Reliability and validity of maternal recall of injuries in Pacific children: findings from the Pacific Islands Families Study

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Abstract

Background: *Childhood injury is one of the leading causes of morbidity and mortality worldwide. Many epidemiological studies use self-report injury data to understand the pattern of injury, and to identify risk factors and potential injury countermeasures, but the veracity of these data is not without question.*

Aims: *To investigate the reliability and validity of the use of maternal recall of childhood injuries in a birth cohort study of Pacific mothers residing in New Zealand.*

Methods: *As part of the Pacific Islands Families Study (PIFS), this study included 1,354 Pacific children born in Auckland in 2000 whose mothers completed a questionnaire at 6-weeks, 1-year, 2-years, 4-years, and 6-years postpartum. Maternal reports of child injuries and medical attendance events reported were matched to listings held within the National New Zealand Health Information Service's National Medical Discharge Summary (NMDS) database.*

Results: *Overall, 120 child injury events were listed in the NMDS database and 139 in the PIFSquestionnaires. Kappa statistics demonstrated a modest level of agreement between the NMDS database listings and the mothers reporting of childhood injuries over the six years postpartum. However, McNemar's test of symmetry revealed no systemic under-reporting by the mothers, suggesting that the use of maternal proxy reporting of childhood injuries is a valid measure in this population.*

Discussion: *While maternal proxy reporting of Pacific childhood injuries was found to be a valid measure, some evidence of misinterpretation of questions was found; suggesting continued vigilance and development of maternal completed childhood injury questionnaires is warranted.*

Introduction

Childhood injury is one of the leading causes of morbidity and mortality worldwide and concern is increasingly expressed at the lack of comprehensive data availability and quality data to inform policies and injury prevention strategies.[1]

Childhood injury in New Zealand

In 2007, a UNICEF report identified New Zealand was ranked the lowest overall of 24th out of 24 Organisation for Economic Co-operation and Development (OECD) countries for 'deaths from accidents and injuries per 100 000 under 19 years of age'.[2] New Zealand's death rate of 23.1 per 100,000 was over three time higher that the highest ranked country, Sweden, which had a death rate of 7.6 per 100,000.[2] A review of New Zealand morbidity data from 1998-2002 found injury to be the leading cause of death in children aged 1-4 years and accounted for 38% of all 1-4 years old deaths. For children aged under <1 year, death due to injury is the fourth largest cause of death.[3] Between 2001 and 2005 the New Zealand child injury death rate was 11.1 children per 100,000. During the time period of 2003-2007 there were 58,761 (97.8%) hospital admissions for unintentional injuries and 1,323 (2.2%) for intentional injuries for New Zealand children aged 0-14 years of age.[4]

Childhood injury for Pacific children residing in New Zealand

During the 2003-2007 period an average of 8.0 Pacific children died per annum from unintentional injuries, and 10.7% of all unintentional childhood injury admissions in New Zealand were for Pacific children.[5] Pacific children aged 0-14 years were identified to be at significantly higher risk for various types of injury related admissions than similarly aged MĐori, European or Asian children. Compared to European children, these higher injury risk types included: electrical/fire burns (rate ratio (RR) 2.55), pedestrian injuries (RR 2.87), and inanimate mechanical forces (RR 1.89).[4] It is noteworthy that a significant socio-economic gradient was also found in these injury types, with injury risk highest for children living in the highest areas of deprivation.[4] At the time of the 2001 census, 42% of Pacific peoples were found to live in the highest area of deprivation (NZ Deprivation Index decile 10), considerably higher than the anticipated 10%.[6,7]

Measurement issues in childhood injury assessment

Inherent strengths and weaknesses are present in all measurement methods, but ensuring measurement tools are valid and reliable is necessary to minimise bias that may adversely affect study findings, through misclassification.[8,9] In today's world of increasingly constrained financial resources, these biases could potentially lead to devastating consequences by the provision of ineffective policies or initiatives, which could in fact compound existing inequalities.[10-13]

