**Table 1**—*Serological results correlated (P<0.05 is significant) with questionnaire recall of illness and sick leave in 518 subjects. Values are numbers (percentages) of subjects unless stated otherwise*

| Questionnaire recall | Respondents (n = 518) | Serological result | | P value | Relative risk (seropositivity) |
|---|---|---|---|---|---|
| | | Positive (n = 120) | Negative (n = 398) | | |
| Influenza | 161 (31) | 49 (41) | 112 (28) | 0.006 | 1.53 |
| Sick leave owing to influenza | 120 (23) | 42 (35) | 78 (20) | 0.0005 | 1.91 |
| Any respiratory infection | 351 (68) | 87 (73) | 264 (66) | 0.209 | 1.25 |
| Sick leave owing to respiratory infection | 202 (39) | 58 (48) | 144 (36) | 0.019 | 1.46 |
| Doctor-diagnosis of influenza | 53 (10) | 22 (18) | 31 (8) | 0.0009 | 1.97 |

(3.5% (1.4% to 5.1%)), with both type A and type B occurring in five samples (1.0%). No significant associations were found between serological result and age, sex, occupation, or hospital site.

Table 1 shows the serological results correlated with questionnaire recall. Only 49/161 (30%) subjects recalling influenza had positive serological results, implying a high rate of self misdiagnosis. Of the 120 subjects with a seropositive result, 71 (59%) could not recall influenza and 32 (28%) could not recall any respiratory infection. Recall of sick leave owing to influenza (P = 0.0005, relative risk of seropositivity 1.91) and a doctor-diagnosis of influenza (P = 0.0009, 1.97) had the strongest associations with a positive serological result. In all, 42/518 (8%) subjects both had a seropositive result and recalled sick leave owing to influenza (median duration four days); this approximately represents the time lost from work that potentially could have been prevented by vaccination.

## Comment

We found that 23% of healthcare workers in acute hospitals had serological evidence of influenza infection during a mild epidemic season. In comparison, clinical and virological reporting of influenza-like illnesses in primary care during this period estimated a peak incidence of between 0.15-0.2%.[4] If influenza among healthcare workers is such a common event, with between 28% and 59% of cases estimated as subclinical, cross infection risk to patients seems likely and sustains the argument for controlled trials of vaccination of healthcare workers. In fact we have subsequently shown a significant reduction in mortality of elderly patients in units where healthcare workers were vaccinated.[5]

Funding : The study was funded partly from departmental funds and partly from a donation by Medeva, a manufacturer of influenza vaccine, to the West of Scotland Influenza Study Group.

Conflict of interest: None.

1 Prevention and control of influenza. Recommendations of the Advisory Committee on Immunization Practices (ACIP). *MMWR* 1994;Apr 21:44.
2 Joint Committee on Vaccination and Immunisation. *Immunisation against infectious diseases*. London: HMSO, 1992.
3 Wood JM, Gaines-Das RE, Taylor J, Chakreverty P. Comparison of influenza serological techniques by international collaborative study. *Vaccine* 1994;12:167-74.
4 Fleming DM, Chakraverty P, Sadler C, Litton P. Combined clinical and virological surveillance of influenza in winters of 1992 and 1993-4. *BMJ* 1995;311:290-1.
5 Potter J, Stott DJ, Roberts MA, Elder AG, O'Donnell B, Knight PV, *et al.* Influenza vaccination of healthcare workers in long-term care hospitals reduces the mortality of elderly patients. *J Inf Dis* (in press).

*(Accepted 16 October 1996)*

# Are British hospitals ready for the next major incident? Analysis of hospital major incident plans

Simon Carley, Kevin Mackway-Jones

Although major incidents are uncommon, they require careful planning and preparation if they are to be managed well.[1 2] In 1990 guidelines were issued for health service arrangements for major incidents.[2] These required regional health authorities to ensure that comprehensive plans were in place for all health service responses to an incident. We examined hospital major incident plans to assess the level of compliance with these guidelines.

## Methods and results

The major incident plan was requested from all 224 British hospitals with an emergency department receiving more than 30 000 patients a year. Altogether 142 (63%) were received and analysed. The number of plans complying with different aspects of current guidance are shown in table 1.

