



Older people playing ball: What is the risk of falling and injury?

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Summary Increasing physical activity amongst seniors is important for public health, yet guidance is needed to minimise injury risks. To describe the incidence of falls/injuries in a walking team ball game (Lifeball) designed for seniors, a prospective cohort study was undertaken amongst community dwelling Lifeball participants in Australia. Players completed a telephone survey soon after commencing Lifeball (2004) and 12 months later (2005). Attendance and incident records were audited for the period. Subjects joined a Lifeball group with opportunity to play at least once per week. Baseline was completed by 284 players aged between 40 and 96 years (mean 67 years), with most (83.8%, 238/284) female. Of 263 followed up, the average attendances was 25, with 19.3% attending on fewer than 4 occasions and 14.3% attending 52 or more times. Most (93.9%) reported no injuries requiring medical attention. However, 16 (6.1%) had injuries requiring medical attention and their 27 injuries represent an injury rate of 3.3 per 1000 hours of participation. Twenty participants (7.6%) had a Lifeball fall equating to a fall rate of 2.8 per 1000 hours of participation. Falls in Lifeball were not associated with measured predictors (age, gender, falls history, perceived falls risk or hours played). Incident records showed a trip/stumble involving rushing, walking backwards, or overextending (all against rules) as common falling causes. Lifeball is not 'risk free' however due to a lack of comparative data it is difficult to compare injury rate to relevant activities. Prevention of injury should concentrate on enforcing safety rules.

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Introduction

Although a physically active lifestyle is important in the prevention of chronic disease,¹ activity levels tend to decline with increasing age² with almost half (46%) of Australian adults aged 60–75 years insufficiently active for a health benefit.³ Considering seniors generate the highest expenditures for medical care⁴ and the proportion and number of seniors in developed nations is expected to rise,⁵ increasing physical activity in this age group is an important strategy.

Yet guidance is needed as to which activities give the greatest health benefits while minimising injury risks⁶ as activities should be challenging but also safe.⁷ However there is a lack of research on sport and recreational injury generally,⁸ and for older adults particularly,⁹ and about activities that have low injury incidence or limited participation.¹⁰ In addition, most data lacks information as to how often the activity is undertaken,^{8,11} meaning there is no ability to calculate 'true' risk.^{9,10} There is a need for more studies¹² to examine the relationship between 'dose' and safety of exercise.

While internationally recognised ball sports promote physical activity, they may not be appropriate or safe for seniors. One rapidly growing community team activity from Australia designed specifically to cater for the need of seniors is 'Lifeball'. 'Lifeball' is a walking, team ball game developed for community dwelling seniors who enjoy the comradeship of team ball sports, but wish for a slower pace than the traditional basketball or netball. Lifeball was developed on the premises that walking is an exercise of choice for seniors¹³ and exercising with others in group programs is an important enabler to seniors' activity participation.¹⁴

At the time of this study, Lifeball was played in three states of Australia (NSW, QLD and WA) by approximately 600 seniors per week in 47 groups.¹⁵ By mid-2007 this had increased to an average of 1000 per week playing in 73 groups in four states (Wilson-Lord 2007, Personal communication). Lifeball is played on a court (basketball, netball or tennis) with two opposing teams aiming to advance the ball to score a goal. It incorporates walking, passing and throwing to encourage physical movement and teamwork. Lifeball has modified rules and equipment designed to reduce injury risk, such as: no body contact, only walking forward, throwing no higher than opponents' shoulders, and lower goal posts. It is played with six per team; although player number can be modified.¹⁵ This paper describes the incidence, nature and rate of falls and injuries experienced during Lifeball in regional and rural NSW, Australia.

Method

The study entailed a prospective cohort design. Men and women were recruited from community groups and from the general population in four participating Health Service Areas (in NSW) to join a Lifeball group with opportunity to play at least once per week. On the first day they registered to play during the recruitment period from 1st March to 30th October 2004, players were invited to consent (or if overlooked, at their next game). Players were eligible if they had minimal exposure to Lifeball (i.e. played not more than three games). Consenting eligible persons was then surveyed by Computer-Assisted Telephone Interview (CATI) using GEIS software¹⁶ at baseline-2004 and at follow-up, 12 months later (2005).

