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Contributors: GSE studied monozygotic twins at the Joslin Clinic (Boston, Massachusetts) and at the Barbara Davis Center (Denver, Colorado). GSE, the principal investigator, formulated the hypothesis and is the guarantor for the paper. MJR organised the study and contributed to the genetic analyses. MR is the principal investigator in the DAISY study. LY carried out islet cell autoantibody analysis. SG contributed to clinical follow up and referral of the twins. RBE and CCP carried out cytoplasmic islet cell antibodies assay. The paper was written by MJR and GSE.

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- 1 Verge CF, Gianani R, Yu L, Pietropaolo M, Smith T, Jackson RA, et al. Late progression to diabetes and evidence for chronic  $\beta$  cell autoimmunity in identical twins of patients with type I diabetes. *Diabetes* 1995;44:1176-9.
- 2 Dib S, Vardi P, Connelly J, Eisenbarth GS, Soeldner JS. Immune changes associated with insulin dependent diabetes may remit without causing the disease: a study in identical twins. *BMJ* 1986;292:1670.
- 3 Srikanta S, Ganda OP, Eisenbarth GS, Soeldner JS. Islet cell antibodies and  $\beta$  cell function in monozygotic triplets and twins initially discordant for type I diabetes mellitus. *N Engl J Med* 1983;308:322-5.
- 4 Srikanta S, Ganda OP, Jackson RA, Gleason RE, Kaldany A, Gorovoy MR, et al. Type I diabetes mellitus in monozygotic twins: chronic progressive beta cell dysfunction. *Ann Intern Med* 1983;99:320-6.
- 5 Kumar D, Gemayel NS, Deapen D, Kapadia D, Yamashita PH, Lee M, et al. North-American twins with IDDM: genetic, etiological, and clinical significance of disease concordance according to age, zygosity, and the interval after diagnosis in first twin. *Diabetes* 1993;42:1351-63.
- 6 Kyvik KO, Green A, Beck-Nielsen H. Concordance rates of insulin dependent diabetes mellitus: a population based study of young Danish twins. *BMJ* 1995;311:913-7.
- 7 Petersen JS, Kyvik KO, Bingley PJ, Gale EAM, Green A, Dryberg T, et al. Population based study of prevalence of islet cell autoantibodies in monozygotic and dizygotic Danish twin pairs with insulin dependent diabetes mellitus. *BMJ* 1997;314:1575-9.
- 8 Hawkes CH. Twin studies in diabetes mellitus. *Diabet Med* 1997;17:347-52.
- 9 Rowe RE, Leslie RDG. Twin studies in insulin-dependent diabetes and other autoimmune diseases. *Diabetes Metab Rev* 1995;11:121-36.

