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Author

Spinks, A., Turner, C., McClure, R, Nixon, J

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SYSTEMATIC REVIEW

Community based prevention programs targeting all injuries for children

A Spinks, C Turner, R McClure, J Nixon

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See end of article for authors' affiliations

Correspondence to: Cathy Turner, Injury Research Unit, School of Population Health, Mayne Medical School, University of Queensland, Herston Rd, Herston, QLD 4006, Australia; C.Turner@sph.uq.edu.au

Objective: Community based models for injury prevention have become an accepted part of the overall injury control strategy. This systematic review of the scientific literature examines the evidence for their effectiveness in reducing all-cause injury in children 0–14 years of age.

Methods: A comprehensive search of the literature was performed using the following study selection criteria: community based intervention study; children under 14 years; outcome measure was injury rates; and either a community control or an historical control was used in the design. Quality assessment and data abstraction were guided by a standardized procedure and performed independently by two authors. Data synthesis was in tabular and text form with meta-analysis not being possible due to the discrepancy in methods and measures between the studies.

Results: Thorough electronic and library search techniques yielded only nine formally evaluated community based all-cause child injury prevention programs that have reported actual injury outcomes. Of these nine studies, seven provided high level evidence where contemporary control communities were used for comparison; the remaining two used a pre and post-design or time trend analysis where historical data from the community were used as the comparison. Only three of the seven studies with contemporary control communities found significant effect of the intervention; the two studies without controls noted significant reductions in injury rates after the intervention period.

Conclusion: There is a paucity of research from which evidence regarding the effectiveness of community based childhood injury prevention programs can be obtained and hence a clear need to increase the effort on developing this evidence base.

Since the development of the public health/epidemiological approach to injury control¹ pioneered by Haddon² and Gordon³ in the 1960s, models upon which interventions have been based have undergone progressive development. During the 1970s, there was a strong focus on engineering solutions and top down legislative changes. These solutions have immediate applicability and are largely effective in highly defined, single purpose public environments such as the workplace and road environment. In other areas such as childhood injury, however, environments are far more varied, less clearly delineated, largely private, and hence far less easy to engineer and regulate. Researchers in these contexts have concentrated on developing specific countermeasures which have not achieved the level of success anticipated. It was realised that simply introducing the countermeasure (for example, car seat restraints, bicycle helmets) was not sufficient, and that an effective means of conveying the countermeasure was necessary, so that it could become embedded in the social and physical structures of community function.^{4,5} On the strength of this realisation the community based (or community intervention) models for injury prevention were developed in the 1980s and 1990s and have now become an accepted part of the overall injury control strategy.⁴

The community based model has been characterised as having a shared ownership of the injury problem and its solution by experts and community members, and joint responsibility for determining appropriate priorities and interventions. It acknowledges a complex causal web embedded in social and organisation structures; a coordinated multistrategy response; and an emphasis on optimising community involvement.⁴ This model underpins a number of growing global movements, including the United States

National Safe Kids and Safe Kids Worldwide Campaigns and the World Health Organization (WHO) Safe Communities and similarly inspired national movements in other individual countries such as the Canadian Safe Communities Foundation and the Beterem National Centre for Children's Health and Safety in Israel. These programs, despite having originated in different parts of the world in order to confront unique political, environmental, and sociocultural challenges, all have similar frameworks for action in that the community is the driving impetus for injury reduction activities.

For example, the United States Safe Kids Campaign was established in 1987 and is currently comprised of approximately 500 individual chapters. The campaign acts at a community level through education via media campaigns and retail promotions; community empowerment through grassroots organisations, environmental changes, legislative enactment of safety regulations and standards; and evaluative research and injury surveillance. The global campaign, Safe Kids Worldwide Campaign was inspired by the United States campaign and established in 2000 with 14 member countries.

