

ABC OF HEALTH INFORMATICS

Frank Sullivan and Jeremy C Wyatt

Foreword by Sir J A Muir Gray



Blackwell
Publishing

BMJ

ABC OF HEALTH INFORMATICS

ABC OF HEALTH INFORMATICS

FRANK SULLIVAN

*NHS Tayside professor of research and development in general practice and primary care,
University of Dundee*

JEREMY C WYATT

Professor of health informatics, University of Dundee

BMJ
Books

 **Blackwell**
Publishing

© 2006 by Blackwell Publishing Ltd
BMJ Books is an imprint of the BMJ Publishing Group Limited, used under licence

Blackwell Publishing, Inc., 350 Main Street, Malden, Massachusetts 02148-5020, USA
Blackwell Publishing Ltd, 9600 Garsington Road, Oxford OX4 2DQ, UK
Blackwell Publishing Asia Pty Ltd, 550 Swanston Street, Carlton, Victoria 3053, Australia

The right of the Author to be identified as the Author of this Work has been asserted in accordance with the Copyright, Designs and Patents Act 1988.

All rights reserved. No part of this publication may be reproduced, stored in a retrieval system, or transmitted, in any form or by any means, electronic, mechanical, photocopying, recording or otherwise, except as permitted by the UK Copyright, Designs and Patents Act 1988, without the prior permission of the publisher.

First published 2006

1 2006

Library of Congress Cataloging-in-Publication Data

Sullivan, Frank (Frank M.)

ABC of health informatics/Frank Sullivan, Jeremy C. Wyatt.

p. ; cm.

Includes bibliographical references and index.

ISBN-13: 978-0-7279-1850-5 (alk. paper)

ISBN-10: 0-7279-1850-8 (alk. paper)

1. Medical informatics. I. Wyatt, J. (Jeremy) II. Title.

[DNLN: 1. Medical Informatics. W 26.5 S949a 2006]

R858.S85 2006

610.28—dc22

2005037646

ISBN-13: 978 0 7279 1850 5

ISBN-10: 0 7279 1850 8

A catalogue record for this title is available from the British Library

Cover image is courtesy of Mark Garlick/Science Photo Library

Set by BMJ Electronic Production

Printed and bound in Singapore by COS Printers Pte Ltd

Commissioning Editor: Eleanor Lines

Editorial Assistant: Victoria Pittman

Development Editor: Sally Carter/Nick Morgan

Production Controller: Debbie Wyr

For further information on Blackwell Publishing, visit our website:

<http://www.blackwellpublishing.com>

The publisher's policy is to use permanent paper from mills that operate a sustainable forestry policy, and which has been manufactured from pulp processed using acid-free and elementary chlorine-free practices. Furthermore, the publisher ensures that the text paper and cover board used have met acceptable environmental accreditation standards.

Contents

<i>Foreword</i>	vii
1 What is health information?	1
2 Is a consultation needed?	4
3 Why is this patient here today?	7
4 How decision support tools help define clinical problems	10
5 How computers can help to share understanding with patients	13
6 How informatics tools help deal with patients' problems	16
7 How computers help make efficient use of consultations	19
8 Referral or follow-up?	22
9 Keeping up: learning in the workplace	25
10 Improving services with informatics tools	29
11 Communication and navigation around the healthcare system	32
12 eHealth and the future: promise or peril?	35
Glossary	39
Index	43

Foreword

Information technology is worthy of consideration in its own right as a prime mover of change, and not simply as a means to an end. White's *Medieval Technology and Social Change* is a wonderful and short classic. The author, a distinguished historian, points out that most history is written by priests and politicians, "scribblers" in his words, who are concerned with policy and strategy documents or ideology. However, massive changes are brought about in society by the introduction of technologies that have unforeseen social impacts. For example, the stirrup led to the creation of feudalism; the heavy plough to the manorial system in northern Europe.