Accurate data provides a robust foundation that is "essential for identifying, prioritizing issues, high risk groups and understanding the burden of injury" (page 11).[14] The use of maternal recall for reporting of childhood health issues is a commonly used measurement tool and is frequently used in childhood injury research studies. Despite its use being recognized as contentious, validity and reliability studies are infrequently undertaken to assess its accuracy.[9,15-17] Using maternal report injury data from a large cohort of Pacific infants measured over five measurement waves from 6-weeks to 6-years postpartum, this study aimed to examine the validity and reliability of the use of maternal recall in accounting for childhood injuries. National Health Index (NHI) listings contained within the National Medical Discharge Summary (NMDS) database acted as the criterion measure.

Methods

Study design

The Pacific Islands Families Study (PIFS) follows a cohort of Pacific infants born at Middlemore Hospital, South Auckland, between 15 March and 17 December 2000. In depth details of the PIFS are available

elsewhere.[18,19] A detailed description of this reliability and validity supplementary study is also available elsewhere.[20]

PIFS participants

All potential participants were selected from live births where at least one parent was identified as being of Pacific Islands ethnicity and a New Zealand permanent resident. Information about the study was provided to mothers of potential participants and consent was sought to make a home visit 6-weeks postpartum. Approximately 6-weeks after infants' births, female interviewers of Pacific Islands ethnicity who were fluent in English and a Pacific Islands language visited mothers in their homes. Once eligibility was confirmed and informed consent obtained, mothers participated in one-hour interviews concerning family functioning and the health and development of the child. When the children reached their first, second, fourth and sixth birthdays all maternal participants were re-contacted and revisited by a female Pacific interviewer. Again, consent was obtained before the interview was conducted. To be included in this study, mothers also consented for their child's medical records to be reviewed at Middlemore Hospital, where the NHI index number was ascertained.

PIFS injury and medical attendance measures

Measures of injury were elicited from maternal reports in each measurement wave and became more detailed over time. At 6-weeks, falls, fractures, and cuts were included but by the 4-years questions had been extended to include contact with an object, application of bodily force, crushing, falling, penetrating force, threats to breathing, burns/scalds, a motor vehicle accident, poisoning, ingestion of a foreign body, and any other cause. Medical attendances injury and non-injury questions covered a variety of settings including traditional healer visits, General Practitioner, emergency clinic, emergency department, specialist, and finally outpatient clinic visits. For hospital attendances mothers were asked to report the main reason for the visit, the number of nights in hospital, age of child, the specific place of attendance, and if the visit suggested by a health professional. At the 6-year measurement only the first two questions remained. For the purpose of these analysis, only information pertaining to hospital attendances were utilised to ensure comparability with the NMDS database.

NHI injury measures

The Statistical Classification of Diseases and Related Health Problems Code 10th Revision (ICD-10-AM) was used to ascertain injury and non-injury status for the NMDS database medical attendance listings.[21] An injury was defined if the ICD-10-AM-I primary diagnostic code was included in the injury chapter between S00 and T98.3.

NZHIS data transfer

The New Zealand Health Information Service (NZHIS) Information Analyst used the provided ICD classification codes to dichotomise the medical attendance into the binary outcome: injury or non-injury event. No specific details were requested on the specific diagnosis, severity or cause of either the injury or non-injury medical attendance event. To ensure the anonymity of participants, an independent person (the PIFS Data Manager), co-ordinated this process. Once the data were recieved, de-identified data were then given to the researchers, who at no time during the study was able to identify individual study participants except in a coded unidentifiable form.

