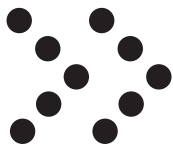


Section 2

Update on the Effectiveness of Interventions to Increase Physical Activity - What Works?



Wendy J Brown

School of Human Movement Studies, University of Queensland

❖ SECTION 2

UPDATE ON THE EFFECTIVENESS OF INTERVENTIONS TO INCREASE PHYSICAL ACTIVITY – WHAT WORKS?

The aim of this chapter is to update the evidence presented in *Getting Australia Active* (Bauman et al 2002), especially as it relates to intervention studies which shed some light on potentially effective intervention strategies for improving population levels of physical activity. This summary review is based on individual reviews of recently published work, conducted by 17 independent researchers with expertise in the promotion of physical activity in a variety of settings.¹² Their individual reviews are included in the Appendices. In cases where there is a dearth of intervention work, or for which results of intervention studies are not available, the reviewers have drawn on observational studies to inform future directions for interventions.

Methods

Each reviewer conducted a comprehensive search of the research literature using on-line data bases such as MEDLINE, PUBMED, PSYCHINFO and SPORTDISCUS. The searches focused mainly on primary research articles on physical activity interventions that have been published since 1999, using a range of key-words specific to the population group or setting. In some cases, reference lists of retrieved articles were also searched for additional publications. Searches were limited to include only articles in English. For the section on physical activity and chronic disease, searches were made of the Cochrane database and of specific ‘review’ journals.

¹² Kylie Ball, Wendy Brown, Liz Cyarto, David Dunstan, Billie Giles-Corti, Andrea Lange, Gavin McCormack, Gary Moorhead, Alison Marshall, Yvette Miller, Neville Owen, Terri Pikora, Jo Salmon, Tya Shannon-Smith, Trevor Shilton, Ben Smith and Anna Timperio.

The focus of each review was on interventions to increase physical activity behaviours. A summary of the evidence is described here in the following categories:

- People (children and adolescents, young adults, older people and indigenous populations)
- Organisations (schools, primary health care and workplaces)
- Mediated approaches (mass media, print materials, telephone, and internet). This section includes some community-wide interventions.
- Environments (transport, physical environments)
- Physical activity for the control of chronic health problems (obesity, diabetes, and progressive resistance training)

2.1 People

Children and adolescents (in ‘out-of-school’ settings)

The chapters in Part 3 of *Getting Australia Active* explored the (then) current thinking about the effectiveness of interventions to promote physical activity in three specific ‘life stage’ population groups (childhood and adolescence, young and older adulthood) as well as in other specific population groups such as people with disabilities, people from non-English speaking backgrounds and Indigenous Australians. Most of the evidence was based on observational studies, and the chapter concluded with a call for better-designed research to evaluate promotion strategies in most of these groups.

In her review of recently published literature, Anna Timperio found nine intervention studies with children (up to 12 years) and five with adolescents (13–18 years) (see Appendix 1A). Most were conducted in the United States, either as after school, summer camp or family-based interventions. In general, sample sizes were small, and results were mixed. The most effective studies were a comprehensive school and family program in Greece (Manios et al. 2002), and a US mother and daughter program (Ransdell et al. 2003). The Greek intervention involved both school-based education and parental meetings, with a high level of intervention maintained over the six year program.

Although two of the studies reviewed reported reduced time spent watching TV, links between physical activity and TV time were not reported, and need to be clarified. Overall, five of the 14 studies reviewed show promise for behaviour change in this area, and provide useful insights for the development of Australian studies (of which none are published to date).

Young adults

Kylie Ball's review of the recent 'young adult' literature found only three intervention studies with young adults (18–30 years) and one Australian study of mothers (in their 20s and early 30s) with young children (see Appendix 1B). The four studies showed mixed results, with one reporting a small short-term increase in physical activity, one reporting a change in stage of change, one reporting no change and the fourth reporting a decline in physical activity. As young adulthood is a time of transition that is associated with significant declines in physical activity, more work is still required with this population group, particularly in light of recent Australian evidence that early adult life events such as getting married and having children are times of decreasing physical activity.