We spend a great deal of time agonising about the future of the medical profession and the nature of clinical practice and education, but information technology is a tool that will be as dramatic in its impact as the stirrup or the heavy plough. Often people try to dissociate themselves from information technology and say they are in knowledge management or the information business, but information technology is itself of vital importance and we should be proud to be making the tools.

This collection of essays, from two distinguished and practical clinical academics, gives an excellent introduction to the revolutionary potential of healthcare information technology, the social impact of which will be enormous. We are fortunate today that those who create and develop such tools are, unlike their glorious predecessors, able to write—and to write beautifully. I have great pleasure in recommending this book to readers from all backgrounds as an accessible, comprehensive survey of this revolutionary technology.

Sir JA Muir Gray
Director of Clinical Knowledge, Process and Safety
NHS Connecting for Health

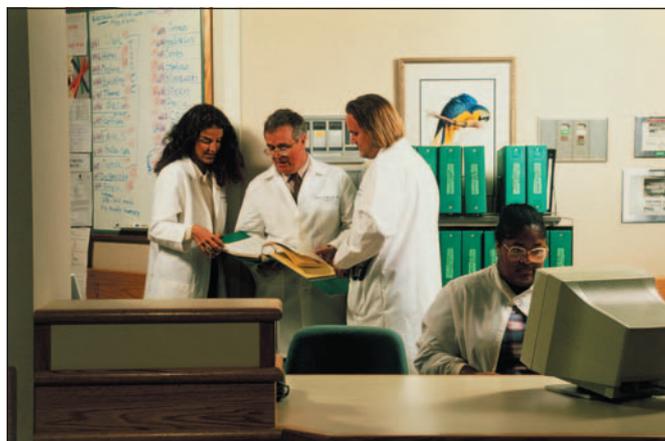
Further reading

White L, Jr. *Medieval technology and social change*. New York: Oxford University Press Inc, 1968.

1 What is health information?

Information is an ethereal commodity. One definition describes it as the data and knowledge that intelligent systems (human and artificial) use to support their decisions. Health informatics helps doctors with their decisions and actions, and improves patient outcomes by making better use of information—making more efficient the way patient data and medical knowledge is captured, processed, communicated, and applied. These challenges have become more important since the internet made access to medical information easier for patients.

This ABC focuses on information handling during routine clinical tasks, using scenarios based on Pendleton's seven-stage consultation model (see box opposite). The chapters cover wider issues arising from, and extending beyond, the immediate consultation (see box below). Questions on clinical information that often arise in clinical and reflective practice are dealt with, but discussion of specific computer systems is avoided.



JOHN GREIM/SPL

Some questions on clinical information

Medical record keeping

- What records to keep?
- In what format?
- What data to enter, and how?
- How to store records, and for how long?
- With whom to share the record?

How to use the information records contain

- To manage my patients?
- To audit and improve my service?
- To support my research?
- To feed another information system?

How to communicate with my colleagues and patients

- Face to face?
- On paper?
- Using the internet?

Clinical knowledge sources

- What knowledge sources are out there, and how to select them?
- How to use these sources to answer my own, and my team's, clinical questions?
- How to keep knowledge and skills up to date?
- How to use knowledge to improve my own, and my team's, clinical practice?

Pendleton's consultation model, adapted for ABC series

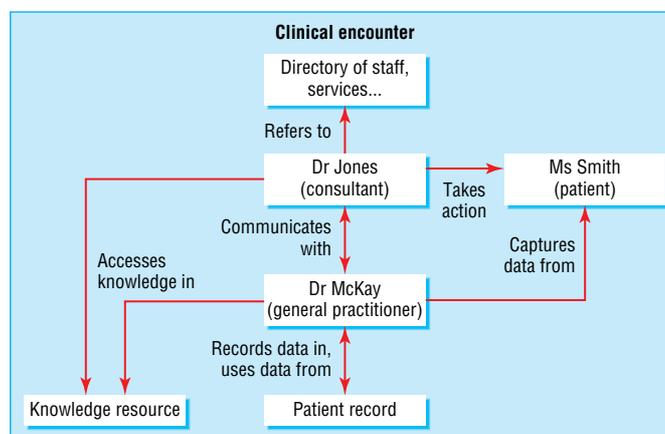
- Discover the reason for the patient's attendance
- Consider other problems
- Achieve a shared understanding of the problems with the patient
- With the patient, choose an appropriate action for each problem
- Involve the patient in planning their management
- Make effective use of the consultation
- Establish or maintain a relationship with the patient