Matching criteria

Manual matching was employed to review the injury and non-injury events from both the NHI listings and PIFS reports resulting in five matching categories: complete match; time difference; reason difference; time and reason difference; and no report. The 'complete match' category was defined as any stated injury event that was recorded in both the listed NHI and PIFS reported events, with all details corresponding. Whereas the 'time difference' category was used to capture those events that appeared to match in all aspects except the reported 'number of nights spent in hospital'. These two classifications were deemed as having a high probability of capturing the same injury event and were thus used to define an injury event match for the purpose of this study. The 'reason difference' category focused on those events where an injury was reported in either measurement source but not recorded in the other but a non-injury event was found that had the potential to match. While the 'time and reason difference' category captured similar events, associated with a time difference as well. The final category 'no report' essentially captures all events where no injury event was recorded in either source, or could be satisfactorily be found to match. Factors that impacted on this ability included multiple and close together admissions, incorrect age at time of event in both the 'reason 'and 'time and reason' categories. For the purpose of this paper, 'reason difference', 'time and reason difference' and 'no report' classifications were defined as being a non-matched injury event.

Statistical analysis

All statistical analyses were performed using Stata version 11[22], with α=0.05 used to determine statistical significance. Each measurement wave was considered separately and no formal across wave analysis was undertaken. Fisher's exact tests of significance were undertaken to compare the distribution of injuries between the two measurement methods. The kappa statistic was then used to reveal the agreement beyond chance between PIFS mothers reporting of injuries in the questionnaires and listings in the NHI database. The corresponding levels of agreement were then classified using Landis and Koch's characterisation.[23] Kappa values of κ<0.00 were taken to indicate poor agreement; κ= 0.00-0.20 slight agreement; κ=0.21-0.40 fair agreement; κ=0.41-0.60 moderate agreement; 0.61-0.80 substantial agreement; and 0.81-1.00 was taken to represent almost perfect agreement beyond chance.[23] McNemar's test of symmetry was undertaken to identify any existing direction of misclassification between the PIFS mother's reports of injuries and the NHI database listing of injuries, by reviewing the symmetry of the discordant injury reports.

Ethics

Ethical research approval for the study was sought and gained from the Northern X Regional Ethics Committee, under expedited review of observational studies, and the Auckland University of Technology Ethics Committee (AUTEC).[20]

Results

Sample participants

The PIFS included maternal interviews for 1,398 Pacific infants at the 6-weeks measurement wave, of which 1,354 (96.9%) were able to be matched with the NHI database. Maternal interviews relating to 1,241 children at 1-year, 1,162 children at 2-years, 1,066 children at 4-years and 1,019 children at the 6-years measurement wave were subsequently made. Matching between the PIFS and NHI databases was successful for 1,205 children at 1-year, 1,137 at 2-years, 1,048 at 4-years, and 996 at the 6-year measurement waves. Table 1 presents selected maternal and child socio-demographic variables at the 6-weeks measurement wave.

Table 1. Frequencies and percentages of sample socio demographic characteristics at the baseline 6-week measurement wave of the total sample

	n	(%)
Child sex		
Boy	691	(51)
Girl	663	(49)
Multiplicity of birth		
Singleton	1,311	(97)
Twins	43	(3)
Maternal age (years)		
<20	108	(8)
20-29	705	(52.1)
30-39	496	(37)
≥40	45	(3.3)
Ethnicity		
Samoan	632	(46.7)
Tongan	290	(21.4)
Cook Island Māori	230	(17)
Niuean	59	(4.36)
Other Pacific	43	(3.2)
Non Pacific	100	(7.4)
New Zealand born		
Yes	453	(33.5)
No	901	(66.5)
Household income		
$0-$20,000	450	(33.2)
$20, 001-$40,000	693	(51.2)
>$40,000	164	(12.1)
Unknown	47	(3.5)
Highest educational qualification		
No formal qualifications	522	(38.6)
Secondary	455	(33.6)
Post-secondary	377	(27.8)
English fluency		
Proficient	843	(62.3)
Otherwise	511	(37.7)
Understands English well?		
Strongly agree	671	(49.6)
Agree	535	(39.5)
Neither disagree or agree	110	(8.1)
Disagree	22	(1.6)
Strongly disagree	16	(1.2)
Speaks English well?		
A lot	713	(52.7)
Quite a lot	318	(23.5)
Somewhat	234	(17.3)
A little	77	(5.7)
Not at all	12	(1.9)

