Evaluation of the use of ultrasonography in primary care

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Ultrasonography is proposed as a useful diagnostic aid for primary care physicians. This prospective study describes the demand for ultrasound examinations, excluding heart, vessels and pregnancy monitoring, in primary care in Switzerland. Eleven independent physicians requested an average of 2.7 ultrasound examinations per month and 18 residents 1.9 per month, which was similar to the figure of 2.2 obtained in a population-based study of 82 primary care physicians serving a region of 80,000 inhabitants. Current demand for ultrasound scanning is low and does not indicate systematic training of primary care physicians until the efficacy of ultrasonography in this setting has been shown.

Key words: demand, primary care physicians, ultrasound scanning

In recent years, ultrasonography has become a significant non-invasive instrument for medical investigation and is considered by some as the 'stethoscope of the future',[1] although this statement has been made without firm evidence concerning efficacy. While ultrasound scanning was initially confined to radiologists and specialists, it is now in the process of being introduced into the practices of certain primary care physicians.

The introduction of ultrasound scanning into primary care physicians' offices with the possibility of self-referral opens up many unresolved questions concerning effectiveness, training, maintenance of skills and cost control. We do, however, lack such basic information as the frequency of demand for ultrasound scanning in primary care medicine. We prospectively studied the demand for ultrasound scanning in a group of primary care physicians in private practice or under training and compared our results with a population-based study in a defined area.

PATIENTS AND METHODS

Prospective study

Two groups of primary care physicians participated in the study. The first group included 11 board-certified primary care physicians (general internists and family practitioners, three females and eight males and mean age 46 years), established in private practice in the western part of Switzerland for a mean of 13 years (range 6–18 years).

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These physicians belonged to a specific group involved in teaching and research in primary care. Half of them work in an urban and half in a rural setting. The second group consisted of 18 residents (five females and 13 males and mean age 30 years) in training in general or internal medicine at a primary care facility, the medical out-patient clinic of the University of Lausanne. The residents were supervised by five senior registrars. Patient care was comparable in both types of setting, although the absence of routine recording of diagnostic information did not allow an adjustment for differences in morbidity, co-morbidity or severity of disease. Care of pregnant women was infrequent.

Each physician was asked to record prospectively on an *ad hoc* questionnaire all ultrasound examinations requested over a two month period (November to December 1993). Ultrasound examinations of the heart and vessels as well as pregnancy monitoring were not included. None of the physicians was trained in ultrasound techniques nor did they possess equipment; the residents had the possibility to request ultrasound scanning in-house while the independent primary care physicians had to refer their patients to a radiologist. There were no explicit financial constraints in either type of setting. Physicians specified their demand for ultrasound scanning as follows: upper and lower abdominal, upper or lower abdominal and non-abdominal (thyroid, musculoskeletal and others). They indicated the purpose of the examination and its degree of urgency. In addition, they were asked to state if the result had any influence on their attitude to patient care.

Population-based study

A population-based evaluation was performed in an area of 80,000 people in the western part of Switzerland. At this time, all ultrasound examinations in this area were performed exclusively by the same group of hospital-based radiologists. We included all ultrasound examinations,

excluding heart, vessels and pregnancy monitoring, requested by the 82 primary care physicians (72 general internists and family practitioners and ten pediatricians) in practice in and around the city of Neuchâtel over a three month period (January to March 1993). The register of ultrasound scans performed was used as the source of information.

Statistical methods

The χ^2 test was used to assess statistical significance when comparing proportions. The Mann–Whitney U-test was used in the comparison of rates of use of ultrasound examinations (per month, per 1,000 consultations). An α value of 0.05 was used as the threshold for statistical significance.

RESULTS

Prospective study

The 29 physicians ordered a total of 126 ultrasound examinations overall, 104 of them being abdominal and 22 non-abdominal (*table 1*). Demand was heterogeneous between the two groups (p=0.013) and residents requested more upper abdominal and less 'other' ultrasound examinations. Because physicians in private practice see more patients than residents in training, the number and type of ultrasound examinations per 1,000 consultations were calculated for both groups: residents requested on average twice as many ultrasound examinations as independent primary care physicians (17.2 versus 9.7 ultrasound examinations per 1,000 consultations), a difference which was, however, not statistically significant (p=0.11).

Table 2 describes the average demand for ultrasound scanning per month by primary care physicians and residents in the prospective study, compared to that by primary care physicians in the population-based study.

Primary care physicians considered their demands as urgent in 12% and residents in 15% of the situations. The investigation of a new medical condition was the purpose of most ultrasound examinations requested (primary care physicians 81% and residents 88%) whereas examination of an existing condition was much less frequent (19 and 12% respectively). A new clinically relevant diagnosis was found in only a few cases (3 and 10%) and the ultrasound scanning led to a change in the care process in only a minority of cases (10 and 16%), in primary care physicians and residents respectively.

Population-based study

Overall, the group of 82 primary care physicians requested 531 ultrasound examinations during the three month period. *Table 2* shows the type and average demand for ultrasound examination per month per physician. Compared to the general internists and family practitioners, the pediatricians requested the same number of ultrasound examinations per month, but they did, however, order more non-abdominal examinations, particularly ultrasound examinations of the hip. Globally, 2.2 ultrasound examinations were performed per 1,000 persons per month (95% CI: 1.9–2.5).