One regional health service coordinated the study with management by a project advisory team (representatives from all Health Service Areas, funding bodies and the National Lifeball Steering Committee). Hunter Area Research Ethics Committee gave ethics approval, reference no. 03/10/15/3.13.

Surveys were developed in consultation with the project advisory team. The baseline survey addressed: (1) demographics, (2) physical activity, (3) falls and injury, (4) players experience of Lifeball and (5) health status and quality of life. For the purposes of this paper, the falls and injury domain will be reported on with reference to key demographic indicators.

While not formally validated, falls questions were selected from well established Australian population surveys including the NSW Older Peoples Health Survey 1999,¹⁷ NSW Adult Health Survey,¹⁸ and the Falls Reduction Community Baseline Survey conducted by Queensland Health.¹⁹ The falls and injury domain in the baseline questionnaire included: self-rated falls risk,¹⁹ and the number of falls during the past 12 months.¹⁷

The follow-up survey readdressed baseline domains. Additional relevant questions include the: number of falls at Lifeball in the past 12 months,¹⁷ number and nature of injuries, whether a new or existing injury and the number of injuries from Lifeball.¹⁹ An injury was defined as 'any pain or discomfort that was felt during or soon after playing a Lifeball game' that the subject believed 'might have been caused or made worse by Lifeball' that required medical attention'. All injuries, not just fall-related injuries, were included.

If subjects had a Lifeball fall, they were also asked how many Lifeball sessions they had attended at the time of the fall. Both surveys were pre-tested with staff members and pilot tested with a sample

of existing Lifeball players not eligible to participate. See online supplementary file for more detail.

Attendance records were maintained by Lifeball group leaders for the study period and submitted for auditing to the facilitating health service. Incident report forms were completed by group leaders for all falls (including those that did not result in injury) and/or injuries requiring first aid treatment sustained by any players. This was an existing form used by Lifeball Australia¹⁵ and recorded date and time, description of incident, name of player, and nature of injury. Only incident records involving a fall were audited.

To describe the nature of falls experienced by players the CATI falls/injury data were first examined independently and secondly match-merged with incident report data by first name, last name, gender and site. To describe the nature of injuries the CATI falls/injury data were examined independently.

To calculate the Lifeball falls and injury rate, attendance data were merged with the CATI data. Hours of activity were calculated at 1.25 h per attendance (based on a 2 h Lifeball session minus 30 min for a tea break and 15 min for player changes/toilet breaks/arriving late). Number of falls was divided by the number of participants and then multiplied by 100 and expressed as a percentage. Number of falls was also divided by the total number of participant hours (duration \times players \times attendances = 8147), multiplied by 1000 to derive a rate per 1000 h. The same procedure was followed to calculate injury rate per 100 participants and injury rate per 1000 participant hours.

Multivariate logistic regression was used to predict whether or not a person was likely to fall in Lifeball using 'fell or not in Lifeball' as the outcome variable. Predictor variables were entered into the model (perceived risk: low compared to medium/high, 'fell in previous 12 months', age (<65 or \geq 65), gender and hours per year of Lifeball played) with sequential removal of non-significant variables to produce the final model. All analysis used SAS software.

Results

A total of 284 completed the baseline (67.3%, 284/422). Consenters were similar to non-consenters in terms of gender (female consenters 83.8%, female non-consenters 86.4%, $p=0.56$) and age (median age, consenters 67.0 and non-consenters 66.5, $p=0.49$). Most were female (83.8%, 238/284) with age ranging from 40 to 96

years (mean 67). At baseline, the majority (79.9%, 227/284) rated their risk of falling as low, with 28.9% (82/284) reported having at least one fall in the previous 12 months, and 37.8% of these (31/82) reporting more than one fall.

At follow up, 92.6% (263/284) were resurveyed. The mean number of Lifeball sessions attended by CATI respondents during the year was 25, with 19.3% attending on fewer than 4 occasions and 14.3% attending 52 or more times (once a week for a year). Attendance data were available for 98.1% (258/263) of CATI participants. Incident reports were located for 12 of the 23 falls reported in the CATI survey.

