Chapter 2

Automatic registration of falls and other accidents among community dwelling older people: feasibility and reliability of the Telephone Inquiry System

Wijlhuizen GJ, Hopman-Rock M, Knook DL, Cammen TJM van der

Abstract

Introduction and purpose
The longitudinal registration of accidents, including falls, among people aged 65 and older is both time-consuming and expensive. For this reason, a computerised method for telephone accident registration, ‘Telephone Inquiry System (TIS)’, was developed and its feasibility (participation, successful dialogues) and reliability (distribution of accidents regarding location, falls requiring medical attention, and falls resulting in fractures) were evaluated.

Method
The TIS is an Interactive Voice Response computer system by which people are telephoned and asked about involvement in accidents and falls in a structured automatic dialogue. If people reported involvement in an accident, details about the circumstances were asked personally by telephone. It was tested in two prospective follow-up studies among community dwelling older people aged 65 and older in the Netherlands between 1994 and 2003.

Results
Of the 3,500 and 8,650 people invited to participate in the two studies, 30.1% and 24.0% did, respectively. In total, the TIS made 48,966 attempts to have an automatic dialogue with respondents, of which more than 70% were successful. Sixty percent of the accidents happened in and around the home. Twenty-five percent of the falls required medical attention and at least 3.3% resulted in a fracture.

Conclusions
The TIS appears to be a feasible and reliable method for semi-automatically registering accidents among community dwelling older people. Valid comparison of data between countries and communities is made possible because the registration is not influenced by differences in patient flows and the questions and procedures are highly standardised.
Introduction

Longitudinal registration of accidents, in particular falls, among older people has been used in many studies to identify risk factors or to evaluate interventions.\(^1\)\(^-\)\(^6\) Two methods of registration are available. First, direct telephoning, which is usually combined with the use of a fall-diary. Second, postal reports, where participants mail information about their falls on a postcard and are telephoned to remind them to do so. It is important to gather accident information frequently in order to minimize underreporting due to forgetting. However, acquiring accident information from large numbers of participants is time-consuming. Therefore, a telephone accident registration system was developed that would reduce the active involvement of the participant and minimizes administration. The system, which operates almost entirely automatically, is called the Telephone Inquiry System (TIS). The TIS is an interactive voice response computer system that telephones people and asks questions in a structured dialogue. The TIS telephones people once per month and asks them whether they have had an accident (falls, burns, collisions, etc.) in the previous month. Each month, it generates a list of people who reported an accident that required the collection of additional information (circumstances, injury) in a telephone interview.

The TIS can operate multiple independent processes in order to telephone and interview several respondents simultaneously. For the system to be operational, digitally recorded names of the participants, remarks and questions, the telephone numbers, the individually preferred days of the week and times of the day for the telephone call are stored in a database. A voice recognition unit is used to interpret the answers (‘yes’ or ‘no’). People whose answers are not recognized by the TIS after repeated trials are put through to a help-desk.

Method

The TIS was used in two follow-up studies among community-dwelling older people; the ‘Safety observed study’ (Study 1; n=1055; 15 months follow-up)\(^5\) and the ‘Safety in your own hands study’ (Study 2; n=2080; 20 months follow-up).\(^6\) Before the start of accident registration, all participants received written instructions about the TIS phone call and the accidents/falls that should be reported. These included home/leisure and traffic accidents regardless of whether or not injury was sustained. During the registration period, the system started at 10.00 hours until 20.00 hours. If participants were not at home, the TIS automatically called again the next day. When a person was contacted, a short introduction was given by a digitally recorded voice, followed by the questions given in table 1. First, the TIS identified the participant, or
the person answering the telephone was asked instead. If an accident was reported, within 3 days a computer-aided personal telephone interview was taken. If no accident was reported, the TIS called again the next month.

**Table 1**  The digitally recorded introduction and questions that were asked in the ‘Safety observed’ study by the telephone inquiry system during the dialogue with the respondents.

| Introduction | Good morning/afternoon/evening, you are speaking with the accident registration system of the Leiden ‘Safety Observed’ study. I call you every month to ask whether [name of the respondent] was involved in an accident at home, in the traffic or elsewhere. You can answer the questions with the words ‘yes’ or ‘no’ after the sound signal. I will ask you the following questions:  
| Id | Am I speaking to [name of the respondent]?
| ‘Yes’ → Acc
| ‘No’ → Wp
| Acc | Have you had an accident that did or did not result in an injury in the past month?
| ‘Yes’ → We will call you back to ask about the circumstances
| ‘No’ → We call you next month again
| Wp | Can [name of the respondent] come to the telephone within 1.5 min?
| ‘Yes’ → Would you please ask [name of respondent] to come to the telephone → Id
| ‘No’ → Ins
| Ins | Can you answer the question instead of [name of the respondent]?
| ‘Yes’ → Acc
| ‘No’ → We will call [name of respondent] again another time

**Table 2**  Indicators of feasibility and reliability of the application of the telephony inquiry system (TIS) in two follow-up studies.

