that severe infection with respiratory syncytial virus is a common cause of hypoxaemia in infants.

Our study has shown that clinical signs requiring minimal basic skills and training to recognise can be used for formulating guidelines on the rational use of oxygen. These signs can also be used to identify those children with an acute lower respiratory tract infection requiring referral to a specialist centre.

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Contributors: MW initiated the research and helped design the study protocol. KM, the principal investigator of the Hib vaccine trial, helped design the study protocol. BG participated in the design of the study, and interpreted and reviewed the paper. AO, CO, and SU were involved with the design and execution of the study, data collection, data documentation, and clinical evaluation of the children. SJ and SU were involved with analysis and interpretation of data. RA performed the microbiological tests and also participated in the review of the paper. The paper was written jointly by SU, MW, KM, SJ, and BG. SU and MW will act as guarantors for the paper.

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1 Loweski J. Mortality from acute respiratory infections in children less than 5 years of age: global estimates. *World Health Stat Q* 1986;5:247-52.
2 Denny F, Loda FA. Acute respiratory infections are the leading cause of death in children in developing countries. *Am J Trop Med Hyg* 1986;35:1-2.
3 Greenwood BM, Greenwood AM, Bradley AK, Tulloch S, Hayes R, Oldfield FSJ. Deaths in infancy and early childhood in a well-vaccinated, rural, West African population. *Ann Trop Paediatr* 1987;7:91-9.
4 Sazawal S, Black RE. Meta-analysis of intervention trials on case-management of pneumonia in community settings. *Lancet* 1992;340:528-33.
5 World Health Organisation programme for the control of acute respiratory infections. Acute respiratory infections in children: case management in small hospitals in developing countries. Geneva: WHO/ARI/90.5,1990.
6 Onyango FE, Steinhoff MC, Wafula EM, Wariua S, Musia J, Kitonyi J. Hypoxaemia in young Kenyan children with acute lower respiratory infection. *BMJ* 1993;306:612-4.
7 Levene S, Mckenzie SA. Pulse oximetry in children. *Lancet* 1988;i:415-6.
8 Reuland DS, Steinhoff MC, Gilman RH, Bara M, Olivares EG, Jabra A, et al. Prevalence and prediction of hypoxemia in children with respiratory infections in the Peruvian Andes. *J Pediatr* 1991;119:900-7.
9 Lozano JM, Steinhoff M, Ruiz JG, Mesa ML, Martinez N, Dussan B. Clinical predictors of acute radiological pneumonia and hypoxaemia at high altitude. *Arch Dis Child* 1994;71:323-7.
10 Cherian T, John TJ, Simoes E, Steinhoff MC, John M. Evaluation of simple clinical signs for the diagnosis of acute lower respiratory tract infection. *Lancet* 1988;i:125-8.
11 Spooner V, Barker J, Tulloch S, Lehman D, Marshall T, Kajoi M, et al. Clinical signs and risk factors associated with pneumonia in children admitted to Goroka hospital, Papua New Guinea. *J Trop Pediatr* 1989;35:295-300.
12 Dyke T, Lewis D, Heegaard W, Manary M, Flew S, Rudeen K. Predicting hypoxia in children with acute lower respiratory infection: a study in the highlands of Papua New Guinea. *J Trop Pediatr* 1995;41:196-201.
13 Shann F, Barker J, Poore P. Clinical signs that predict death in children with severe pneumonia. *Pediatr Infect Dis J* 1989;8:852-5.
14 Stadie WC. The oxygen of the arterial and venous blood in pneumonia and its relation to cyanosis. *J Exp Med* 1919;30:215-40.
15 Mulholland EK, Olinsky A, Shann FA. Clinical findings and severity of acute bronchiolitis. *Lancet* 1990;335:1259-61.
16 Reynolds EOR. Arterial blood gas tensions in acute disease of lower respiratory tract in infancy. *BMJ* 1963;1:1192-5.
17 Hall CB, Hall WJ, Speers DM. Clinical and physiological manifestations of bronchiolitis and pneumonia. Outcome of respiratory syncytial virus. *Am J Dis Child* 1979;133:798-802.
18 Simpson H, Flenley DC. Arterial blood-gas tensions and pH in acute lower-respiratory-tract infections in infancy and childhood. *Lancet* 1967;1:7-12.
19 Dyke T, Brown N. Hypoxia in childhood pneumonia: better detection and more oxygen needed in developing countries. *BMJ* 1994;308:119-20.
20 O'Dempsey TJD, Todd J. Respiratory rates are poor predictors of hypoxaemia. *BMJ* 1993;306:1342.
21 Weber MW, Usen S, Palmer A, Jaffar S, Mulholland EK. Predictors of hypoxaemia in hospital admissions with acute lower respiratory tract infection in a developing country. *Arch Dis Child* 1997;76:1-5.
22 Mulholland EK, Hilton S, Adegbola RA, Usen S, Oparaugo A, Omosigho C, et al. Randomised trial of Haemophilus influenzae type b-tetanus protein conjugate for prevention of pneumonia and meningitis in Gambian infants. *Lancet* 1997;349:1191-7.
23 Cane PA, Pringle CR. Evolution of subgroup A respiratory syncytial virus: evidence for progressive accumulation of amino acid changes in the attachment protein. *J Virol* 1995;69:2918-25.
24 Seaton A, Seaton D, Leitch AG. Functions of the respiratory tract. In: *Crofton and Douglas's Respiratory diseases*, 4th edn. Oxford: Blackwell Scientific, 1989.
25 Margolis PA, Ferkol TW, Marsocci S, Super DM, Keyes LL, McNutt R, et al. Accuracy of the clinical examination in detecting hypoxemia in infants with respiratory illness. *J Pediatr* 1994;124:552-60.
26 Spiteri MA, Cook DG, Clarke SW. Reliability of eliciting physical signs in examination of the chest. *Lancet* 1988;1:873-5.
27 Wang EE, Milner RA, Navas L, Maj H. Observer agreement for respiratory signs and oximetry in infants hospitalised with lower respiratory infections. *Am Rev Respir Dis* 1992;145:106-109.