Description of the injury event data

In total, 139 separate inpatient or outpatient hospital injury event child injury events were reported by PIFS mothers and 120 injury events were obtained from the NHI database for this sample over the time-frame of this study. Of these, 2 injury events were reported in the PIFS and 3 injury events were reported in the NHI database at the 6-week measurement wave; 24 PIFS and 26 NHI injury events were identified at 1-year; 56 PIFS and 52 NHI injury events were identified at 2-years; 24 PIFS and 17 NHI injury events were identified at 4-years; and, 33 injury events were reported in the PIFS and 22 injury events were reported in the NHI database at the 6-years measurement waves. Inpatient and outpatient NHI and PIFS injury events are shown in Figure 1. A significantly greater number of inpatient injury events were listed in the NHI database than in the PIFS questionnaires and conversely a greater number of outpatient injury events were reported in the PIFS questionnaires than listed in the NHI database (Fisher's exact test P=0.001).

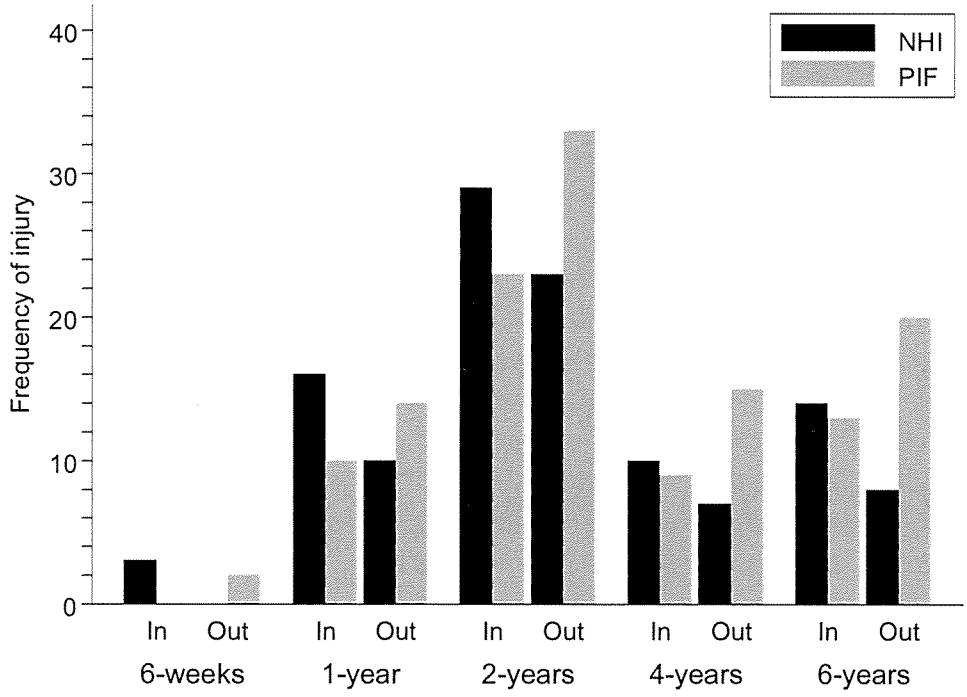

Figure 1. Frequencies of reported inpatient (In) and outpatient (Out) injury events for NHI and PIFS individuals over the PIFS measurement waves

Concordance and agreement in injury events reported between PIFS and NHI information sources

Overall, 216 separate injury events from 184 children were identified. Only, 43 (19.9%) of these events were matched in both PIFS and NHI databases; with 96 (44.4%) events in the PIFS unmatched in the NIH database and 77 (35.6%) events identified in the NHI database unmatched in the PIFS. Table 2 presents an overview of distributions of injury events and subsequent concordance between the PIFS reported and the NHI listed injury events over the five measurement waves. Overall the kappa values ranged from κ=0.18 to κ=0.39. Despite the modest kappa values, no significant asymmetry was demonstrated between the reported PIFS questionnaire injury events and the listed NHI events. Analyses of concordance by inpatient and outpatient injury events were not undertaken due to the small number of matched injury events observed.

