probably inappropriate. Although patients at the end of the clinic still tended to wait longer than those with earlier appointments, the new system also reduced this inequity.

Few problems were encountered in implementing the new appointments system. Such a system, however, may not be appropriate for haematology and diabetes

clinics, when a blood test is usually required before the consultation, or if a high proportion of patients require ambulance transport.

From the economic point of view a reduction in patients' waiting time represents a cost saving. As there was no appreciable change in either the total duration of the clinics or the number of patients seen it is unlikely that the time costs had merely been transferred to the doctor. It seems reasonable to conclude that a reduction in waiting time for patients may result in improvements in efficiency.

I thank Mrs I Hall, nursing auxiliary, for her help with this study.

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Effect of new appointments system on waiting times and number of patients seen, December 1988-June 1989

Month	Mean waiting time (mins)	Mean maximum waiting time (mins)	Mean No of patients per clinic	Mean total clinic duration (mins)
December 1988	39.6	78.8	15.8	187
January 1989	41.4	61.3	12.2	169
February 1989	28.6	48.4	14.6	185
March 1989	10.9	47.6	14.5	186
April 1989	12.7	48.7	14.2	158
May 1989	8.2	38.2	15.0	162
June 1989	9.5	37.1	15.4	160

Availability of transplantable organs from brain stem dead donors in intensive care units

Sheila M Gore, R M Ross Taylor, John Wallwork

Abstract

Objective—By audit from January to June 1989 to quantify, separately for hearts, kidneys, liver, lungs and corneas, the possible increases in transplantable organs from brain stem dead potential donors in intensive care units and to compare them with the increases achieved in October-November 1989, during intense, national publicity about transplantation.

Design—Prospective audit of all deaths in intensive care units in England from 1 January to 30 June 1989 and subsequent case study of the impact of publicity on offers and donations during October-November 1989.

Setting—15 regional and special health authorities in England.

Patients—5803 patients dying in intensive care units, of whom 497 were confirmed as brain stem dead and had no general medical contraindication to organ donation.

Main outcome measures—Organ specific suitability for transplantation (as reported by intensive care units); consent for donation of specific suitable organs; and procurement of specific organs reported as suitable for transplantation and offered.

Results—In the 497 (8.6%) brain stem dead potential donors we estimated the organ specific suitability for heart as 63%, kidneys 95%, liver 70%, lungs 29%, and corneas 91%. Refusal of relatives (30%) accounted for major losses of suitable organs of all types. For kidneys the loss was equivalent to 44% of brain stem dead actual kidney donors. No discussion of organ donation was the second most important reason for missed kidney donors, the loss being equivalent to 10% of brain stem dead actual donors. Non-procurement or difficulties with allocating organs was the second most notable cause of missed suitable liver and lung donors; 29% (55) of the offered total of 189 liver donors and 27% (21) of 78 offered suitable lung donors in six months. Non-procurement of suitable, offered organs was rare for kidneys and modest, of the order of 13% and 10% respectively, for heart and corneas. Corneal donation from brain stem dead potential donors might be improved nearly as much (that is, a 78% increase in brain stem dead actual corneal donors)

by specific measures to promote corneal donation when other organs are offered as by reducing the overall refusal rate. Restricted offers, non-procurement, and no discussion of donation accounted for nearly equal numbers of lost donations of hearts (each equivalent to 15% of donated hearts). During October-November 1989 when there was intense, positive publicity about transplantation the rates of refusal and non-discussion fell compared with during January-June (22%, 36/163 v 30%, 138/460; 7%, 33/497 v 2%, 4/167 respectively). Offers of suitable donors increased significantly ($p < 0.02$) compared with the first six months of 1989, most notably for heart donors (80 v 60.1 expected) and kidney donors (122 v 102.1 expected) but only for kidneys was there a noticeable 17% increase in actual donors (118 actual audited donors v 100.8 expected donors; $p = 0.09$).

Conclusions—Four strategies to increase the supply of transplantable organs from brain stem dead potential donors in intensive care units were identified: (a) reducing refusal of relatives (b) avoiding non-procurement of actually suitable organs (by logistical initiatives) and deterioration of initially suitable organs (by donor care initiatives); (c) converting restricted offers to unrestricted offers; and (d) ensuring discussion with families. Early referral to the transplant team or coordinator gives time for discussion about donor care and agreement on medical suitability for donation of specific organs. Solving some of the logistical problems of non-procurement may be a prerequisite for increased offers to be translated into increased donations. The impact of publicity therefore needs to be measured on offers of suitable donors as well as by actual donations.