- 10 Atkinson MA, Maclaren NK. Islet cell autoantigens in insulin dependent diabetes. *J Clin Invest* 1993;92:1608-16.
- 11 Verge CF, Stenger D, Bonifacio E, Colman PG, Pilcher C, Bingley PJ, et al. Combined use of autoantibodies (IA-2ab, GAD65, IAA, ICA) in type 1 diabetes: combinatorial islet autoantibody workshop. *Diabetes* 1998;47:1857-66.
- 12 Hawa M, Rowe R, Lan MS, Notkins AL, Pozzilli P, Christie MR, et al. Value of antibodies to islet protein tyrosine phosphatase-like molecule in predicting type 1 diabetes. *Diabetes* 1997;46:1270-5.
- 13 Rewers M, Bugawan TL, Norris JM, Blair A, Beaty B, Hoffman M, et al. Newborn screening for HLA markers associated with IDDM: diabetes autoimmunity study in the young (DAISY). *Diabetologia* 1996;39:807-12.
- 14 Ziegler AG, Ziegler R, Vardi P, Jackson RA, Soeldner JS, Eisenbarth GS. Life table analysis of progression to diabetes of anti-insulin autoantibody-positive relatives of individuals with type I diabetes. *Diabetes* 1989;38:1320-5.
- 15 Falorni A, Örtqvist E, Persson B, Lernmark L. Radioimmunoassays for glutamic acid decarboxylase (GAD65) and GAD65 autoantibodies using  $^{35}\text{S}$  or  $^3\text{H}$  recombinant human ligands. *J Immunol Methods* 1995;186:89-99.
- 16 Verge CF, Gianani R, Kawasaki E, Yu L, Pietropaolo M, Jackson RA, et al. Prediction of type I diabetes in first-degree relatives using a combination of insulin, GAD, and ICA512bdc/IA-2 autoantibodies. *Diabetes* 1996;45:926-33.
- 17 Gianani R, Rabin DU, Verge CF, Yu L, Babu S, Pietropaolo M, et al. ICA512 autoantibody radioassay. *Diabetes* 1995;44:1340-4.
- 18 Kawasaki E, Yu L, Gianani R, Verge CF, Babu S, Bonifacio E, et al. Evaluation of islet cell antigen (ICA) 512/IA-2 autoantibody radioassays using overlapping ICA512/IA-2 constructs. *J Clin Endocrinol Metab* 1997;82:375-80.
- 19 Pilcher CC, Elliott RB. A sensitive and reproducible method for the assay of human islet cell antibodies. *J Immunol Methods* 1990;129:111-7.
- 20 Bugawan TL, Erlich HA. Rapid typing of HLA-DQB1 DNA polymorphism using nonradioactive oligonucleotide probes and amplified DNA. *Immunogenetics* 1991;33:163-70.
- 21 Lorenzen T, Pociot F, Hougaard P, Nerup J. Long-term risk of IDDM in first-degree relatives of patients with IDDM. *Diabetologia* 1994;37:321-7.
- 22 Kyvik KO, Green A, Beck-Nielsen H. The most recent part of the Danish twin registry. Establishment and analysis of zygote specific twinning rates. *Ugeskr Laeger* 1996;158:3456-60.
- 23 Svendsen AJ, Kreutzfeld JC, Lund EB, Kyvik KO, Green A. Incidence of juvenile-onset diabetes in Denmark. A prospective registration in the counties of Fyn, Ribe, Sønderjylland and Vjlel. *Ugeskr Laeger* 1997;159:1257-60.
- 24 Johnston C, Pyke DA, Cudworth AG, Wolf E. HLA-DR typing in identical twins with insulin-dependent diabetes: difference between concordant and discordant pairs. *BMJ* 1983;286:253-5.

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## Training in large bowel cancer surgery: observations from three prospective regional United Kingdom audits

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Operative experience under the supervision of a consultant must be at the core of any surgical training programme. Almost no objective data on general surgical training, however, exist in the United Kingdom. Colorectal cancer surgery represents a substantial part of general surgery; the operations are of differing complexity, and a third present as emergencies. Individual surgeons may influence outcome after colorectal cancer surgery.<sup>1</sup> We determined trainee surgeons' supervised experience in three prospective UK colorectal cancer audits.

### Methods and results

The audits covered 1990-4. The number of resections undertaken by trainees, and the proportion of these supervised by a consultant, were determined. A supervised resection was one in which the operation note named the consultant as the assistant. These audits did not record observational supervision. Right hemicolectomy and anterior resection for rectal and rectosigmoid cancers were considered to be representative of operations undertaken by junior and senior trainees. The current number of specialist registrar posts is 21 in Lothian and Borders, 50 in Wessex, and 125 in Trent and Wales.

Altogether, 7282 elective and 1594 emergency resections were performed (table); trainees performed 2772 (39.8%) of the elective and 1089 (65.2%) of the emergency resections. A consultant was present at 63.7% (5653) of all resections (54.9% (4874) as the surgeon and 8.8% (779) as assistant to a trainee). Consultants supervised 20.2% (779/3861) of the resections performed by trainees.

Of the 2275 right hemicolectomies performed, trainees undertook 1300 (57.1%), and a consultant assisted in 198 (15.2%) of these. Of 1849 elective anterior resections performed for rectosigmoid and rectal cancers, trainees undertook 571 (30.9%), and a consultant assisted in 197 (34.5%) of these.

