glucose lowering in type 2 diabetes. N Engl J Med 2008; 358: 2545–59.
27. Bathum L, Christiansen L, Jeune B, Vaupel J, McGue M, Christensen K. Apolipoprotein e genotypes: relationship to cognitive functioning, cognitive decline, and survival in nonagenarians. J Am Geriatr Soc 2006; 54: 654–8.
28. Bergman A, Atzmon G, Ye K, MacCarthy T, Barzilai N. Buffering mechanisms in aging: a systems approach toward uncovering the genetic component of aging. PLoS Comput Biol 2007; 3: e170.
29. Silverman JM, Smith CJ, Marin DB *et al*. Identifying families with likely genetic protective factors against Alzheimer disease. Am J Hum Genet 1999; 64: 832–8.
30. Silverman JM, Schnaider-Beeri M, Grossman HT, Schmeidler J, Wang JY, Lally RC. A phenotype for genetic studies of successful cognitive aging. Am J Med Genet B Neuropsyciatr Genet 2008; 147B: 167–73.

doi: 10.1093/ageing/afr124
Published electronically 18 September 2011

Feasibility of repeated use of the Health Risk Appraisal for Older people system as a health promotion tool in community-dwelling older people: retrospective cohort study 2001–05

SIR—Promotion of health and prevention of disability in later life continue to be major health policy priorities in England [1, 2]. A system of NHS self-completion on-line 'Life Checks' has been developed [3] which could potentially contribute to health gain in those who use it [4]. However, a web-based health assessment tool may not be the most effective way to reach the older population; an alternative method would be to use general practitioners' lists.

The Health Risk Appraisal for Older people (HRA-O) system is the most extensively evaluated approach for promoting health and well-being in later life. A self-completion, multidimensional postal questionnaire collects information on health, functional status, health behaviours, preventive care and psychosocial factors. Based on a computer expert system's analysis of questionnaire responses, it profiles individuals' health and lifestyle and gives tailored advice in the form of a printed report on maximising health, lifestyle changes and preventive care and suggests useful local sources of help.

The acceptability and feasibility of the HRA-O in British primary care has been reported [5] but its performance when used repeatedly by a cohort of older people has yet to be studied. Using data from the London arm of a European Union funded RCT (Pro-Age) [6] and an English Department of Health funded follow-up study (SWISH) [7, 8], this paper explores the feasibility of repeated HRA-O use by reporting response rates to HRA-O use on three occasions over 4 years and by describing characteristics of non-responders within this retrospective cohort of older people.

Methods

Three general practices in London were recruited and randomised to a multi-centre, multi-national RCT investigating the effect of the HRA-O on health behaviours and status [9]. A full account of the trial methodology is available elsewhere [10].

General practitioners identified their eligible patients aged 65 and over who were living at home, without (i) evidence of need for human assistance in basic activities of daily living, (ii) high dependency due to major physical or psychiatric illness, or cognitive impairment or (iii) a terminal illness, and with a sufficient level of English to complete the questionnaires. HRAO questionnaires were posted at baseline (2001) and 1-year follow-up (2002). Full details of the trial outcomes are available in an earlier publication in this journal [6]. The SWISH study allowed us to follow-up this population and invite them to complete the HRA-O again in 2005.

At each data collection point questionnaires were posted with a study information sheet and covering letter from the patient's GP. All participants received personalised feedback on each completion of the HRA-O. Eligibility was checked prior to each contact to ensure that paperwork was not sent to people who had moved, died or developed severe mental illness, or who were receiving palliative care. Reasons for exclusion were recorded.

One of the three original practices discontinued involvement in 2005. Therefore this secondary analysis focuses on the sub-sample of patients from the two general practices who received the HRA-O questionnaire on three occasions over 4 years.

Independent variables were socio-demographic (age, gender, income, education), health risk behaviours and lack of preventive care uptake as collected in the HRA-O. The full list of independent variables is available as Supplementary data in *Age and Ageing* online, Appendix 1.

Binary logistic regression analyses were used to calculate unadjusted and adjusted odds ratios and 95% confidence intervals for non-response in 2002 and 2005.

Two binary logistic regression models were constructed: first including all significant associations from the bivariate analyses at both $P < 0.01$ and $P < 0.05$ levels (plus age and gender) and second including only those significant at the $P < 0.01$ level. Significant variables were entered in a single step, to determine variables that remained independently associated with non-response.