As a second example, the WHO Safe Communities concept was formally initiated in 1989 as a response to a successful pilot project in Sweden in which a 23% decrease in total population injury rates was achieved.⁶ The Safe Communities ideology stipulates that safety can be achieved through integrated, collaborative efforts that are implemented in a supportive social, cultural, and political environment and that community members play the leading role for injury prevention.⁷ Currently, there are 78 formally designated WHO Safe Communities and 11 Affiliated Support Centres around the world, with many more communities under preparation to meet the WHO Safe Community criteria. Many of these

Table 1 Studies of community based prevention programs targeting all injuries in children aged 0–14 years

Study	Location, community population/size, and demographics	Time frame for intervention	Type of control	Type of intervention	Outcomes: measures/method	Results
Studies designed with community controls Schlesinger <i>et al.</i> , 1966 ¹³	Rockland County, New York State, USA n=4041 homes n=4616 children based on 1962 census	January 1962–June 1963	Control community nearby: n=4063 homes n=4106 children based on 1962 census. Matched on family demographics, SES, type of housing, social interests	Intensive education program. Organization of neighbourhood discussion groups. Monthly newsletters mailed to families. Distribution of printed materials and brochures	Medically attended injuries for children aged under 7 years obtained directly from physicians, dentists, and hospitals via data collector visits every two weeks. Three month reporting to account for seasonal variation from baseline December 1960 one year before program and then to November 1963 six months after program ceased	Incidence rates of all injuries per 1000 children under 7 years: no differences found between study group and control group for age and sex adjusted injury rates during the three years
Guyer <i>et al.</i> , 1989 ¹⁴	Nine cities in Massachusetts, USA. Total population 139810	September 1980– June 1982	Five control communities matched initially from 1970 census data on demographics, total population 146866. NB: by 1980, control communities did actually differ demographically with higher proportions of poorer and Hispanic households. This led to higher baseline injuries SES controlled for in analysis	Targeted injury counseling for parents of young children. School and community burn prevention education. Household injury hazard identification and control. Community-wide promotion of poison control telephone information service. Public education concerning poison prevention. Promotion of child automobile restraint use	Injuries in children aged 0–5 years requiring emergency department or hospital treatment or resulting in death. Injury cases recorded at 23 hospitals based on a surveillance system 1979–82	Crude incidence rates (per 10000 per year) for all targeted injuries (MVA, burns, falls, poisoning): Intervention: Control: pre, 477.42; post, 523.96 SES adjusted odds ratio for all injuries in pre-intervention period v post-intervention for intervention community v control is 0.99 (95% CI 0.83 to 1.19)
Davidson <i>et al.</i> , 1994 ¹⁵ Safe Kids/Healthy Neighbourhoods Coalition	Central Harlem, Northern Manhattan, USA. Non-targeted: children aged <5 years (1990) 39.5% live below poverty line Baseline injury rates twice as high as control community	First three years of intervention: 1989–91. Injury rates from 1983–88 (pre-intervention) with injury rates during intervention period. Comparing targeted v untargeted age groups and injuries types in intervention and control community	Control community: Washington Heights 30.7% live below poverty line	Coalition formed represented by at least 26 official and voluntary organisations. 25 new playgrounds constructed and 18 existing playgrounds refurbished and fenced. Targeted pedestrian safety education to grade 3 students. Bicycle helmet giveaway programs. Supervised recreational programs with adult mentoring including a dance program, art studio, baseball league programs. Removal of existing summer programs from streets to playgrounds	Northern Manhattan Injury Surveillance System + death certificates. RR of severe injury and mortality due to all targeted injuries (assault, MVA, outdoor falls, guns) in children aged 5–16 years	Central Harlem: RR 0.56 (95% CI 0.45 to 0.71). Washington Heights RR 0.68 (95% CI 0.52 to 0.87)
Svanstrom <i>et al.</i> , 1995 ¹⁶ Lidköping Accident Prevention Program	Lidköping, Sweden (municipality in Skaraborg County). Population 35949. Agricultural and manufacturing county	1984–91	Comparable community controls: four bordering municipalities using the same hospital (population 42000) and whole of Skaraborg County (population 280000)	Implementation of WHO Safe Communities model. This included: (1) Formation of interdisciplinary group represented by health professionals, teachers, municipal administration, police, Red Cross, and residents. (2) Educational campaigns for general safety, bicycle safety, child safety seat use. (3) Training of sport coaches, day and child care staff, and parents in safety and first aid. (4) Environmental changes—for example, playgrounds, bicycle lanes, gymnasiums.	Hospitalisation discharge data of injuries. Change in injury rates (% per year) for boys and girls in Lidköping compared with control communities	Boys: Lidköping: decrease 2.4%, control: increase 0.6%, Skaraborg: decrease 1.0% Girls: Lidköping: decrease 2.1%, control: increase 2.2%, Skaraborg: decrease 0.3%