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Female medical leadership: cross sectional study

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Abstract

Objective To assess the relation between male and female medical leadership.
Design Cross sectional study on predictive factors for female medical leadership with data on sex, age, specialty, and occupational status of Norwegian physicians.
Setting Oslo, Norway.
Subjects 13 844 non-retired Norwegian physicians.
Main outcome measure Medical leaders, defined as physicians holding a leading position in hospital medicine, public health, academic medicine, or private health care.
Results 14.6% (95% confidence interval 14.0% to 15.4%) of the men were leaders compared with 5.1% (4.4% to 5.9%) of the women. Adjusted for age men had a higher estimated probability of leadership in all categories of age and job, the highest being in academic medicine with 0.57 (0.42 to 0.72) for men aged over 54 years compared with 0.39 (0.21 to 0.63) for women in the same category. Among female hospital physicians there was a positive relation between the proportion of women in their specialty and the probability of leadership.
Conclusion Women do not reach senior positions as easily as men. Medical specialties with high proportions of women have more female leaders.

Editorial
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Introduction

The Norwegian labour market has adjusted to the increased proportion of career women with an equal opportunities policy of positive sex discrimination in favour of women and improved social benefits. Dual career families are now the norm rather than the exception; current employment rates for women and men in Norway are 56% and 70%, respectively. Maternity leave has improved, and working women are entitled to full cash benefits for 42 weeks or 80% benefits for 52 weeks, and men are entitled to 2 weeks' paternity leave. The public day care coverage is 60%, and parents are allowed 10 days' paid leave a year per child for illness in children. Despite this liberal equity policy and an increase in the number of women working, relatively few women hold positions of leadership in industry, business, or the public sector, including health care.[1]

Up to the 1990s, when the proportion of women among medical students reached 50%, women had the advantage of positive sex discrimination in medical schools. Now, though universities use this to increase the proportion of women in academic posts, there is no such policy in the appointment of hospital doctors and public health positions.

