

## Incidence and consequences of falls due to stroke: a systematic inquiry

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## Abstract

**Objective**—To undertake a systematic inquiry into the incidence and consequences of falls in a cohort of elderly patients with stroke after discharge from hospital.

**Design**—Administration of a questionnaire to patients and main carers at discharge from hospital and eight weeks and six months later.

**Setting**—Bradford Metropolitan District.

**Subjects**—108 patients recruited to the Bradford community stroke trial. Patients were recruited to the trial if they were 60 years or over and resident at home with some residual disability.

**Main outcome measures**—Number of falls, motor club assessment, Barthel index, Frenchay activities index, and Nottingham health profile. Stress in carers was indicated by the general health questionnaire.

**Results**—Of 108 patients, 79 (73%) fell in the six months after discharge from hospital with a total of 270 falls reported. Patients who fell in hospital were significantly more likely to fall at least twice at home after discharge ( $\chi^2=8.16$ ;  $P=0.004$ ). "Fallers" (two or more falls) were less socially active at six months and more had depressed mood. Carers of these patients were significantly more stressed at six months (53% v 18%;  $\chi^2=8.5$ ;  $P=0.003$ ).

**Conclusion**—Stroke is associated with a risk of falling at home and affects the lives of patients with stroke and their carers. Falling and fear of falling is an important issue which needs to be dealt with by the multidisciplinary team.

## Introduction

Falls are the commonest type of home accident among elderly people and are a major threat to their health and independence.<sup>1</sup> There have been several studies into prevalence of falls in the community,<sup>2,3</sup> acute care settings,<sup>4</sup> rehabilitation hospitals,<sup>5</sup> and nursing homes.<sup>6</sup> Many medical and environmental factors have been identified. We examined specifically falls in older people at home who had been disabled by a stroke.

## Subjects and methods

We undertook a systematic inquiry into falls as part of the Bradford community stroke trial. We studied the concerns of patients and carers about falling; the incidence of falls; the effects of falls; the characteristics of patients who fell; and whether a particular group of patients "at risk" of falling could be identified.

The trial was a randomised comparison trial of day hospital attendance or home physiotherapy in elderly patients with stroke discharged from hospital.<sup>7</sup> Patients were recruited to the trial if they were 60 years or over, had some residual disability related to stroke (Barthel index<sup>8</sup> score at discharge of less than 20), and lived at home. A questionnaire on falls was developed

and administered by face to face interview of patients and carers at discharge from hospital and at eight weeks and six months after discharge home. Questions were asked about the occurrence of falls before the stroke, falls in hospital, falls at home after discharge, and if the patient had been taught how to get up from the floor. Details of the most recent fall (the cause, time, place, time spent on ground, injuries sustained, and assistance sought) were recorded. During this structured questioning the main carer was asked about concerns they had in relation to their partner or relative falling; if these concerns affected their own social activities; and for how long they were prepared to leave their partner or relative alone in the house.

Several assessments were incorporated into the randomised trial protocol. These included the Barthel index (a measure of disability), the motor club assessment<sup>9</sup> (an indicator of balance and movement), the Frenchay activities index<sup>10</sup> (an assessment of social activity), and the Nottingham health profile<sup>11</sup> (perceived state of health). The main carers also completed the general health questionnaire-28 as an indicator of wellbeing.<sup>12</sup> On recruitment to the trial patients were assessed for neglect (Albert's test<sup>13</sup>), proprioception, loss of sensation, and cognitive function.<sup>14</sup> Using similar methodology to Blake *et al*, we recorded details of comorbidity on a dichotomous (present-absent) scale. These included self reported poor eyesight, heart disease, diabetes, chronic obstructive airways disease, previous stroke, and hypertension.

Statistical analysis was performed with the SPSS-X software package on the Bradford University mainframe. Overstall has suggested that patients most susceptible to falls, "true fallers," should be so classified if they have fallen twice or more in an index year.<sup>15</sup> The category of "non-fallers" therefore includes those patients who have fallen only once. By using this classification characteristics of fallers and non-fallers at discharge were compared with the  $\chi^2$  statistic and Mann-Whitney U test. A logistic regression analysis was also undertaken to identify factors which might predispose stroke patients to fall.