Although 119 plans used action cards, in only 65 were these comprehensive enough to include all staff likely to be involved in the response to a major incident. In only 106 were cards for the hospital coordination team (senior nurse, senior manager, and senior doctor) available. Overall only six (4%) plans complied fully with health service guidelines.

## Comment

Clear directions were given in 1990 for the formulation of hospital major incident plans,[2] but these findings, six years later, show that few plans conform to the guidance given. Action cards act as aides-mémoire and are essential to inform staff rapidly of their duties during a major incident. Although many hospitals used action cards, most had too few to instruct all staff. Concern at alerting procedures has been expressed following many major incidents in Britain.[1 3 4] The ambulance service will usually notify hospitals of a major incident using a specified form of words,[2] designed to avoid confusion between agencies. Yet the correct form of words was specified in fewer than half the plans analysed.

Many people may arrive at a hospital during a major incident. Plans were generally in place for the management of the press, relatives, and volunteers, but few arranged for the management of visits from people such as politicians or royalty; these may be disruptive to a receiving hospital in the days after an incident and should be planned for.[2]

As well as the actions specified in the official guidance plans also need to pay attention to practical matters such as the management of traffic flow, staff children, staff reporting areas, and ambulance communications. Few plans covered these subjects.

Major incidents require good interservice liaison.[1] This is provided through police and ambulance officers despatched to the receiving hospital. Although most plans cater for the police, few plans made arrangements for the ambulance liaison officer (who may be the only means by which the hospital can communicate with the scene).

Insufficient training and preparation have repeatedly been cited as problems in the preparation for major

**Department of Emergency Medicine, Manchester Royal Infirmary, Manchester M13 9WL**
Simon Carley, *Royal College of Surgeons of England Hillsborough research fellow*
Kevin Mackway-Jones, *consultant*

Correspondence to:
Dr Carley.

*BMJ* 1996;313:1242–3

**Table 1**—*Number of emergency plans that contained specified elements of planning*

| Arrangements specified in guidance | No of plans (%) |
|---|---|
| Action cards | 119 (84) |
| Standard alerting messages | 67 (47) |
| Handling relatives | 123 (87) |
| Handling press | 132 (93) |
| Liaising with police | 126 (89) |
| Handling volunteers | 105 (74) |
| Handling important visitors | 35 (25) |
| Audit of plan | 58 (41) |
| Training requirements | 35 (25) |
| Managing injured children | 44 (31) |
| All guidance | 6 (4) |

incidents,[5] yet few plans specified plans for audit or the training of staff. Few plans specified procedures for the management of children, and when they were included they typically consisted of the use of a paediatrician to help in the triage and treatment of paediatric casualties. This is unlikely to be adequate in an incident resulting in large numbers of injured children.

Health service guidelines state that plans should be reviewed at regional level. The small number of plans conforming with current guidance shows that this review procedure is not effective. Most hospital major incident plans need revision, and methods of reviewing plans should be strengthened in the light of these results.

Funding: SC's fellowship is funded by the Hillsborough Fund.

Conflict of interest: None.

1 New B. *Too many cooks?* London: King's Fund Institute, 1992.
2 NHS Management Executive. *Emergency planning in the NHS: health services arrangements for dealing with major incidents.* London: NHSME, 1990 (HC(90)25).
3 Hidden A. *Investigation into the Clapham Junction railway accident.* London: HMSO, 1989.
4 Malone WD. Lessons to be learned from the major disaster following the civil airliner crash at Kegworth in January 1989. *Injury* 1990;21:49-52.
5 Nancekievill DG. On site medical services at major incidents. *BMJ* 1992;305:721-7.

*(Accepted 26 September 1996)*

# Blood pressure and mortality in healthy old people: the r shaped curve

John M Starr, Susan Inch, Susan Cross, Ian J Deary, William J MacLennan

In middle age mortality rises exponentially with increased blood pressure. In advanced age, however, people with the highest systolic pressures are less likely to die than those with lower pressures.[1] This paradox is usually attributed to the association of diseases, such as cancer and cardiac failure, with low blood pressure. We sought to reduce the confounding effect of disease by prospectively examining blood pressure and mortality in healthy old people.