Table 1 Total number (percentage) and type of ultrasound examinations requested during a period of two months by primary care physicians and residents

Type of ultrasound examination	Primary care physicians n=11		Residents n=18	
	n	%	n	%
Abdominal	44	75	60	90
Upper and lower	16	27	14	21
Upper only	12	21	28	42
Lower only	16	27	18	27
Non-abdominal	15	25	7	10
Thyroid	6	10	6	9
Other[a]	9	15	1	1
Total	59	100	67	100

a: Other ultrasound examinations: popliteal cysts (3), cervical masses (2), articulations (2), muscular masses (1), salivary gland (1) and breast (1)

DISCUSSION

Despite the fact that the efficacy of ultrasound scanning as a multipurpose diagnostic tool in the hands of primary care physicians has not been demonstrated, ultrasonography is acclaimed as a highly useful technology in this setting. The relative simplicity of the ultrasound technique, together with the relatively low cost of acquisition of equipment, may explain its popularity. Nevertheless, the physicians' ownership of new diagnostic facilities can lead to conflicts of interest and an increase in health care costs. Self-referral for medical imaging (radiography and ultrasound scanning), in which physicians perform and interpret diagnostic imaging examinations concerning their own patients rather than referring them to imaging specialists, has attracted considerable attention in recent medical literature.[2–6] Self-referral by the primary care

Table 2 Number and type of ultrasound examinations requested per month by primary care physicians and residents (average, minimum and maximum)

Type of ultrasound examination	Prospective study		Population-based study
	Primary care physicians n=11	Residents n=18	Primary care physicians n=82
Abdominal	2.0 (0.5–3.5)	1.7 (0.5–3.0)	1.9 (0.3–5.3)
Non-abdominal	0.7 (0.0–2.0)	0.2 (0.0–1.0)	0.3 (0.0–1.3)
Total	2.7 (0.5–4.5)	1.9 (0.5–4.0)	2.2 (0.3–5.3)

physician may be particularly problematical.[7–9] The use of ultrasound scanning has so far only been studied in specific populations, such as pregnant women.[10]

Why did the primary care physicians included in this study make little use of ultrasound examinations? We only can suggest possible hypotheses. Firstly, seasoned clinicians may feel confident in the results of their clinical examination and consider that their patients will not benefit from ultrasound examinations. Secondly, physicians may lack specific training and may not be familiar with the indications for this relatively new technique. Thirdly, the need to refer their patients elsewhere for ultrasonography may act as a deterrent. In addition, lack of evidence of efficacy might lead to restricted use. Finally, financial considerations may lead to a limitation of demand, but in this study apparently did not interfere with our findings. Our observation that residents in training requested twice as many examinations as compared to their more experienced colleagues is difficult to understand in the absence of an adjustment for case mix, but this higher rate of use by residents might also have been due to some of the aforementioned reasons.

If the efficacy of ultrasound scanning as a diagnostic tool in primary care practice were proved, this low rate of demand for ultrasound scanning in primary care would raise questions concerning the training of physicians in ultrasound techniques. Training and mastery of technical skills demand access to a sufficient number of patients. With an average of 2.2 ultrasound examinations per month, primary care physicians, even well-trained, cannot adequately maintain their technical skills based on their own regular need for ultrasound examinations. Hence, this study does not in fact support systematic training of all primary care physicians in ultrasound techniques. Ultrasound examinations should currently be performed by physicians who have access to a sufficient number of patients and who are willing to assume the responsibility of obtaining sufficient training and mastering the technical skills. In future, however, the situation may change with the development of smaller bedside ultrasound equipment for use as an imaging adjunct to clinical examination.[11] If this were the case, and relevant evidence of effectiveness would be provided, obtaining sufficient training and mastering the ultrasound techniques should be integrated into medical education at a very early stage in order to familiarize students with a three-dimensional anatomical view of the body.

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REFERENCES

1 Filly RA. Ultrasound: the stethoscope of the future, alas. Radiology 1988;167:400.

2 Relmann AS. Dealing with conflicts of interest. N Engl J Med 1985;313:749–51.

3 Morreim EH. Conflicts of interest: profits and problems in physician referrals. JAMA 1989;262:390–4.

4 Stark FH. Physicians' conflicts in patient referrals. JAMA 1989;262:397.

5 Hyman DA, Williamson JV. Fraud and abuse: setting the limits on physicians' entrepreneurship. N Engl J Med 1988;320:1275–8.

6 Childs AW, Hunter ED. Non-medical factors influencing use of diagnostic X-ray by physicians. Med Care 1972;10:323–35.

7 Radecki SE, Steele JP. Effect of on-site facilities on the use of diagnostic radiology by non-radiologists. Invest Radiol 1990;25:190–3.

8 Strasser RP, Bass MJ, Brennan M. The effect of an on-site radiology facility on radiologic utilization in family practice. J Family Pract 1987;24:619–23.

9 Hillman BJ, Joseph CA, Mabry MR, Sunshine JH, Kennedy SD, Noether M. Frequency and costs of diagnostic imaging in office practice: a comparison of self-referring and radiologist-referring physicians. N Engl J Med 1990;323:1604–8.

10 Bucher HC, Schmidt JG. Does routine ultrasound scanning improve outcome in pregnancy? Meta-analysis of various outcome measures. BMJ 1993;307:13–7.

11 Evens RG. The future of ultrasonography. Report of the Ultrasonography Task Force. JAMA 1991;266(3):406–9.

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