## Results

One hundred and twenty four patients were recruited to the trial, but 12 were unavailable for interview at eight weeks and a further four patients were unavailable at six months. Table I shows the characteristics of the 108 patients included in this survey.

**Number of falls reported**—Only 23 (21%) patients reported that they had fallen in the year before their stroke, but 50 (46%) patients fell at least once while in hospital and 79 (73%) fell in the six months after discharge. Of these 79 patients, 31 were "new fallers" who had not reported falling previously; the remaining 48 had fallen either in hospital (40) or at home before their stroke (8). Table II records the numbers of falls after discharge, with just under half the patients (51)

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TABLE I—Characteristics of patients available for reassessment at six months

Characteristic	Patients (n x 108)
No of men	57
No of women	51
No with right hemiplegia	46
No with left hemiplegia	57
No with other effect	5
No with previous stroke	30
No who lived alone	31
Median (range) age (years)	70 (60-89)
Median (range) Barthel index at discharge	15 (4-19)

TABLE II—Number of falls reported by 108 patients in six months after hospital discharge

No of falls	No of patients
0	29
1	28
2-5	36
6-10	11
> 10	4

TABLE III—Activities being undertaken when fall occurred among 79 patients who fell

Activity	No of patients
Walking	41
Transfers	21
Stairs/steps	6
Washing	3
Bending	5
Cooking	1
Unable to say	2

having fallen at least twice and a total of 270 falls being reported. The falls were not confined to the early period after discharge: 145 were reported in the first eight weeks and 125 in the eight week to six month period. Details of the most recent fall when the patients were interviewed at six months are reported below.

**Circumstances of the fall**—Tables III and IV give details of the activities being undertaken and the reasons given for falling. Most falls occurred during the day in the lounge or bedroom, with only nine occurring at night. Patients fell while undertaking "basic" activities such as walking or transferring and not while undertaking "extended" activities (for example, reaching) in which body displacement is greater.<sup>16</sup> Six patients reported falling while negotiating stairs or steps, and nine patients fell outside. Only 24 of the 79 who fell at all had been able to get up from the floor unaided, 36 needed assistance from a relative, and 19 called on help from a variety of services (police, ambulance staff, home help, warden, and community physiotherapist). Most patients were able to get off the floor fairly quickly, but one patient remained on the floor for three hours. Thirty two patients had been shown how to get up from the floor by a physiotherapist. Subsequently, 24 of these patients fell at home, but the specific training they had received did not influence their ability to arise from the floor unaided ( $\chi^2=3.06$ ;  $P>0.05$ ).

**Consequences of falling**—Despite the high number of falls reported, serious injuries were uncommon. Only four patients suffered a fracture (or 1% of falls), and only one patient was admitted to hospital as a direct result of a fall. Thirty eight patients, however, suffered soft tissue injuries. Many patients (34) felt the need to discuss the fall with someone other than their family and friends, and 21 called the doctor or attended the casualty department.

**Impact on resident main carers**—Many of the 74 carers

TABLE IV—Reasons given by 79 patients for falling

Reason given	No of patients
Lost balance	24
Performing transfers	17
Foot got stuck	11
Do not know	10
Fell over obstacle	8
Legs gave way	6
Dizziness	1
Unable to say	2

TABLE V—Median (interquartile range) scores of fallers and non-fallers at discharge from hospital

Index	Non-fallers (0 or 1 falls) (n x 57)	Fallers ( $\geq 2$ falls) (n x 51)	P value (Mann-Whitney)	Median of differences (95% confidence interval)
Abbreviated mental test score	10 (9-10)	9 (9-10)	0.67	0 (0 to 0)
Age (years)	69 (66-75)	71 (65-76)	0.81	0 (+3 to 2)
Barthel index (0-20)	16 (13-18)	15 (12-16)	0.045	1 (0 to 2)
Motor club assessment (0-45)	38 (32-40)	33 (29-38)	0.005	4 (1 to 6)
Walking speed (in seconds)*	18 (11-35)	20 (14-35)	0.39	+2 (+6 to 3)
Nottingham health profile (100-0)†	15 (5-41)	20 (8-39)	0.50	+2 (+10 to 5)

\*Fifteen patients were unable to walk 5 metres.