Data from Finland suggest that female physicians are largely excluded from decision making in medical research,[2–4] but few studies have explored the relation between specialty and career choices and female leadership in medicine. As the purpose of the Norwegian equal opportunities policy has been to favour women in the workforce and strengthen their participation in all employment positions to obtain equity, it is of interest to study the extent to which female Norwegian doctors have succeeded in reaching senior positions.

With data on specialty and occupational status of Norwegian physicians we examined the distribution of female and male leaders with respect to age and type of job. We then estimated the probability of leadership for different categories of female and male physicians. Finally, we explored whether leadership among female hospital physicians is related to the proportion of women in the specialty.

Methods

Study population

Data on all Norwegian physicians were made available from the masterfile of the Norwegian Medical Association, which is a complete register of all Norwegian physicians, including the 6% who are not members of the association. All those active in October 1997 with information on sex, age, specialty, and job category were included, comprising 13 844 physicians, 3939 women and 10 131 men.

Variables

On the basis of the differences in career patterns between clinical and non-clinical doctors and differences between public and private health care, employment posts were grouped into four categories: hospital medicine (including teaching hospitals), public health (state, county, or municipality), academic medicine (university positions outside hospitals), and private health care (including occupational health care).

Leadership was the outcome of interest. For the purpose of this study leaders were defined as chief executive officers or senior consultants of the hospitals or clinical departments, full time and part time professors and principal research officers, and central and local government medical officers. Within private health care and industrial concerns chief medical physicians and medical directors in research departments were defined as leaders.

We assumed that the potential for support from colleagues—such as mentoring and mutual information on career opportunities—was likely to be associated with membership of a specialist category, particularly in hospitals. To explore the impact of the proportion of women in a specialty on female leadership we stratified the female physicians working in hospital into four groups: non-specialists, those belonging to the nine specialties with women comprising 2% to 14% of physicians (neurological surgery (2%), general surgery (5%), plastic surgery and dental, oral, and maxillofacial surgery (7%), otorhinolaryngology (8%), medical genetics (10%), clinical chemistry (11%), general medicine (12%), and community medicine (14%)), those belonging to the 10 specialties with women comprising 15% to 24% (anaesthetics (16%), ophthalmology and clinical neurophysiology (19%), immunology (20%), rheumatology (21%), general practice (22%), paediatrics (23%), and radiotherapy, physiotherapy and microbiology-bacteriology (24%)), and finally those belonging to the nine specialties with more than 24% of women (neurology (25%), radiology (26%), dermatovenereology (28%), occupational medicine, pathological anatomy, and psychiatry (29%), obstetrics and gynaecology (32%), and child psychiatry (59%)). The female specialists working outside hospital were excluded from the analyses because they, to a large extent, are employed in working settings where leadership is irrelevant according to our criteria about mentoring support from colleagues.

Statistical analyses

Numbers of leaders with respect to sex, age, and job category are described as proportions with 95% confidence intervals. The probabilities of leadership for different sex and categories of age and job as well as the probability of leadership among female hospital physicians belonging to groups with different proportions of female specialists were estimated with logistic regression models.

Results

Of all physicians in the study, 28% were women. The mean age for women was 40.5 years and for men 46.5 years. The proportion of male physicians who were leaders was 14.6% (95% confidence interval 14.0% to 15.4%) compared with 5.1% (4.4% to 5.9%) for women. The mean age for female leaders was 49.7 (48.6 to 50.7) years and for male leaders 52.8 (52.4 to 53.3) years. Table 1 shows the numbers of physicians in the different age and job categories and the corresponding proportion of leaders.

