electronic medium. This medium is well suited to being searched, updated, and copied. We are currently exploring this option locally.[5] Any electronic method of dissemination will require careful management and will in itself only be a further tool to aid decision making.

Contributors: AH and DK designed, initiated, and coordinated the study. DP assisted with the design, interpretation, and direction of the study. FP collected the data and assisted with their analysis and interpretation. The paper was written jointly by AH, DK, DP, and FP. AH and DK are guarantors for this study.

Funding: Cambridge and Huntingdon Health Authority.

Conflict of interest: None.

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(Accepted 23 June 1998)

Legibility of doctors' handwriting: quantitative comparative study

Ronan Lyons, Christopher Payne, Michael McCabe, Colin Fielder

Concern has been expressed that poor legibility of doctors' handwriting may lead to prescription errors[1] and problems with referral letters.[2] Using computer technology to assess handwriting in an objective manner, we compared doctors' handwriting with that of administrative staff and other healthcare professionals in a Welsh health district.

Subjects, methods, and results

We contacted the staff in three main settings—the health authority headquarters, an accident and emergency department, and various departments in another hospital—and asked them to complete a form that contained boxes for the respondent's name, the 26 letters of the alphabet, and the digits 0-9. They were told that examples of handwriting were needed to test computer software for optical character recognition and were asked to write as neatly as possible. All 92 staff present in the three settings were asked to participate, and none refused. We analysed their responses with Teleform, a software package that allows handwritten replies on standard forms to be scanned and translated into text for computer analysis.[3] Any unrecognised characters are highlighted, and an error score is generated.

For the analysis, the staff were divided into three groups: doctors, nurses plus other medical professions, and administrative staff. We collated the results with the SPSS statistical program. As the error scores were not normally distributed, we used median values when comparing each group and used the Kruskal-Wallis or Mann-Whitney U test to test any observed differences for significance. In order to control for possible confounding we examined the effects of sex, setting, and age separately.

The table shows the median legibility error score for each professional group. Numeric legibility was similar for all groups and not considered further. For letters there was a significant difference between the groups ($P=0.006$). The doctors had a higher median score compared with the other two groups individually ($P=0.01$ for nurses plus other medical professions, $P=0.005$ for administrative staff) or combined ($P=0.001$). Analysis of female respondents alone revealed a similar pattern, with the doctors having a higher median error score than the other two groups ($P=0.032$ for nurses plus other medical professions, $P=0.09$ for administrative staff, $P=0.036$ for the groups combined).

The doctors had a slightly higher median age (37.5 years) than did the other two groups (33.0 years and 31.5 years respectively), but this difference was not significant ($P=0.78$), nor was there any significant effect of age on legibility for all respondents or for doctors alone. The doctors in each of the three main settings—health authority headquarters, accident and emergency department, and departments in another hospital—had similar median error scores (7.0, 7.0, and 8.0 respectively, $P=0.51$).

Comment

This study suggests that doctors, even when asked to be as neat as possible, produce handwriting that is worse than that of other professions. This provides supportive evidence for the commonly held belief that the legibility of doctors' handwriting is unusually poor. A small prospective study in the United States reported no difference between the legibility of doctors' handwriting and that of other healthcare professionals,[4] but this study used a subjective assessment of readability and the comparison group was confined to senior non-medical staff.

A surprising finding of our study is that the poor legibility was confined to letters of the alphabet rather than numbers. This may reflect the importance attached by doctors to the legibility of drug doses.

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BMJ 1998;317:863–4

Median legibility error score of each occupational group

	Median error score (interquartile range)			Difference (P value)	
	Doctors	Nurses and other medical professions	Administrative staff	Overall	Doctors *v* rest
All subjects:	(n=38)	(n=32)	(n=22)		
Letters of alphabet*	7 (0-10)	3 (1-6)	4 (2-5)	0.006	0.001
Numerals†	1 (0-1)	1 (0-2)	0 (0-1)	0.15	0.60
Women only:	(n=13)	(n=28)	(n=16)		
Letters of alphabet*	6 (3-10)	3 (1-6)	3 (1-5)	0.10	0.036
Numerals†	1 (0-1)	1 (0-1)	0 (0-1)	0.29	0.82

*Maximum possible error score=26.
†Maximum possible error score=10.