Table 2. Frequencies and percentages of reported injury events in the PIFS and NHI databases over the measurements waves, together with the kappa (κ) measure of agreement and McNemar's test of symmetry p-value

Measurement wave	In PIFS but not in NHI		In NHI but not in PIFS		In PIFS and in NHI		Kappa		McNemar's
	n	(%)	n	(%)	n	(%)	κ	(95% CI)	P-value
6-weeks*	2	(0.2)	3	(0.2)	0	(0.0)			
1-year	14	(1.2)	16	(1.4)	10	(0.8)	0.39	(0.33, 0.44)	0.86
2-years	34	(3.0)	30	(2.6)	22	(1.9)	0.38	(0.32, 0.44)	0.71
4-years	20	(1.9)	13	(1.2)	4	(0.4)	0.18	(0.12, 0.24)	0.30
6-years	26	(2.7)	15	(1.6)	7	(0.7)	0.20	(0.14, 0.26)	0.13

*Numbers were too small to estimate κ and McNemar's statistics confidently.

Discussion

Agreement between PIFS self-reports of child injury and NIH database listings of children's injuries ranged from 'poor' to 'moderate' over the measurement waves for the various matching definitions employed. To compare these findings to those from other studies that focused on mother's recall of childhood injuries to medical attendances, a review was intended. However, few injury specific studies were found. The review was then expanded to include maternal recall findings from birth and postnatal activities, infant care and health care utilisation. In these studies, agreement ranged from fair to substantial for emergency department attendances and hospital admissions.[17,24] In relation to the recall of other medical related events, agreement was more modest and ranged from poor to substantial.[17, 25, 26] However, these studies employed a variety of research methodologies, with some being more robust than others. Moreover, different statistical analyses were undertaken, and some used kappa statistics but failed to investigate the levels of symmetry between the measurement methods. Although agreement was generally marginally better in the reviewed studies compared to the findings presented here, the impact of larger sample sizes, higher injury numbers, and the broadening of the focus are likely to have contributed to these increased kappa values.

No systemic under-reporting of injury events by the PIFS participants were found, this suggests that the level of overall recall bias was low. In contrast to the PIFS, maternal under-reporting of hospital attendance for childhood injuries has been demonstrated elsewhere.[25, 27] Kennan and colleagues found 47% of mothers under-reported and 34% over-reported overall medical attendance visits, despite interviews being held three times over the study year.[25] Matching between medical records and mothers reports occurred in only 20% of events. A significantly lower average number of emergency room visits were reported by the mothers than were listed in the medical records.[25] Similar findings by Stone and colleagues revealed a significantly greater number of children were listed as injured in primary care medical records than reported by the mothers.[27] As both of these studies targeted groups with families identified to be at risk, the ability to generalize their findings may be limited.

Study Limitations

In spite of the large cohort size, the very small number of injuries hampered these investigations. Moreover, the 6-years analyses were also restricted by the inability to separate emergency clinic visits from hospital visits for the analysis. Other potentially limiting factors in the PIFS that may also have negatively impacted concordance was the restricted number of hospital events able to be captured in each questionnaire and the one year period of injury recall for participants. D'Souza-Vazirani and colleagues found a disproportionate number of recent injuries occurring close to the interview were recalled accurately.[24] Accordingly a recall

time of one to six months has been found to be advantageous for increased accuracy of recall of medical attendance events for injury events.[28,29] Whilst the comprehension of questions by PIFS mothers could have been an issue, the mothers were matched where possible with ethnic specific interviewers who were conversant in their own language. Researcher assisted interviewer techniques were also undertaken. Both sought to alleviate any misinterpretations that might have occurred and are recognised to be a necessity when working with Pacific peoples and culturally diverse groups.[20,30,31]

While the study sought to capture inpatient and outpatient visits, the following factors may have impacted on the concordance found. The NMDS database is not designed to capture outpatient visits as such; only emergency department visits with more than three hour's treatment time are captured and deemed to constitute an inpatient admission. However, this practice has not been uniformly introduced or implemented in different hospitals around New Zealand.[32,33] The significant differences found between the proportion of matching and non-matching injury events between PIFS and NHI may well be influenced by these differences. The quality of the data that the NHI database contains is not only dependent on the NZHIS procedures or coders who enter the information into the ICD-10-AM-1 format for the NHI database use, but is dependent on the practices and communications between the child, their caregiver and the hospital staff.[34] This may have impacted on recall by the mothers as well.