The probability of being a leader was estimated by a logistic model with sex, age, and job categories as additive covariates. Table 2 gives the estimated probabilities of leadership for the different combina-

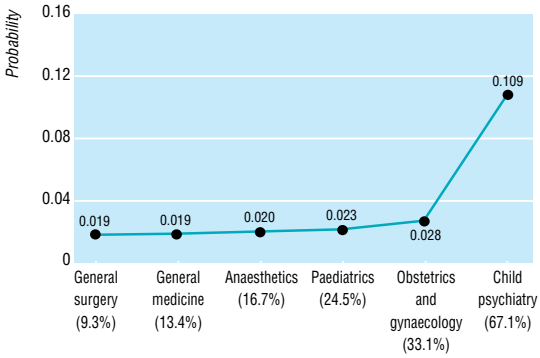
Table 1 Senior posts among 13 844 Norwegian physicians according to sex, age, employment category, and leadership status

	Women		Men	
Category	**No (%; 95% CI) of leaders**	**No of non-leaders**	**No (%; 95% CI) of leaders**	**No of non-leaders**
Age (years):				
<45	58 (2.1; 1.6 to 2.7)	2701	225 (5.1; 4.6 to 5.9)	4112
45 to 54	84 (10.5; 8.5 to 12.8)	719	620 (17.6; 16.4 to 18.9)	2906
>54	57 (16.8; 13.1 to 21.4)	281	611 (29.4; 27.4 to 31.4)	1470
Employment category:				
Private health care	44 (3.7; 2.7 to 4.9)	1155	242 (7.5; 6.6 to 8.5)	2983
Public health	59 (11.7; 9.1 to 14.9)	444	348 (27.4; 25.0 to 30.0)	922
Academic medicine	6 (6.4; 2.6 to 13.9)	88	85 (35.4; 29.4 to 41.9)	155
Hospital medicine	90 (4.3; 3.5 to 5.3)	2014	781 (13.2; 12.4 to 14.1)	4428
All physicians	199 (5.1; 4.4 to 5.9)	2701	1456 (14.6; 14.0 to 15.4)	8488

tions of age and job situation. As some of these groups are quite small the confidence intervals are correspondingly wide—for instance, the 95% confidence interval for the estimated probability of 0.39 for female academics over 54 years was 0.21 to 0.63 whereas the corresponding interval for the male probability of 0.57 was 0.42 to 0.72. The age gradient, assumed to be the same for men and women, was significant as was the sex effect, with an adjusted odds ratio of 2.0 (1.6 to 2.4) in favour of men.

A possible period effect (that it is easier for female physicians to reach leadership now than, for example, 10 to 15 years ago) was explored by including the interaction of women under 45 years versus men and older women in the above model. This covariate had no significant effect, however, and the estimated probabilities in table 2 remained almost the same.

The 2033 women currently employed in hospital medicine were included in a logistic regression analysis of the possible impact of proportion of women in different specialties on the probability of female leadership. Covariates were age, the proportion of women in the specialty (squared), and a dummy variable for specialist or non-specialist. All three covariates showed significant effects, with t values of 7.13, 4.0, and 3.45, respectively. The figure shows the estimated probabilities of leadership for five major specialties plus the female dominated specialty of child psychiatry by using this model. There was a slight increase in probability of leadership with increased proportion of women, but the differences between the groups were not significant.



Estimated probability of leadership for 50 year old female specialist working in hospital in six different specialties with varying proportions of women. Derived from logistic regression model with 2033 hospital based female physicians

Discussion

Although the present study on careers of female physicians shows that few women reach senior positions, an encouraging finding, considering the steady increase in female medical graduates, is that the proportion of women in any medical specialty may be a determinant for female leadership. Nevertheless, there was no increased probability for leadership positions among the new generation of female physicians.