<table>
<thead>
<tr>
<th>Feasibility indicators</th>
<th>Safety Observed Study⁵</th>
<th>Safety in your own hands study⁵</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of invited persons</td>
<td>3,500</td>
<td>8,650</td>
</tr>
<tr>
<td>Participation in follow-up (%)</td>
<td>30.1</td>
<td>24.0</td>
</tr>
<tr>
<td>Number of trials with TIS to contact respondents</td>
<td>15,120</td>
<td>33,846</td>
</tr>
<tr>
<td>Successful automatic dialogues with TIS (%)</td>
<td>76.9</td>
<td>72.8</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Reliability indicators</th>
<th>Safety Observed Study⁵</th>
<th>Safety in your own hands study⁵</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total number of registered accidents</td>
<td>845</td>
<td>968</td>
</tr>
<tr>
<td>Accidents in and around home (%)</td>
<td>61.0</td>
<td>60.0</td>
</tr>
<tr>
<td>Total number of falls</td>
<td>361</td>
<td>432</td>
</tr>
<tr>
<td>Falls requiring medical attention (%)</td>
<td>25.0</td>
<td>25.2</td>
</tr>
<tr>
<td>Falls resulting in fracture (%)</td>
<td>3.3</td>
<td>5.1</td>
</tr>
</tbody>
</table>
Results

The results of the follow-up studies are presented in table 2 to illustrate the feasibility and reliability of the TIS. Of the people asked to participate in the follow-up studies, 30.1% (Study I) and 24.0% (Study II) complied. In total, the TIS made 48,966 attempts to have a dialogue with respondents, and 76.9% of these dialogues were successful in Study I and 72.8% in Study II. About 20% of the calls were put through to the help desk. In about 5% no contact was made because persons were not at home at the times of the calls. In each of the studies the compliance of the participants was comparable, on average about 1% dropped out of the cohort each month; in about 30% of the drop-out the use of the TIS dialogue was mentioned as a reason. Although no systematic analysis of specific reasons was possible due to the demands of the medical ethics committee, the most often mentioned problems were: repeated recognition failure by the TIS; and persons reporting they could not hear the telephone voice properly.

In Study I, 61.0% of the 845 reported accidents happened in and around the home and in Study II, 60.0% of the 968 accidents. In Study I, 25.0% of the 361 falls reported required medical attention (hospital, general practitioner, physiotherapist, dentist) and 3.3% resulted in fractures. In Study II, 25.2% of the 432 falls reported required medical attention and 5.1% resulted in a fracture.

Discussion

The technical features of the TIS made it possible to have contact with about 95% of the participants each month. Once the specific application has been built, it can be run automatically several times at relatively low costs, although the help-desk interviewers are needed. As an indication, the current operational costs are estimated to be approximately €5000 (set-up cost) and €500 per 1000 persons per month, including telephone costs, the help desk service and accident interviews.

A structural property of the TIS is that the dialogues are fully structured and therefore identical for all participants, which minimizes interviewer bias.

Although older people may have been unwilling to ‘talk’ with a computer, the participation in both studies was comparable to that (30%) reported by Hornbrook et al. More than 72% of the 48,966 TIS telephone calls were answered successfully, indicating that respondents could cope with the system. The help-desk facility is regarded as important for the compliance of the participants, because it gave individual support and feedback to those persons who experienced a problem. Because the voice recognition technology is innovating rapidly, recognizing answers will be further improved.
The distribution of accidents in and around the home and outside the home was compatible in both studies, as was the proportion of falls requiring medical attention or resulting in fractures. The proportion of fractures was comparable to those found in community studies involving registration by personal telephoning (2.5%)\(^1\) and registration by mailing fall reports (5.1%).\(^2\) These findings indicate a fair reliability of the TIS. It is concluded that the TIS is feasible in terms of patient willingness and ability to use the system, and that enough indications exist about the reliability of the system for registering accidents and falls among community-dwelling elderly individuals. The relatively low cost of the TIS makes its further use and development viable.

**Acknowledgements**

The authors acknowledge the contribution of Aad van Keulen and his colleagues of Unicall Ltd for their contribution in the development, testing and application of the TIS.
Literature


5. Wijlhuizen GJ, Staats PGM, Radder JJ. Veiligheid in de peiling; een epidemiologisch onderzoek naar determinanten van ongevallen die in en om huis plaatsvinden bij ouderen (65 – 84) (safety observed; an epidemiological study on determinants of home accidents among persons aged 65 to 84). Leiden, TNO Prevention and Health 1996.

6. Wijlhuizen GJ, Radder JJ, Graafmans WC. Effectevaluatie grip op eigen veiligheid; resultaten van een onderzoek naar het effect van een multimethode interventie gericht op reductie van ongevallen bij ouderen (65 +) in sneek (effect evaluation safety in your own hands; results of a study on the effectiveness of a multimethod intervention aimed at reduction of accidents among persons aged 65 and older in the city of sneek). Leiden, TNO Prevention and Health 2003.