagnosis (221) and only 50% of patients had discussed the long-term health risk of OP with their physicians. Of these only 2% of patients had discussed medication options. This poor awareness of OP is reported to be much higher in men than women. A cohort study revealed that only 54% of 145 male participants knew they could be affected by OP(232). A self-reported survey conducted in South Australia also reported poor public knowledge of the individual risk factors of OP, particularly among men (233). Consumer unawareness of OP inevitably poses a barrier to medication compliance. A study of 1725 women who received medication following a fracture revealed that 73.6% of these women adhered to the medication regimen (230).

- ❖ **Public awareness of OP and perception of personal risk is low.**
- ❖ **Males a less aware of their risk of OP than females.**
- ❖ **Compliance to medication may limit effectiveness of OP interventions**

Health Professional Barriers

The Bone and Joint Decade and the International OP Foundation recently initiated a multinational survey of orthopaedic surgeons to assess the level of practice regarding the management of patients with OP fractures (234). Results of the survey revealed that although the majority of surgeons reported positive attitudes in identifying and evaluating OP in patients with fragility fractures, only 10% of them regularly initiated post-fracture bone density scanning. Moreover, over 50% of surgeons' surveyed believed that they were inadequately informed of OP and indicated the need for further professional education and training. This survey reflected the opinions of surgeons working within different sectors of the health system. A further survey of

1000 family physicians in Canada in 2003 reported that 80% of physicians wanted to be more informed about bone density testing for OP as well as the pharmacological and non pharmacological management of OP. Over 80% of physicians were interested in decision aids for OP (235). The survey also found that although physicians reported that risk factors for OP were the most influential factors for initiating Bone density testing, recent fracture was considered a low-grade risk factor (235). Similar results have been found in a UK study (236) Taylor and colleagues (236) conducted a survey of general practice population regarding their attitudes towards, and knowledge of, OP. The authors found that although general practitioners' awareness of the importance of preventing OP was high, 66% of general practitioners were unconvinced of the effectiveness of drug therapy. General practitioners also expressed a need for greater education of OP during their medical training (236). Jaglal et al reported that 70% of family physicians had not read recently published OP management guidelines (235).

The exchange of information regarding OP between health professionals and patients has also been found to be deficient. A prospective evaluation study found that although the majority of participants had a regular family doctor, their doctor was less commonly a source of information regarding OP, ranking fifth after television, newspapers, books and friends (232). A survey of public awareness of OP amongst patients with fractures similarly found that only 29% of patients who were aware of their OP received their knowledge from doctors (205).

Systemic barriers: Perceived professional roles and models of care

One of the most significant systemic barriers to identifying and treating OP in high-risk populations is the blurred lines of responsibility and lack of communication between orthopaedic surgeons and primary care physicians (237, 238). Simonelli and colleagues conducted a survey of primary care physicians and orthopaedic surgeons to investigate their perceived roles of in the identification and treatment of OP in patients hospitalised with a fragility fracture (238). The survey revealed that orthopaedic surgeons were consistent in their opinion that post-fracture attention to OP should rest with the primary care physicians. Orthopaedic surgeons also supported the role of nurse practitioner to promote the educations of primary care physicians regarding OP. In contrast, primary care physicians did not support the role of a nurse practitioner. Kaufman et al (237) reported similar results. A further survey of 89 orthopaedic surgeons believed that their treatment focus should be on immediate fracture management and not future fracture prevention (239).

- **There is a significant gap between current practice and that recommended by evidence-based clinical practice guidelines for the treatment of fragility fractures.**
- **There are numerous systemic, consumer and professional barriers to the provision of best practice management of OP fractures, the most significant of which are OP awareness, medication compliance and blurred lines of responsibility amongst health professionals.**

Special Groups: OP in men

The prevalence of OP in men is dramatically increasing world wide. It is estimated that 19% of men older than 50 years suffer from OP (240). In Australia, it is estimated that 30% of men over 60 years will suffer from an OP fracture (241). Men account for approximately 20% to 30% of all hip fractures (242) and have higher morbidity and mortality than in women. Studies have shown that 20.7% of men over 75 years die after sustaining a hip fracture, as compared with 7.5% of women (243).

Research into OP in men has been sparse. There remain no strict criteria for defining OP in men (240). Kiebzac et al evaluated post-hip fracture OP treatment of men and found a significant lower rate of treatment in men compared to women(204). Kiebzac et al also found that while the mortality rate of men (32%) was significantly higher than for women (17%; $p = 0.003$), only 4.5% of men received any kind of OP treatment as compared to 27% of women ($p < 0.001$). A retrospective chart review of male veterans found that none of the men's records included a diagnosis of OP in the 6 months prior to or following a fracture (213). In another prospective cohort study with historical controls, authors found that although all of the women with OP, as assessed by BMD test, were receiving treatment for OP, none of the men with OP as assessed by BMD test were treated (220). Colon-Emeric et al reported similar under-treatment of men with hip fracture at discharge in retrospective cohort study (207)

Diamond et al conducted a systematic review of RCTs evaluating treatment of OP in men and developed guidelines for treatment of OP in men (224). The authors emphasized the limited number of studies conducted in this area in comparison to women. Thus, their guidelines were based on studies of women. It is not known whether these guidelines have been effectively implemented or evaluated although there is an obvious need for further research in this area.

- ❖ **OP in men is under-diagnosed and under-treated**
- ❖ **There is a paucity of OP therapeutic studies in men**
- ❖ **The effectiveness of clinical guidelines for the management of OP in men is unknown**

6.3 Public Health Interventions for treating first fragility fracture

6.3.1 Promotion of health lifestyles

Community based health promotion programs for the improvement of bone health {Level IV (+) Evidence}

Increasing knowledge about OP in association with increasing self-efficacy in patients have been found to be more effective in health promotion than increasing knowledge

alone (244). A preliminary evaluation of the OP Self-Management Course (OPSMC), conducted by Arthritis Victoria revealed a significant increase in preventive behaviours, particularly exercise and calcium intake even after six months after completion of the course (244, 245). Similar results have been found in a study investigating long-term behaviour changes after OPSMC (244, 246).

❖ Community based self management courses promote better knowledge and self efficacy which in turn improves OP lifestyle behaviours

Exercise {Level I (+) Evidence}

A systematic review of 18 RCTs found that aerobics, weight bearing resistance exercises and walking are effective in increasing the BMD of the spine and hip in postmenopausal women (247). Other systematic reviews have demonstrated exercise induced increases muscle strength, which may reduce the risk of falls (81, 248).

Fall prevention strategies {Level I (+) Evidence}

The majority of fractures are associated with a fall. High level evidence supports the effectiveness of targeted fall prevention programs in significantly reducing falls rates in the general population (249). One specific falls prevention strategy, hip protectors, have been shown to reduce fractures in the institutionalised elderly (250).

Models of care for management of people with fragility fracture

Multidisciplinary care programs {Level II (+) – III-3 (+) Evidence}

The use of a multidisciplinary approach for the identification and treatment of OP has been demonstrated to improved fragility fracture management. A New Zealand study, which evaluated a protocol driven ortho-geriatric rehabilitation ward intervention, demonstrated a 62.8% compliance with recommendations for investigation, an increase in BMD measurement from 11% to 93% and increased vitamin D measurement from 12% to 95%(251). Calcium, vitamin D or both were prescribed after implementation of the intervention in 85% patients. Another prospective cohort study reported 90.7% follow-up using a care pathway and a multidisciplinary care approach(252).

Specialist models of care {Level II (+) Evidence}

Specialist models of care for fracture management are accessed from acute public hospitals and the community. They range from traditional orthopaedic fracture clinic review to specialist physician of OP and first fracture clinics. A role for specialist clinics has also been established in other areas to target high-risk groups with success. In Victoria there are Falls Clinics and Movement Disorder Clinics (47).

