The Association between Visual Impairment and Mortality in Elderly People

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Summary

By linking together the results from two surveys of elderly people in an English community it has been possible to consider visual impairment as a possible risk factor for mortality in people aged 75 years and over. Although minor degrees of visual impairment are associated with an increased mortality rate, blind people survive better than those with less serious visual impairments. Associations are considered between visual impairment and other known risk factors for mortality in the elderly. Visual impairment is shown to be associated with degree of social contact, whether a person lives alone, dementia score, physical activity score and number of unmet needs.

Introduction

The factors associated with survival in the elderly are not necessarily the same as those that are associated with the survival of the population as a whole. Studies of mortality in the elderly [1–7] have identified numerous risk factors, most of which are highly interdependent. These identified risk factors appear to be associated with mortality by a combination of four routes; either they measure intrinsic ageing processes, are related to particular physical diseases or psychological states, or they are related to social factors such as isolation and difficulties with self-care. Whatever the mechanism by which they reflect a person's survival chances, easily measured risk factors should play an important role in the screening of the elderly and the planning of services for preventive care.

Using the results from an approximately 5-year follow-up of a study of vision and eye disease amongst the elderly in an English community, the plausible use of vision as a predictor of survival is investigated. Associations between visual impairment and other acknowledged risk factors for survival in the elderly are then considered.

Methods

A regularly updated age–sex register is in operation in Melton Mowbray in Leicestershire. The task of ensuring the completeness of the register has been simplified greatly by the fact that the whole town is served by a single 12-doctor general practice. The register contains some 32 000 names and has proved a useful sampling frame for a number of surveys.

In 1981 a study was undertaken of all those people who were aged 75 years or over on 31 December 1980 [8]. The survey looked at such factors as general health, social isolation and the provision of services. Subsequently, the same sample formed the basis of a second survey, this time of eye disease in the elderly [9]. This second survey involved detailed eye examinations of a random sample of 469 of those in the original list who survived into 1982.

By combining the information from these two surveys and from a subsequent 5-year follow-up, a database has been formed containing information on general health, social factors, eye disease and survival. This information has been used to investigate the association between visual impairment and sur-

vival in the elderly by using a regression analysis based on the Cox model [10].

For the purposes of this study, vision was defined as the corrected visual acuity of the subject's better eye. The visual acuities were measured using Snellen charts at 6 m and then grouped into five categories:

(1) 6/6 or better,
(2) 6/7.5 to 6/9,
(3) 6/12 to 6/18,
(4) 6/24 to 6/60,
(5) worse than 6/60.

It is not possible to make an exact correspondence between these categories and the registration of the blind, because the blind register takes account of both visual acuity and reductions in visual fields. However, all people in category 5 would be eligible for blind registration, and inclusion in category 4 approximates to eligibility for partial-sight registration.

Measurements of a number of previously acknowledged risk factors for mortality [11] were taken from the original survey and compared with the grouped visual acuities. These risk factors were: living alone, an incontinence scale, a physical-activity scale, dementia, and unmet need. We also considered the protective effect of good social contact. Social contact was measured on a scale suggested by Tunstall [12] with a high level of social contact being defined as a score of 40 contacts per week or more. The physical-activity scale was constructed from mobility about the home, getting to and from the toilet, getting out of a chair, getting in and out of bed, and dressing. The derivation of the scales for physical activity and incontinence have been described elsewhere [13]. Dementia was measured by the Information sub-test of recognition devised by Pattie and Gilleard [14]. Unmet need was measured by assessing whether the elderly person needed extra help in any of 19 areas. These areas included help with housework, help with dressing and chiropody. The recorded score was the total number of unmet needs.

Table I. Five-year survival against vision in the better eye (see text for group definitions)

Vision group	Number	Survived (%)	Died (%)	Moved (%)
1	84	79	15	6
2	208	71	27	2
3	96	68	29	3
4	44	64	27	9
5	37	92	5	3

Table II. Relative risk (RR) of death for each vision group adjusted for age and sex (see text for vision-group definitions)

Vision group	RR	95% Confidence interval
Using Group 1 as the base:		
1	1.00	
2	1.62	(0.87, 3.01)
3	1.83	(0.93, 3.63)
4	1.72	(0.77, 3.84)
5	0.35	(0.08, 1.57)
Using group 5 as the base:		
1	2.83	(0.83, 12.5)
2	4.58	(1.11, 18.8)
3	5.18	(1.22, 21.9)
4	4.86	(1.08, 21.9)
5	1.00	
Comparing combined groups:		
1 & 5	1.00	
2, 3 & 4	2.10	(1.19, 3.68)

Results

Table I shows the pattern of unadjusted survival for the five categories of vision. If these results are adjusted for age and sex, the effect of vision on survival remains significant ($p = 0.02$) and, as Table II shows, the group with worst vision still shows the best survival. No significant difference was found between group 1 with the best vision and group 5 with the worst vision, or between the three intermediate categories. However, groups 1 and 5 together are significantly different from the other groups ($p = 0.02$).