Twenty (7.6% 20/263) CATI participants at follow up had experienced a Lifeball fall. Seventeen fallers reported one fall and three reported two falls. Of these 23 falls, 10 falls resulted in injuries requiring medical care. Incident report forms provided a more comprehensive description of the incident for 12 of the 23 falls, including 6 of the 10 falls that resulted in injury needing medical care. In eight cases falls were attributed to a trip or stumble either involving tripping over their own or others' feet (six) or rushing (two). For the other four; two mentioned over-extending when catching a ball (one also involved rushing); one that their feet got stuck and one that they were walking backwards. The logistic regression model showed that none of the predictor variables were significant in predicting whether a person would fall or not in Lifeball.

Most (93.9%, 247/263) reported no injuries requiring medical treatment. The 16 players reporting injuries injured a total of 27 body parts (nine injured one body part, three injured two body parts, and four injured three parts of the body). Knee injuries were most common (seven), ranging in severity from pain through to dislocation and torn tendons.

The nature of injuries ranged from bruising, pain and cuts or grazes through to dislocations or broken bones. While most injuries involved bruising, pain and/or strains, two people broke bones (one a pelvis, the other a leg and wrist). The majority of injuries (22/27) were the result of a new injury. All players who reported an injury requiring medical attention from a Lifeball fall had played at least 5 games and most (17/20) had played more than 10 games. Twenty of these injuries were associated with 10 falls (see [Table 1](#)).

The falls rate per 100 participants, for the 12 months was 8.7. For the 257 CATI participants with attendance data, the rate per 1000 h of Lifeball participation was 2.8. The injury rate was 10.3 per 100 participants and 3.3 per 1000 h of play (see [Table 2](#)).

Table 1 Details of Lifeball related injuries for the 16 injured players including: body part injured, nature of injury, number of new injuries, number of injuries associated with a fall and number of falls associated with injury

Person	Body part injured	Nature of injury	Number of new injuries	Number of injuries associated with a fall	Number of falls associated with injury
1	Head	Swelling and fluid	1	1	1
2	Knee	Pain	1	1	1
3	Elbow	Bruised	1	1	1
	Knee	Bruised	1	1	
4	Face (other than eye)	Bruised	1	1	1
	Knee	Dislocated	1	1	
5	Elbow	Cuts/grazes	1	1	1
	Hand or finger	Dislocated	1	1	
	Knee	Bruised, cuts/grazes	1	1	
6	Ribs	Bruised	1	1	1
7	Leg	Broken	1	1	1
	Wrist	Broken	1	1	
8	Neck	Sprain/strain	0	0	
9	Arm	Bruised	1	1	1
	Leg	Bruised	1	1	
	Pelvis	Broken (four fractures)	1	1	
10	Knee	Sprain/strain (torn tendons)	1	0	
11	Knee	Sprain/strain (arthritis)	0	0	
12	Hand or finger	Tendon injury	1	0	
13	Neck	Sprain/strain	0	0	
14	Shoulder	Pain (bursitis)	1	0	
15	Back	Pain	0	1	1
	Hip	Pain	1	1	
	Shoulder	Pain	1	1	
16	Hand or finger	Pain	1	1	1
	Knee	Cuts/grazes	1	1	
	Arm	Bruised, Cuts/grazes	0	0	
Totals			22	20	10

Table 2 Numbers and rate of falls and injury in Lifeball

	Number of injuries/falls	Rate/100 participants ^a	Rate/1000 participant hours ^b
Falls	23	8.7	2.8
Injuries	27	10.3	3.3

^a Based on 263 participants.

^b Based on 257 of the 263 participants who had attendance data and 8147 h of total play.

Discussion

This study is one of the few that provides a risk assessment of a team game and the only one focused on team game designed specifically for seniors (Lifeball). It is unclear how generalisable this sample is; nevertheless the sample size

is reasonable and subjects were drawn from a large diverse geographical region. Its strength is having frequency and duration of play.