Introduction

Confidential audit of all deaths in intensive care units in England (except coronary care only units and neonatal intensive care units) was initiated by the Department of Health after a recommendation by the Working Party on the Supply of Donor Organs for Transplantation.¹ It gave estimates of 1700 possible brain stem deaths and 1200 confirmed brain

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stem deaths annually in England,² which are half and one third respectively of Jennett's much quoted figure published in 1981.³ Also reported was a 30% (95% confidence interval 24% to 36%) rate of refusal of donation by relatives; in only 6% (3% to 9%) of cases was organ donation not discussed with the family of a brain stem dead potential donor.

In this second audit report we quantify for heart, kidneys, liver, lungs, and corneas the possible increases in transplantable organs from brain stem

dead potential donors, which are estimable with data from the first and second phases (1 January 1989 to 30 June 1989) of the confidential audit of all deaths in intensive care units in England. Quantification depends on three variables: organ specific suitability for transplantation (as reported by intensive care units), consent for donation of specific suitable organs; and procurement of specific organs that are reported as suitable for transplantation and have been offered.

Methods

The audit started on 1 January 1989 in regional and special health authorities in England and was coordinated through designated regional staff as previously described.² For patients with confirmed brain stem death and no general medical contraindication to organ donation the audit recorded whether organ donation was suggested to the relatives, which solid organs were suitable for transplantation and which were donated; and whether corneas were suitable for transplantation and were donated.

Data on the suitability of organs for transplantation were reported by the staff of the intensive care unit without necessary corroboration by a transplant team and possibly without consideration of deterioration in suitability between confirmation of brain stem death and arrival of the transplant team. These caveats on reported suitability of organs are important, especially for lungs.

Results

The figure shows the audit flow chart for 5803 (93.3%) deaths in intensive care units reported from 1 January 1989 to 30 June 1989. In 497 patients (8.6 (SE 0.4%)) brain stem death was confirmed in the absence of any general medical contraindication to organ donation, and this analysis is confined to these 497 potential donors. In four patients there were no known relatives and in 33 there was no discussion of organ donation; organ donation was suggested to relatives of 460 patients and the refusal rate was 30% (138 refusals) (95% confidence interval 26% to 34%). Not all organs from these lost potential donors were suitable for transplantation, as shown for hearts (table I) and for other organs (appendix, p 152).

SUITABILITY OF HEARTS FOR TRANSPLANTATION

Table I shows the suitability of hearts for transplantation against the background of relatives' consent to organ donation and also whether "suitable" hearts were donated. Suitability was not always ascertained; ascertainment was more likely if the relatives consented to organ donation than otherwise (94% (304/322) cases of consent *v* 85% (148/175)). Moreover, the transplant team or coordinator was almost always contacted if the relatives consented to organ donation (313/322, 97% of donors), but less often with refusals (57/138, 41%) and when there were no known relatives or organ donation was not discussed (5/37, 14%).

Reliability of the judgment of suitability of the heart as well as its ascertainment was therefore superior in cases of consent, and likewise for other organs (appendix). We therefore based our estimates of organ specific suitability on the subset of 322 cases of consent for which suitability was ascertained. Among 304 donors with consenting relatives, for whom suitability of the heart for transplantation was ascertained, the heart was reported as suitable in 193—that is, in 63% (58% to 69%).

SUITABILITY OF OTHER ORGANS FOR TRANSPLANTATION

With the above method we estimated that in brain stem dead potential donors the kidneys were suitable

Phases 1 and 2 of audit of brain stem dead transplantation donors, January-June 1989

TABLE I—Suitability of hearts from potential donors with brain stem death for transplantation as reported by intensive care units. Figures are numbers of donors

	Suitable hearts				Total
	Donated	Not procured	Not offered	Unsuitable hearts	
No known relatives or transplantation not discussed	1		12	19	37
Refusal by relatives			87†	29	138
Consent	155	23	15	111	322
Total	156	23	114	159	497

Given relatives' consent and organ suitability for transplantation was determined as:

% Suitable = $\frac{193}{(193+111)} \times 100 = 63\%$ (95% confidence interval 58% to 69%).