**Departments of Geriatric Medicine and Psychology, University of Edinburgh, Edinburgh EH4 2DN**
John M Starr, *senior lecturer in geriatric medicine*
Susan Inch, *research nurse*
Susan Cross, *research nurse*
Ian J Deary, *professor of psychology*
William J MacLennan, *professor of geriatric medicine*

Correspondence to:
Dr J M Starr, Royal Victoria Hospital, Edinburgh EH4 2DN

*BMJ* 1996;313:1243–4

## Subjects, methods, and results

We screened general practice casenotes of 10 000 patients aged over 69 years to identify healthy subjects for a study of the effects of hypertension on cognition.[2] We visited 1467 subjects at home and asked about health problems and medications. Six hundred and three subjects (237 men, 366 women), mean age 75.7 years (range 70-88 years), reported no health problems and were taking no regular medication. We asked about educational attainment and occupation and at the end of the 20 minute interview measured blood pressure in a sitting position with a standard sphygmomanometer. Mean systolic blood pressure was 160 mm Hg (range 100-220 mm Hg) and mean diastolic blood pressure 86 mm Hg (range 50-120 mm Hg).

Four years later we determined the outcome in all 603 subjects by revisiting general practitioners' surgeries and tracing those cases not found via the local primary care division. Sixty nine subjects (40 men, 29 women) were identified as having died, and we found death certificates for 67. Logistic regression revealed male gender (odds ratio 1.61, 95% confidence interval 1.23 to 2.12 ) and older age (odds ratio 1.17, 1.10 to 1.25, per year) as the only factors associated with increased mortality. Systolic blood pressure as a continuous variable improved the model only marginally (P = 0.051, positive relation). Diastolic pressure, education, and occupation had no effects. To investigate the possibility of a non-linear relation between blood pressure and mortality, we stratified systolic pressure into three groups close to the 33rd and 67th centiles: low (<150 mm Hg, n = 192), medium (150-169 mm Hg, n = 182), and high (≥170 mm Hg, n = 229). Entering these blood pressure groups significantly improved the age-sex mortality model ($\chi^2$ = 6.68 with 2 df, P = 0.04), with low systolic blood pressure associated with a lower risk (odds ratio 0.59, 0.38 to 0.92) and medium systolic blood pressure a higher risk (1.47, 1.01-2.15) than high systolic blood pressure. Table 1 shows the crude mortality for each group. The excess deaths in the medium and high groups were mostly due to cardiovascular and cerebrovascular disease.

**Table 1**—*Crude four year mortality rates not adjusted for age or sex by systolic blood pressure group for 603 healthy old people. Expected deaths per group adjusted for age and sex but not blood pressure*

| Systolic blood pressure | No of subjects screened (% total) | No of deaths (% total, % of blood pressure group) | Expected deaths (% total) |
|---|---|---|---|
| Low (<150 mm Hg) | 192 (32) | 13 (19, 7) | 20.5 (30) |
| Medium (150-169 mm Hg) | 182 (30) | 27 (39, 15) | 21.2 (31) |
| High (≥170 mm Hg) | 229 (38) | 29 (42, 13) | 27.3 (40) |
| Total | 603 (100) | 69 (100, 11) | 69 (100) |

## Comment

We found that healthy old people with casual systolic readings below 150 mm Hg have a better survival than those with higher pressures. Only 17 subjects (2.8%) had systolic readings below 120 mm Hg, suggesting that subjects with serious disease had been excluded from the group. Mortality was 5% in subjects with readings below 140 mm Hg, 8% in those with pressures of 140-149 mm Hg, rising to 16% in those with pressures of 150-159 mm Hg and 14% in those with pressures of 160-169 mm Hg. Although regression to the mean will affect high and low casual readings, the medium readings are probably close to prevalent pressure. The group with high blood pressure may fare better than the medium group because they are more likely to be treated.[3] We identified 30 subjects started on antihypertensive medication where blood pressure at initiation had been noted by the general practitioner. Median starting pressure was 200 mm Hg: only one person with