Because the medical career structure has been slow to adapt to the changing profile of medicine[5] it has been questioned whether female physicians have the same opportunities as their male colleagues or if they are exposed to barriers which mean that they are likely to have a secondary role.[3 5] In addition to individual constraints such as family preferences and lack of leadership ambitions,[6–8] attention has been drawn to structural constraints as the explanation of why female physicians who aspire to top positions meet invisible barriers. Deficiencies in career advice and counselling from patrons and colleagues may contribute to the "glass ceiling" effect on women's upward mobility.[9–11] According to Kanter, who studied the impact of organisational characteristics on internal labour market patterns, the gradient of the existing sex ratio in a corporation is a strong predictor for career opportunities for women.[12] She argues that women in a minority are exposed to exaggerated attention and lack of integration, reactions that will not appear in groups with less

Table 2 Estimated probabilities of leadership among Norwegian physicians in 1997 based on logistic model (numbers in parentheses)

	Women			Men		
Employment category	**<45 years**	**45-54 years**	**>54 years**	**<45 years**	**45-54 years**	**>54 years**
Private health care	0.01 (741)	0.04 (314)	0.08 (148)	0.02 (1162)	0.09 (1371)	0.16 (714)
Public health	0.06 (365)	0.23 (101)	0.37 (45)	0.11 (661)	0.38 (446)	0.55 (202)
Academic medicine	0.06 (64)	0.24 (26)	0.39 (5)	0.12 (105)	0.40 (71)	0.57 (71)
Hospital medicine	0.02 (1613)	0.10 (372)	0.18 (145)	0.05 (2498)	0.19 (1700)	0.32 (1130)

Key messages

- Men have significantly higher probability for all leadership positions
- Women are underrepresented in higher medical administrative positions
- Leadership positions for women are especially prevalent in public health, where working hours are regulated
- In hospitals the proportion of female physicians in the specialty is a determinant for female leadership

skewed sex ratios. Hence the size of the female minority group has to be sufficient to achieve the positions necessary to change the organisational structure.[12] The fact that the relation between female leadership and the proportion of women in the specialty is positive supports this view if we are willing to equate the specialty union with Kanter's organisation.

Despite the recognition of dual careers, a policy of equal opportunity, and improvement of crèche facilities, the present study shows that women still do not reach senior positions as easily as men. The few female leaders in the study worked in public health and female supported hospital specialties. General practice and community health are deemed less prestigious than hospital career jobs,[3 13] and women report less interest in academic careers and leadership than men.[14 15] Even though the proportion of women in medicine is increasing, women tend to have employment characterised by routine work and low salary.[2 3 5 16] The progress towards parity remains slow and in certain sex stereotyped specialties, such as surgery and general medicine, women still comprise a tiny minority of the most senior grades.[2 3 16–18]

Without disregard of discrimination issues, the underrepresentation of women in positions of authority may reflect some systematic, underlying effect whereby women simply do not choose to take on heavily committed senior positions. Because it is difficult to get away from the traditional linking of age to grade so prevalent in medicine[5] women face a trade off between career posts associated with power and influence and family and emotional responsibilities. Although marriage and children are traditional constraints on the careers of female physicians, other factors, such as long hours and on call, impose considerable strain on relationships because careers of partners also have to be taken into account.[5 19] Even in dual career families, women are traditionally in charge of caring work.[19] The present study suggests that female physicians give priority to emotional and family commitments at the expense of power and influence on medical decisions. A reassessment of the traditional linkage between career advantage and age is needed in the medical career structure. More part time opportunities and flexibility of careers would make it possible to give familial commitments precedence and subsequently make a preference shift towards influential medical positions.

Conclusion

Despite an equal opportunities policy with positive sex discrimination in favour of women and a liberal labour market encouraging female participation, Norwegian women still have difficulties in reaching medical career posts. Leadership jobs for women were associated with public health, where working hours are regulated. A promising finding is that the probability of women's achieving senior positions seems to increase with the proportion of women in the specialty. The results suggest that women face a trade off between family commitments and influence in medical leadership.

We thank professor Tore Schweder for helpful advice on the statistical analyses.