Ms Smith is a 58 year old florist with a 15 year history of renal impairment caused by childhood pyelonephritis who is experiencing tiredness and muscle cramps. She has sought medical attention for similar problems in the past, and is considering doing so again

Capturing and using information

Consider the different forms that information can take, where each form comes from, its cost, and how to assess the quality of the information. These issues arise during a general practitioner's (Dr McKay) encounter with Ms Smith.

Dr McKay applies her own clinical knowledge and skill, perhaps augmented by a textbook or other knowledge source, to capture relevant data from Ms Smith. Dr McKay browses Ms Smith's record to check her medical history. She updates the record and either takes action herself, or telephones a consultant nephrologist (Dr Jones), who suggests 1 α -hydroxy cholecalciferol 0.5 μ g daily for Ms Smith. Dr McKay then follows up the telephone conversation with the consultant by issuing an electronic prescription. The prescription transfers through a secure local network to Ms Smith's usual pharmacist



Information flows in a clinical environment

along with a formal online outpatient referral request. Dr Jones checks a hospital phone directory on the web before referring Ms Smith to the dietician for a low calcium diet. Ms Smith is kept informed of these developments by telephone before her appointment the next week.

Representing, interpreting and displaying information

When Dr McKay reads Ms Smith’s patient record what she sees on the page is not actually information, but a representation of it. A “real” item of information, such as the fact that Ms Smith has hypercalcaemia, is distinct from how that item is represented in an information system (for example, by selecting Ms Smith’s record and writing “Hypercalcaemia,” or choosing a Read code that updates Ms Smith’s computer-based record). The real information is also distinct from a person’s interpretation of it, which might resemble a fragment in a stream of consciousness, “Remember to check on Ms Smith—calcium problem back again.” These distinctions reflect common sense and semiotic theory: real things only exist in the physical world, and each person interprets them in private and associates their own images with them.

Back in the clinical world, the lesson is that we should capture and represent each item of information in a form that helps each user—whether human or computer—to find and interpret it. The next time Dr McKay logs into Ms Smith’s computer record, although Ms Smith’s serum calcium may be represented internally in the computer as the real number 2.8, on the computer screen it can be shown as a figure, a red warning icon, a point on a graph showing all her calcium results, or as the words “Severe hypercalcaemia” in an alert. These display formats can all be achieved with a paper record, but it would take more time and effort to annotate abnormal laboratory results with a highlighter pen, graph the values on a paper chart, or write an alert on a Post-it note and place this on the front of Ms Smith’s record.

Selecting a format is important because it determines how to represent each item of information in a system, and in turn how each item is captured. When information is captured and represented on paper or film, it is hard to change the order in which each item appears or to display it in other formats. When information is captured and stored on a computer, however, it can be shown in a different order or grouped in different ways. When data is coded and structured, or broken down into simple elements, it can be processed automatically—for example, the computer can add the icon, graph the data, or generate the alert about Ms Smith.

Sources of clinical information

Clinicians use three types of information to support patient care: patient data, medical knowledge, and “directory” information. This description ignores two questions, however: where does the knowledge in a textbook come from, and how do we improve on the methods used to manage patients? Patient data are the source in both cases (see box opposite). Local problems—such as an adverse event or failure to implement a guideline that everyone agrees to apply to their patients—can be picked up by quality improvement activities such as clinical governance. In well organised clinical environments and specialties, a registry is used to capture patient experiences and monitor for adverse outcomes.