There are many interrelated reasons which might explain the good survival of the group with worst vision. A number of factors that are suspected of being linked with mortality show a similar pattern to mortality when looked at together with vision. Here we consider six such factors; living alone, incontinence, social isolation, dementia, physical activity and unmet

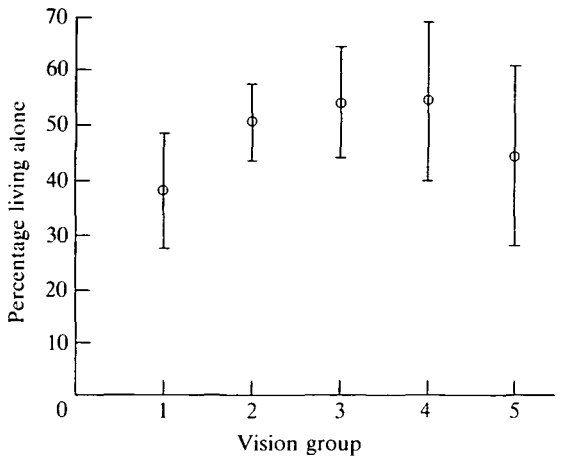

Fig. 1. The percentage of people in each vision group who were living alone, together with 95% confidence limits.

need. For these six acknowledged risk factors only incontinence showed no relationship with visual impairment ($p = 0.66$). Graphs showing the values of the other risk factors for each visual acuity group are presented as Figs 1 to 5.

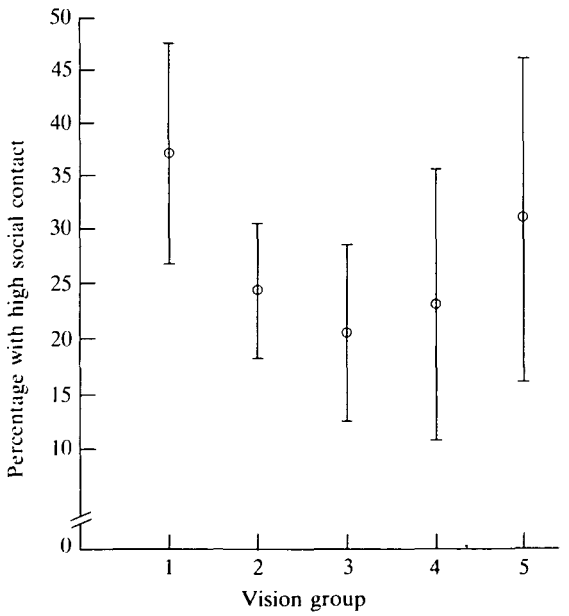

Fig. 2. The percentage of people in each vision group who had high levels of social contact, together with 95% confidence limits.

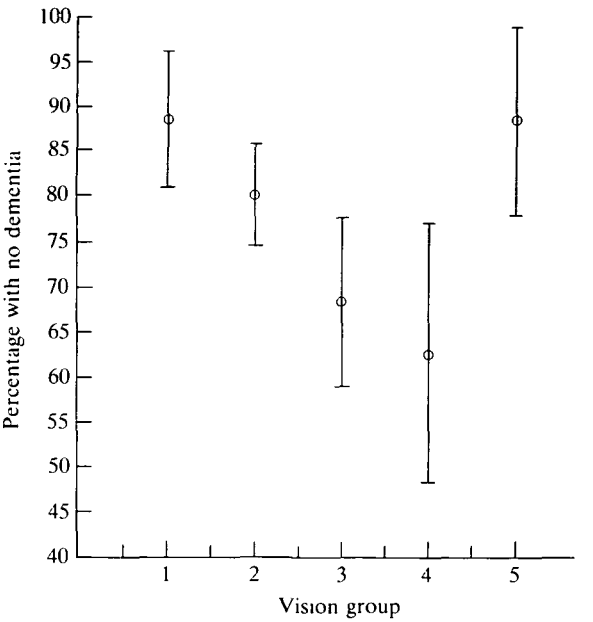

Fig. 3. The percentage of people in each vision group who obtained full marks in the dementia test, together with 95% confidence limits.