Table 1 Continued

Study	Location, community population/size, and demographics	Time frame for intervention	Type of control	Type of intervention	Outcomes: measures/method	Results
Patricou <i>et al</i> , 1997 ¹⁶	Naxos, Greece. Population 14465; island	1994	Comparable island community: population 3802	Open town meetings attended by health professionals, journalists, teachers, traffic police, women's leagues, town residents. Educational seminars for parents. Workshops for teachers targeting safety at school. Interactive courses with primary and secondary schoolchildren. Removal of hazards from playgrounds and school yards	Self reporting of injuries over 255 days from households: diary format. NB: break in recording over summer period when island population swells with tourists	No difference in injury rates. NB: data collected in sentinel community only, not whole community. 0–18 years: RR 0.85 (95% CI 0.68 to 1.06) for all accidents and RR 0.79 (95% CI 0.60 to 1.06) for home accidents
Coggan <i>et al</i> , 2000 ⁸	Waitakere, New Zealand. Population 155000. Large urban multicultural. Third of population under 20 years	Evaluation over three year period 1995–97	Control community: size 147000, matched on demographics, new housing development, road safety and crime safety workers	Implementation of WHO Safe Community model (no further information provided)	Hospitalizations for injury. Morbidity data 1989–1998	Significant improvement in children ($p < 0.05$)
Lindqvist <i>et al</i> , 2002 ¹⁷	Motala, Ostergotland, Sweden. Population data not provided	Program started in 1985. Pre-data collected 1983–84. Post-data collected 1989	Comparable neighbouring community (similar age and gender structure)	Implementation of WHO Safe Communities model. This included: (1) Mass media safety education. (2) Training of nurses to provide age adjusted safety information to parents at annual health visits. (3) Production of video demonstrating safety modifications in the home. (4) Environmental maintenance of playgrounds, schools, and day care centres. (5) Workshops for sport coaches and referees. (6) Implementation of "Safe way to school" program. (7) Safe cycling program with subsidised bicycle helmets.	All injuries in children aged 0–15 years treated at health care units and local hospital. Comparing pre-intervention (1984–14) and post (1989) data. Odds ratios giving change in injury rates post-intervention v pre-intervention	Minor injury (AIS 1) intervention: OR 0.89 (95% CI 0.80 to 0.99). Moderate (AIS 2) injury intervention: OR 0.49 (95% CI 0.41 to 0.57). Severe injury (AIS 3–6) intervention: OR 1.28 (95% CI 0.72 to 2.27). All injury intervention: OR 0.74 (95% CI 0.68 to 0.81). Control: OR 0.93 (95% CI 0.82 to 1.05)
Studies designed with the intervention community as an historical control						
Jeffs <i>et al</i> , 1993 ²⁰	Illawarra, NSW, Australia. Intervention: Shellharbour. Population 230000	Baseline data collected 1987. Community information campaign 1990–91	Historical control (although control communities are mentioned their purpose seems to be for knowledge/attitudes component)	Implementation of WHO Safe Communities model. This included: (1) Formation of intersectoral taskforce represented by 13 agencies. (2) Community information campaign via mass media. (3) Backyard cleanups. (4) Bicycle safety campaigns.	Injury surveillance in four hospitals for children 0–14 years	17% decrease at A&E departments for children for injuries pre-intervention v post-intervention in Shellharbour. (20731/100 000 in 1987 to 17288 /100000 in 1991) 14% decrease in severe injuries (653/100000 to 586/100000)
Tamburro <i>et al</i> , 2002 ²³	Shelby County, Tennessee, USA	1990–97	Historical control	Implementation of SAFE KIDS coalition; examples of activities include: (1) Mass media/television campaigns. (2) School and holiday safety festivals. (3) Bicycle rodeos and support of state helmet legislation. (4) Smoke detector hand out program and education. (5) Baby walker campaign. (6) Child safety seat campaign and checks. (7) School pedestrian education.	Children <9 years presenting for unintentional injury to a children's medical center, emergency department or outpatient clinics	Rate of severe targeted injuries decreased from 3.5 per 1000 during first two years to 2.0 per 1000 in year 7 (1996). (RR 0.77 95% CI 0.66 to 0.90) Non-targeted injuries increased from 1.4 to 2.5/1000

AIS, Abbreviated Injury Score; CI, confidence interval; MVA, motor vehicle accident; OR, odds ratio; RR, relative risk; SES, socioeconomic scale.