Sometimes, however, patient data are used to suggest, or even answer, more general questions—for example, about drug

Common sense meets semiotic theory

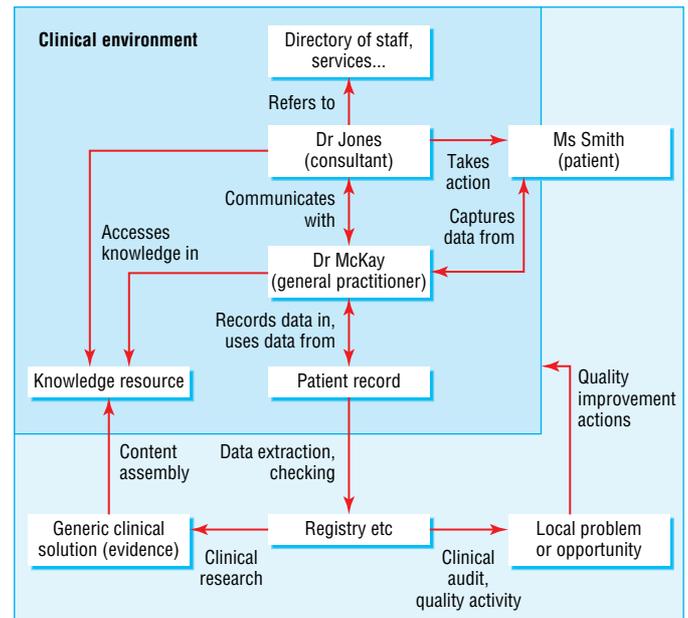
In her shop, Ms Smith sells a kind of flower that grows on shrubs with prickly stems and serrated leaves. Humans use consistent symbols to represent these things (for example, “rose; roos”). However, each person privately adds their own connotations to these symbols

Some definitions of rose from *Chambers 21st Century Dictionary*

- An erect or climbing thorny shrub that produces large, often fragrant, flowers that may be red, pink, yellow, orange, or white, or combinations of these colours, followed by bright-coloured fleshy fruits
- The national emblem of England
- A light pink, glowing complexion (put the roses back in one’s cheeks)
- A perforated nozzle, usually attached to the end of a hose, watering can, or shower head that makes the water come out in a spray



Possible formats to display information include informal or structured text, tables, graphs, sketches, and images. The best format for each item of information depends on who will use it, how they will use it, for what task, and on the formats readily available. With permission from Klaus Gulbrandsen/SPL



Information flows in clinical and non-clinical environments

effectiveness, disease aetiology, or the accuracy of tests. The results should be high quality, generic evidence that can be safely applied outside the specific clinical environment that is being studied. Often, this evidence is published as if it were the final word. Clinical epidemiology shows us, however, that the results of a single study often differ substantially from the “truth.” Well conducted systematic reviews of all rigorous, relevant studies are a better approximation, and are an example of the content assembly methods used to develop good quality knowledge resources.

The costs of information

To a businessman, information must seem the ultimate product: once it is captured, it can be sold any number of times without using up the original supply. Unfortunately for clinicians, each item of information that is captured, processed, and displayed has an associated cost or risk. By choosing to code the current problem as chronic pyelonephritis only (see figure above), Dr McKay fails to record the endocrine dimension with potential loss of explanatory power for others looking at Ms Smith’s records. Entering more than one code takes extra time and may cause difficulties in interpretation for secondary use of the data.

Information costs are especially high for data captured by health professionals in the structured, coded representation often required by computerised record systems. If the information is only ever going to be read by humans, it should not be captured as structured data because this will discourage doctors from recording useful free text that computers do not need to “understand”—for example, “Ms Smith is going to Spain for a holiday, her cat died last week.” All patient record systems should allow easy entry of such unstructured text (perhaps by voice recognition) to support the human side of medicine, and to help maintain the therapeutic relationship with patients.

