# Assessment of a screening process to detect patients aged 60 years and over at high risk of hypothyroidism

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*SUMMARY. General practitioners are increasingly expected to screen elderly patients for common disorders, such as hypothyroidism, and the identification of at-risk patients by simple means would reduce the financial and other costs of such screening. A general practice based study of 1193 patients aged 60 years and over has been carried out to investigate the usefulness of the following factors in identifying those in whom biochemical testing for hypothyroidism would be indicated: personal history or family history of thyroid disease, symptoms of thyroid disease and body mass index. Of the 190 patients with either a personal or family history of thyroid disease, 28 (14.7%) had an elevated concentration of thyroid-stimulating hormone. Thus, 66 of the 94 patients (70.2%) with elevated concentrations of thyroid-stimulating hormone had no such thyroid history. Similarly, only nine (4.7%) of the patients with a personal or family history of thyroid disease required thyroxine replacement therapy. Thus, 22 of the 31 patients (71.0%) requiring such treatment had no such history. Discriminant analysis of the responses of women patients to questions concerning personal or family history of thyroid disease, the presence of symptoms of hypothyroidism, their age and body mass index identified only 51.3% of those with an elevated thyroid-stimulating hormone concentration and 77.2% of those with normal thyroid-stimulating hormone. Analysis of the responses of the men patients was even less discriminating.*

*It is suggested that general practitioners who wish to screen for hypothyroidism among their elderly patients should use a biochemical assay since neither questionnaire nor body mass index differentiate the majority of patients with elevated thyroid-stimulating hormone values from those who do not have elevated values.*

## Introduction

RECENT changes in the way general practitioners work, including an obligation to offer to see every patient at least once in every three years and to visit those aged 75 years and over annually,[1] have greatly changed the emphasis of primary medical care. Such regular contacts provide an ideal opportunity for proactive care. Some authorities argue that routine screening for hypothyroidism, at least in the elderly, should be included in any such programme since hypothyroidism is common and easily treatable.[2] Others argue that routine biochemical screening is not justifiable.[3,4]

We have previously reported findings from a UK general practice based survey of patients aged 60 years and over.[5] The great majority of patients with elevated concentrations of thyroid-stimulating hormone (77%) had persistently abnormal levels; such patients are at increased risk of developing overt hypothyroidism.[6] It has been stated that 'a high index of suspicion should help select those most at risk'[7] of having hypothyroidism, and also that 'thyroid-stimulating hormone . . . should be checked in all elderly patients who present with . . . vague complaints'.[8] Stott and Williams also argue however that 'the clinical diagnosis of hypothyroidism is notoriously difficult in old people'.[8]

The aim of this study was to determine whether it is possible to identify elderly patients at risk of hypothyroidism reliably using the following factors, personal history and family history of thyroid disease, symptoms of thyroid disease and body mass index, or whether the identification of patients with this important condition depends on screening using a biochemical test.

## Method

The study was carried out in an urban general practice with three partners and 5600 registered patients. All 1347 patients aged 60 years and over in the practice were sent a letter asking them to take part in the study. A total of 1210 patients (89.8%) gave their written consent. Seventeen patients were excluded as they were already receiving thyroxine replacement therapy. A questionnaire concerning personal and family history of thyroid disease and also symptoms of thyroid disease, such as change in bowel habit and weight loss, was completed for the remaining 1193 patients by a doctor or nurse, either at the surgery or at the patients' home if they were housebound (Appendix 1). The patients were then weighed, their height measured and a body mass index (height in metres divided by weight in kilograms squared) calculated. Each patient had a thyroid-stimulating hormone assay performed. The reference range was taken to be 0.5–5.0 mU $l^{-1}$ (U = international activity unit). For patients with thyroid-stimulating hormone concentrations outside the reference range a further assay for free thyroxine concentration was carried out.

The results of the questionnaire were analysed to determine the positive predictive value, sensitivity and specificity of the questions concerning personal history, family history and symptoms in identifying subjects with elevated concentrations of thyroid-stimulating hormone. Analysis of the questionnaire was repeated for those patients who required thyroxine replacement within approximately one year of the initial test. The effect of using the body mass index to target patients who should receive biochemical testing was investigated both separately and in combination with the questionnaire results and the patients' age. Discriminant analysis of the results was performed using the *SPSS* statistics package for social sciences.

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## Results

Table 1 summarizes the results of the thyroid-stimulating hormone assay by patients' age and sex (this data has been reported in more detail previously[5]). Thyroid-stimulating hormone concentrations above the upper limit of the reference range were four times more common among women than men (11.6% versus 2.9%). Thirty one patients (24 women, seven men) were given thyroxine replacement therapy, either immediately or within the first year of follow up. These patients had both elevated thyroid-stimulating hormone levels and low free thyroxine concentrations.