*Includes suitability not known or donation not known, or both.

†Including 36 discussed with transplant team or coordinator.

‡Including 13 for whom there was no offer.

for transplantation in 95% (92% to 97%); the liver in 70% (64% to 75%); and the corneas in 91% (87% to 94%). The corresponding estimate of 45% for lungs does not fit with experience of cardiothoracic surgeons. Indeed, among the 55 donors with lungs reported as suitable but not procured (appendix), non-suitability of the lungs at donor operation may be inferred for the 34 patients who became heart donors. In the other 21 patients we did not know whether a cardiothoracic team attended; the heart was either not suitable (two), not offered (one), or "suitable but not procured" (18). Inferring non-suitability of lungs at donor operation in 34 of the 55 donors revises to 29% (24% to 34%) our estimate of brain stem dead potential donors whose lungs are probably still suitable for transplantation at the time of donor operation.

POSSIBLE INCREASES FOR HEART DONATION

From January to June 1989, 156 heart donors were reported to the confidential audit. Table II shows that an additional 155 suitable heart donations would have been possible if there were no refusal by relatives (a); no non-procurement (b); no restricted permission or offers (c); and no non-discussions (d). These possible increases are derived from table I as follows. Among the 138 potential donors whose relatives refused organ donation, we estimated that 87 potential donors (63%) had suitable hearts (a); 23 suitable hearts were not procured (b). Restricted permission by otherwise consenting relatives led to no offer of a suitable heart in 15 donors and in 13 other potential donors the heart was not offered, its suitability for transplantation being reported as "not known" (footnote to table I). Yet of the 13 potential donors we expect the heart to have been suitable in eight (63%). Table II therefore shows the loss of 23 suitable hearts (15+8) because of no offer by otherwise consenting relatives (c). Of the 37 potential donors who had no known relatives or for whom organ donation was not suggested to the family, we estimate that 23 (63%) had suitable hearts from whom there was only one donation (see table I) and so we estimate the loss of 22 suitable hearts due to non-discussion (d).

POSSIBLE INCREASES FOR DONATION OF OTHER ORGANS

Possible increases in donors of other organs (table II) were worked out similarly using the tables in the appendix and the above organ specific estimates of suitability for transplantation.

Table II shows that for every organ measures to improve the rates of consent (a+c+d) have greater potential than initiatives in procuring or allocating organs to increase the supply of transplantable organs from brain stem dead potential donors. The major gain derives from measures to reduce the overall refusal rate (a) but corneal donation might be improved as much by specific measures to promote corneal donation when other organs are offered. Failure to discuss organ donation with relatives (d) comes second after refusal by relatives in accounting for the loss of suitable kidney donors whereas difficulties in procuring or allocating organs are the second most notable cause of missed suitable liver and reportedly suitable lung donors. Non-procurement, restricted offers, and no discussion (b+c+d) accounted for nearly equal numbers of lost heart donations.

Non-procurement of organs that were reportedly suitable for transplantation and were offered accounted for 23 hearts (13% of the offered total of 179; 95% confidence interval 8% to 18%); only four kidney donors (1% of 304 offered kidney donors); 55 livers (29% of the offered total of 189; 22% to 36%); 21 lung donors (27% of 78 offered lung donors potentially still suitable at donor operation; 17% to 37%); and 16 corneal donors (10% of 167 offered corneal donors; 5% to 14%). Thus non-procurement of suitable offered organs was rare for kidneys; modest, of the order of 13% and 10%, for heart and corneas respectively; and substantial, at around 30%, for liver and lungs.

CASE STUDY OF OFFERS AND DONATIONS DURING PUBLICITY CAMPAIGN

Even if effective publicity and professional education (affecting measures a and c and d) lead to increased offers of suitable organs, non-procurement could compromise actual donations. This will happen if non-procurement occurs owing to saturation of existing transplant services so that extra offers cannot be utilised rather than because of different criteria of suitability being applied by intensive care doctors and transplant doctors.