Specialist models of care have been evaluated by numerous studies. Hajcar et al surveyed patients who had previously attended Fracture clinics and found that less than 20% had undergone investigation and adequate treatment of OP at one year follow-up (211). Another cross sectional study reported that only 13% of participants

were receiving adequate treatment, 47% were receiving partial treatment and 40% were not receiving any treatment for OP as defined by National OP Foundation (NOF) guidelines.

In a pre-post intervention study, Hawker et al evaluated the effect of education and advice in five community based fracture clinics of hospitals in Canada (181). Patients attending the clinics who had had a fragility fracture were (a) assessed by an orthopaedic surgeon (b) provided with information about their future fracture risk (c) given advice to undergo further physician assessment for the condition and, (d) given a letter for their physician. At three months follow-up, patients in the intervention group were more likely to have had a follow-up physician assessment (adjusted Odd Ratio 1.85, $p = 0.02$) and a BMD test (adjusted OR 5.22, $p < 0.0001$) as compared to the control group. Despite this positive effect however, treatment recommendations received by these patients were found to be significantly lower than those received by controls (adjusted OR 2.07, $p < 0.07$). The authors concluded that simple fracture clinics might increase follow up and investigation but not treatment for OP in fragility fracture patients. Conversely, Ashe et al in a controlled trial found that providing a simple intervention involving writing reminders for patients at fracture clinics and faxing these to their family physicians initiated OP investigation as part of post-fracture care in 92% of patients as compared to 23% in usual care group (253, 254). A similar pattern of findings has been found following a retrospective cohort study. Researchers introduced a new protocol in specialist fracture clinics which involved providing options such as referrals to an OP clinic, BMD testing, prophylactic treatment or reminder notes to the family physician for further investigation. They found that at two month follow up management of OP increased in hip fracture inpatients from 22% to 75% ($p < 0.00001$) and in distal radius fracture patients from 0% to 81% ($p < 0.00001$) (255).

Despite the increasing international interest in specialist models of care, First Fracture Clinics (FFC) are not been widely established in Australia [personal communication with Prof. J. Wark, Department of Medicine, University of Melbourne and Prof. L. March, Department of Rheumatology, Royal North Shore Hospital]. Notwithstanding OP clinics have been established in conjunction with the orthopaedic fracture clinics in some hospitals in New South Wales (Royal North Shore Hospital, Royal Prince Alfred Hospital). The Royal North Shore Hospital, Department of Rheumatology is currently piloting a program to identify patients attending orthopaedic fracture clinics and offering referral for OP assessment and treatment. This program is yet to be evaluated {personal contact with Prof. L. March, Department of Rheumatology, Royal North Shore Hospital, NSW}.

- ❖ **The most appropriate model of specialist care is yet to be defined.**
- ❖ **Establishment of specialist clinics necessitates careful consideration of local contextual needs and available staff resources.**
- ❖ **Access to up to date evidence based information in a user -friendly format about fracture risk and management is needed by health professionals.**

- ❖ **Further research in this area is indicated.**
- ❖ **Development of decision aids may be a useful tool for health professionals and consumers.**

6.4 Reducing the risk of Vitamin D Deficiency

6.4.1 Optimizing Nutritional Intake for Calcium and Vitamin D

Vitamin D deficiency holds significant consequences for bone density and risk of fracture and falls particularly in the aging population (98, 256-258). The extent of these health risks varies according to the degree of Vitamin D deficiency. NHMRC recommends a daily oral intake of 10 µg (400 IU) for those who are housebound or not exposed to direct sunlight for at least 1-2 hours per week (259, 260). Increasing vitamin D intake or casual exposure to sunlight may not only decrease the risk of poor bone health, fracture and falls in susceptible individuals, but also reduce other diseases such as cancers, diabetes (type I), and possibly multiple sclerosis (261).

There are two chemical forms of vitamin D, (1) Cholecalciferol (Vitamin D3), a nature form, and (2) Ergocalciferol (Vitamin D2), manufactured by ultraviolet light. Vitamin D plays a vital role in the absorption of calcium and phosphorous and their maintenance with the normal serum range. Vitamin D also helps to sustain a wide variety of metabolic and physiological functions, including bone health and normal neuro-muscular function (260). In general, 80 to 100% of vitamin D is primarily derived from cutaneous synthesis following exposure to ultraviolet light (262), thus with adequate exposure to sunlight dietary supplementation of vitamin D might not be necessary. In some circumstances, however, mediated by age, skin colour, amount of time spent outdoors and latitude, exposure to Vitamin D due to sunlight alone may be insufficient and cause Vitamin D deficiency, leading to a need for dietary supplementation of Vitamin D in some (260).

6.4.2 Prevalence of Vitamin D Deficiency in Australia

Vitamin D deficiency is common throughout the western world, including Australia. Evidence from several studies (98, 263-266) has demonstrated that the prevalence of Vitamin D deficiency is much higher than previously thought (260). The standard test for vitamin D is measurement of 25-Hydroxy vitamin D (25 OHD), representing the main circulating form of vitamin D. A low serum 25 OHD concentration is the hallmark of vitamin D deficiency. According to the level of 25 OHD in the body, vitamin deficiency can be classified as either marginal (25 OHD levels ranging from 25 – 50nmol/L) or frank (25OHD levels < 20 –25 nmol/L). The highest rates (80%) of frank deficiency occur in dark-skinned, veiled and or pregnant women (263). Institutionalised elderly people are also a high risk group.

The Elderly and Vitamin D

A study of marginal deficiency rates in the institutionalised elderly revealed that 76% of nursing home residents and 53% of hostel residents were Vitamin D deficient

(267). Similar results were reported following a study of frail institutionalised older people in Northern Sydney (268). This study revealed that 86% of women and 68% of men living in nursing homes and hostels were marginally vitamin D deficient. A further study conducted in older women in residential care across Australia, however, reported slightly lower rates. In this study, authors found frank deficiency (25OHD < 25 nmol/L) in 22% of women in low care and 45% of women in high care (98). Another high-risk group was found to be mothers of infants treated with rickets (265).

Multicultural Communities and Vitamin D

Studies have demonstrated that women that are veiled or have dark skin pigmentation are susceptible to vitamin D deficiency (263, 265, 269). Moreover, veiled women with vitamin D deficiency were found to have high bone turn over and a risk of osteoporotic fractures (269). A high rate of Vitamin D deficiency has also been reported amongst the migrant mothers of Africa and Indian sub-continent descendents. A cross sectional study (265) conducted in Melbourne of mothers of infants presenting with clinical features of rickets reported a high prevalence of hypovitaminosis D in this sub-group of the population. All but one of the participants was a migrant from Africa and Indian sub-continent.

Young Australians and Vitamin D

The prevalence of vitamin D deficiency in younger Australians has also been found to be high. In a Geelong OP study, Pascoe et al found that the marginal deficiency rate among young women aged 20 to 39 years was 43%. Of these, 8% had frank deficiency at the end of winter (264).

- **Women that are veiled or have dark skin pigmentation are susceptible to vitamin D deficiency.**
- **Elderly people who are immobile and have limited sunshine exposure are at high risk of having vitamin D deficiency.**
- **Young Australians are also at risk of hypovitaminosis D**

Consequences of Vitamin D deficiency

Vitamin D and Bone Density {Level I (+)}

A positive relationship has been observed between serum vitamin D concentration and Bone Mineral Density. Nonetheless, evidence from a systematic review addressing the effect of vitamin D supplements on vertebral and non-vertebral fracture reported no reduction in hip fracture when vitamin D supplement was used without calcium supplementation (270). There were, however, methodological flaws in the analysis of this study data that may account for this finding(271). Another recently conducted meta-analysis of 25 RCT investigated the efficacy of vitamin D

treatment in the prevention of OP in post menopausal women (271). Results of this review revealed that vitamin D supplementation reduced the incidence of vertebral fractures (271) and was associated with a trend towards a reduced incidence of non-vertebral fractures (RR 0.77, 95% CI 0.57-1.04, P = 0.09). The majority of patients in the trials that evaluated vertebral fractures received hydroxylated vitamin D, whilst the majority of patients participating in the trials that evaluated non-vertebral fractures received standard vitamin D.

