article

Genetics in clinical practice: general practitioners' educational priorities in European countries

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Purpose: To assess how general practitioners (GPs) from European countries prioritized their genetic educational needs according to their geographic, sociodemographic, and educational characteristics. **Methods:** Cross-sectional survey, random and total samples of GPs in five European countries (France, Germany, the Netherlands, Sweden, and United Kingdom), mailed questionnaires; Outcome: Genetic Educational Priority Scale (30 items; six subscores). **Results:** A total 1168 GPs answered. Priorities differed ($P < 0.001$) but were consistently ranked across the countries. Previous education had a marginal effect on priorities. Women gave higher priorities than men to Genetics of Common Disorders (adjusted odds ratio [OR_{adj}], 2.5; 95% confidence interval [CI], 1.6–3.8), Psychosocial and Counseling Issues (OR_{adj}, 1.6; 95% CI, 1.1–2.5), and Ethical, Legal, and Public Health Issues (OR_{adj}, 1.3; 95% CI, 1.1–1.8), but lower than men to Techniques and Innovation in Genetics (OR_{adj}, 0.7; 95% CI, 0.5–0.9). Older physicians gave higher priorities to Basic Genetics and Congenital Malformations (OR_{adj}, 1.5; 95% CI, 1.1–1.9), and to Techniques and Innovation in Genetics (OR_{adj}: 1.3; 95% CI, 1.0–1.7), compared with their younger colleagues. **Conclusions:** Expressed genetic educational needs vary according to the countries and sociodemographics. In accordance, training could be more focused on genetics of common disorders and on how to approach genetic risk in clinical practice rather than on ethics, new technologies, or basic concepts. ***Genet Med* 2008:10(2):107–113.**

Key Words: *education, genetics, physicians*

The expansion of genetic knowledge has implications for health service provision in all fields of medicine and in particular genetic testing has been debated.[1–7] It is believed that the task of first informing families about genetic risks and testing will fall to primary care providers who will then "triage" patients for referral to more specialized genetic services. European health care systems differ in the role of general practitioners (GPs) and in particular their gatekeeper function relating to access to genetic services. In some European countries, patients have direct access to specialists, whereas in others patients must be referred to a genetic service by a primary care provider. Whatever the health system, it is believed that specialist geneticists and genetic counselors may not be available in sufficient numbers to offer adequate genetic services for family disease. Recommendations have been made for core competencies in the field of genetics for health care providers by the National Coalition for Health Professional Education in Genetics in the United States[8] and also in the United Kingdom.[9] The free market across Europe for health care provision makes it important that there is consistency in genetic education sensitive to population needs. Little is known, however, about the opinions of primary care providers themselves, particularly in Europe, and what they consider to be their needs for genetic education in respect to their daily practice.

We investigated first how GPs in five different European countries prioritize their genetic educational needs, and second, the differences observed according to their geographic, sociodemographic, and educational characteristics.

MATERIALS AND METHODS

Design and sample

A random sample of GPs, obstetricians, pediatricians, and midwives in France, Germany, the Netherlands, Sweden, and United Kingdom was surveyed postally with a self-administered questionnaire and a small monetary incentive for the

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respondents (10€). In every country, at least one reminder was mailed. Some countries organized a second reminder or a telephone recall to achieve the required minimal sample size of 200 physicians by type of practice.

Questionnaire

Dependent variables

The questionnaire included 122 items 30 of them relating to educational priorities in genetics: the Gen-Ep scale. Based on the results of the factor analysis which demonstrated the existence of six components, the items were grouped into six scales, each representing a particular field of genetics education. These subscales were named "Approaching Genetic Risk Assessment in Clinical Practice: AGRACP," "Basic Genetics and Congenital Malformations: BGCM," "Ethical, Legal and Public Health Issues: ELPHI," "Genetics of Common Diseases: GCD," "Psychosocial and Counseling Issues: PCI," and "Techniques and Innovation in Genetics: TIG" and ranged from 1 (lowest priority) to 5 (highest priority).

Details about the construction and the validation of the Gen-Ep scale are presented elsewhere,[10] (in this issue, page 99).

Independent variables and covariates

Respondents' educational characteristics were assessed through closed questions about undergraduate, specialist, and continuing medical education (CME) in genetics and their respective perceived value.

The frequency that genetics was encountered in daily practice was assessed by the following question: "How often in your clinical practice does genetics present as an element in a case? (every day, once a week, once a month, about two to three times a year, less than two to three times a year)."

Sociodemographic characteristics described age, gender, and practitioners' country of practice.