**Table 1.** Results of the thyroid-stimulating hormone (TSH) assay.

| Age (years) | No. of women | % of women with TSH concentration (mU $l^{-1}$): ⩽5 | >5 | No. of men | % of men with TSH concentration (mU $l^{-1}$): ⩽5 | >5 |
|---|---|---|---|---|---|---|
| 60–74 | 499 | *87.2* | *12.8* | 405 | *96.7* | *3.2* |
| ⩾75 | 184 | *91.8* | *8.2* | 105 | *98.0* | *1.9* |
| Total | 683 | *88.4* | *11.6* | 510 | *97.1* | *2.9* |

### *Personal or family history of thyroid disease*

Table 2 shows the number of women answering yes to the questions concerning personal or family history of thyroid disease. More of the 79 women with elevated thyroid-stimulating hormone levels had either a personal or family history or both (34.2%) than any of the other combinations, and thus this combination has the highest sensitivity. However, using this combination 146 of the women patients (21.4%) would have to be tested. The combination of personal and family history of thyroid disease resulted in the highest specificity (that is the fewest patients incorrectly identified as having abnormal thyroid-stimulating hormone levels) but only two of the 79 women with elevated levels were identified using this combination.

The group with either personal or family history or both also includes more of those requiring thyroxine replacement than any other group (eight out of the 24 women, 33.3%) but this is still a minority of those who required such treatment.

Of the 15 men with elevated thyroid-stimulating hormone values, none had a personal history of thyroid disease and only one claimed a family history. The one patient with a family history was one of the seven men requiring thyroxine replacement therapy.

Overall, 190 men and women had either a family or personal history or both (15.9% of the total); these included 28 of the 94 patients with elevated thyroid-stimulating hormone concentrations (29.8%) and nine of the 31 (29.0%) requiring thyroxine replacement therapy.

### *Symptoms of thyroid disease*

Table 3 shows the number of women responding positively to the questions concerning symptoms of thyroid disease. All of the predictive values are low: the highest is for weight loss with 16.7% of those answering yes to this question having an elevated thyroid-stimulating hormone concentration. In general, when the sensitivity of a question concerning symptoms was high, the specificity was low. For example, the sensitivity of 'preference for warm weather' as a marker of elevated thyroid-stimulating hormone levels was 70.9% but 452 women (66.2%) answered yes to this question and thus the specificity was low at only 34.4%. Similarly, analysis of the replies of the 24 women requiring thyroxine replacement therapy showed the predictive value of these questions to be low, with the highest predictive value being only 5.8% for positive answers to the question concerning a hoarse voice.

**Table 2.** Positive predictive value, sensitivity and specificity of questions concerning personal or family history of thyroid disease among the women in the study.

| Question | No. of women answering yes ($n=683$) | No. of women with elevated TSH answering yes ($n=79$) | Positive predictive value (%) | Sensitivity (%) | Specificity (%) |
|---|---|---|---|---|---|
| Personal history | 65 | 15 | *23.1* | *19.0* | *91.7* |
| Family history | 99 | 14 | *14.1* | *17.7* | *85.9* |
| Personal but no family history | 47 | 13 | *27.7* | *16.5* | *94.4* |
| Personal and family history | 18 | 2 | *11.1* | *2.5* | *97.4* |
| Family history but not personal history | 81 | 12 | *14.8* | *15.2* | *88.6* |
| Either personal or family history or both | 146 | 27 | *18.5* | *34.2* | *80.3* |

*n* = total number of women in group. TSH = thyroid-stimulating hormone.

**Table 3.** Positive predictive value, sensitivity and specificity of questions concerning symptoms of thyroid disease among the women in the study.

| Question | No. of women answering yes ($n=683$) | No. of women with elevated TSH answering yes ($n=79$) | Positive predictive value (%) | Sensitivity (%) | Specificity (%) |
|---|---|---|---|---|---|
| Preference for warm weather | 452 | 56 | *12.4* | *70.9* | *34.4* |
| Slowing down | 441 | 49 | *11.1* | *62.0* | *35.1* |
| Preference for cold weather | 274 | 29 | *10.6* | *36.7* | *59.4* |
| Tremor, anxiety | 245 | 23 | *9.4* | *29.1* | *63.2* |
| Palpitations | 181 | 20 | *11.0* | *25.3* | *73.3* |
| Weight gain | 123 | 16 | *13.0* | *20.3* | *82.3* |
| Weight loss | 84 | 14 | *16.7* | *17.7* | *88.4* |
| Hoarse voice | 69 | 11 | *15.9* | *13.9* | *90.4* |
| Change in bowel habit | 46 | 4 | *8.7* | *5.1* | *93.0* |

*n* = total number of women in group. TSH = thyroid-stimulating hormone.

Among the men patients, positive predictive values of symptoms were generally low with the highest being 5.8% (for hoarse voice). Similarly when the sensitivity of a question was high (the highest being 46.7% for 'preference for cold weather') this was at the expense of low specificity (59.0%) as 210 men (41.2%) answered this question positively.