Older people

In the last five years there has been much more work in the field of physical activity with older people than with younger adults, building on the earlier review by King of 29 community-based trials (King 1991), which was reviewed in *Getting Australia Active*. This focus on older people probably reflects the current government policy on healthy ageing and concerns about the health 'crises' which are likely to occur as the current generation of baby boomers ages. In his review, Gary Moorhead found thirteen intervention studies published in the last five years, most of which were randomised control trials. Seven were based in the United States, two in the United Kingdom, two in Australia and one in Belgium, with participants mostly drawn from nursing homes and retirement villages, general practice, and health and senior citizens' centres. (See Appendix 1C). Most of the interventions involved either individual advice or group settings such as gymnasias or walking groups, and it is notable that interventions with

higher levels of contact, complemented by multiple reinforcements of the physical activity message were most successful.

Although these studies add considerably to our understanding of effective regimens for increasing physical activity among older people, there is still a need for research on the benefits of different types of activity (such as gardening, which may be important in maintaining functional independence in older age) and on acceptability, adherence, and longer term maintenance of participation among older people. Studies with the very old and frail elderly are also needed.

(The evidence relating to the health benefits of progressive resistance training is reviewed separately in Part 5 below).

'Special' populations

In light of the absence of population studies with people with disabilities, and of Australian studies of people from non-English speaking backgrounds, there is little information on which to base any update of the information presented in *Getting Australia Active* in these areas. Research and evaluation resources are still required for this work.

In his review of work with Aboriginal and Torres Strait Islander people (see Appendix 1D), Trevor Shilton points out that there has been an increase in the number and diversity of programs that address physical inactivity in ATSI communities, but that few have been evaluated or published in the literature. In view of the health disparities between ATSI and non-Aboriginal people, there is an urgent need for well-designed and evaluated interventions in these communities. There is some ongoing work, mainly in Queensland and Western Australia, which focuses on issues such as self-efficacy and social support, with some rural programs focusing on activities such as hunting, fishing and dancing as ways to promote activity. There is, however, a need for much more effort in this area, in relation to both measurement and interventions, in urban, as well as in rural and remote indigenous people. There is also still a clear need to work with communities to create more supportive environments and policies which will encourage physical activity.

2.2 Organisations

Schools

In *Getting Australia Active*, schools were identified as important settings for physical activity programs, as they reach the entire population aged from 5 to 17 years. Jo Salmon's review of interventions in the school setting found eight studies published since 1999, with only two of these reporting a significant increase in physical activity. (see Appendix 2A). Most of these school-based studies were not specifically targeted to increase physical activity, but included it as a strategy for prevention of weight gain. The most effective studies were the ones that included changes to the school's physical or policy environments, in addition to curriculum change. A separate review, which focused only on policy and environmental work in the schools setting found one more recently published intervention study (Sallis et al. 2003), which reported that increased support for physical activity in the form of supervision, more equipment and improved policies, resulted in increased levels of physical activity among boys, but not girls (see Appendix 4). The review of transport interventions by Terri Pikora also found two published studies of strategies to increase active transport to/from school, and one of these showed significant improvements in walking and cycling among public, but not private schools (see Appendix 4).

In Australia, it is reasonable to assume that there is a link between involvement in school-based physical education and physical activity. However, this link has not yet been clearly demonstrated, and we do not know whether increasing activity (and therefore presumably skill development) in school physical education per se results in greater participation in sport or activity outside school hours, or when children leave school. Cohort studies would be needed to explore this issue. The most promising results have come from interventions with a 'whole-school' approach, and this, together with provision of more school-community linked programs (Stone et al. 1998), is likely to facilitate continuation of participation in physical activity after leaving school. School-based interventions, which incorporate combinations of educational, policy

and social support strategies, are suggested as a model for further development in Australia. The recommendations for best practice in interventions, made in the *Getting Australia Active* report are largely unchanged by recent evidence.

Primary health care

In his review of interventions in primary health care settings, Ben Smith reiterates the attraction (outlined in *Getting Australia Active*) of promoting physical activity through these services, because of their wide population reach and the perceived influence that GPs and other health care practitioners can have on health behaviours. Ten studies were reviewed in *Getting Australia Active*, and most of these found that brief interventions involving verbal advice and written materials (e.g. pamphlets booklets or 'prescription') produced only modest short term changes in physical activity. In this update of studies published since 1999, twelve single focus physical activity interventions and four multiple risk factor interventions, were identified (see Appendix 2B). Four of the physical activity interventions were conducted with older people, and one with children, so there is some overlap here with the evidence presented in Section 1. In general, the evidence confirms the effectiveness of GP-based interventions, at least in the short term, particularly when the primary focus is on physical activity.