Other potential impacts on recall

Couglin identifies five main influences that impact on recall bias in research studies including: time interval since exposure, significance of the event, interviewing techniques used, the impact of social desirability bias, personal characteristics (memory, motivation, educational level, and health literacy level).[35] These factors could further impact on agreement found when combined with the effect of socio-demographic factors shown to also influence accuracy of recall. Initial plans to investigate such factors were not undertaken due to the low injury numbers and modest kappa values. These may have shed light on influences that impact on recall for Pacific mothers, although conclusions reached in previous studies are inconclusive and often conflicting in nature. For example Pless and Pless found younger maternal age increased the accuracy of recall, which is in direct contrast to the findings of D'Souza-Vazirani and colleagues who found older mothers recalled more accurately.[24, 26] In relation to the impact of parity, Elkadry and colleagues found that with each extra child a significant 37% reduction in the odds of recalling events accurately was found,[36] whilst others found no such association.[24,28] In regards to education, Elkadry and colleagues found higher education levels was associated with significantly better recall,[36] a result also demonstrated by Cummings and colleagues.[28.]

Tate and colleagues found lower levels of agreement for mothers with immigrant status and to whom English is a second language.[37] Nuances of language and the impact of culture have been identified as important considerations, within health research and healthcare practice alike, undertaken with Pacific people in New Zealand.[30,38] In the overall study sample, 66.5% of the mothers self-identified as not being born in New Zealand born, and 62.3% identified themselves to speak English fluently (see Table 1). These factors are likely to impact on the ability for maternal injury recall.

With such ethnic diversity there are obvious challenges in undertaking research of Pacific peoples within their respective communities. In seeking to uphold research principles and practices, careful consideration of the need to provide balance between these differences and scientific ideals is imperative in any research undertaken. Del Boca and Noll (39, pS358) state "Self report data are inherently neither valid nor invalid, but

vary with the personal circumstances of the respondent and the methodological sophistication of the data gatherer". They advocate the important issues to focus on should in fact be what conditions are conducive to facilitating accurate recall from participants and what procedures foster valid responses. Differing world views and levels of health literacy among different communities require adjustments to be made to measuring tools, to ensure they do capture what they intend to.[31]

Policy and Research Implications

Research on the health literacy levels of Pacific peoples living in New Zealand is advocated in order to gain knowledge on how best health researchers can pose questions on injury or illness to elicit the required information. Integral to this would be the need to focus on reviewing the differences between parent perceptions of what constitutes an illness/injury and associated medical definitions. The crucial role of pretesting of injury and medical attendance questions is further suggested to ensure questions asked are salient, with terminologies understood by participants.[40] The development of internationally standardized and recognized proxy/self-report forms for parents to be used in child injury research is advocated, mindful that cultural considerations are integral in the development, implementation and ultimately the effectiveness of such a tool.

Conclusion

Overall, the results suggest that the use of maternal recall in measuring injuries in Pacific children was found to be a valid measurement tool, given no systematic under-reporting of childhood injuries by PIFS mothers was found. Some evidence of misinterpretation of questions were identified, and suggests continued vigilance and development is necessary in designing the most effective questions to elicit accurate information about child injuries and corresponding medical attendance events. At the heart of any research is the participants and their respective communities and it is to them who we need to turn to enquire about how to improve the methods we use to gain information, after all who else is in a better position to tell us. It is imperative for all parties to work collaboratively to maximize our respective strengths to improve child health and wellbeing and in doing so continue to refine our ability to capture adequate data on childhood injuries, not just for the children of today, but for the generations of children to follow us

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