During October-November 1989 there was intense, sustained publicity about transplantation, the original focus of which was two patients who desperately needed liver transplants. We reviewed its impact on refusal by relatives and failure to ask about organ donation and on suitable offered donors and actual donations.

Compared with the 30% refusal rate in January-June 1989 that during October-November was 22% (36 out of 163 families; $p=0.06$); the rate of non-discussion was 7% in January-June, and only 2% (four out of 167 families) in October-November. Restricted offers of suitable hearts, however, were little changed (15/193 (8%) in January-June *v* 5/75 (7%) in October-November), those of suitable livers were 16 out of 204 (8%) in January-June compared with four out of 77 (5%) in October-November. If families who make restricted offers do so after due consideration they may be unlikely to change their decision, irrespective of publicity.

Table III shows suitable offered donors in two audit periods: January-June 1989 (out of 497 brain stem dead potential donors) versus October-November 1989 (out of 167 potential donors). For comparison are shown the expected offers for October-November if there was no change in offer pattern from January-June. Increased offers of suitable donors occurred in October-November compared with the first six months of 1989 ($\chi^2_3=13.6$, $p=0.02$), most notably for offered heart and

TABLE II—Possible increases in transplantable organs from brain stem dead potential donors as reported by intensive care units, January-June 1989

	Heart	Kidney	Liver	Lung*	Cornea
Number of transplanted donors from audit	156	300	134	57	151
Possible increase in donors of suitable organs	155	171	206	82	290
No refusal by relatives (a)	87	131	97	40	125
No non-procurement (b)	23	4	55	21	16
No restricted permissions or offers (c)	23	4	29	11	118
No non-discussion (d)	22	32	25	10	31
% Possible increase through measures to improve rates of consent (a+c+d)	85	98	73	74	94

*Revised to take some account of deterioration in lungs by time of donor operation.

TABLE III—Case study of offered and actual donors January-June and October-November 1989. Figures are numbers except when stated otherwise

Audit phase	Heart	Kidney	Liver	Lung*	Cornea
<i>Audit offers compared with expected offers</i>					
"Suitable" offered donors:					
Jan-Jun	179	304	189	78	167
Oct-Nov	80	122	73	32	61
Expected offers Oct-Nov (if no change from Jan to Jun)	60.1	102.1	63.5	26.2	56.1
<i>Audit donors compared with expected donors</i>					
Actual donors:					
Jan-Jun	156	300	134	57	151
Oct-Nov	55	118	48	16	53
Expected donors Oct-Nov (if no change from Jan-Jun)	52.4	100.8	45.0	19.2	50.7
<i>Non-procurement (%†)</i>					
Jan-Jun	13	1	29	27	10
Oct-Nov	19	3	34	50	13

*Revised to take some account of deterioration in lungs by time of donor operation.

†Defined as "suitable" but not procured/("suitable" but not procured plus suitable and donated) $\times$ 100%.

kidney donors. Table III also shows actual donors in the January-June audit and in that of October-November. For comparison are shown the numbers of donors expected for October-November if there was no change in donor pattern, including non-procurement rates, from January-June. We note that only for kidney donors in October-November was there a noticeable 17% increase in donors compared with January-June

($p=0.09$). The global comparison ($\chi^2=3.90$) of actual and expected donors based on January-June is unexceptional. Thus extra offers of suitable hearts, livers, lungs, and corneas in October-November ($\chi^2=9.7$, $p<0.05$) were not translated into donations. However, non-procurement rates (table III) increased in October-November compared with January-June, which may explain why increases in actual donations (kidneys excepted) were not observed.

Appendix

Suitability for transplantation of organs from brain stem dead potential donors alone as reported by intensive care units. Figures are numbers of donors

	Suitable corneas			Unsuitable corneas	Other*	Total
	Donated	Not procured	Not offered			
No known relatives or transplantation not discussed	3		16	5	13	37
Refusal by relatives			104†	7	27	138
Consent	148	16	87	26	45‡	322
Total	151	16	207	38	85	497

Given relatives' consent and organ suitability for transplantation was determined as:

$$\% \text{ Suitable} = \frac{251}{(251+26)} \times 100\% = 91\% \text{ (95\% confidence interval 87\% to 94\%).}$$

*Includes suitability of corneas not known or donation not known, or both.

†Including 45 discussed with transplant team or coordinator.