Analysis

For univariate comparisons, χ^2 tests were used to compare proportions and analysis of variance to compare means. The level of significance was taken as $P < 0.05$. Respondents and nonrespondents have been compared for age and gender according to the country of practice.

Physicians' sociodemographic and educational characteristics were assessed according to their country of practice. Second, univariate analysis of GP's priorities for educational needs was carried out adjusted afterward for covariates and confounding factors (age, gender, education in genetics, and genetics in practice) with stepwise logistic regression (SPSS version 12 software). For this stepwise logistic regression, the dependent variable (educational priority sub score) was dichotomized as values higher and lower than the median of the overall sample. Six models were carried out separately for the six subscores as dependent variables. Covariates were entered into a model for a univariate P value ≤ 0.10. The final level of significance was $P < 0.05$.

RESULTS

Description of the samples

National samples of respondents did not differ for gender of practicing GPs in all the countries except Germany, where male physicians were over-represented. Respondents were younger than the national population of practicing GPs in France; they were older than the reference population in Germany, Sweden, and United Kingdom; and, they did not differ in the Netherlands,[10] (see details in this issue, page 99).

The overall response rate was 29% ($n = 1168$) and differed significantly ($P < 0.001$) across the countries: 21% in Germany ($n = 251$), 23% in the United Kingdom ($n = 165$), 27% in the Netherlands ($n = 254$), 39% in Sweden ($n = 262$), and 49% in France ($n = 236$).

Sociodemographic characteristics differed across the countries (Table 1). Swedish and British GPs were more frequently female, while French, German, and Dutch physicians were male in more than 65% of the cases (Table 1). The proportion of physicians older than 50 was also much higher in Germany and Sweden (>60%) compared with that in other countries.

Genetic educational characteristics and frequency of genetics in medical practice differed significantly across the countries (Table 1).

- Undergraduate training in genetics was said to have been received by 76.5% of the overall sample of GPs but more frequently in Sweden (93.7%) and the Netherlands (85.7%) than in other countries (France 55.8%, Germany 66.8%, the United Kingdom 77%). This training was assessed to be useful by 46.7% of the overall sample, more frequently in the Netherlands and the United Kingdom than in the three other countries (Table 1).
- Postgraduate training in genetics was clearly not organized for the GPs in these five countries since it was declared to be absent in 93.9% of the cases.
- CME in genetics was present in the Netherlands (43.8%) and to a lesser extent in the United Kingdom (21.1%). For the three other countries, it was said to be unusual (from 2.3% in Sweden to 8.6% in France) but considered to be useful in those cases.
- The frequency that genetics was encountered in medical practice was reported to be less than once a month in 65.8% of the overall sample. German, Dutch, and British physicians believed that they encountered genetics more frequently, >22% said that genetics problems were seen at least once a week in their usual practice compared with 7% French and 5.4% Swedish physicians (Table 1).

Country's educational priorities in genetics

The highest priority for genetic education was Genetics of Common Diseases (mean, 3.49; SD, 0.80), followed by Approaching Genetic Risk Assessment in Clinical Practice (mean, 3.39; SD, 0.77), Psychosocial and Counseling Issues (mean, 3.13; SD, 0.86), Basic Genetics and Malformations (mean, 3.0; SD, 0.77), Ethical, Legal, and Public Health Issues (mean, 2.86;

Table 1
Characteristics of the sample (GPs)

	France $N = 236$		Germany $N = 251$		The Netherlands $N = 254$		Sweden $N = 262$		UK $N = 165$		Total $N = 1168$	
	n	%	*n*	%	*n*	%	*n*	%	*n*	%	*n*	%
Gender ($P < 0.001$)												
Male	182	77.1	175	69.7	167	65.7	145	55.3	95	57.6	764	65.4
Female	54	22.9	76	30.3	87	34.3	117	44.7	70	42.4	404	34.6
Age ($P < 0.001$)												
≤50	131	55.5	99	39.4	146	57.5	97	37	99	60	572	49.0
>50	105	45.5	152	60.6	108	42.5	165	63	66	40	596	51.0
Undergraduate training in genetics ($P < 0.001$)												
No	103	44.2	82	33.2	36	14.3	12	4.7	38	23	271	23.5
Yes useless	52	22.3	59	23.9	63	25	131	51.2	37	22.4	342	29.7
Yes useful	78	33.5	106	42.9	153	60.7	113	44.1	88	53.3	538	46.7
Postgraduate training in genetics ($P = 0.001$[a])												
No	222	94.5	228	91.9	227	89.4	253	97.7	159	97	1089	93.9
Yes useless	0	0	3	1.2	6	2.4	0	0	1	0.6	10	0.9
Yes useful	13	5.5	17	6.9	21	8.3	6	2.4	4	2.4	61	5.3
Continuous Medical Education in genetics ($P < 0.001$[a])												
No	213	91.4	241	96.8	141	56.2	253	97.7	136	82.9	984	85.1
Yes	20	8.6	8	3.2	110	43.8	6	2.3	28	17.1	172	14.9
Yes (useless/useful)	(1/19)		(1/7)		(3/107)		(1/5)		(2/26)		(8/164)	
Frequency of genetics in medical practice ($P < 0.001$)												
At least once a week	16	7	67	26.8	72	28.5	14	5.4	37	22.7	206	17.9
Once a month	34	14.9	31	12.4	68	26.9	18	6.9	37	22.7	188	16.3
Less frequently	178	78.1	152	60.8	113	44.7	227	87.7	89	54.6	759	65.8