Safe Communities target childhood injury specifically as part of their program activities.

Characteristic of community based prevention strategies is the devolving of ownership, responsibility, and costs from centralised government departments back to the community. Justification for the substantial imposition on the community is that these multistrategy multifocused, community based childhood prevention programs are effective in reducing the frequency and severity of injury in children. The aim of this paper is to test this hypothesis by systematically reviewing the relevant evidence in the literature.

METHODS

An electronic search for published studies was conducted using WebSPIRS as a search tool for Medline (1966–2003), CINAHL (1982–2002), and PsycINFO (1872–2003) databases. The following search strategy was used:

(child* OR adolescent OR pediatric OR paediatric) AND (strateg* OR intervention* OR program* OR prevent*) AND (injur* OR wound* OR trauma OR fracture*) AND (community OR communities OR population)

The initial deliberately broad search strategies yielded over 22000 studies based on child injury prevention related search terms. When the search was limited to look at studies conducted within a community or population setting, the combination of the search terms above yielded 3441 abstracts from Medline, 3261 abstracts from CINAHL, and 545 abstracts from psycINFO. Based on examination of these titles and abstracts, full texts for 35 studies were retrieved.

Further potential studies were identified by screening the reference lists of existing systematic reviews on this topic.^{8–11} Separate hand and electronic searches of the journals *Injury Prevention* (1995–2003) and *Accident Analysis and Prevention* (1995–2003) were performed, however no further articles were identified. A key word search of EMBASE (1992–2003) and the Cochrane library did not reveal any suitable literature.

After closer examination of the full text of the retrieved studies by the first author, a large number were discarded as they either lacked an evaluation component or clearly did not meet the definition for a community based intervention. The second and third authors independently examined the remaining 12 as per the following study selection criteria:

- (A) Community based intervention study; defined as an intervention that applies more than one single strategy and is targeted towards a whole community or group of individuals therein.
- (B) Target population is children under 14 years.
- (C) Outcome measure is injury rates from all causes.
- (D) Community control or historical control is used in the design.

Nine studies met all the inclusion criteria for this review and were subject to a further data extraction process conducted independently by the second and third authors with the first author acting to reconcile differences. This process was guided by a standardized abstraction procedure developed to improve the evaluation of the quality of studies selected in a review.¹² The form constructed for the purpose of this review is available on request. Each study was independently assessed for the quality of the execution of the study by the second and third authors. The results of the data abstraction process are outlined in table 1.

RESULTS

Seven studies were designed with community controls for comparison with the intervention community.^{13–19} A further two studies were designed using the intervention community

as an historical control in a before-after design.^{20–21} Meta-analysis was not possible due to the diversity of the interventions and the outcome measures reported in each of the studies reviewed. Three studies that were screened by the second and third authors were excluded.^{22–24} The reasons for exclusion were: the paper described part of a larger study¹⁴ already included for analysis²²; no injury outcomes were evaluated²³; and the study did not meet definition for a community based intervention.²⁴

Studies evaluating a community based intervention using a control community design

Schlesinger *et al* evaluated the impact of a childhood injury prevention project implemented in Rockland County, New York State that focused on community based education of self selected groups.¹³ Injury rates for children under 7 years were compared for those families exposed to the project interventions to a comparable group of non-exposed families. Injury incidence rates for children under 7 years were assessed every three months for 12 months before, during, and six months after the project. No differences were found between the study group and the control group for age and sex adjusted injury rates or injury severity. The authors note the importance of continued reporting for a sustained period of time when evaluating community programs, particularly post-program, to ensure valid conclusions are derived.