‡Including 34 for whom there was no offer.

	Suitable kidney pair			Unsuitable kidney pair	Other*	Total
	Donated	Not procured	Not offered			
No known relatives or transplantation not discussed	3		15	12	7	37
Refusal by relatives			116†	7	15	138
Consent	297	4	2	17	2‡	322
Total	300	4	133	36	24	497

Given relatives' consent and organ suitability for transplantation was determined as:

$$\% \text{ Suitable} = \frac{303}{(303+17)} \times 100\% = 95\% \text{ (92\% to 97\%).}$$

*Includes suitability not known or donation not known, or both.

†Including 51 discussed with transplant team or coordinator.

‡Including two for whom there was no offer.

	Suitable liver			Unsuitable liver	Other*	Total
	Donated	Not procured	Not offered			
No known relatives or transplantation not discussed	1		14	15	7	37
Refusal by relatives			93†	20	25	138
Consent	133	55	16	88	30‡	322
Total	134	55	123	123	62	497

Given relatives' consent and organ suitability for transplantation was determined as:

$$\% \text{ Suitable} = \frac{204}{(204+88)} \times 100\% = 70\% \text{ (64\% to 75\%).}$$

*Includes suitability not known or donation not known, or both.

†Including 38 discussed with transplant team or coordinator.

‡Including 18 for whom there was no offer.

	Suitable lung pair			Unsuitable lung pair	Other*	Total
	Donated	Not procured	Not offered			
No known relatives or transplantation not discussed		1	11	18	7	37
Refusal by relatives			71†	42	25	138
Consent	57 (57)	55 (21)‡	17 (6.5)‡	160 (204.5)‡	33§	322
Total	57	56	99	220	65	497

Given relatives' consent and organ suitability for transplantation was determined as:

$$\% \text{ Suitable} = \frac{129}{(129+160)} \times 100\% = 45\% \text{ (39\% to 50\%).}$$

*Includes suitability not known or donation not known, or both.

†Including 28 discussed with transplant team or coordinator.

‡Revised estimate (see text) taking some account of deterioration in lungs by time of donor operation in a minimum of 34 out of 55 donors.

$$\% \text{ Suitable} = \frac{57+21+55 \times 17}{289} \times 100\% = 29\% \text{ (24\% to 34\%).}$$

§Including 16 for whom there was no offer.

Discussion

Confidential audit of all deaths in intensive care units (1 January-30 June 1989) confirmed a 30% rate of refusal by relatives, which is comparable with the British Kidney Patient Association's annual survey conducted by Gallup in March 1989, in which 70% of 1003 people surveyed said that they would be willing to donate their kidneys after death. If an organ is not suitable for transplantation it will not be used, consent notwithstanding. Thus refusal by relatives or no discussion about organ donation when organs are unsuitable anyway does not decrease the supply of transplantable tissue. We estimated organ specific suitability in brain stem dead potential donors from intensive care units for heart as 63%; kidneys 95%; liver 70%; lungs 29%; and corneas 91%.

Refusal by relatives accounts for major losses of suitable organs. Notably, these include 131 lost kidney donors in six months, equivalent to 44% of brain stem dead actual kidney donors. No discussion of organ donation was the second reason for missed kidney donors, with 32 kidney donors lost on this account, equivalent to 10% of brain stem dead actual kidney donors from intensive care units.

Restricted permission (or no offer) by relatives who consented to other organ donation meant the loss of four suitable kidney donors, equivalent to 1% of brain stem dead actual kidney donors, but the loss of 118 suitable corneal donors, equivalent to 78% of actual corneal donors. Measures to promote corneal donation when relatives consent to donation of solid organs could increase substantially the supply of HLA typed corneal tissue and so improve the degree of HLA matching available to patients who need it, about one quarter in the corneal transplantation waiting list.⁴ Restricted permission (or no offer) accounted for the loss of 23 hearts, 29 livers, and 11 suitable lung donors, equivalent to 15%, 22%, and 19% respectively of corresponding actual donors. Oversight by medical or nursing staff—in not reminding relatives that offers of suitable heart, liver, lungs or corneas give life or sight—could masquerade as relatives' unwillingness and so be counted inappropriately as restricted permission. We recommend that donation of other organs besides kidneys should be discussed routinely when organ donation is suggested to relatives.