[a]"Yes useless" and "yes useful" grouped together; *P* values correspond to χ^2 testing.

SD, 0.80), and last, Techniques and Innovations in Genetics (mean, 2.76; SD, 0.87). These results are detailed by country in Table 2. Ranking of priorities was consistent across the five countries, but absolute scores differed significantly ($P < 0.001$).

Multivariate adjustment for educational priorities in genetics

Country differences

Country differences remained for all educational priority scores after adjustment on covariates and possible confounders (gender, age, previous training in genetics, genetics in practice). Details are presented in Tables 3 and 4.

For GCD and AGRACP, French, German, and Dutch GPs quoted higher priorities than British physicians ($P < 0.05$); Swedish physicians did not differ from the British ones (Table 3).

For PCI, BGCM, ELPHI, and TIG, only French physicians differed from the British, assessing higher priorities for these four kinds of genetic educational needs ($P < 0.05$). GPs in the three other countries were comparable to the United Kingdom physicians in their assessment of priorities (Table 4).

French physicians systematically quoted the highest priorities for educational training in genetics, whereas British physicians were those stating the lowest ones.

Gender differences

Women gave significantly higher priorities than did men to GCD ($P < 0.001$), PCI ($P < 0.001$), and ELPHI ($P < 0.05$) but lower than men to TIG ($P = 0.005$). There were no gender differences for AGRACP and BGCM.

Age differences

Physicians older than 50 gave higher priorities to BGCM ($P = 0.003$) and to TIG ($P < 0.05$), compared with their younger colleagues (Table 4). There were no age differences for the four other scores.

Table 2
GP's Genetic Educational priorities scores (ranging from 1 the lowest to 5 the highest priority) by country

Educational priorities	France	Germany	The Netherlands	Sweden	UK	Total
Genetics of Common Diseases (GCD)						
n	224	250	247	256	158	1135
Mean	3.70	3.62	3.43	3.31	3.37	3.49
Median	4.00	3.80	3.60	3.40	3.20	3.60
SD	0.78	0.76	0.81	0.82	0.75	0.80
Approaching Genetic Risk Assessment in Clinical Practice (AGRACP)						
n	224	250	246	255	158	1133
Mean	3.58	3.40	3.34	3.36	3.23	3.39
Median	3.60	3.50	3.40	3.40	3.20	3.40
SD	0.73	0.75	0.81	0.74	0.80	0.77
Psychosocial and Counseling Issues (PCI)						
n	222	250	248	254	159	1133
Mean	3.34	3.04	3.02	3.09	3.25	3.13
Median	3.38	3.00	3.25	3.00	3.25	3.25
SD	0.80	0.83	0.88	0.86	0.88	0.86
Basic Genetics and Congenital Malformations (BGCM)						
n	222	249	244	253	154	1122
Mean	3.29	3.07	2.94	2.79	2.92	3.00
Median	3.40	3.00	3.00	2.80	3.00	3.00
SD	0.72	0.77	0.77	0.78	0.69	0.77
Ethical, Legal and Public Health Issues (ELPHI)						
n	221	250	248	254	156	1129
Mean	3.11	2.73	2.87	2.71	2.97	2.86
Median	3.17	2.67	3.00	2.83	3.00	3.00
SD	0.81	0.86	0.82	0.84	0.78	0.84
Techniques and Innovation in Genetics (TIG)						
n	220	250	247	254	157	1128
Mean	3.03	2.88	2.60	2.60	2.66	2.76
Median	3.00	2.80	2.60	2.60	2.60	2.80
SD	0.83	0.90	0.90	0.82	0.80	0.87