Guyer *et al* report on a statewide community based injury prevention program designed to reduce the incidence of burns, falls in the home, motor vehicle occupant injuries, poisoning, and suffocations in 0–5 year olds.¹⁴ The intervention was implemented in nine cities in Massachusetts with the baseline and post-program injury incidence rates of these communities compared with those obtained from five control communities. While the control communities were originally matched demographically based on census data their demographic distribution changed during the time of the study to include higher proportions of poorer Hispanic households. Results were stratified and analyzed according to three levels of median family income and while there was a significant reduction in motor vehicle occupant injuries, no association was found between the intervention and a reduction in any of the other targeted injuries post-campaign. An effort was made to assess the outreach of the program with the authors estimating about 42% of households were exposed to one or more interventions over the two year period. Statewide legislation for child auto restraints was being debated at the time of the study and may partially explain why a positive finding was found only for motor vehicle occupant injuries; study results indicate that the level of child auto restraint use rose in both the intervention and control communities post-campaign.

A Safe Kids/Healthy Neighbourhoods coalition in Central Harlem was formed in 1989 initially to target a reduction in outdoor falls for children aged 5–16 years.¹⁵ Over the next three years community activities expanded to include targeting a reduction in traffic accidents, assaults, and firearms for the same age group and then compare the injury incidence for these causes in Central Harlem to the incidence in a nearby health district, Washington Heights that received no intervention. Injury outcomes data were obtained from a surveillance system operating in two major hospitals that served both communities. There was an overall decline in injuries for the age group and outcomes targeted in the intervention community, however a similar decline also occurred in the control community. The risk of outdoor falls actually increased in the intervention community with the authors suggesting that the program led to an increase in supervised sporting activities for school aged children and that the outcome measure used could not adequately

distinguish between indoor and outdoor falls due to classification coding. There was a specific reduction in the incidence of assault and gun injuries in the intervention community that did not occur in the control community, however there was an equal reduction in motor vehicle injuries across both communities. The authors acknowledge a secular trend and/or spillover effects as possible reasons for their mixed findings.

Svanstrom *et al* report on the impact of the safe community intervention targeting childhood injuries in Lidköping, Sweden.¹⁶ Injury incidence rates in the intervention community were compared over the nine year study period with injury incidence in four bordering municipalities and against the injury incidence for the whole of the county. Results indicate an average annual decrease of 2% over the nine years for both sexes in the intervention community and an average annual increase for boys of 0.6% and for girls of 2% in the neighboring control communities. There is no discussion of similarities or differences between Lidköping and the four control municipalities to determine if these small variations in rates could be explained by other confounding factors. While the linear regression analysis provides an average annual percentage change, it is not clear whether this analysis was adjusted for secular trends occurring before or during the intervention.

A health education injury prevention program was implemented and evaluated on one Greek island with another Greek island serving as a control community that received no intervention.¹⁷ The program targeted home injuries for children aged less than 18 years. The study was very small, relied on self report for injury outcomes, and did not show a significant reduction in injuries as a result of the program. Study outcomes were also not measured during the summer months due to the impact of tourism in both communities. The authors suggest that large scale national injury prevention programs seem to be more successful in reducing injuries rather than specific small scale intervention projects similar to their own study.

An evaluation of the Waitakere Community Injury Prevention Project is reported by Coggan *et al*.¹⁸ While the program was based on the WHO safe community model and targeted all ages, childhood injuries were a specific focus and separate analysis is reported for the 0–14 year age group. Significant reductions in injury incidence for children were found in the two years after the program with corresponding increases in the comparison community. One limitation of the study is the lack of detail in reporting the findings, only a *p* value is reported based on an unknown test to determine significant changes in the regression slopes pre-intervention and post-intervention. Incidence rates are reported graphically with trends indicating an increase in incidence from 1989 for the intervention community, the comparison community and the whole of Auckland.

The impact of a WHO Safe Community model on the incidence of injuries for children aged 0–15 years was evaluated by Lindqvist *et al*.¹⁹ The safe community of Motala, Sweden was assigned a control community for comparison of minor, moderate, and severe injuries of all types in children. Results indicate a post-program reduction in injuries for all children aged 0–15 years of 26% in the intervention community and a 7% non-significant reduction in the control community exposed only to national prevention programs. Detailed data on minor, moderate, and severe injuries are not provided for the control community and the population size of each community is not given. Crude injury counts provided suggest the control community was much smaller than the intervention community, which may also explain the lack of statistical significance for the odds ratio calculated to determine an effect post-program in injury

rates. It is not clear whether pre-program and post-program data on injury rates were collected using the same methods, which could be a serious limitation to the study findings. Firstly, pre-program injury rates differed between the control and intervention communities which the authors explain was due to the difference in the proportions of each population seeking medical care from the one hospital used to collect outcome data. Secondly, changes in injury rates are only provided for the intervention community. More information is required in order to draw valid conclusions from this study design.