Results

Baseline characteristics of participants in the trial have been reported in earlier publications [10]. In 2001, 812 older

people were posted the HRA-O questionnaire. Initial response rates were very high (n = 716, 88.2%) and remained high 1 year later in 2002, when all 716 respondents from 2001 were sent the HRA-O questionnaire again, and 582 completed it (81.3%). Before the third mailing in 2005 an eligibility check of the 582 responders excluded 141 (24.2%) (see Figure 1). Response rates in 2005 from the remaining 441 participants fell to 65.1% (n = 287).

Table 1 reports the characteristics of non-responders at the second (2002) and third (2005) mailings of the questionnaire, as well as age and gender, using unadjusted and adjusted odds ratios.

In 2002, non-responders were significantly ($P < 0.01$) more likely to be dependent on state pension alone (i.e. were less well off), more likely to have been using tobacco in 2001 and significantly less likely to have had a dental check in the 12 months preceding 2001. Low uptake of dental care is likely to be linked to being on a lower income. No additional variables were significant at $P < 0.05$ level.

After adjusting for age, gender and the above three significant associations, tobacco use and income remained independently associated with non-response. Non-responders were 2.18 times more likely to be tobacco users and 1.72 times more likely to be dependent on state pension alone.

Non-response to the third mailing of the HRA-O was significantly associated with being less well off financially and less educated. In terms of health risk behaviour, those that were at risk of depression, rated their health as fair or poor, reported low levels of physical activity and had low levels of fruit and fibre in their diet in 2002 were less likely to respond. Non-responders in 2005 were also less likely to have had a dental check or flu vaccination in the 12 months before the 2002 HRA-O completion.

Regression models, using first the variables significant at both $P < 0.05$ and $P < 0.01$ and then those significant just at the $P < 0.01$ level (as well as age and gender), identified the same variables independently associated with non-response. Non-responders were 1.99 times as likely to be less well off financially, 2.49 times likely to be at risk of depression, 1.80 times likely to report low physical activity and 1.82 times likely not to have had a dental check in the last 12 months.

Discussion

The best approach to health promotion for older people is still widely debated [11], particularly following the negative findings of the large MRC trial. Our study, using a postal self-completion HRA-O system showed that the HRA-O is feasible (in terms of response rates) in a heterogeneous older population with sequential use over 4 years.

The MRC trial reported response rates of 83.5% from single-use of a postal screening questionnaire in the older population [12]. The use of an accompanying covering letter from the GP, stamped address return envelope and association with a university are factors identified in a systematic review on increasing response rates to postal questionnaires and were used in this study [13].

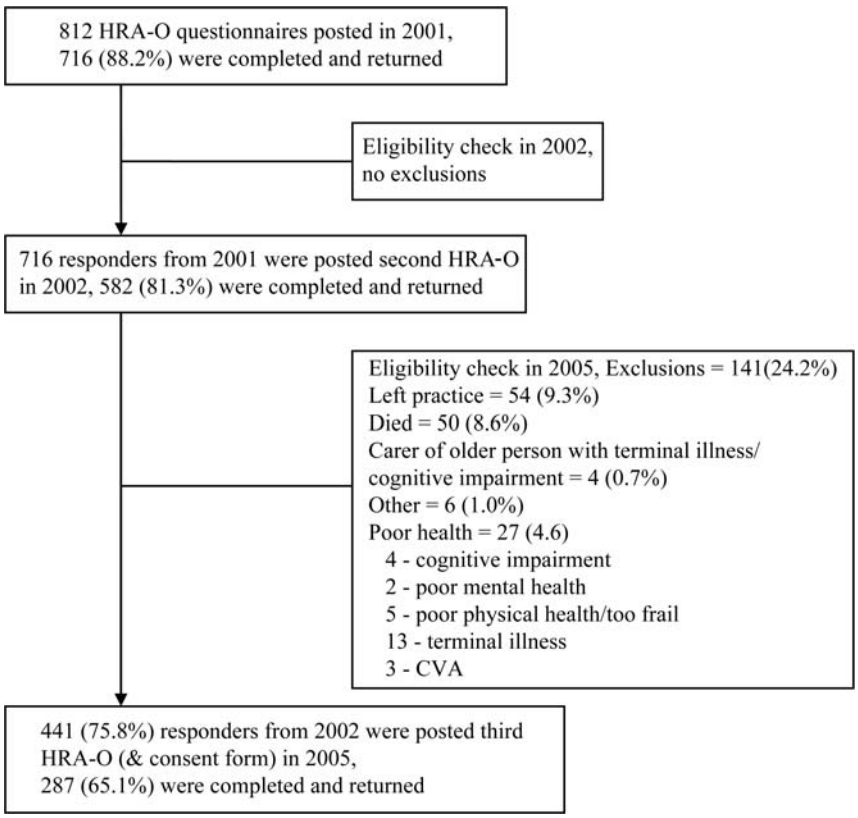

Figure 1. Attrition in responders to HRA-O over time—known causes.