Training in genetics and frequency of genetics in medical practice

Marginal effects of previous training in genetics on the assessment of educational priorities were observed. The occurrence of postgraduate training in genetics was associated with rating a higher priority for training for TIG ($P = 0.05$). Poorly rated undergraduate training was associated with a higher priority for TIG compared with a useful undergraduate training ($P < 0.05$). Finally, those who had not had CME training in genetics gave a higher priority to GCD more often ($P < 0.05$). There was a significant interaction ($P < 0.05$) between country and undergraduate training for defining the priority of BGCM. Only for Swedish physicians, poor evaluation of their undergraduate training was associated with a lower need for the BGCM training. This effect was not observed for the other countries.

Frequency of genetics in medical practice was not significantly associated with educational priorities in univariate comparisons and therefore was not entered in the multivariate modeling.

DISCUSSION

Statement of principal findings

This survey is the first to attempt to assess perceived educational needs in genetics among a sample of European primary care providers. Of the six different educational fields investi-

Table 3
Factors associated with a higher educational priority (dependent variable) after multivariate adjustment by logistic regression for each of the first three educational genetic priorities subscores (GCD, AGRACP, PCI)

	Genetics of Common Diseases (GCD) (0,1) (<3.6, ≥3.6)			Approaching Genetic Risk Assessment in Clinical Practice (AGRACP) (0,1) (<3.4, ≥3.4)			Psychosocial and Counseling Issues (PCI) (0,1) (<3.25, ≥3.25)		
	Adj OR	95% CI	*P*	Adj OR	95% CI	*P*	Adj OR	95% CI	*P*
Country			<0.001			0.001			0.003
France (1)	2.47	1.61–3.78	0.001	2.36	1.55–3.60	0.001	1.65	1.08–2.51	0.02
Germany (1)	1.77	1.16–2.69	0.007	1.61	1.07–2.43	0.02	0.91	0.60–1.38	NS
Netherlands (1)	1.56	1.02–2.39	0.04	1.59	1.06–2.40	0.02	0.88	0.58–1.32	NS
Sweden (1)	0.91	0.60–1.40	NS	1.23	0.81–1.84	NS	0.85	0.56–1.29	NS
United Kingdom (0)	—								
Gender									
Female (1)	1.56	1.20–2.03	0.001	1.19	0.92–1.54	NS	1.83	1.41–2.37	0.001
Male (0)									
Age									
>50 (1)	0.79	0.61–1.61	NS	0.85	0.67–1.10	NS	0.92	0.71–1.18	NS
≤50 (0)									
Continuous Medical Education									
No (1)	1.52	1.04–2.23	0.03	NE			NE		
Yes (0)									

Variables shown as (NS) were entered into the model but were not selected because they did not fulfill the selection criteria (in $P = 0.05$; out $P = 0.10$). Those variables that were not significant in univariate comparisons were not entered (NE) into the models.
Adj OR, adjusted odds ratio; 95% CI, 95% confidence interval.

gated, GPs rated "Genetics of Common Diseases" as their highest priority. These assessments differed significantly across the countries, but also according to physicians' gender and age. Previous education in genetics had a marginal effect in particular at the postgraduate level. This occurred infrequently, but when it did it was assessed to be useful for the majority of the respondents. French, German, and Dutch physicians rated higher needs than their Swedish and British colleagues for "Genetics of Common Diseases" and "Approaching Genetic Risk Assessment in Clinical Practice." For the other four dimensions (ethical, counseling, innovations, and basic genetics), French physicians expressed higher needs, than their colleagues. Gender and age had a significant impact on assessing the different priorities.

Strengths and weaknesses of the study

This study was a mailed survey with a low response rate even with mail and telephone reminders and a small financial incentive recommended for increasing the response rates.[11,12] We acknowledge that the low response rate may significantly influence the generalizability of the results obtained in particular for a descriptive assessment of the priorities for a given country population of GPs. Educational priorities and previous educational training in genetics were assessed not taking into account physicians' knowledge, as this has been previously studied and found inadequate.[13,14]

Strengths and weaknesses in relation to other studies discussing important differences in results