†Nine patients had difficulties in comprehension and were therefore unable to complete profile.

were worried about the possibility of the patient falling irrespective of whether or not a fall had occurred. This concern decreased only slightly over time, with 42 carers expressing concern at eight weeks and 33 at six months. Only one third of the carers acknowledged that this concern limited their social activities, but of the patients with a resident main carer, half were not left alone for more than one hour.

TABLE VI—Category analysis of Nottingham health profile for fallers and non-fallers and general health questionnaire completed by main carer six months after discharge from hospital. Figures are numbers (percentages) of those able to answer questions

Index	Non-fallers (0 or 1 falls)	Fallers ( $\geq 2$ falls)	$\chi^2$	P value
Nottingham health profile:				
No of patients	50	47		
Score				
0-29	36 (72)	22 (47)	6.4	0.01
$\geq 30$ (depressed mood)	14 (28)	25 (53)		
General health questionnaire†:				
No of carers	33	30		
Score:				
0-4	27 (82)	14 (47)	8.5	0.003
$\geq 5$	6 (18)	16 (53)		

\*Eleven patients (seven non-fallers and four fallers) had comprehension difficulties and were therefore unable to complete profile.

†Eleven carers (three of non-fallers and eight of fallers) were unable to complete the questionnaire.

#### DIFFERENCES BETWEEN FALLERS AND NON-FALLERS

With the classification suggested by Overstall<sup>15</sup> there were 57 non-fallers who had fallen only once or not at all, and 51 fallers who had fallen at least twice (table V). There were no significant differences between the two groups in age, sex, mental state, proprioceptive loss, neglect (Albert's test<sup>13</sup>), previous stroke, living alone, or number of falls in the year before the stroke. Patients who fell in hospital were significantly more likely to fall at least twice at home after discharge (50 patients fell in hospital, 31 of whom subsequently fell more than once at home,  $\chi^2=8.16$ ;  $P=0.004$ ).

**Balance**—The motor club assessment is an index of functional movement and includes items which assess balance (sitting balance, standing balance, and standing on one leg). Fallers had significantly lower scores at discharge ( $P=0.005$ ; table V).

**Disability**—There was a significant difference between the two groups in Barthel index at discharge, and this difference was maintained over the six months (median score at six months 17 (non-fallers) v 16 (fallers); median of difference 2; 95% confidence interval 0 to 3; Mann-Whitney test  $P=0.01$ ). Time taken to walk 5 metres was similar for the fallers and non-fallers at discharge from hospital, but when the patients were reassessed at six months a significant difference in walking speed had developed (12 v 24 seconds; -8; -14 to -3;  $P=0.003$ ).

**Comorbidity**—No significant differences were found between fallers and non-fallers for the presence of additional health problems: poor eyesight, heart disease, diabetes, chronic obstructive airways disease, previous stroke, or hypertension.

**Social activity and mood**—Patients who had fallen at least twice were less socially active when assessed at six months (score for Frenchay activities index (10 v 4; 4; 2 to 7;  $P<0.001$ ). More of the fallers reported depressed mood (a score of 30 or more on the Nottingham health profile<sup>17</sup>), and significantly more carers of fallers were stressed at six months (a score of 5 or more on the general health questionnaire<sup>12</sup>; table VI).

#### IDENTIFICATION OF POTENTIAL FALLERS

A logistic regression analysis was undertaken by using fallers and non-fallers as grouping criteria and included sex, age, presence or absence of associated medical problems, mental state test score, Albert's

test, proprioception (pass/fail), time taken to walk 5 metres, number of falls in hospital, and whether patients lived alone or with a carer. The Barthel index, Nottingham health profile, and motor club assessment scores at discharge were also included. Only "fall in hospital" was a significant predictor of falling at home with an odds ratio of 2.0 (95% confidence interval 1.2 to 3.5).