Table 1. Characteristics of non-responders to the HRA-O on second (2002) and third (2005) mailings

	2002		2005	
	Unadjusted odds ratios (95% CI)	Adjusted odds ratios (95% CI)	Unadjusted odds ratios (95% CI)	Adjusted odds ratios (95% CI)
Male	0.82 (0.56–0.19)		0.94 (0.63–1.39)	
Aged 75 and over	0.81 (0.55–1.18)		1.19 (0.80–1.77)	
Receives only state pension	1.77 (1.20–2.60)**	1.72 (1.13–2.62)*	1.91 (1.26–2.89)**	1.99 (1.26–3.14)*
Basic education only			1.64 (1.09–2.46)*	
At risk of depression			2.19 (1.26–3.66)**	2.49 (1.33–4.64)*
Fair or poor self-rated health			2.00 (1.20–3.35)**	
Current tobacco use	2.32 (1.39–3.87)**	2.18 (1.27–3.74)*		
Low physical activity			2.13 (1.32–3.42)**	1.80 (1.07–3.02)*
Low fruit/fibre consumption			1.54 (1.00–2.35)*	
No dental check up in last 12 months	1.72 (1.15–2.56)**		1.87 (1.20–2.93)**	1.82 (1.12–2.96)*
No flu vaccine in last 12 months			1.70 (1.01–2.88)*	

*$P < 0.05$
**$P < 0.01$

Older people who did not engage with HRA-O questionnaire completion after 1 year were more likely to be on a lower income and use tobacco. After 4 years non-response was associated with low income, fair/poor self-rated health, depression risk, low physical activity, low fruit/fibre consumption and no flu vaccination or dental check. The negative impact of another socio-demographic factor, low educational level, on oral health-related quality of life has also been reported [14]. It is, however, important to note the lack of association with non-response at 4-year follow-up of age, gender, functional ability, pain, co-morbidity, memory, falls, lifestyle factors (tobacco and alcohol use) and preventive care uptake (blood pressure measurement and eyesight check).

Engagement with the repeated use of a health promotion system which gives personalised feedback may be affected by the content of the feedback. Those encouraged to make further changes to health behaviour and lifestyles may be deterred from further participation, whereas those praised for healthier lifestyles may be more likely to respond.

Although the characteristics of those less likely to respond over time make the HRA-O system unsuitable for reducing inequalities, non-response is itself potentially a useful marker for an emerging at-risk group. The system elicits responses from an active and potentially socially important section of the older population upon whom others may depend. Older people provide over a third of the so-called 'informal care' of ill and disabled people, are a major source of childcare for the increasing number of working mothers, and are the backbone of the voluntary sector [15]. Preventive care interventions aimed at this group may be particularly valuable.

Those who completed the HRA-O questionnaire were participating in a trial, not responding to a component of routine medical care, so their responses may differ from those of a population invited to take part in a health promotion programme. The practices involved were in suburban London, and this study population may not be representative of older populations elsewhere.

To maximise engagement and further explore the feasibility of using the HRA-O system as a health promotion tool for the older population, further work is required to test the impact of HRA-O when embedded within an intervention programme designed to support repetitive assessments. This would allow comparison between consumer-driven approaches to health promotion like 'Life Checks' and approaches made through primary care.

Key points

- Multi-component interventions targeting several health behaviours can improve general health perception and self-efficacy in old age.
- HRA-O is the most extensively evaluated approach for promoting health and well-being in later life, but little is known about the impact of its repeated use.
- Repeated use of the postal, self-completion HRA-O questionnaire is feasible in a heterogeneous older population, with response rates remaining high with sequential use over 4 years.
- Although characteristics of those less likely to respond repeatedly over time make the HRA-O tool unsuitable for reducing inequalities, an economically active and socially important section of the older population upon whom others may depend can be profiled, with a view to targeting health promotion interventions.

Acknowledgements

We thank the practices who took part in the two studies, members of the older people's and lay advisory group, and all the older people who completed the HRA-O questionnaire.