Contributors: GSB and KJK initiated the study and formulated the hypothesis; OGA made data available from the masterfile of the Norwegian Association. KJK and OGA were responsible for the data analysis. The paper was written jointly by OGA, GSB, and KJK. KJK is guarantor for the study.

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1 Statistisk Sentralbyrå. *Sosialt utsyn 1998. Statistiske analyser (Social overview 1998. Statistical analyses).* Oslo: Statistisk Sentralbyrå (Bureau of Statistics), 1998.
2 Altekruse JM, McDermott S. Contemporary concern of women in medicine. In: Rossner I, ed. *Feminism within the science and health professions: overcoming resistance.* Oxford: Pergamon Press, 1987;65-88.
3 Riska E, Wegar K. Women physicians: a new force in medicine? In: *Gender, work and medicine. Women and the medical division of labour.* London: Sage Studies in International Sociology, 1993;77-94.
4 Kane-Berman J. Women as managers in the health services. *Curationis* 1989;12:5-8.
5 Allen I. *Doctors and their careers: a new generation.* London: Policy Studies Institute, 1994.
6 Horner M. Toward an understanding of achievement related conflicts in women. *J Soc Issues* 1972;28:157-75.
7 Kuhn A. Structures of capital and patriarchy in the family. In: *Feminism and materialism.* London: Routledge and Kegan Paul, 1978.
8 Terborg J. Organizational and personal correlates of attitudes towards women as managers. *Acad Management J* 1977;20:89-100.
9 Lyness KS, Thompson DE. Above the glass ceiling? A comparison of matched samples of female and male executives. *J Appl Psychol* 1997;82:359-75.
10 Levinson W, Kaufman K, Clark B, Tolle SW. Mentors and role models for women in academic medicine. *West J Med* 1991;154:423-6.
11 Lorber J. Why women physicians will never be true equals in the American medical profession. In: Riska E, Wegar K, eds. *Gender, work and medicine. Women and the medical division of labour.* London: Sage Studies in International Sociology, 1993;62-76.
12 Kanter RM. *Men and women of the corporation.* New York: Basic Books, 1977.
13 Lambert TW, Goldacre MJ, Edwards C, Parkhouse J. Career preferences of doctors who qualified in the United Kingdom in 1993 compared with those of doctors qualifying in 1974, 1977, 1980, and 1983. *BMJ* 1996;313:19-24.
14 Wiers-Jenssen J, Vaglum P, Ekeberg O. Career plans of future physicians. Level of ambition and plans for specialization among medical students. *Tidsskr Nor Laegeforen* 1997;117:2807-11.
15 Leonard JC, Ellsbury KE. Gender and interest in academic careers among first and third year residents. *Acad Med* 1996;71:502-4.
16 Martin SC, Arnold RM, Parker RM. Gender and medical socialization. *J Health Soc Behav* 1988;29:333-43.
17 Harris M, Conley-Muth M. Sex-role stereotypes and medical specialty choice. *J Am Med Wom Assoc* 1981;36:82-4.
18 Allen I. *Doctors and their careers.* London: Policy Studies Institute, 1988.
19 Hofoss D, Gjerberg E. Physicians' working hours. *Tidsskr Nor Laegeforen* 1994;114:3059-63.

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Correction

Factors affecting likelihood of applicants being offered a place in medical schools in the United Kingdom in 1996 and 1997: retrospective study

Several errors occurred in this article by McManus (24 October, pp 1111-1117). It was not made clear that the whole of the first paragraph was a quotation from the 1986 paper by Horton (cited as reference 1). In table 2 the results for the University of Birmingham were wrong: the symbol • should have appeared in three additional rows— "has made an insurance choice," "is female," and "is from an ethnic minority." In figure 3 the odds ratio for Birmingham for 1997 should have been 1.526 (95% CI 1.1616 to 2.007), placing it between Glasgow and Leicester; the values for 1996 are correct but in the wrong position (further details of the corrected analysis are available at www.cvcp.ac.uk/chms/).