In his review, Ben Smith notes that few interventions have been tested within the time and resource constraints of routine practice (Kerse et al. 1999; Smith et al. 2000) and this, together with the short-term duration of changes in physical activity that have been reported, needs to be taken into account when making recommendations for promoting physical activity in primary care settings. A feasible approach for GPs and other primary care practitioners to take is to undertake brief physical activity interventions to advise patients with health risk factors and other conditions that could be improved by increased participation in physical activity. These include those with hypertension, high blood cholesterol, overweight or obesity, glucose intolerance, or symptoms of anxiety or depression. Parallel to this there is a need for investigation of

the impact of partnerships involving primary care practitioners, other health care professionals and community physical activity programs in achieving more sustained increases in physical activity participation. Some studies for example, Halbert et al. 2000; Elley et al. 2003, have shown promising long-term effects from engaging exercise scientists in interventions delivered to general practice patients. However, a key consideration in these physical activity promotion models is that they draw upon resources and personnel that are likely to be available in a range of community settings.

Workplaces

Although workplace health promotion programs have considerable potential in terms of the health, productivity, and quality of life of the workforce, the evidence presented in *Getting Australia Active*, found that there was little evidence to support the reality of this potential. In her review, Alison Marshall found 32 new intervention studies published since 1998. Most involved health checks, education programs, and motivational prompts to be more active, workplace 'exercise programs' or incentive-based programs (see Appendix 2C).

Despite the fact that the workplace has the potential to provide a captive audience, the challenges of dealing with organisations to positively influence behaviour in the worksite setting remain. It would appear that a shift in focus from individual/personal behaviour change to a more comprehensive approach, including changing the organisational structure and culture of the workplace, highlighting physical activity opportunities and providing a supportive environment for physical activity, may be more successful. The 'CHEW' checklist, which was developed in Australia was identified as a useful way of identifying workplace attributes that could potentially be modified to promote physical activity, particularly in blue-collar worksites.

In her review of specific environmental impacts on workplace physical activity, Tya Shannon-Smith did not find any recently published papers, but details of one study, which was published in 1991 but not reported in *Getting Australia Active*, are reported in Appendix 2C. The results suggest that, in a 'defined'

community (in this case a US naval base), simple environmental and social changes can be successful in promoting physical activity. Similarly, in her review of specific transport interventions associated with worksites, Terri Pikora found one Scottish study that promoted active commuting, with some success in promoting walking, but not cycling (see Appendix 4B).

In general, despite the number of studies reviewed here, the results offer little additional evidence to that provided in the *Getting Australia Active* report. This may reflect the practical difficulties of conducting scientifically rigorous programs in this setting, or there may indeed be a case to support the view that changing behaviour in this setting is complex and difficult, especially if it involves changing workplace and organisational culture without affecting the corporate 'bottom line'. There is a need for greater understanding and evaluation of desirable employer related outcomes (reduced absenteeism, job stress, turnover and improved productivity, job satisfaction) and exploration of how these relate to physical activity promotion and adoption. Despite the evidence that suggests that this will be a very difficult area in which to achieve change, well-designed and evaluated studies with more innovative and proactive intervention strategies, are still needed.

2.3 Mediated Approaches

The main advantage of 'mediated' approaches to changing physical activity behaviour is that they do not require face-to-face delivery of information and hence can be widely disseminated to large population groups. In their review of this area, Alison Marshall and Neville Owen found 20 intervention studies based on mass media or community-based programs, six studies on self-help print materials, four telephone-based interventions and four internet programs (see Appendix 3A).

This evidence builds considerably on that presented in *Getting Australia Active* which described earlier Australian and overseas mass-media campaigns as well as the *Active Australia* initiatives of 1998 and 1999.

Mass-media

Almost all the work in this area (13 publications since 1999) has used paid television and print media advertising, and the results indicate the effectiveness of this approach in raising awareness of the importance of physical activity. While there have been few positive changes in behaviour following media campaigns, many researchers have acknowledged the importance of this approach as part of broader community wide interventions. Further exploration of the use of mass media in whole community interventions is required, especially in relation to its impact on mediators of behaviour such as stage of change which may, over time, lead to population changes in physical activity.