The software used in this study was not intended primarily to assess the quality of handwriting. However, it is possible that further development of handwriting recognition technology will lead to a clinical and epidemiological tool that would be particularly useful for monitoring change in individual performance over time.

Contributors: RL conceived and designed the study, designed the forms, and provided critical comment on the analysis and writing up. CP contributed to the study design, undertook data analysis, and wrote the article. MMcC and CF recruited participants, supervised data collection in the two hospital settings, and provided comments on the text.

Funding: None.

Conflict of interest: None.

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(Accepted 16 July 1998)

Netlines

Countdown to Y2K

- Given the gravity of the problem and the fact that there are less than 16 months to go before the millennium bug strikes, I have decided that each Netlines from now until early in the next millennium will feature related sites. For an apocalyptic view see **http://www.garynorth.com**, and for a more light hearted one see **http://www.leonardsloan.com/about/y2k/index.htm**.
- Will the lights go out? Decide for yourself after visiting **http://www.euy2k.com/newsroom.htm**. If you want to stay informed consider a subscription to Y2K News Magazine (**http://www.y2knews.com**). For Oxfordshire Health Authority's view of the problem and advice see **http://www.oxonphd.demon.co.uk/**, and for Scottish Health on the Web's view see **http://pc47.cee.hw.ac.uk/y2k/**.
- If the Y2K problem isn't enough to worry about then consider the week 1056 rollover problem, which will affect the Global Positioning System (GPS) in August 1999: **http://www.sustainableworld.com/y2kgps/gpsbug.html**. As some computer systems use GPS to get an accurate time, it won't be just sailors who are affected.

Free short internet address

- If you have a site with a long web address you might like to consider using the internet jump facility (**http://fast.to**). You can set up a free address of the sort **http://fast.to/YourSite**, which will automatically redirect the user to your chosen site. The only drawback is that you must place an advert for the service on your web page to use it.

Royal College of Surgeons of Edinburgh discussion forum, JavaScript, and Hogarth

- A web based discussion forum for The Royal College of Surgeons of Edinburgh has been set up on **http://www.groups.rcsed.ac.uk/disc/forum.htm**. It is worth a visit to see the excellent use of JavaScript. For another example of JavaScript in action, see my colleague Nick Loman's work on Hogarth's *Christ at the Pool at Bethesda* (**http://www.medmicro.mds.qmw.ac.uk/admissions/hogarth/**). Note that you may have to switch JavaScript on in your browser before you can benefit from these sites. For more information on JavaScript, visit JavaScript World (**http://www.jsworld.com/**) or the relevant entry on the Web Reference site (**http://www.webreference.com/programming/javascript.html**).

Electrocardiograms and multiple choice questions

- Dean Jenkins, a specialist registrar at Llandough Hospital, has put together a couple of useful medical websites: a library of 12 lead electrocardiograms on **http://homepages.enterprise.net/djenkins/ecghome.html** and a bank of multiple choice questions for MRCP on **http://homepages.enterprise.net/djenkins/mcqs/**. The questions have a neat feature that allows searching for online information by sending keywords from each question to a search engine.

Spam, cookies, privacy, email, and patients

- For a useful "Privacy primer for the web," see this online article by Robert Sikorski and Richard Peters in the *JAMA* website (**http://www.ama-assn.org/sci-pubs/journals/archive/jama/vol_279/no_15/jn80001x.htm**). For guidance on how to communicate with patients via email see "Guidelines for the clinical use of electronic mail with patients" from the American Medical Informatics Association (**http://amia2.amia.org/positio2.htm**).

The Risk Files

- The Risk Files (**http://www.cybermedic.org/**) is a free publication dedicated to informing healthcare professionals about the internet and related issues. It is compiled and issued monthly by Ahmad Risk and delivered by email.

Rheumatology website

- The International League of Associations for Rheumatology, an umbrella organisation for rheumatology associations worldwide, now has a website (**http://www.ilar.org/**), packed full of information and links about the world of rheumatology.

Internet Resources for Medicine and Bioscience, 4th edition

- Those helpful folk at OMNI (**http://www.omni.ac.uk**) have recently produced the fourth edition of this attractive and useful leaflet. It is available in Adobe Acrobat format from their website on **http://www.omni.ac.uk/leaflet4.pdf**.

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