All of these factors showed a significant association with the grouped visual acuities ($p < 0.05$).

When linking together the results of two separate surveys of the same community, it is

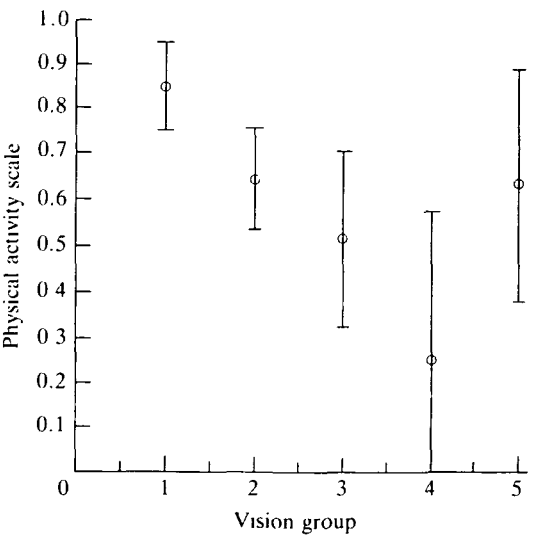

Fig. 4. The average physical activity score for people in each group, together with 95% confidence limits.

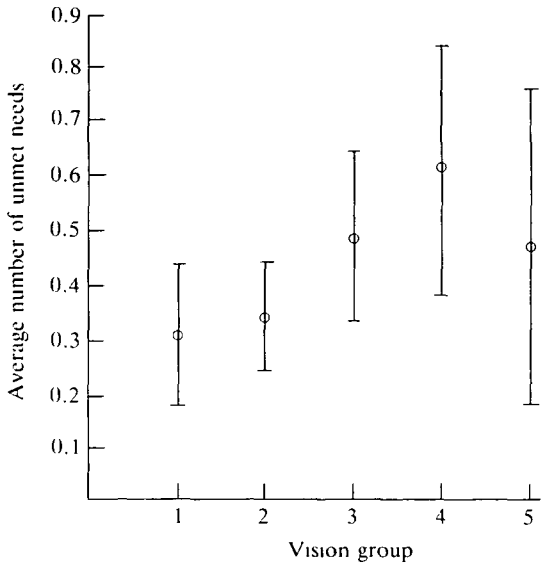

Fig. 5. The average number of unmet needs for people in each vision group, together with 95% confidence limits.

important to ensure that the samples used were not biased. Selection bias and non-response would have a major impact on the results. Two checks for bias were made in this study.

In the original survey the elderly had been asked to assess their own vision problems as none, moderate or severe. Although subjective, this measure does give some indication as to whether the selection for the subsequent eye survey was biased. Testing for a difference in the person's self-assessment of vision problems, between those selected and those not selected, produces a non-significant result ($p = 0.65$).

The eye survey involved a long and detailed examination of each subject and the entire study took nearly two years to complete. During this time a number of potential subjects died or moved from the district and therefore those included in the eye survey tend to show better survival than those who were omitted. However, there is no evidence to suggest any association between survival, inclusion in the eye survey and the subjective assessment of eye problems ($p = 0.83$).

Discussion

The tests that related the assessments of vision of the two surveys showed that selection bias was not a problem for this study, and therefore Tables I and II give a true reflection of the association between survival and visual impairment. The most notable aspect of these results is the good survival observed in vision category 5, those with the poorest vision. This group showed similar survival to those with unimpaired vision. People in the intermediate categories survived less well.

Fig. 1 shows that living alone is related to visual impairment in much the same way as survival and shows that a blind person is more likely to live with a sighted friend or relative than is a less seriously visually-impaired person. Living alone is closely related to social isolation, a factor that was linked by Blazer [5] to elderly persons' survival. As Fig. 2 shows, those with the worst vision have, on average, more social contact than those with a less serious visual impairment.

Maule *et al.* [15] found an association between chronic brain syndrome and poor vision, and dementia has been shown to be associated with survival [3, 11]. As Fig. 3 illustrates, dementia is also associated with vision. The plot gives the percentage of people obtaining full marks on the dementia test. In this test the elderly blind and those with 6/6 vision performed equally well. Perhaps more surprisingly, the blind also show comparatively high physical activity scores (Fig. 4).