Print materials

Six studies of print materials were reviewed. Those which involved stage-targeted and individually-tailored print materials have shown some success in changing physical activity behaviour in the short term. More work is required to explore the effectiveness of print materials with large numbers of people in large scale dissemination trials, and with hard-to-reach sectors of the population.

Telephone

Although a review of telephone mediated intervention studies (Castro and King 2002) has suggested that this might be a promising approach to increasing population levels of activity, the three papers reviewed here illustrate only small effects and high drop-out rates, particularly in studies which used automated telephone counseling systems rather than health educators. While the utility of telephone for reinforcement and social support was demonstrated in some of the primary care trials, as a 'stand-alone' intervention this medium does not appear to show great promise as a behaviour change agent.

Internet

Although the results from three randomised trials published since 1999 point to the potential of this 'new' medium for changing physical activity

behaviour, the studies reviewed highlight the difficulties of engaging and retaining participants in interventions that rely solely on internet or email technology.

According to Marshall and Owen, none of the strategies reviewed is likely to be effective in isolation. Several studies have shown the potential of using two or more forms of mediated intervention (e.g. print plus telephone) or of using one of these mediated strategies in conjunction with broader community based or settings approaches (e.g. in primary care or in workplaces).

Low-cost delivery of advice, motivational prompts and guidance for behaviour change would be a great asset in terms of effecting population changes in physical activity. It remains to be seen, however, whether these approaches can completely replace the 'human' face of counselling in behaviour change.

2.4 Environments

Transport

In 2001 the National Public Health Partnership and the Strategic Inter-Governmental Forum on Physical Activity and Health produced a report on Active Transport¹³ that includes a comprehensive review of work conducted in this area up to that time. The report described a portfolio approach to planning interventions, and identified determinants of active transport (e.g., demographic characteristics, attitudes, knowledge, skills, physical environment and policy environment), which could be addressed in settings such as schools, universities, workplaces, shopping centres, health services, and local government areas. Five interventions for each setting were then identified using a nominal group decision-making process. These include: pedestrian friendly environments, shower and change facilities, provision of paths and cycle ways and improved public transport. The report called for intervention strategies to be supported by appropriate data and research to monitor their effectiveness. In her review

¹³ Promoting Active Transport – an intervention portfolio, to increase physical activity as a means of transport. SIGPAH 2001.

of this area, Terri Pikora found only four published intervention studies since 1999, two of which were conducted in schools and two in workplaces. Details of these studies are included in Appendix 4B.

Physical environments

At the time of writing, *Getting Australia Active*, environmental and policy change were seen to be emerging influences on population levels of physical activity. The role of sectors other than health (e.g. education, sport and recreation, transport, urban planning etc) was recognised, and the relationships between environmental variables and physical activity were described.

In their update of this evidence, Gavin McCormack, Andrea Lange and Billie Giles-Corti found 43 observational studies that add to the evidence of links between physical activity and the environment (see Appendix 4A). They list factors such as access to and proximity of facilities and open space, aesthetics and attractiveness, safety, footpaths, traffic urban design and urban sprawl as important correlates of physical activity. They also summarise a range of initiatives in the United States, which are attracting considerable research investment to assess the impact of urban design and the built environment on physical activity.

Only two intervention studies were found. One was an innovative Australian prospective study of use of a new 'rail trail' which found no significant change in physical activity among the cohort studied, even though there was an increase in bike traffic using the trail. The other study, in a UK shopping mall, found increased use of stairs by women, but not men, after point of choice prompts were installed adjacent to the escalators. This is a simple environmental change approach, which could easily be disseminated.

This update review calls for more studies with objective measures of public activity and more prospective and quasi-experimental study designs. There is also a need to further explore the interactions between, and relative contributions of, individual, social and physical environmental factors to physical activity behaviour.

2.5 Physical Activity and Chronic Disease

It is now very clear that physical activity plays a role in both the prevention and management of many chronic diseases. The 'prevention' evidence is updated in Chapter One of this report. In terms of 'management' of chronic disease, the information presented in *Getting Australia Active* focused almost entirely on hypertension and cardiac rehabilitation. While review of all the primary research relating to the role of physical activity in the management of chronic disease is beyond the focus of this report, summary reviews of work conducted in relation to overweight and obesity and diabetes are included here.