Vitamin D and Risk of Fracture {III (+) evidence}

Evidence linking vitamin D deficiency and bone loss or osteoporotic fractures is limited. A cohort study investigated vitamin D deficiency as a risk factor for the first hip and vertebral fracture in 271 women (272). Women whose serum concentration vitamin D was in the lowest quintile had a significant increase in the risk of hip fracture (relative risk, 2.1; 95 percent confidence interval, 1.2 to 3.5). Authors, however, found no significant relationship between serum vitamin D concentrations and the risk of vertebral fracture. Another case control study investigating risk factors of hip fractures in elderly women reported an increased risk of hip fracture in association with lower vitamin D intake (Relative Risk 3.9, 95% CI 1.7 – 9.3) (273). These studies demonstrated an increased risk of hip fracture in individuals with hypovitaminosis D.

Vitamin D and Falls (Level I (+) evidence)

Evidence from recently a conducted meta-analysis supports the presence of a strong association between vitamin D deficiency and falls. Vitamin D deficiency has been found to be an established risk factor for falls. Studies have shown that vitamin D supplements reduce the incidence of falls by 22% (corrected OR, 0.78; 95% confidence interval [CI], 0.64-0.92) when compared to patients receiving calcium or a placebo(97). From the pooled risk difference, the number needed to treat (NNT) was 15 (95% CI, 8-53), or equivalently 15 patients would need to be treated with vitamin D to prevent 1 person from falling. Subgroup analyses suggested that the effect size was independent of calcium supplementation, type of vitamin D, duration of therapy, and sex.

A further RCT conducted across residential care in various states of Australia investigated serum Vitamin D and falls in older women (98). The authors reported low levels of serum vitamin D were an independent predictor of incident falls. Adjusted hazards ratio for falls among these residents was 0.74 (95% confidence interval=0.59-0.94; P= 0.01), implying a 20% reduction in the risk of falling with the doubling of vitamin D intake.

Vitamin D supplementation:

- ❖ **Is an effective therapy for preventing vitamin D deficiency.**
- ❖ **Reduces the risk of falls among institutionalised older individuals**
- ❖ **Decreases vertebral fractures, however, its impact on non-vertebral fractures is uncertain.**

6.4.3 Public Health Initiatives to Prevent Vitamin D Deficiency and Related Consequences

6.4.4 General awareness

Despite the high prevalence of hypovitaminosis D in distinct communities, initiatives aimed at prevention remain sparse (274). Fisher et al conducted a retrospective chart review of 1134 patients admitted to a Canberra hospital for low-impact hip fracture between 1995 and 2003. The authors found that although 78% of these patients had low serum level of 25 OHD, only 7.6% were receiving vitamin D supplementation (275). In Australia, interventions regarding general public awareness are negligible. OP Australia provides patient fact sheet that include only limited information regarding Vitamin D. Similarly, only some information of vitamin D is available in Arthritis Victoria information sheets.

❖ **There is limited available information and inadequate access to information regarding vitamin D deficiency is negligible**

Fortification of food {Level II (+) evidence}

The dietary intake of Vitamin D of Australians is low and inadequate relative to requirements (260). There are very few foods such as fatty fish (salmon, sardines, herring, mackerel), meat and eggs that naturally contain vitamin D (260). Daily consumption of these food sources is often impractical. Fortification with vitamin D for different food may be useful alternative. Evidence from RCTs (276-278) has demonstrated the effectiveness of the fortification of different daily consuming nutrients such as milk, orange juice, in reducing hypovitaminosis D. Two RCTs (277, 278) conducted in Ireland assessed the efficacy and acceptability of vitamin D fortified milk for the management of vitamin D deficiency in the elderly population. Both studies revealed a significant increase in serum vitamin D levels in individuals receiving vitamin D fortified milk as compared to those having non-fortified milk. It was also concluded that vitamin D-fortified liquid milk is a safe, effective, and acceptable method of administering vitamin D to the elderly, community-based and institutionalized population. Tangpricha and colleagues in a controlled trial of vitamin D fortified orange juice, demonstrated a 150% increase in serum level of Vitamin D after 12 week (276).

In Australia, only table edible oil spreads and table margarine are required to be fortified with Vitamin D. Others food such as skim milks, yoghurts, cheese are voluntary fortified by the suppliers (260). Most fortified foods have a minimal dose of vitamin D due to safety and other reasons. A report by Nowson and Margerson on Vitamin D fortification in Australia concluded that it would be unrealistic to expect the achievement of the required dietary intake alone (260).

❖ **There is limited natural supply of vitamin D in food.**
 ❖ **Current fortification practice is not optimal to achieve the required dietary intake.**

❖ More widespread fortification of foods may be a useful method to tackle hypovitaminosis D, particularly in high-risk groups.

Recognition of high-risk groups {Level IV (+) evidence}

Recognition of high-risk groups should be a major public health measures. This recognition will enable the targeting and implementation of appropriate interventions for persons at risk of hypovitaminosis D (256). In Australia, high-risk groups are include elderly institutionalised elderly people, veiled women, women with dark skin pigmentation, migrants mothers of Africa and Indian sub-continent whose infants present with clinical features of rickets. Reluctance in consuming vitamin D supplementations due to cultural and religious belief is a particular barrier to the prevention and treatment of hypovitaminosis D in the Muslim community. Recently, some vitamin D supplementations have been approved by the Muslim Council of Australia (From Personal Contact with Prof. John Wark, Department of Medicine, Melbourne University).

❖ Recognition of high-risk group will enable appropriate interventions to be targeted at greater risk of vitamin D deficiency.

6.4 Recommendations

It is recommended that Public health initiatives be undertaken to;

- Promote increased public and professional understanding and awareness of OP.
- Target special at risk groups such as men
- Promote healthy lifestyle behaviours aimed at improving bone health
- Support access to information for health care professionals and consumers about OP and vitamin D Deficiency.
- Support research into the most appropriate specialist models of care for based on evidence based clinical practice guidelines.
- Promote PHI that reduce the risk of vitamin D deficiency in high risk groups in the community

7. DEPRESSION, ANXIETY AND ARTHRITIS

Depression and anxiety disorders are an international public health concern. Depression and anxiety are defined by the Diagnostic and Statistical Manual of Mental Disorders (DSM-IV-TR) (279) as follows:

Major depression is an illness characterized by one or more major depressive episodes each lasting at least 2 weeks and characterised by either depressed mood or the loss of interest or pleasure in nearly all activities. In children and adolescents, the mood may manifest itself as being irritable rather than sad. A diagnosis of major also requires the experience of at least four of the following symptoms:

- Significant changes in appetite
- Significant weight loss/gain
- Loss of sleep
- Reduced psychomotor activity
- Reduced energy;
- Feelings of worthlessness or guilt;
- Difficulty thinking, concentrating, or making decisions
- Recurrent thoughts of death or suicidal ideation including suicidal plans, or attempts.