Non-procurement of suitable organs which had been offered for transplantation was rare for kidneys (1% of 304 brain stem dead offered kidney donors); modest for hearts and corneas (13% and 10% of offered donors of hearts and corneas, 23 heart and 16 corneal donors respectively not procured); but substantial for liver and lungs at around 30% of offered livers and reportedly suitable lungs (55 livers and 21 lung donors not procured in six months).

Possible reasons for non-procurement of offered, reportedly suitable heart, liver, or lungs are different criteria of suitability being applied by intensive care and transplant doctors; deterioration in condition of the donor so that organs thought suitable at the time of offer were not so when the transplant team arrived⁵; non-availability of the retrieval surgical or anaesthetist team or of the recipient (because choice depends on physical size); insufficient cooperation amongst

retrieval surgeons resulting in non-procurement of some organs⁶; non-availability of theatre time, of staffed intensive care bed⁷ (for several days post-operatively), or of sufficient units of appropriate blood (for liver transplantation).

Publicity has been recognised as a key to the future of organ donation, but finding solutions to some of the problems of non-procurement, as well as avoiding deterioration of donor organs,⁸ may be prerequisites for increased offers to be translated into increased donations. During October-November 1989 sustained, national publicity about transplantation was associated with reduction by a quarter in refusal by relatives (from 30% to 22%) and a reduction in failure to ask about organ donation of about two thirds. Compared with the first six months of 1989, October-November saw appreciable increases (around a fifth) in suitable offered donors of specific organs, but only in the case of kidneys was there a corresponding 17% increase in actual donations; increased rates of non-procurement were also a feature. If transplant services are already operating to capacity full advantage cannot be taken of increased offers of such organs as liver, heart, or lungs. Percentage increase in actual donations then underestimates the impact of publicity and other measures to enhance offers of suitable organs for transplantation. A side effect of the October-November publicity to enhance offers might have been some relaxing of criteria of reporting or assessing organ suitability by intensive care units, which had to be compensated for by increased rates of non-procurement of reportedly, but not actually, suitable organs.

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Audit in Person

Impact of medical audit advisory groups

Clive Richards

Medical audit is a key feature of recent changes to the NHS and is an essential part of the new contract for general practice. Although the term medical audit is used freely, it is necessary to define it. Many definitions have been attempted, but all have in common a systematic critical analysis of aspects of quality of care, reference to standards of care, and commitment to change. Medical audit is not a synonym for traditional review or research activities, as emphasised recently in the report *The Quality of Medical Care*¹ by the government's standing medical advisory committee in its robust statement that "the essential nature of medical audit is a frank discussion between doctors, on a regular basis and without fear of criticism, of the quality of care provided as judged against agreed standards but in a context which allows evolutionary change in such standards."

Medical audit for family doctors is complicated by additional audits of their contractual obligations—for example, measurement of procedures for payment. Audit activities must differentiate between contractual audit, which is a management task whose prime purpose is control, and medical audit, which is a professional task with a prime purpose of education. The dividing line between these two types of audit is often blurred, and the skills and resources for each can be shared. Often the crucial difference between the two will be that of intention. An audit of prescribing to exert downward pressure on costs is clearly a contractual audit and a managerial activity whereas the same procedure undertaken voluntarily to develop a

logical treatment policy is a medical audit and an educational activity. Any organised medical audit activity in general practice must acknowledge this distinction.

Structure

The formal mechanism for organising medical audit in general practice will be via a new committee, the medical audit advisory group, structural arrangements for which were described in *Medical Audit in the Family Practitioner Services* health circular (HC (FP)(90) 8). The group will be a committee of the family health services authority, which will appoint its members. There will be up to 12 medically qualified members, most of whom will be general practitioner principals appointed after consultation to ensure that they command the confidence of the profession locally. Appointment to the group will take into account factors such as the distribution of urban and rural practices and the sex and ethnic composition of the local general practitioners. In addition, the group will contain doctors with recognised skill and experience of medical audit. The circular also suggests appointment of a local consultant associated with audit activities in the hospital services and a public health physician. The group will also need to liaise with those responsible for postgraduate medical education, and so the general practitioner members will need to include representatives of the important local and regional educational organisations.

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