### *Body mass index*

There was a very weak correlation between thyroid-stimulating hormone values and body mass index (correlation coefficient 0.063, $P<0.05$). The mean body mass index among those requiring thyroxine replacement therapy (27.4, range 21.0–35.9), was

only slightly higher than in the 1162 patients not requiring therapy (25.5, range 15.2–42.5) but this difference did achieve statistical significance ($t=2.766$, $P<0.01$).

### *Discriminant analysis*

Discriminant analysis of all replies to the questions concerning symptoms of thyroid disease by the women patients identified only 46.0% of those women with elevated thyroid-stimulating hormone values and 76.0% of those with normal thyroid-stimulating hormone values. A further discriminant analysis of the questionnaire but including only those symptoms classically regarded as indicative of hypothyroidism (change in bowel habit, weight gain, preference for warm weather and 'slowing down'), plus personal history, family history, body mass index and age identified only 51.3% of women with elevated thyroid-stimulating hormone concentrations and 77.2% of those with normal thyroid-stimulating hormone concentrations.

Discriminant analysis of questionnaire replies from the men patients found the questions to be even less discriminating than for the women.

## Discussion

In considering instituting screening programmes in the elderly, general practitioners will wish to consider many factors, including the prevalence of the condition, the sensitivity and specificity of tests, and the presence of a pre-symptomatic stage of the disease. In addition, any method of identifying a high-risk group of patients will be useful as it will reduce both financial and opportunity costs (that is the time and effort which might be spent on some other activity). We have previously shown[5] that there is a high prevalence of thyroid failure (both overt hypothyroidism requiring thyroxine replacement and subclinical hypothyroidism) among those aged 60 years and over, particularly women, confirming the Whickham data.[4] General practitioners who wish to identify elderly patients with hypothyroidism might attempt to reduce the need for biochemical testing by asking patients about previous thyroid history and symptoms of thyroid disease, and by weighing them. We have reported here a large scale and systematic attempt to relate personal and family history of thyroid disease, symptoms of thyroid disease, and estimation of body mass index to both elevated thyroid-stimulating hormone concentrations and to the need for thyroxine replacement therapy in elderly people.

Although it is clear from our data that women patients with either a personal or family history of thyroid disease or both constitute a high risk group (18.5% had elevated thyroid-stimulating hormone values), screening this group alone would miss 66% of women with elevated thyroid-stimulating hormone concentrations as well as 67% of the women requiring thyroxine replacement. In addition, the responses of elderly patients (men and women) to questions concerning thyroid symptoms had little predictive value in identifying those who were more likely to have abnormal thyroid function tests. Similarly, the predictive value of thyroid symptoms was low among those patients requiring thyroxine treatment. Assessment of body mass index was not found to differentiate those with either abnormal thyroid-stimulating hormone concentrations or those requiring thyroxine treatment; thus preliminary screening by weighing and measuring patients would not be helpful. Division of women patients by age (for example into those aged between 60 and 74 years and those aged 75 years and over) demonstrated that elevated thyroid-stimulating hormone levels were more common in those between the ages of 60 and 74 years but were by no means rare in those aged 75 years or more. A discriminant analysis incorporating women's answers to those questions about symptoms classically regarded as indicating hypothyroidism, plus personal history, family history, body mass index and age, identified only just over half of those with elevated thyroid-stimulating hormone concentrations.

In conclusion, we have found that it is not possible to identify most elderly patients with hypothyroidism using a questionnaire on thyroid history and symptoms of thyroid disease, and the body mass index. A 'high index of suspicion' should not therefore be relied on as a guide in deciding which elderly patients require biochemical testing. It follows that if general practitioners are to identify the majority of their elderly patients who need thyroxine replacement therapy, and the majority of those with elevated thyroid-stimulating hormone values, biochemical testing of all women aged 60 years and over will be necessary. If all patients with hypothyroidism are to be identified men will also need to be tested.

If general practitioners do not wish to institute such screening programmes then, as a minimum, they should monitor biochemically the thyroid function of all their women patients aged 60 years and over who have a personal or family history of thyroid disease since these patients are at particularly high risk. It is not clear as yet how frequently such biochemical testing should be carried out, but we are following up these patients in an attempt to answer this question. However, a screening system could easily be combined with the requirement to see all patients at least once in three years.[1]

**Appendix 1.** Questionnaire concerning personal and family history of thyroid disease and classical thyroid symptoms.

1. Have you ever had anything wrong with your thyroid gland?
2. So far as you know, has any member of your family had anything wrong with his or her thyroid gland?
3. Have you lost weight recently (and not been deliberately dieting)?
4. Have you developed constipation or diarrhoea in the last few months?
5. Have you, or others, noticed that your voice has become croaky or deeper recently?
6. Have you gained weight recently?
7. Does cold weather suit you?
8. Does warm weather suit you?
9. Have you found yourself 'slowing down' a lot?
10. Have you felt shaky or more anxious recently?
11. Have you had palpitations recently?

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