Generalized Anxiety Disorder is characterised by an excessive anxiety and worry (apprehensive expectation) about a number of events or activities, occurring more days than not for a period of at least 6 months. The individual with anxiety disorders finds it difficult to control their worry. The anxiety and worry are accompanied by at least three additional symptoms from the following list (only one additional symptom is required in children):

- Restlessness,
- Being easily fatigued,
- Difficulty concentrating,
- Irritability,
- Muscle tension
- Disturbed sleep

In Australia, it is estimated that approximately 18% of adults have experienced a mental illness at least once in their lifetime. Depression is the fourth highest cause of death and disability (280). The incidence of anxiety disorders is also pervasive in the community. In 1997, the prevalence of depression and anxiety was estimated to be 5.8% and 9.7%, respectively (281) and contributed 3.7% to the total disease burden (282). These data are comparable with international estimates (283).

Depression and anxiety are highly co-morbid. Depression is more likely to be associated with anxiety than any other disorder. Just over half of patients that experience clinical depression also experience anxiety disorder(284). Figure.1 shows the relationship between depression and anxiety and thus the importance of concurrent consideration of both illnesses.

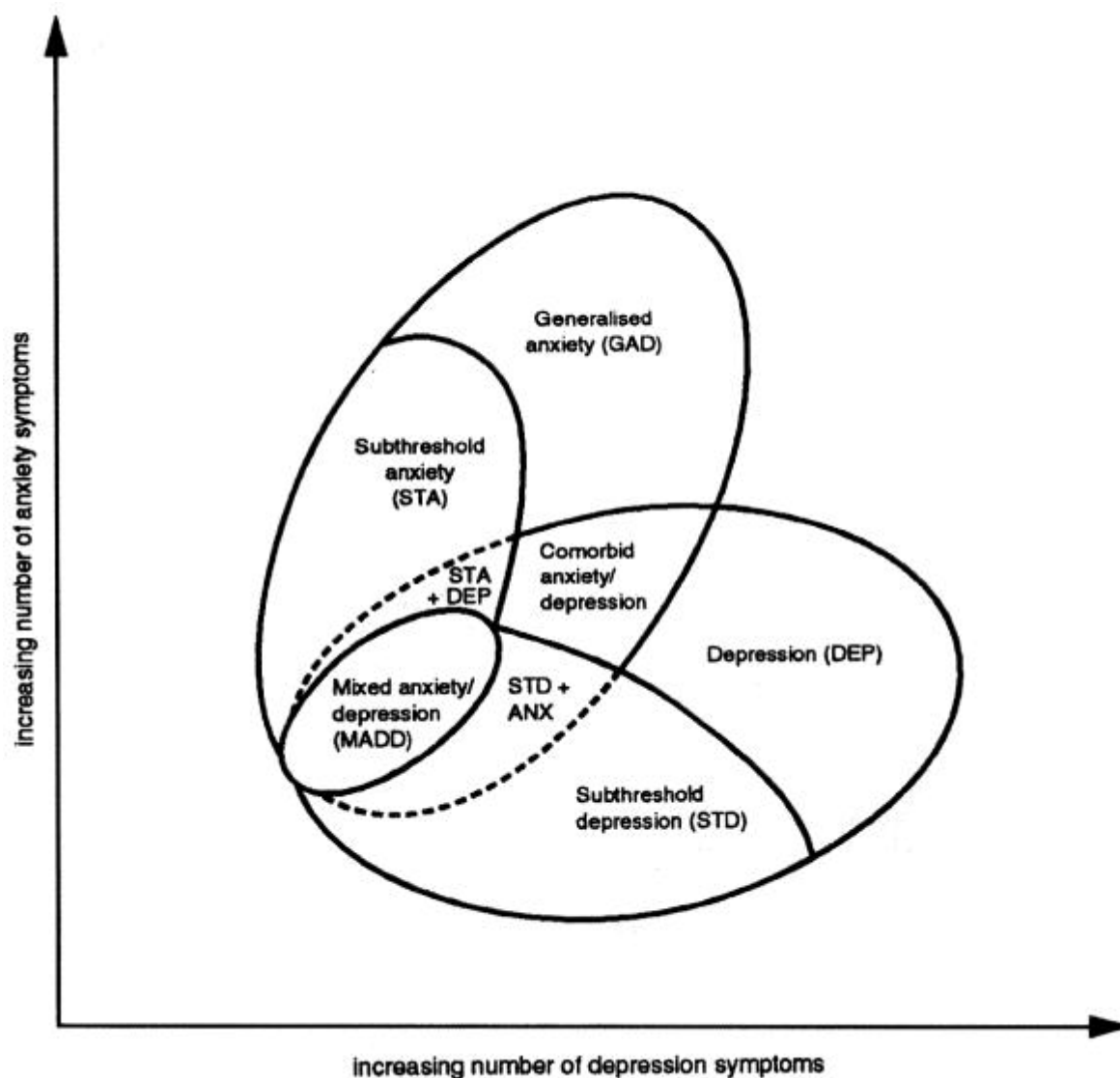


Figure 1. Diagrammatic representation of the anxiety and depression symptoms in the case studies (284) {Reprinted with the permission from Dr.T.B.Ustun,WHO}.

7.1 Co-morbidity of arthritis, depression and anxiety

The co morbidity of chronic physical diseases and mental illness, including anxiety and depression is well documented in the literature (70, 285, 286). Depression is considered not only a response to physical illness, but an influential factor in the course of the physical illness itself (286). Studies have documented an increased risk of institutionalisation and mortality in patients with co morbid chronic physical illnesses, depression and anxiety (287, 288). Arthritis and musculoskeletal diseases have been linked to depression in particular. (70, 71, 285, 289-291). Few studies have specifically addressed co morbidity of arthritis and musculoskeletal disease and anxiety.

In 1997, the impact of arthritis on mental health was assessed using data from the 1997 Mental Health Survey. This survey revealed an increased prevalence of depression in people with arthritis (13.9%) as compared to the general population (11.3%). The relative risk of mental health problems (14.3%) in patients with arthritis was reported to be 1.44 (95% CI 1.12-1.85, $p < 0.01$). Dunlop et al (70) conducted a population based longitudinal study to investigate the attributable risk of various chronic illnesses to depression. This study found that arthritis had the largest attributable risk of depression (AR = 18.1%) than all other chronic diseases. Similarly, a recent study investigating the effectiveness of a systematic primary care intervention across 18 primary health care centres in America reported that over half (56%) of the participants had coexisting arthritis at baseline (292).

7.1.1 Rheumatoid Arthritis {Level I (+) evidence}

A number of studies have investigated the co morbidity of depression and RA. A systematic review (289) of 12 independent studies comparing depression rates in RA patients and healthy controls revealed a significantly higher prevalence of depression among patients with RA as compared to healthy individuals (combined effect size Pearsons' $r = 0.21$, $p < 0.0001$; heterogenous). This difference persisted even after controlling for age, sex and socio-economic status. The review also reported a strong association between depression and RA-associated factors including their degree of physical disability, disease activity and disease duration. In addition to these higher rates of depression, anxiety was also found to be significantly higher in RA patients as compared with the normative group of age-equivalent working adults ($p < 0.0001$). A recent observational study further assessed the strength of the association between the physical characteristics and social stresses of RA and depression (290). Results revealed that 39.2% of 74 patients with RA were also clinically depressed (290). A similarly high prevalence of depression in RA patients has been reported by other cross sectional studies (293-295). The estimated prevalence of depression in individuals with RA recognized in these studies was found to be between 15 and 42%. Demographic characteristics and rheumatoid arthritis were not associated with a diagnosis of depression.

Osteoarthritis {Level IV (+) Evidence}

To date, very little research has investigated the co morbidity between mental health and osteoarthritis (OA). In a cross sectional study, Blixen and colleagues evaluated depression, social support and quality of life in older adults with OA (71). They found that amongst 50 patients, 40% experienced depression with mild to moderate symptoms, whilst a further 6% reported severe depression. A survey of mental illness in OA patients in primary care similarly identified a prevalence of moderate to severe anxiety and depression in 47% of OA patients surveyed ($n = 200$) (296). Hurley et al evaluated the psychosocial sequelae of OA in a narrative review. They concluded that people with OA are more likely to demonstrate symptoms of depression in accordance with the nature, intensity of the symptoms such as pain and disability from this condition (297).