### Discussion

It is surprising that there has been no previous study which has specifically studied the issue of falls in survivors of stroke who live in the community. In our group of patients with stroke three quarters fell in the first six months after discharge from hospital. Previous community surveys of elderly people have reported rates of falling of 35%<sup>2</sup> and 34%<sup>3</sup> during an index year. Thus, and perhaps not unexpectedly, stroke as a condition is associated with a high risk of falling. Cummings *et al* have highlighted the difficulties that elderly people have in recalling falls,<sup>18</sup> particularly for those with low mental test scores. Most of our patients, however, had high mental test scores and were interviewed in the presence of a carer who could confirm the accuracy of the events recalled.

The main limitations of our study lie in the selective nature of our sample population, which was dictated by the randomised trial comprising the main purpose of our work.<sup>7</sup> Patients who had minimal physical disability from their stroke (Barthel index of 20) and those patients discharged to institutional care were excluded. Also excluded were those patients not admitted to hospital and younger patients. The subjects were therefore patients aged over 60 with mild to moderate disability (median Barthel index of 15) who had been admitted to hospital and subsequently returned home. This does, however, form a group of patients with which many rehabilitation staff will be familiar, and the high risk of falling in these patients needs to be better acknowledged in preparing patients and their carers to cope at home, especially as most of the falls had taken place after "basic" rather than "extended" activities.<sup>16</sup>

The reasons given for the falls reflect stroke related disability with most patients overbalancing while transferring or because their foot had become stuck. "Dizziness" preceding a fall was uncommon (only one patient) in contrast with results from community surveys of falls.<sup>3</sup> One explanation for this unusually low finding is that some of the patients who did not know the reason for falling might have actually experienced a black out or dizzy turn.

Our separation of the patients into two groups (fallers or non-fallers) is as previously suggested.<sup>15</sup> It acknowledges an important epidemiological aspect of falls in older people which occur as a non-random distribution and do not fit a Poisson function.<sup>19</sup> Thus the category of non-fallers includes some people who will by chance have fallen occasionally, and true fallers are those who are most susceptible to falls.

Patients were most likely to fall if they had suffered a fall in hospital and had lower scores on the Barthel index and motor club assessment at discharge. The motor club assessment is similar to a previously described mobility score which was also a successful discriminator separating non-fallers from fallers.<sup>20</sup>

The fallers had significantly slower walking speeds at six months. Whether this was the cause or result of the falls cannot be inferred from our study, but the adverse functional effects of repeated falling have been reported elsewhere and are well known to geriatricians.<sup>21,22</sup> Similarly, the direction of the relation between the observed lower scores for social activity and lower mood in the fallers is speculative. A possible

### Key messages

- Falls are common in patients discharged home after stroke
- Major injury is rare
- Falling in hospital is a significant predictor for falling at home
- Patients identified as being "at risk" should be given advice and guidance by the multi-disciplinary team before discharge

and reasonable inter-relation, however, would be falls accelerating the background decline in mobility,<sup>23</sup> which further increases the risk of falls and increases disability producing social restriction and low mood. Further work needs to be undertaken to test this specific interpretation.

It is a concern that so many patients fell in the months after discharge. Targeting of the patients at increased risk of falling (lower Barthel index scores, lower motor club assessment scores, and fallers in hospital) would seem sensible. Counselling and provision of pendant alarms needs investigation. A common approach is to prepare the patient with instruction from a physiotherapist on how to get up from the floor. This technique is inconsistently applied,<sup>24</sup> and in our study, although just over a quarter of the patients received such training, most still required help to get up from the floor after their fall. Provision of physiotherapy both to prevent falls<sup>25</sup> and after a fall<sup>26</sup> has been shown to be beneficial. Physiotherapy applied as a late intervention in stroke has also been studied and has some effect,<sup>23</sup> particularly in improving speed of gait, a factor associated with falling in our study.

The incidence and consequences of falls for patients with stroke and their carers seem to be important issues which need greater attention in clinical and research terms.