Conflicts of interest

None declared.

Ethical approval

Ethical approval for the Pro-Age study was sought from Brent Medical Ethics Committee and King's College Hospital Research Ethics Committee, and for the SWISH study from Guy's Hospital Research Ethics Committee.

Funding

European Commission project QLK6-CT-1999–02205 (the Pro-Age study) and the English Department of Health Modernising Adult Social Care programme (the SWISH study).

Supplementary data

Supplementary data mentioned in the text is available to subscribers in *Age and Ageing* online.

Kalpa Kharicha[1,*], Steve Iliffe[1], Danielle Harari[2], Cameron G. Swift[3], Claire Goodman[4], Jill Manthorpe[5], Gerhard Gillmann[6], Andreas E. Stuck[7]

[1]*Research Department of Primary Care and Population Health, UCL, London, UK*
Tel: +44 (0)20 7830 2392; Fax: +44 (0)20 7794 1224.
Email: k.kharicha@ucl.ac.uk

[2]*Department of Ageing and Health, Guy's and St Thomas' NHS Foundation Trust, London, UK*

[3]*Department of Health Care of the Elderly, King's College London, London, UK*

[4]*Centre for Research in Primary and Community Care, University of Hertfordshire, Hatfield, UK*

[5]*Social Care Workforce Research Unit, King's College London, 150 Stamford Street, London SE1 9NN, UK*

[6]*Swiss Federal Office of Statistics, Neuchâtel, Switzerland*

[7]*Division of Geriatrics, Department of General Internal Medicine, Inselspital and University of Bern, Bern, Switzerland*

[*]*To whom correspondence should be addressed*

References

1. Department of Health. The National Service Framework for Older People. London: The Stationery Office, 2001.
2. Department of Health. Equity and Excellence: Liberating the NHS, Cm 7881. London: The Stationary Office, 2010.
3. www.midlifecheck.co.uk (accessed 28 July 2010).
4. Gill TM, Williams CS, Richardson ED, Tinetti ME. Impairments in physical performance and cognitive status as predisposing factors for functional dependence among nondisabled older persons. J Gerontol A Biol Sci Med 1996; 51: M283–8.
5. Iliffe S, Kharicha K, Harari D, Swift C, Stuck A. Health risk appraisal for older people in general practice using an expert system: a pilot study. Health Soc Care Community 2005; 13: 21–9.
6. Harari D, Iliffe S, Kharicha K *et al* Promotion of health in older people: a randomised controlled trial of health risk appraisal in British general practice. Age Ageing 2008; 37: 565–71.
7. Iliffe S, Kharicha K, Harari D, Swift C, Goodman C, Manthorpe J. User involvement in the development of a health promotion technology for older people: findings from the SWISH project. Health Soc Care Community 2009; August 25 [Epub ahead of print].
8. Manthorpe J, Kharicha K, Goodman C, Harari D, Swift C, Iliffe S. Smarter working in social and health care: professional perspectives on a new technology for risk appraisal with older people. Br J Social Work 2010; 40: 1829–46.
9. Stuck AE, Elkuch P, Dapp U, Anders J, Iliffe S, Swift C. for the Pro-Age pilot study group. Feasibility and yield of a self-administered questionnaire for health risk appraisal in older people in three European countries. Age Ageing 2002; 31: 463–7.
10. Stuck AE, Kharicha K, Dapp U *et al* The PRO-AGE study: an international randomized controlled study of health risk appraisal for older persons based in general practice [ISRCTN28458424]. BMC Med Res Methodol 2007; 7: 2.
11. Stuck AE, Egger M, Beck JC. Preventing disability in elderly people. Lancet 2004; 364: 1641–2.
12. Smeeth L, Fletcher AE, Stirling S *et al* Randomised comparison of three methods of administering a screening questionnaire to elderly people: findings from the MRC trial of the assessment and management of older people in the community. BMJ 2001; 323: 1403–7.
13. Edwards P, Roberts A, Clarke M *et al* Increasing response rates to postal questionnaire: systematic review. BMJ 2002; 324: 1183.
14. Tsakos G, Sheiham A, Iliffe S *et al* The impact of educational level on oral health-related quality of life in older people in London. Eur J Oral Sci 2009; 117: 286–92.
15. Audit Commission. Don't Stop Me Now: Preparing for An Ageing Population, London; Audit Commission, 2008.

doi: 10.1093/ageing/afr126
Published electronically 6 October 2011