Although the response rate was low, it is comparable to other surveys of this type. However, this survey is one of the few sources of information comparing physicians in a number of European countries in their needs for training in genetics according to their own practice. It is of interest to show the different response rates according to the countries because a low response rate has also to be considered as an indicator of interest for the topic of the survey. It has been suggested that the most interested physicians are more likely to answer and therefore are likely to be over-represented in the analyzed sample. If this is correct, the highest answer rate which was seen in the returns by French physicians is paralleled by the systematically high priorities given in their scores. The low response rate and lower priorities given by British physicians is perhaps disconcerting in view of last years health policy in favor of genetics putting the GPs at the front line of primary care genetics[15]; it may also reflect the increase in workload with the new contract in which genetics was not specified. Previous qualitative studies with face-to-face interviews have assumed that training about genetic testing, counseling, and ethical issues were considered as high priorities by GPs who lacked confidence and knowledge in the field of medical genetics.[14,16] Since interviews are more likely to yield socially desired answers, this may ex-

Table 4
Factors associated with a higher educational priority (dependent variable) after multivariate adjustment by logistic regression for the last three educational priority subscores (BGCM, ELPHI, TIG)

	Basic Genetics and Malformations (BGCM) (0,1) (<3.0, ≥3.0)			Ethical, Legal, Public Health (ELPHI) (0,1) (<3.0, ≥3.0)			Techniques and Innovations in Genetics (TIG) (0,1)(<2.8, ≥2.8)		
	Adj OR	95% CI	*P*	Adj OR	95% CI	*P*	Adj OR	95% CI	*P*
Country			0.000			<0.0000			0.001
France (1)	4.56	2.43–8.53	0.000	1.88	1.24–2.87	0.003	2.07	1.34–3.20	NS
Germany (1)	1.41	0.85–2.34	NS	0.76	0.49–1.13	NS	1.53	1.01–2.33	0.05
Netherlands (1)	1.24	0.78–1.96	NS	1.09	0.73–1.64	NS	1.03	0.68–1.57	NS
Sweden (1)	0.96	0.58–1.59	NS	0.73	0.46–1.06	NS	1.03	0.67–1.58	NS
United Kingdom (0)	ref			ref		—			
Age									
>50 (1)	1.48	1.14–1.92	0.003	0.86	0.67–1.10	NS	1.34	1.03–1.73	0.03
≤50 (0)									
Gender									
Female (1)	0.84	0.64–1.10	NS	1.33	1.06–1.79	0.02	0.68	0.52–0.89	0.005
Male (0)									
Postgraduate education									
Yes (1)									
No (0)	NE	NE	NE	NE	NE	NE	1.67	1.01–2.78	0.05
Undergraduate			NS						0.02
No (1)							0.99	0.69–1.43	NS
Yes useless (2)							1.40	1.01–2.8	0.04
Yes useful (0)									

Variables shown as (NS) were entered into the model but did not fulfill the selection criteria (in $P = 0.05$; out $P = 0.10$). Those variables not significant in univariate comparisons were not entered (NE) into the models.
Adj OR, adjusted odds ratio; 95% CI, 95% confidence interval.

plain why ethical needs appeared with a higher importance in these surveys compared with ours. Few quantitative surveys are available on this topic and the strength of our study was to build and to validate an extensive measure for the assessment of genetic educational needs making possible intergroup comparisons.

Meaning of the study: possible explanations and implications for clinicians, genetic teachers and policymakers

CME in genetics seemed to be only a moderate priority among primary care providers perhaps because of the increasing general workloads and the daunting complexity of increasing genetic knowledge.[6,17] However, GPs gave high scores to genetic knowledge about common diseases and perhaps because of well-publicized progress in testing in cancer in particular[6,18] and also with other common diseases.[4] Primary care providers considered training in risk assessment in clinical practice as a more important educational priority than innovations and ethical aspects. These results should be taken into account when planning postgraduate and CME and in the appraisal of the current content of CME in different European countries.

Unanswered questions and future research

Involving GPs in the "new genetics" by encouraging them to adequately inform their patients about family risks, initiating genetic testing and appropriate referral to genetic services are clearly international challenges albeit with some national variation of details.[19,20] The awareness of the impact of marketing on the delivery of genetic testing is also a important issue to consider.[21,22] It is not only a question of training but a question of choice of practice for the future. This clearly raises questions about the quality of care delivered but also about policy and training issues for primary care and genetics. The complexity of genetic knowledge, in particular in the context of common disorders, its related uncertainties, and its dynamic content, is clearly a future challenge for all health care providers, physicians, nurses, or social workers. Future research is necessary to determine what kind of standardized and assessed complementary tools (professional guidelines, labelized websites, information leaflets, decision aids . . . .) could be effective in helping non genetic health care providers in delivering adequate information to their patients.

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