Osteoporosis {Level III-2 (+) Evidence}

Schweiger et al conducted a follow up cohort study over a period of 24 months to examine the association between OP and depression. The authors reported that among

OP patients, bone loss was 10 to 15% greater in individuals with a diagnosis of depression as compared to non-depressed controls (298). A population based cross-sectional study of pre- and postmenopausal women (N = 1566) also demonstrated that 16% of OP participants were clinically depressed (299). A more specific study reported that among women with OP and depression, BMD was 6% lower at the spine and 14% lower at the hip, in comparison to control women without depression (300). As well, a community based survey of middle-aged Portuguese women (N = 102) found a significant higher prevalence of depression amongst women with OP (77%) non-OP women (54%) {OR, 2.9 (95% CI 1.0 to 7.6)} (301). These differences were independent of age or body mass index.

❖ **People suffering from arthritis have an increased prevalence of mental health diagnoses, namely depression and anxiety.**

7.2 Improving awareness and management of anxiety and depression in OA, rheumatoid arthritis (RA) and OP

7.2.1 Barriers to dementia/anxiety investigation and treatment in RA, OA and OP

The scarcity of research examining the dynamics underlying the co morbidity of arthritis, depression and anxiety highlights the importance of considering the potential barriers to identifying, treating and managing such co morbidity.

Consumer Barriers

It is well documented that that depression and anxiety often go unrecognized and untreated amongst clinicians particularly within the primary care sector (302). One reason for this may be patients reluctance to report mental health symptoms to their health professional for fear of the negative social stigma and discrimination attached to mental illness in the community (303). This reluctance is also compounded by patients' poor understanding of their mental health symptoms and the possibilities for treatment which in turn result in feelings of shame, guilt and hopelessness (303, 304). A telephone survey (305) conducted across four Australian states (New South Wales, Victoria, Queensland, South Australia) of community awareness of mental illness revealed that only 2% of those surveyed recognized depression as major health problem and only 28% stated that they were likely to seek assistance from a general practitioner for mental health symptoms. These findings have been supported by other studies (283, 306).

- ❖ **Community awareness of mental illness is poor.**
- ❖ **Negative social stigma associated with mental illness is a barrier to effective identification and treatment.**
- ❖ **Poor awareness and negative social stigma collectively exacerbate the difficulty in identifying and managing co morbidity of arthritis, depression and/or anxiety.**

Health Professional Barriers

Approximately 50% of people receiving treatment for depression do so from the primary care sector (303). Despite this, primary care professionals often lack adequate training, knowledge and experience in dealing with mental illness, partly due to limited access to mental health resources but also due to poor confidence and negative attitudes towards dealing with mental health symptoms (303). This problem has persisted even after the development of evidence based clinical practice guidelines for the treatment of various mental illnesses (307).

Numerous studies have examined the characteristics mental health treatment and management in the primary care sector. Cross sectional studies of primary care practice suggest that adherence to clinical practice guidelines is poor (308, 309) and that dose and duration of treatment is often inadequate for those have already been diagnosed (310). The Health Omnibus survey of South Australia showed that although 69% of patients with major depression had consulted their general practitioners, only 10% had consulted psychiatrists and only 19.5% were currently receiving medication (283). These findings are consistent with those of community based studies(311, 312). A narrative review of depression diagnosis in primary care settings also reported that depression is accurately diagnosed in only 30 to 40% of cases (303). Similarly, a cross-sectional survey of primary care physicians revealed that 50.3% of participating physicians had substituted diagnoses for one or more patients using the Diagnostic and Statistical Manual of Mental Health (310). The most common reason for misdiagnosis was uncertainty about the diagnosis (310).

Regarding patients with arthritis, studies of practice patterns have found that screening for depression is not a standard practice in the routine assessment of patients with arthritis(313). A cross sectional survey of British general practitioners found that depression and anxiety were often underestimated. General practitioner recognized depression was 6.0% as compared to self-reports of 8.3%, whilst GP recognized anxiety was 11.9% as compared to patient self-reports of 24.4% (296).

❖ Poor awareness, training and knowledge of mental illness amongst health professionals are major barriers to recognising and treating depression in the arthritis population.

7.2.3 Public health Intervention for treating depression in patients suffering from arthritis conditions

Studies have documented a wide variety of public health interventions aimed at preventing or reducing depression and anxiety in the general population. Few of these approaches, however, have been applied to patients with arthritis. This review considers selected interventions that may be transferable to the arthritis population.

Patient Education {Level II (+) Evidence}

Patient education has been shown to be effective in overcoming barriers to the management of depression. In particular, education-based interventions have been shown to increase patient knowledge, desired protective behaviours, medication

compliance as well as improve perceived self efficacy and reduce pain and disability (314-316). A RCT of the impact of a patient education program provided by a trained educator to patients attending an ambulatory rheumatology care clinic found that at eight week follow up, patients receiving the education program demonstrated significantly greater knowledge of their condition as compared to patients receiving usual care ($p = 0.02$)(314).

❖ Patient education is effective in producing positive outcomes in dealing with physical and psychological outcomes associated with arthritis

Health professional education {Level II (-) Evidence}

In contrast to patient education, education programs targeting clinicians' knowledge, attitudes and guideline implementation have been shown to have minimal effectiveness (317). Worall and colleagues conducted a RCT to examine the effectiveness of a professional education program to improve physician management of mental illness. Forty-two primary care physicians were randomly assigned to an intervention group (3-hour case-based educational session on clinical practice guidelines (CPGs) for depression and access to a psychiatrist for consultation) or to a control group (receipt of CPGs without educational session or access to the psychiatrist). Results revealed no significant difference between physicians in the intervention and control group in the diagnosis of depression amongst physicians. Physicians in the intervention group did, however, have a higher overall rate of referrals to psychiatrists and other mental health professionals (15.4% v. 3.5%, $p = 0.05$) as compared to controls. Authors concluded that educational interventions had only a modest beneficial effect on the outcomes for patients with mental illness. Other studies have supported this finding (318). No study to date has evaluated the effectiveness of professional education programs for treating and managing mental illness in patients with arthritis.

❖ Professional education has only a modest effect in improving on clinical practice in the treatment and management of mental illness.

❖ Further research is needed to specifically investigate the effect of professional education on the treatment and management of mental illness in patients with arthritis

Collaborative Care {Level II (+) Evidence}

Multidisciplinary care incorporating patient education and shared care between primary care physicians, psychiatrists and psychologists has been found to be effective in reducing mental illness and improving compliance to treatment. Katon et al conducted a RCT (319) investigating a stepped collaborative care program that included patient education, psychiatrist visits, and primary physician care for patients with depression. Results revealed that the collaborative care program was associated with a greater recovery rate (44% vs. 31%, $p = 0.05$), increased treatment compliance (68.8% vs. 43.8%, $p < 0.0001$) and a higher patient satisfaction with care ($p = 0.04$) as compared with patients receiving usual care.

A similar collaborative treatment model for patients with arthritis has been evaluated. A RCT (292) of 1801 depressed older adults with arthritis across 18 primary care clinics in USA implemented a model of care in which patients received depression care management by nurses or psychologists working in collaboration with their primary care physician. This management involved patient education, social support and a brief course of psychotherapy. At 12 months follow up, patients involved in the collaborative intervention experienced reduced depressive symptoms, a lower mean score for pain (5.62 vs. 6.15, $p = 0.009$) and reduced interference with daily activity due to arthritis (95% CI -1.0 to -0.19 , $p = 0.004$) and due to pain (95% CI -0.41 to -0.10 , $p = 0.002$).