Lifeball is not 'risk free' as falls and injuries did occur. Due to a lack of comparative data, it is difficult to draw firm conclusions about the rate of injuries for seniors playing Lifeball in compari-

son to other sports or activities. However, we do know that the greatest determinant of injury risk in recreational injury is the nature of the activity, with sport,²⁰ particularly contact sport, carrying the greatest risk.¹⁰ Acute injuries are common in elderly people participating in sport activities which demand high coordination, reaction time and balance capabilities, such as ball games, downhill skiing and gymnastics.²¹

Consistent with previous studies, knee injuries were most common.^{20,22} In a recent Australian report netball and basketball (games with some similarities to Lifeball) had higher hospitalised knee injuries than all other sports combined and also, for those aged over 45, knee injuries were the most common injury.²³ Other common injuries in our study involved pain, bruising or strains. However two people reported three injuries involving broken bones. Whilst uncommon, fractures are of concern.

Injuries were often a result of a fall, making falling during the game a concern. In Australia falls were the cause of injury in 32% of basketball cases and in 30% of netball cases.²³ Falls are a particularly common cause of recreation-related injury,⁸ with around 10% of all falls-related deaths resulting from recreational or athletic activities.¹⁰ Falls are one of the most common causes of fatal injuries for seniors.²⁴

An examination of circumstances around Lifeball falls showed that in 5 of the 12 cases documented in incident report forms, Lifeball rules (i.e. 'walking backwards' and 'rushing'), and recommendations (no 'overextension' when catching) were not adhered to. This confirms that existing rules and recommendations are well founded and must continue to be enforced to minimise injury.

It is unfortunate that incident report forms only provided a description of the incident for half of the self-reported falls and 6 of 10 falls associated with injury requiring medical attention. Some difference is understandable as incident report forms recorded all falls (regardless of injury) whereas the CATI asked only about injuries requiring medical attention. However, it is unusual that the self-reported cases were higher than the documented cases. Recall periods of longer than 5 weeks may underestimate injury rates.²⁵ It is uncertain whether the four non-documented injurious falls were due to team leaders' neglecting to complete or forward forms to the coordinator or inaccurate recall. Since others have found that patients with injurious falls are more likely to recall falls,²⁶ it seems plausible that team leaders may have neglected to complete or forward forms. As our definition of injury concerned pain or discomfort during or soon

after playing, considered related to playing, some injuries reported in the CATI may not have been evident at the time the game was played and therefore may not have been reported.

Unexpectedly, age was not a factor in falling;²⁷ neither were previous falls, and yet falls history is usually considered a risk factor for future falls.²⁸ Perception of elevated falls risk was also not associated with falls. However, this may reflect inconsistencies in players self-perception of falls risk, with some people who had fallen in the last 12 months also rating their risk of falling as low. Our sample size may have been insufficient to assess these associations, so results should be interpreted with caution. Also those who chose to play Lifeball may be less at risk of falls generally than those who did not participate. Therefore, in terms of screening participants for Lifeball, prior history of falls is not necessarily a basis on which to turn people away, and using a participant self-rated checklist to screen participants for falls risk may not be effective.

Prior to the study, the project team thought a player's risk of falling may increase when new to the game. This does not appear to be the case, with all players who reported a Lifeball fall having this fall after they had played at least five games. This contrasts with a study that found experience from playing a particular sport in the past 12 months reduced injury likelihood.²⁹ Perhaps players tended to play faster and get more competitive after playing for a while, or became less vigilant over time, increasing likelihood of falling and injury.

Limitations

As the CATI was self-report recall bias was possible, as participants were contacted after 1 year, and participants kept no diaries. Secondly, a range of other variables could have been examined for associations with falling. Lastly, intensity of play could not be documented.

Conclusion

This study has provided falls and injury information for a new and developing physical activity that has the potential to fill an important gap as a team-based option for seniors. Lifeball is not risk-free and it would be useful to explore circumstances around falls injuries more fully to know what else can be done to prevent falls. Further research is needed to provide accurate assessments of the influence of regular participation in Lifeball on a person's

overall falls risk and on comparable risks associated with alternative sports and physical activities for seniors.

Practical implications

- Education (both initial and ongoing) and enforcement around existing Lifeball rules is recommended.
- Prior history of falls is not necessarily a basis on which to turn people away, and using a participant self-rated checklist to screen for falls risk may not be effective.

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Appendix A. Supplementary data

Supplementary data associated with this article can be found, in the online version, at doi:10.1016/j.jsams.2007.12.007.

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