Studies evaluating a community based intervention using an historical control design

The impact of another WHO Safe Community model implemented in an Australian city to reduce childhood injuries is reported by Jeffs *et al*.²⁰ Results indicate a 17% decrease in childhood injuries pre-intervention to post-intervention, however the authors note variability across four hospitals in reporting outcome data during the study period and additional under-reporting of injury rates for children treated outside of a hospital. It is difficult to solely attribute the reduction in injury rates to the intervention program without a comparison community and an attempt to control for other confounding factors.

Tamburro *et al* assessed the association between the United States National Safe Kids Coalition and injury rates in one county 10 years after the campaign originated.²¹ Outcome data were based on severe injuries presenting to the only children's hospital in the county from 1990–97. After controlling for secular trends in hospital admission rates and demographics, a 23% reduction for males was noted but no significant reduction for females was found. The authors note the limitations of their study design, particularly the lack of control community for comparison and the impact of potential confounders that might otherwise explain the association found.

DISCUSSION

It is unknown how many community based childhood prevention programs have or are being currently implemented across the globe, however, in just the Safe Kids and Safe Communities networks in North America there are over 300 registered activities. Of all the community based child injury prevention programs throughout the world, we could only find nine whose formal evaluations against injury outcomes have been reported in the scientific literature. Of these nine studies, seven provide high level evidence where contemporary control communities were used for comparison with the remaining two using a pre and post-design or time trend analysis where historical data from the community were used as the comparison. Only three of the seven studies with contemporary control communities found a significant effect of the intervention, with the two studies without controls noting significant reductions in injury rates after the intervention period. There are insufficient studies and too great a variation in the results to provide definitive evidence as to the effectiveness or otherwise of community based, multistrategy multifocused programs for the prevention of all cause injury in children.

Strengths of this review are that it collects for the first time the evidence base justifying what has become a widely practised form of prevention and enables this evidence to be judged on its merits. Limitations in the methodology of this review are unlikely to have influenced the findings. Positive publication bias may have increased the proportion of papers reporting positive results and difficulty ensuring a completely comprehensive ascertainment of relevant published papers may have led to randomly distributed omissions. Key papers, however,

Key points

- Community based models for injury prevention have become an accepted part of the overall injury control strategy.
- There is a paucity of research studies in the literature from which evidence regarding the effectiveness of community based childhood injury prevention programs can be obtained.
- A systematic review of the literature found only nine studies of community based injury prevention programs that included an evaluative component, seven that used a trial design with a contemporary control.
- High quality evaluations of community based injury prevention programs are required to determine if these programs achieve population level improvements in injury outcomes.

will have been referred to in references of the recent articles and some level of confidence in the completeness of the search of at least the peer reviewed literature can be accepted.

The way forward is to identify those elements that distinguish successful community based injury prevention programs. In order for this to be achieved, the evidence base must be broadened to include a wider variety of properly evaluated community based injury prevention programs. This will then enable a more in-depth interpretation of the mediating environmental, cultural, geographical, and political influences that shape communities around the world and impact on population level injury rates.

IMPLICATIONS FOR PREVENTION

There is a paucity of studies in the literature from which evidence regarding the effectiveness of community based childhood injury prevention programs can be ascertained and hence a clear need to increase the effort on developing this evidence base. Formal evaluations should be expected of any new programs undertaken. However sufficient evidence does exist to continue to undertake this form of prevention program pending definitive collation of an evidence base to direct their form and function.

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Authors' affiliations

A Spinks, Injury Research Unit, School of Population Health, Mayne Medical School, University of Queensland, Brisbane, Australia

C Turner, Injury Research Unit, School of Population Health, Mayne Medical School, University of Queensland, Brisbane, Australia
R McClure, Injury Research Unit, School of Population Health, Mayne Medical School, University of Queensland, Brisbane, Australia
J Nixon, Department of Paediatric and Child Health, School of Medicine, University of Queensland, Brisbane, Australia

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