Because of its potential importance in the prevention of management of several chronic health problems, and to the prevention of falls and fractures, we have also included a summary review of the evidence relating to resistance training in older adults.

Overweight and Obesity

In her summary review of physical activity specific interventions for the prevention and management of overweight and obesity, Yvette Miller examined several recent reviews of the literature relating to both children and adults (see Appendix 5A). Although it is clear that the majority of weight loss programs are unsuccessful in the long term as lost weight is regained within five years, there is some evidence to suggest that continued professional contact and self-help groups can help to sustain weight loss.

For children, while interventions which aim to reduce sedentary behaviours by changing the home environment and the school curriculum, appear to have the greatest potential to impact on obesity, no systematic review has yet confirmed the efficacy of this approach.

Among adults, most of the work has been conducted in primary care or clinical settings, and the evidence suggests that interventions that combine dietary and physical activity interventions are more effective than physical activity interventions alone.

The evidence strongly suggests that interventions to promote healthy weight should focus on both improving nutrition and increasing physical activity. Mean energy consumption of Australian adults living in capital cities increased significantly by around 3–4% between 1983 and 1995 (Cook, Rutishauer et al. 2001), and between 1985 and 1995 mean energy intake increased significantly by 11% for girls and 15% for boys aged 10–15 years (Cook, Rutishauer et al. 2001). Therefore intervention programs that address both physical activity and nutrition are more likely to rectify the energy in/energy out imbalance to control overweight and obesity.

However, getting the message of ‘energy balance’ across to the whole population is complex and made more complicated by the fact that the amount of physical activity, which is necessary for weight reduction and subsequent maintenance of healthy weight, is greater than the amount advocated in current physical activity promotion messages (30 minutes a day, which is based on other health benefits attributable to physical activity). In light of the current high prevalence of overweight and obesity in all sectors of the Australian population, population-wide approaches to prevention are urgently required. This is particularly pertinent for the current ‘baby boom’ generation of mid-age Australians, as the number of new cases of obesity-linked health problems is likely to increase dramatically in the next twenty years.

Diabetes

In his review of the literature relating to management of diabetes, David Dunstan found 11 studies (including one meta-analysis of 14 studies) which support the view that interventions can lead to small but clinically meaningful improvements in blood sugar control (HbA_{1c}), even in the absence of marked changes in physical activity (see Appendix 5B). It is notable that one study reported seven fold increases in physical activity following 30 minutes of physician advice, followed by an additional 30 minutes of advice from a counsellor, as well as follow-up telephone calls and visits. This review also examines the promising evidence relating to progressive resistance training as a beneficial intervention for diabetes control, given the important

role of skeletal muscle as a clearance site for glucose.

Larger population-based studies, which are community-based and not dependent on access to a gymnasium, with objective measures of physical activity, are now required to extend these largely ‘clinical’ studies. In view of the high cost to the population of pharmaceuticals for regulation of blood sugar, trials that involve combinations of physical activity and pharmacological intervention are also needed.

Progressive resistance training

In her review of the evidence relating to the importance of resistance (strength) training for improved health in older adults, Liz Cyarto reviewed 18 recently published papers (15 of these were cited in a 2003 Cochrane review), which included outcomes related to physical disability, functional limitation, impairment and/or health, as well as strength, in people aged 60 and over. (see Appendix 5C). Not surprisingly, almost all these studies reported that strength training results in increases in strength, but that this form of training was less effective for older adults with a disability. Most of the papers provide evidence to suggest that strength training may play an important role in the management of specific health problems such as diabetes, osteoarthritis and chronic heart failure. In one study, frequency of training (once, twice or three times a week) made no significant difference to improvements in strength (Taaffe 1999). Because access to a gymnasium is limited for many older adults, there is a clear need for more research into the efficacy of home and community-based strength training programs on a range of health outcomes.

Summary

Although the aim of this review was to ‘update’ the evidence by focusing only on recently published intervention research, it is interesting to note that the findings concur in general with the recommendations of the recent US review of physical activity interventions (Kahn et al. 2002). What is clear from all the evidence is that there is no ‘magic bullet’ approach to getting Australians to be more active. It is evident that all the approaches

currently being evaluated in Australia and elsewhere have the potential to make small, often short term changes to behaviour.