Unmet need, as illustrated by Fig. 5, is less in the blind than it is in those with less serious visual impairments. This reflects their better contacts, both socially and with local agencies.

If the blind are treated as an exception, then a decrease in vision results in a general worsening of survival chances and correlates well with the known risk factors, isolation, dementia, physical activity and unmet need. When assessing risk, those who are blind or nearly so need to be treated as a separate group. They are generally less isolated, better cared for and in a better mental state than those with less serious visual impairment.

Chamberlain [16] found that the use of Snellen charts together with a reading test only had a 75% sensitivity when compared with an ophthalmologist's assessment of visual impairment. The specificity of 70% was also fairly low. Despite these disappointing findings, Snellen charts have considerable advantages.

They are objective, easy and quick to use, and they require a minimum of training for the interviewer. What is more, the results presented here show that visual acuities measured with Snellen charts correlate with survival and are thus suitable for inclusion in any battery of tests given to identify high-risk elderly people.

Visual impairment has two potential uses in screening. It might be used to identify geographical regions that require extra resources for the care of the elderly, or it might be used to identify individuals who require extra care. These two aspects will be considered in turn.

When looking for geographical areas that require extra provision, comparisons are often made on the basis of readily available data, such as the percentage of the elderly who live alone. These data are usually taken from national sources such as the Census or General Household Survey.

It might appear that the size of the blind register would also be a suitable measurement with which to compare geographical areas. However, our results show that the blind survive well and are already generally well cared for. Thus the blind register will not measure the size of the high-risk elderly population in any area. A more suitable measure would be the true size of the population eligible for partial-sight registration. Unfortunately, partial sight is notoriously under-registered [17, 18], and the partial-sight register shows large regional differences [19]. Gibson *et al.* [20] found that in this particular population the sensitivity of the partial-sight register was only 50% and that the register underestimated the prevalence of partial sight by a factor of 1.5. As a consequence the sizes of the blind and partial-sight registers are not suitable measures for use in this type of service planning.

Considering next the screening of high-risk individuals, the results of this study show that visual impairment is an indicator of survival but that the visual acuities need to be interpreted with care. Greater visual impairment is linked to worse survival chances only so long as the person is not blind. People with virtually no vision need to be considered separately.

Visual impairment might be associated with survival through any, or all, of the four routes described earlier. It may act as a social factor by inhibiting elderly people's ability to care for themselves. It may act as a marker for an underlying disease, as for example in the way that retinal vascular disease is associated with hypertension [21]. There may be a psychological effect on the elderly person due to an association between visual impairment and loss of independence, or it may be that any visual impairment is a result of intrinsic (genetically determined) ageing.

The main effects of ageing on the eye [22–24] are that the lens becomes more opaque and loses some of its power to focus, and the macula may lose some of its ability to resolve fine detail. It has been estimated that the retina of an elderly eye may receive only one-third of the light that it received when young [22]. It is possible that the degree of ageing of the eye will reflect the degree of ageing of the body as a whole and hence that visual impairment will reflect general health and biological as opposed to chronological age.

It is likely, as Brauer *et al.* [3] have suggested in relation to other risk factors, that the association between vision and survival is mainly not causal. Instead both factors reflect the general health of the individual. The small causal component will result from such factors as falls, reduced exercise levels and difficulty preparing food, and although this component in the association is smaller it will be susceptible to intervention.

The good survival found in the blind is quite consistent with a non-causal relationship between visual impairment and survival. It arises because blindness is associated with non-fatal diseases, whereas smaller degrees of visual impairment reflect a general deterioration in health. The results show that the elderly blind are generally better cared for by society than those with a less serious visual impairment, but this is not necessarily responsible for their improved survival.

The World Health Organization [25] recently called for the evaluation of screening programmes for the elderly. In such evaluations it is important not to place too much emphasis on survival as a measure of outcome. Although objective, easy to measure and to some extent predictable, survival is unlikely to be improved significantly by intervention. Benefit is more likely to be shown in quality of life.

When elderly people are identified as having

visual impairment, it may be impossible to restore their vision and it may be impossible to improve their survival chances. However, an elderly person who is visually impaired is likely to be suffering from other social disadvantages and these at least may be tackled so as to improve their quality of life.

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