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Conflicts of interest: None.

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## Birth weights of infants of first generation Asian women in Britain compared with second generation Asian women

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### Abstract

**Objectives**—To compare birth weights of infants of first generation Asian women (women born in the Indian subcontinent) with those of infants of second generation Asian women (born in the United Kingdom).

**Design**—Retrospective case note study.

**Setting**—Bolton District General Hospital.

**Subjects**—331 Asian women who gave birth between January 1989 and December 1989: 220 of these women were first generation Asians and 111 were second generation Asians.

**Main outcome measure**—Birth weights of babies born to first and second generation Asian women.

**Results**—At all gestational ages at delivery, babies born to second generation Asian women were heavier than those born to first generation women. The mean birth weight for babies of second generation women was 3196 g, 249 g more than the mean birth weight of 2946 g of babies of first generation women ( $P < 0.001$ ). After a stepwise multiple regression analysis was carried out the adjusted difference in birth weights was 280 g, greater than the crude difference.

**Conclusion**—Birth weights are important in relation to perinatal mortality, which is notoriously high among Asians. The results of this study indicate that there is hope for lowering of perinatal mortality and improving postnatal growth in babies of second generation Asians.

### Introduction

Mothers born in India contribute 1.3% of all live births in the United Kingdom, and mothers born in Pakistan contribute 1.8% of live births.<sup>1</sup> Studies have shown that Asian babies are lighter than white babies.<sup>2,4</sup> For Asian babies a birth weight of less than 2200 g seems to be associated with an increased risk of perinatal mortality.<sup>2,5</sup> This study was undertaken to compare birth weights of babies born to first generation Asian mothers (women born in the Indian subcontinent who subsequently immigrated to the United Kingdom) and birth weights of babies born to second generation Asian mothers (women born in the United Kingdom).

### Subjects and methods

A total of 454 Asian women gave birth at Bolton District General Hospital between January 1989 and December 1989, and a sample of 331 patients was randomly selected from this group. Of this cohort, 220 patients were first generation Asian mothers, and 111 were second generation Asian mothers. The patients' records were scrutinised, and personal details were

noted, including their height and weight at booking in, age, marital status, employment status, religion, place of birth, and smoking habits. Each patient's social class was determined according to her husband's or partner's occupation.

The obstetric details noted were menstrual history; date of last menstruation; use of oral contraceptives within three months of conception; parity; and outcome of previous deliveries, including mode of delivery and birth weight.

Gestational age at booking in was derived from each woman's menstrual history and an ultrasound scan performed at booking. The expected date of each delivery was calculated from the menstrual history provided the dates were sure and the menstrual cycles regular, there was no history of use of oral contraceptives in the three months before conception, and the date of delivery predicted from the ultrasound scan was within one week of the date predicted from the menstrual history. If any of the above criteria were not met then the results of the ultrasound scan were used to calculate the expected date of delivery.

Any complications that occurred before delivery were noted. A detailed record of labour was also noted, and fetal birth weight was recorded.

### STATISTICAL METHODS

The birth weights of the babies studied followed an approximately normal distribution. The overall difference between the first and second generation groups was tested with a two sample Student's *t* test. The individual effects of potential confounding factors (such as parity and social class) on birth weight were examined with two factor analyses of variance; significant effects and interactions were examined in detail with the Tukey multiple comparison test. Forward stepwise multiple linear regression methods were used to evaluate the combined effects of the confounding factors.<sup>6</sup>

### Results

The mean birth weight for babies born to first generation Asian mothers was 249 g less (95% confidence interval 137 g to 362 g) than that for babies born to second generation mothers. This difference was similar for both primiparous (342 g (128 g to 556 g)) and multiparous (314 g (181 g to 447 g)) mothers. Babies born to first generation mothers were significantly lighter on average than those born to second generation mothers for all subgroups examined (table). For both study groups, birth weights rose significantly with increasing parity, maternal age, maternal weight, and gestational age at delivery.

To ensure that the observed difference in crude birth weights was not due to factors other than the birthplace