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## Trainee experience and consultant supervision for all elective and emergency resections

Grade of surgeon	No (%) of operations			No (%) of operations undertaken by trainees who were supervised by consultant		
	Lothian and Borders	Trent and Wales	Wessex	Lothian and Borders	Trent and Wales	Wessex
Elective:						
Consultant	692 (63.4)	1399 (58.7)	2308 (60.6)	0	0	0
Senior registrar	225 (20.6)	324 (13.6)	584 (15.3)	72 (32)	65 (20)	47 (8)
Registrar	161 (17.7)	544 (22.8)	683 (17.9)	85 (53)	150 (28)	153 (22)
Senior house officer	14 (1.3)	115 (4.8)	122 (3.2)	9 (64)	54 (47)	32 (26)
Other	0	0	111 (2.9)	0	0	6 (5)
Total*	1092 (100)	2382 (100)	3808 (100)	166 (15.2)	269 (11.3)	232 (6.1)†
Emergency:						
Consultant	188 (38.9)	154 (30.9)	133 (21.7)	0	0	0
Senior registrar	159 (32.9)	99 (19.9)	162 (26.5)	19 (12)	5 (5)	4 (2)
Registrar	127 (26.3)	223 (44.7)	250 (40.9)	32 (25)	26 (12)	17 (7)
Senior house officer	9 (1.9)	23 (4.6)	37 (6.0)	2 (22)	4 (17)	3 (8)
Other	0	0	30 (4.9)	0	0	0
Total	483 (100)	499 (100)	612 (100)‡	53 (11.0)	35 (7.0)	24 (3.9)

\*Does not include 89 cases in which the operating surgeon was unknown (4 in Lothian and Borders, 85 in Wessex).

†Does not include the six supervised operations undertaken by non-training grade surgeons.

‡Does not include 7 cases in which the operating surgeon was unknown.

## Comment

This study shows that trainee surgeons performing colorectal cancer surgery are receiving insufficient consultant supervision. The audits cover almost a fifth of the UK population and are probably representative of national colorectal cancer surgery. The absolute number of supervised resections likely to be undertaken by a typical trainee seems low. In these audits, however, consultant supervision was determined from the operation note, which documented only direct, not indirect, involvement. The importance of also recording when trainees operate independently but with their consultant immediately available is now recognised.<sup>2</sup> United States residents undertaking a one year colorectal fellowship would expect to perform over 100 large bowel resections,<sup>3</sup> far more than an equivalent trainee in Britain.

As these data were recorded before the introduction of specialist training they might not be considered representative of current practice.<sup>4</sup> Currently, however, no other equivalent data on training exist. In Edinburgh during 1994-7 general surgery performed with consultant supervision increased by 5% but operations performed by trainees fell by 8% (unpublished data). This decrease is in addition to the loss resulting from the shortened specialist training period. There will be a further 14% drop if junior doctors are restricted to 48 hours' work a week.

A core aim of surgical training is consultant supervision during emergency surgery, but such supervision was lacking in these audits. It can no longer be acceptable that inadequately supervised trainees care for critically ill patients. The national confidential inquiry into postoperative deaths suggests that this acknowledged deficiency still has not been addressed.<sup>5</sup> If consultants are to increase their direct supervision of emergency surgery they will have to be relieved of other commitments, and other logistical difficulties, such as theatre availability, will have to be addressed.

Quality of training is an essential part of patients' care. The provision of sufficient protected training time should become a priority when quality protocols are developed. Substantial potential exists to increase the

number of operations performed by supervised trainees, although it will require additional resources.

R J Aitken represents the Lothian and Borders Large Bowel Cancer Project; M R Thompson and J A E Smith represent the Wessex Colorectal Cancer Audit; A G Radcliffe, J D Stamatakis and R J C Steele represent the Trent and Wales Colorectal Cancer Audit.

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- 1 McArdle CS, Hole D. Impact of variability among surgeons on postoperative morbidity and mortality and ultimate survival. *BMJ* 1991;302:1501-5.
- 2 Joint Committee on Higher Surgical Training. *A curriculum, organisation and syllabus for higher surgical training in general surgery and its sub-specialties*. London: Surgical Advisory Committee in General Surgery, 1998.
- 3 American Society of Colon and Rectal Surgeons. *Directory of residency training programs in colon and rectal surgery, 1996-1997*. Chicago, IL: ASCRS, 1996.
- 4 Calman R. Hospital doctors: training for the future. In: Calman K, ed. *The report of the Working Group on Specialist Medical Training*. London: HMSO, 1993.
- 5 Gray AJ, Hoile RW, Ingram G, Sherry KM. *The report of the national confidential enquiry into post operative deaths (NCEPOD)*. London: Royal College of Surgeons of England, 1997. (Accepted 18 November 1998)

## Endpiece Cabbage

A familiar kitchen-garden vegetable about as large and wise as a man's head.

Ambrose Bierce, *The Enlarged Devil's Dictionary* (1906)

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