❖ **Multidisciplinary management of mental illness and arthritis is effective in reducing symptoms and interference associated with disease.**

Community Based Health Promotion Programs {Level II (+) Evidence}

The Arthritis Self-Management Program (ASMP) offered through local chapters of the Arthritis Foundation aims to improve patient self-efficacy and independence. This type of group activity provides avenues for discussing problems, coping solutions and sharing experiences (320). ASMP has been found to be effective in improving functional ability and knowledge regarding self-care behaviour and management of arthritis (321-324).

A RCT investigated the effectiveness of a community based Spanish language arthritis education program in a Spanish-speaking community in USA. The authors reported a significant improvement in exercise, general health, disability, pain, self-efficacy and depression ($p < 0.05$) in treatment subjects at 1 year follow up (325). Similarly, a quasi-experimental study which implemented a comprehensive health promotion program, in 36 Korean outpatients diagnosed with RA reported a reduction in depressive symptoms and pain in these patients (326).. Pain management and psycho-social coping were also significantly improved in the intervention group.

❖ **Community based health promotion programs such are effective in improving patient life style behaviours and coping skills**

❖ **There is limited information regarding the effectiveness of ASMP for people with arthritis who are also depressed and anxious.**

Social support {Level III-3 (+) Evidence}

Social support provides an opportunity for an interpersonal exchange of ideas and experiences and provides emotional reassurance, material assistance, and a sense of continued self-esteem (320). Studies have demonstrated that social support has beneficial effects on physical health and psychological well being in patients with chronic diseases including arthritis (327). Social support has also been found to be effective in minimizing the impact of the physical limitations imposed by RA on psychological adjustment (71). In a cross sectional survey, Weinberger et al, examined data from a longitudinal study on patients with OA. The investigators found that social support provided through bi-weekly telephone calls, which inquired about

the stressors and overall health, resulted in a significant improvement in functional status (physical disability, psychological disability, and pain) (328). A further cross-sectional study of 101 recently diagnosed patients with RA also demonstrated lower levels of depression in patients that received positive help and support from close friends and family. In contrast, the level of depression increased in patients which experienced negative or little support (329). Similar results were demonstrated by another cross sectional study examining depression, social support and quality of life in elderly OA patients. Authors of this study found that the provision of social support was associated with reduced pain and improved function and quality of life (71).

Psychological interventions {Level II (±) Evidence}

The benefits of cognitive-behavioural therapy (CBT) in treating mental illness are well documented (330-333). The specific effects of CBT on mental illness in patients with arthritis, however, have been sparsely studied. A well-designed RCT compared the effect of CBT combined with routine medical treatment versus medical treatment alone on various patient outcomes in RA patients from three hospital rheumatology clinics. The CBT involved patient education, self management skills training. Results revealed that patients receiving CBT in combination with routine medication were less depressed ($p= 0.02$) and experienced significant improvements in joint inflammation ($p < 0.05$) (334) as compared with controls. These results were replicated following a RCT of unselected RA outpatients in Germany (335). RA patients in this study were found to be less depressed ($p= 0.049$), anxious ($p = 0.037$) and helplessness ($p = 0.037$). Patients also expressed less pain ($p = 0.02$) as compared with a usual care control group.

The positive effect of CBT in arthritis patients, however, has not been universal, with two further RCTs reporting no beneficial effect of CBT for RA patients (336, 337). Moreover, a meta-analysis of 25 RCTs examining the efficacy of psychological interventions (such as relaxation, biofeedback, stress management, CBT) for RA did not find a beneficial effect of these interventions (338). The reviewers attributed this finding to the low methodological quality of previous studies in this area. It was also suggested that psychological interventions may be more effective at initial diagnosis as an adjunctive to routine medical treatment to cope. Further research is needed to clarify the dynamics influencing the effectiveness of psychological interventions in patients with arthritis or otherwise.

- **The effectiveness of CBT in treating and managing mental illness is well documented.**
- **The effectiveness of CBT and other psychological interventions in patients with arthritis is unclear.**
- **Further research is needed to clarify the dynamics influencing the effectiveness (or otherwise) of psychological interventions in patients with arthritis.**

7.3 Recommendations

It is recommended that Public Health Initiatives be undertaken to;

- Promote awareness of the risk of anxiety and depression in patients with arthritis and osteoporosis among health care professionals and consumers.
- Promote consumer education about the identification, treatment and management of anxiety and depression
- Promote access to high quality evidence-based CPGs for the identification, treatment and management of anxiety and depression in arthritis and osteoporosis patients.
- Promote awareness and uptake of arthritis and chronic disease self-management programs.
- Promote research to identify the most effective models of care to support consumers with arthritis and osteoporosis who are also experiencing mental illness.
- Promote further research into community based interventions for consumers with arthritis and osteoporosis with mental illness.

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APPENDIX 1: SEARCH STRATEGIES

1. Arthritis and falls

1. exp ARTHRITIS/
2. exp ACCIDENTAL FALLS/
3. 1 and 2
4. from 3 keep 1,4-7,10,14,16,20,29,34,57,59-60,62
5. exp RISK/
6. 1 and 5
7. 2 and 6
8. from 7 keep 1-2,4,7,9,11-12,16-17
9. exp Health Promotion/
10. exp Public Health/
11. exp Health Education/
12. exp Community Health Services/
13. 9 or 10 or 11 or 12
14. exp Accident Prevention/
15. exp Intervention Studies/
16. 14 or 15
17. 16 and 13
18. 2 and 17
19. 3 and 17
20. limit 18 to (human and english language and yr=1990 - 2004 and clinical trial)
21. from 20 keep 1,5-15,17,19-24

2. Osteoarthritis and joint injury

1. exp "Wounds and Injuries"/
2. exp JOINTS/
3. exp OSTEOARTHRITIS/
4. exp RISK/
5. 1 and 2
6. outcome\$.tw.
7. 3 or 6
8. 5 and 7
9. 4 and 8
10. exp INCIDENCE/
11. exp Prevalence/
12. 10 or 11
13. 12 and 3
14. 4 and 13
15. 5 and 14
16. 1 and 14
17. exp Public Health/
18. exp Health Promotion/

19. exp Community Health Services/
20. exp Health Education/
21. 17 or 18 or 19 or 20
22. exp Accident Prevention/
23. 21 and 22
24. 3 or 5
25. 23 and 24
26. *Accident Prevention/
27. 21 and 26
28. 3 and 27
29. 3 or 5
30. 27 and 29
31. *Athletic Injuries/
32. *Athletic Injuries/pc [Prevention & Control]
33. 3 and 32
34. 5 and 32
35. from 34 keep 12,14-16,49
36. exp Athletic Injuries/ or exp Joints/ or exp Acromioclavicular Joint/ or exp Finger Injuries/ or exp Knee Injuries/ or exp Dislocations/ or exp Temporomandibular Joint/ or exp Fractures/
37. 32 and 36
38. 3 and 36
39. 21 and 38
40. 26 and 39
41. 23 and 39
42. joint injury.mp.
43. 3 and 42
44. from 43 keep 4-7,9-10,13-14,19-24,26-29,32,36-37,39-40,44,48,52,54-55
45. 9 and 36
46. 45
47. limit 46 to (human and english language and yr=1980 - 2004)
48. from 47 keep 1,9,18,22,25,40,45,47,51,53,58,63,70-71,82,87-89,96,106,113,115,117

3. Gaps in management of OP

1. exp OP/
2. manage\$.tw.
3. 1 and 2
4. Public Health Practice/
5. 3 and 4
6. 4 and 1
7. interven\$.tw.
8. exp Public Health/ed, mt, st, sn, td [Education, Methods, Standards, Statistics & Numerical Data, Trends]
9. 7 and 8
10. 9 and 1
11. 9 and 3
12. treat\$.tw.
13. 12 and 1