As the current review was essentially an update of evidence published in the last three to five years, it would not be prudent to base recommendations for 'best buys' solely on it. Instead, the updated evidence should be considered in association with that presented in the original *Getting Australia Active* publication, and in light of recommendation from ongoing reviews in the United Kingdom and the United States.

The 'community-wide' and 'environmental and policy' approaches advocated by the US task force and others essentially represents a combination of strategies aimed at raising awareness (e.g. using media), improving self efficacy (e.g. through

information and counselling in different settings, by telephone or internet, in groups or individually) and improving access to places for activity, as well as the availability of physical activity programs. This combination of strategies remains the most strongly recommended approach.

There remains a need for research to implement and evaluate the impact of concurrent and potentially synergistic strategies in whole communities. Moreover, we need more carefully designed and evaluated intervention studies to assess the efficacy of individual strategies in sub-groups of the population, but particularly in those groups that are most likely to be inactive. Current evidence suggests that these include middle-aged adults, older women and Aboriginal and Torres Strait Islander people.



References

- Bauman, A, Bellew, B, Vita, P, Brown, W & Owen, N 2002, *Getting Australia active: towards better practice for the promotion of physical activity*, National Public Health Partnership, Melbourne, Australia.
- Castro, C.M., King, A. 2002, 'Telephone-assisted counseling for physical activity.' *Exercise and Sports Sciences Reviews*, 30(2): 64–68.
- Cook, T, Rutishauser, IHE et al. 2001, *Comparable data on food and nutrient intake and physical measurements from the 1983, 1985 and 1995 national nutrition surveys*, Canberra, Commonwealth Department of Health and Aged Care.
- Elley, C.R., Kerse, N., Arroll, B. and Robinson, E. 2003, Effectiveness of counselling patients on physical activity in general practice: cluster randomized controlled trial. *British Medical Journal*, 326, 793–798
- Manios Y, Moschandreas J, Hatzis C, Kafatos A. Health and nutrition education in primary schools of Crete: changes in chronic disease risk factors following a 6-year intervention programme. *British Journal of Nutrition*, 2002;88:315–324.
- Ransdell LB, Taylor A, Oakland D, Schmidt J, Moyer-Mileur L, Shultz B. Daughters and mothers exercising together: effects of home- and community-based programs. *Medicine and Science in Sports and Exercise*, 2003;35:286–296.
- Halbert, J.A., Silagy, C.A., Finucane, P.M., Withers, R.T. and Hamdorf, P.A. 2000, Physical activity and cardiovascular risk factors: effect of advice from an exercise specialist in Australian general practice. *Medical Journal of Australia*, 173, 84–87.
- Kahn, EB, Ramsey, LT, Brownson, RC, Health, GW, Howze, EH, Powell, KE et al. 2002, 'The effectiveness of interventions to increase physical activity. A systematic review by the U.S. Task Force on Community Preventive Services', *American Journal of Preventive Medicine*, vol. 22, no. S4, pp. S73–102
- Kerse, N.M., Flicker, L., Jolley, D., Arroll, B. and Young, D. 1999, Improving the health behaviors of elderly people: randomised controlled trial of a general practice education programme. *British Medical Journal*, 319, 683–687.
- King A. 1991, Community interventions for promotion of physical activity and fitness. *Exercise and Sport Sciences Review*, 19:211–59.
- Sallis, J. F., McKenzie, T. L., Conway, T. L., Elder, J. P., Prochaska, J. J., Brown, M., et al. 2003, Environmental interventions for eating and physical activity: A randomized controlled trial in middle schools. *American Journal of Preventive Medicine*, 24(3), 209–217.
- Smith, B., Bauman, A., Bull, F., Booth, M. and Harris, M. 2000, Promoting physical activity in general practice: a controlled trial of written advice and information materials. *British Journal of Sports Medicine*, 34, 262–267.
- Stone EJ, McKenzie TL, Welk GJ, et al. 1998, Effects of physical activity interventions in youth: review and synthesis. *American Journal of Preventive Medicine*, 15(4):298–315.
- Taaffe, D.R., Duret, C., Wheeler, S., and Marcus R. 1999, Once-weekly resistance exercise improves strength and neuromuscular performance in older adults. *Journal of the American Geriatrics Society*, 1999; 47:1208–1214.