14. exp Health Maintenance Organizations/ or exp Physician's Practice Patterns/
15. 13 and 14
16. limit 15 to (human and english language and yr=1994-2004)
17. from 16 keep 1-15,19,21-24,26,28-29,32-35,37,39,41,43-45,47,49-50
18. *"Practice Guidelines"/
19. 3 and 18
20. from 19 keep 1-2,5,7-10,12-14

4. Depression, anxiety and arthritis

1. exp Arthritis, Rheumatoid/
2. exp OSTEOARTHRITIS, HIP/ or exp OSTEOARTHRITIS/ or exp OSTEOARTHRITIS, KNEE/
3. exp OP, POSTMENOPAUSAL/ or exp OP/
4. exp DEPRESSION/
5. (1 or 2 or 3) and 4
6. exp ANXIETY/ or exp ANXIETY DISORDERS/
7. (1 or 2 or 3) and 6
8. manage\$.tw.
9. 8 and 7
10. 8 and 5
11. exp Public Health Practice/ or exp Public Health/
12. (4 or 6) and 11
13. 12 and 8
14. (1 or 2 or 3) and 13
15. from 14 keep 1-10,13-21
16. exp Practice Guidelines/
17. 11 and 16
18. (4 or 6) and 17
19. (1 or 2 or 3) and 18

APPENDIX 2: ARTHRITIS VICTORIA SURVEY

Review of the Public Health Interventions for Rheumatoid Arthritis, Osteoarthritis and Osteoporosis ~ A survey of the Victorian Setting 2004/2005

Aim

The aim of this quantitative survey was to provide a snapshot of the public health interventions (non pharmacological) for rheumatoid arthritis (RA), osteoarthritis (OA) and osteoporosis (OP), being utilised in the Victorian public health setting.

The survey is an adjunct to the “Literature review of public health interventions for Rheumatoid Arthritis, Osteoarthritis and Osteoporosis” report, prepared by the Clinical Epidemiology and Health Service Evaluation Unit, Royal Melbourne Hospital.

As such, the survey was created around the evidence-based interventions highlighted in this report. The four key areas surveyed were:

1. Falls and people with arthritis
2. Joint injury and OA
3. Reducing the risk of osteoporotic fracture
4. Depression and anxiety in people with OA, RA and OP.

Method

A total of 57 respondents completed the survey (See Table 1).

The survey was sent to 138 organisations within Victoria. These included Community Health Services, Nursing Services, Falls and Mobility Clinics, and Community Rehabilitation Services.

Data was collected via electronic and postal methods. The mailing lists were collated from a variety of sources, including the Department of Human Services Community Health Services Database (http://www.health.vic.gov.au/communityhealth/ch_centres.htm), the Victorian Falls Clinic Coalition website (<http://www.mednwh.unimelb.edu.au/VFCC/VFCC%20home.htm>) and Arthritis Victoria’s own internal databases.

The survey was sent to organisations in two parts:

- Part A (Falls and people with arthritis and Joint injury and OA) – sent 14th December 2004
- Part B (Reducing the risk of osteoporotic fracture and Depression and anxiety in people with OA, RA and OP) - sent 24th January 2005

Table 1: Respondents

Respondents	Percentage of Total n = 57	
Community Health Services		
Regional	29	50.9%
Metropolitan	16	28.1%
Falls & Mobility Clinics		
Regional	1	1.7%
Metropolitan	2	3.5%
Community Rehabilitation Services		
Regional	5	8.8%
Metropolitan	3	5.3%
Nursing Services		
Regional	0	0%
Metropolitan	1	1.7%

Results

Information from survey part A and part B were collated, and is presented below. There was a significant decrease in responses for Survey part B. Follow-up phone calls and emails resulted in only a small number of additional surveys being returned.

- Survey part A ~ 57/138 (41.3%) returned
- Survey part B ~ 27/138 (19.6%) returned.

A. Falls and people with arthritis

1. Does your organisation run community programs for people with arthritis at risk of falls?

Yes	34 (59.6%)
No	23 (40.4%)

2. If yes, does it fit any of the categories listed below?

Interventions	Number (%) n = 57
Progressive Resistance strength Training [PRT] and Endurance Training [ET]	29 (50.9%)
Balance training	20 (35.1%)
Interventions to Reduce Fear of Falling	20 (35.1%)
Weight Reduction	19 (33.3%)
Home Visits and Home Safety Programs	19 (33.3%)
Multidisciplinary, Multifactorial, Health/ Environmental Risk Factor Screening and Intervention	17 (29.8%)

Other methods including: Hydrotherapy/Balneotherapy, Joint Protection, Heat and Ice, Acupuncture, Massage, Orthotics and Aids to Assist ADLs.	17 (29.8%)
Occupational Therapy and Group Exercises	16 (28.1%)
Patient Education	16 (28.1%)
Tai-Chi	14(24.6%)
Telephone Support	11(19.3%)

Total number of respondents to question 2 = 34

*Respondents could choose as many interventions as applicable to their organisation.

3.If no, is there a reason your organisation is not running a program in this area?

Reason	Number (%) n = 57
General Falls Program – not specifically for people with arthritis	16 (28.1%)
We do not currently have the funds to run such a program	8 (14.0%)
We do not currently have the trained staff to run such a program	3 (5.3%)

Total number of respondents to question 3 = 22

*Respondents could choose as many answers as applicable to their organisation.

Summary

The majority of respondents indicated that they were running some form of community program for people with arthritis at risk of falls (59.6%).

The most popular interventions utilised were Progressive Resistance strength Training [PRT] and Endurance Training [ET] (50.9%), followed by Balance Training (35.1%) and Interventions to Reduce Fear of Falling (35.1%). The least utilised intervention was Telephone Support (19.3%).

When asked to indicate why Community Organizations were not running any programs in the area of falls and people with arthritis, the most common reason provided was that the organisation did run a general falls program, though not specific to people with arthritis (28.1%).

A number of respondents provided additional comments regarding the barriers that prevented them from running interventions specific to people with arthritis. Listed below are the common themes:

Common Themes	Number (%) n = 13
Run general falls program – not specifically for people with arthritis	6 (46.2%)
Provide interventions on individual basis	3 (23.1%)
Lack of space	2 (15.4%)
Lack of staff / trained staff	1 (7.7%)

Lack of funds	1 (7.7%)
Currently planning	1 (7.7%)
Other	1 (7.7%)

Total number of comments = 13. In many of the comments, more than one theme was mentioned.

In sum, evidence based interventions aimed at reducing the risk of falls for people with arthritis are occurring in the Victorian public health setting. These interventions are taking place in the form of: generic falls programs for groups of people with a variety of chronic illnesses (including arthritis), interventions for people with arthritis on an individual basis, and programs such as Tai Chi for Arthritis for groups of people with arthritis.

B. Joint Injury and OA

1. Does your organisation run community programs in injury prevention / minimisation for people at risk of developing OA?

Yes	22 (38.6%)
No	35 (61.4%)

2. If yes, does it fit any of the categories listed below?

Interventions	Number (%) n = 57
Exercise Interventions	19 (33.3%)
Orthoses and Assistive Devices	14 (24.6%)
Electrotherapy Interventions <i>eg diathermy, transcutaneous electric nerve stimulation (TENS)</i>	12 (21.1%)
Behavioural Interventions	10 (17.5%)
Sports / Recreational Activity Injury Prevention	5 (8.8%)
Weight Reduction	5 (8.8%)
Occupational Joint Injury Prevention Programs	3 (5.3%)

Total number of respondents to question 2 = 22

*Respondents could choose as many interventions as applicable to their organisation.

3. If no, is there a reason your organisation is not running a program in this area?

Reason	Number (%) n = 57
General injury prevention / minimisation program – not specifically for people at risk of developing OA	18 (31.6%)
We do not currently have the funds to run such a program	12 (21.1%)
We do not currently have the trained staff to run such a program	10 (17.5%)

Total number of respondents to question 3 = 32

*Respondents could choose as many answers as applicable to their organisation.

Summary

The majority of respondents indicated that they were not currently running some form of community program in injury prevention / minimisation for people at risk of developing OA (61.4%).

For those organisations that were running community programs in injury prevention and OA, the most popular interventions utilised were the Exercise Interventions (33.3%), followed by Orthoses and Assistive Devices (24.6%) and Electrotherapy Interventions (21.1%). The least utilised intervention was the Occupational Joint Injury Prevention Program (5.3%).

When asked to indicate why the Community Organisations were not running any programs in Injury Prevention and OA, the most common reason provided was that the organisation did run a general injury prevention / minimisation program that is not specific to people with or at risk of developing OA.

A number of respondents provided additional comments regarding the barriers that prevented them from running these interventions specifically for people with or at risk of OA. Listed below are the common themes:

Common Themes	Number (%) n = 18
Provide interventions on individual basis	9 (50.0%)
Run general injury prevention / minimisation program – not specifically for people at risk of developing OA	4 (22.2%)
Lack of space	2 (11.1%)
Lack of staff / trained staff	2 (11.1%)
Lack of funds	2 (11.1%)
Currently focusing on different health priority / target audience	2 (11.1%)
Other	1 (5.6%)

Total number of comments = 18. In many of the comments, more than one theme was mentioned.

In sum, evidence based interventions in injury prevention / minimisation for people with, or at risk of developing OA are occurring to some extent in the community. These interventions tend to be on an individual basis or as a general program run for people with a variety of chronic conditions and risk factors.

C. Reducing the Risk of Osteoporotic Fracture

1. Does your organisation run programs aimed at reducing the risk of osteoporotic fracture?

Yes	16 (59.3%)
No	11 (40.7%)

2. If yes, does it fit any of the categories listed below?

Interventions	Number (%) n = 27
Promotion of healthy lifestyle	12 (44.4%)
Community based health promotion programs	6 (22.2%)
Multidisciplinary care programs	4 (14.8%)
Specialist model of care	1 (3.7%)

Total number of respondents to question 2 = 16

*Respondents could choose as many interventions as applicable to their organisation.

3. If no, is there a reason your organisation is not running a program in this area?

Reason	Number (%) n = 27
We do not currently have the trained staff to run such a program	5 (18.5%)
We do not currently have the funds to run such a program	5 (18.5%)

Total number of respondents to question 3 = 10

*Respondents could choose as many answers as applicable to their organisation.

Summary

Although the response rate in this part of the survey was low (19.6%), there is still evidence of trends in the provision of these interventions in the community.

The majority of respondents indicated that they were running programs aimed at reducing the risk of osteoporotic fracture (59.3%). The most popular interventions utilised were the Promotion of Healthy Lifestyle (44.4%), followed by Community Based Health Promotion Programs (22.2%) and Multidisciplinary Care (14.8%). The least utilised intervention was the Specialist Model of Care (3.7%).

When asked to indicate why Community Organisations were not running any programs in reducing the risk of osteoporotic fractures, the most common reasons provided were that the organisation did not currently have the trained staff (18.5%) or the funds to run such a program (18.5%)

A number of respondents provided additional comments regarding the barriers that prevented them from running these interventions. Listed below are the common themes:

Common Themes	Number (%) n = 7
Run generic interventions – not OP specific	3 (42.9%)
Provide interventions on individual basis	3 (42.9%)
Lack of staff / trained staff	2 (28.6%)
Lack of space	1 (14.3%)
Lack of funds	1 (14.3%)
Not required	1 (14.3%)
Small rural service	1 (14.3%)

Total number of comments = 7. In many of the comments, more than one theme was mentioned.

In sum, evidence based interventions reducing the risk of osteoporotic fractures are occurring to some extent in the community. These interventions are often part of a general health promotion strategy encouraging healthy lifestyles.

D. Depression, Anxiety and Arthritis

1. Does your organisation run programs for treating anxiety and depression in people with OA, RA and/or OP?

Yes	8 (29.6%)
No	19 (70.4%)

2. If yes, does it fit any of the categories listed below?

Interventions	Number (%) n = 27
Community based health promotion programs	7(25.9%)
Social support	4(14.8%)
Psychological interventions	4(14.8%)
Patient education	2 (7.4%)
Health professional education	2 (7.4%)
Collaborative care	2 (7.4%)

Total number of respondents to question 2 = 8

**Respondents could choose as many interventions as applicable to their organisation.*

3. If no, is there a reason your organisation is not running a program in this area?

Reason	Number (%) n = 27
General programs for treating anxiety and depression program	10 (37.0%)
We do not currently have the funds to run such a program	6 (22.2%)
We do not currently have the trained staff to run such a program	4 (14.8%)

Total number of respondents to question 3 = 18

**Respondents could choose as many answers as applicable to their organisation.*

Summary

Although the response rate in this part of the survey was low (19.6%), there is still evidence of trends in the provision of these interventions in the community.

The majority of respondents indicated that they were not running programs for treating anxiety and depression in people with OA, RA and/or OP (70.4%). For those organisations that were, the most popular interventions utilised were the Community Based Health Promotion Programs (25.9%), followed by Social Support (14.8%) and Psychological Interventions (14.8%). The least utilised interventions were Patient Education (7.4%), Health Professional Education (7.4%) and Collaborative Care (7.4%).

When asked to indicate why Community Organisations were not running any programs in the area of depression, anxiety and arthritis, the most common reasons provided were that the organisation did run generic programs for treating anxiety and depression, however not specific to people with OA, RA and/or OP.

A number of respondents provided additional comments regarding the barriers that prevented them from running these interventions specifically for people with OA, RA and/or OP. Listed below are the common themes:

Common Themes	Number (%) n = 12
Provide interventions on individual basis	7 (58.3%)
Run general programs for treating anxiety and depression program	2 (16.7%)
Lack of staff / trained staff	2 (16.7%)
Lack of funds	2 (16.7%)
Small rural service	1 (8.3%)
Other	1 (8.3%)

Total number of comments = 12. In many of the comments, more than one theme was mentioned.

In sum, evidence-based interventions for treating anxiety and depression in people with OA, RA and/or OP are occurring to some extent in the community. These interventions are often part of a community based health promotion program.

4. Do you conduct a health assessment for your consumers that would identify the presence of a musculoskeletal condition when they present at your centre?

	Number (%) n = 27
Yes	18 (66.7%)
No	6 (22.2%)
Did not answer	3 (11.1%)

Total number of respondents to question 4 = 24

A number of respondents provided additional comments regarding this health assessment. Listed below are the common themes:

Common Themes	Number (%) n = 20
Health assessment conducted by physiotherapist	10 (50.0%)
Health assessment conducted by other allied health professionals	6 (30.0%)
Other	4 (20.0%)

Total number of comments = 20. In many of the comments, more than one theme was mentioned.

In sum, most organisations conducted a health assessment for consumers that would identify the presence of a musculoskeletal condition (66.7%). Most services surveyed refer clients to a physiotherapist for assessment (50.0%).

Conclusion

The aim of this quantitative survey was to provide a snapshot of the public health interventions (non pharmacological) for rheumatoid arthritis (RA), osteoarthritis (OA) and osteoporosis (OP), being utilised in the Victorian public health setting. The four key areas surveyed were: Falls and people with arthritis, Joint injury and OA, Reducing the risk of osteoporotic fracture and Depression and anxiety in people with OA, RA and OP. Evidence based interventions in all four areas are occurring to some extent in the community. These interventions tend to be on an individual basis or as a generic program run for people with a variety of chronic conditions.