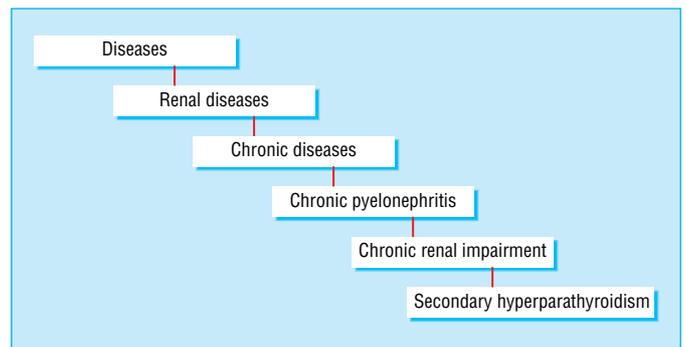
Assessing the quality of information

Imagine that Dr Jones is auditing outcomes in his hypercalcaemic patients and wishes to include Ms Smith’s data. Is her data of adequate quality for this task?

Information only exists to support decisions and actions: if it fails to do this, it is irrelevant noise. The aims of clinical audit are to understand current practice and suggest appropriate actions for the future. If the data are full of errors or incomplete, refer to patients seen years ago, or cannot be interpreted by the user, they are unlikely to help. More subtly, if useful data items are present—for example, serum calcium—but vital context is omitted, such as serum albumin or current treatment, it is still hard to use the data. Without this context, information is often useless; with it, data collected for one purpose can often, but not always, be used for another.

Glossaries for informatics terms

- Coiera E. *Guide to health informatics*. 2nd ed. London: Hodder Arnold, 2003. www.coiera.com/glossary.htm (accessed 26 August 2005)
- Wyatt JC, Liu J. Basic concepts in medical informatics. <http://jech.bmjournals.com/cgi/content/full/56/11/808> (accessed 26 August 2005)



Partial hierarchy of diseases

Quality criteria for patient data

Criterion	How to test it	Comment
Accurate	Comparison with a gold standard source of data—for example, the patient	Technically, validity—does the data item measure what it is meant to? Reliability is a related concept—do two observers agree on the data item?
Complete	Per cent missing data at a given point	Often difficult to estimate without access to multiple sources of information
Timely	Delay from the event the data describes to its availability for use on the information system	Unless data are available at the point they are needed to inform decisions, fulfilling the other criteria is almost worthless
Relevant	Amount that data alter decisions or actions of the user; the impact of leaving an item out of the dataset	Unless data are relevant to information users, they contribute to information overload
Appropriately represented	Degree of structuring and coding of items	Depends on the user of the item and their needs
Relevant detail included	If data are detailed enough to support decisions	Highly dependent on the purpose and confidentiality of the information
Relevant context included	Is there enough context (for example, date patient seen, by whom) to support appropriate interpretation of data?	A key issue, only partially solved in current electronic patient records

Further reading

- Hersh W. What is Medical Informatics? www.ohsu.edu/dmice/whatis/index.shtml (accessed 26 August 2005)
- Pendleton D, Schofield T, Tate P, Havelock P. *The consultation: an approach to learning and teaching*. Oxford: Oxford University Press, 1987
- Nygren E, Wyatt JC, Wright P. Medical records 2: helping clinicians find information and avoid delays. *Lancet* 1998;352:1462-6
- Morris AD, Boyle DI, MacAlpine R, Emslie-Smith A, Jung RT, Newton RW, et al. The diabetes audit and research in Tayside Scotland (DARTS) study: electronic record linkage to create a diabetes register. DARTS/MEMO Collaboration. *BMJ* 1997;315:524-8
- Naylor CD. Grey zones of clinical practice: some limits to evidence based medicine. *Lancet* 1995;345:840-2
- Brody H. *Stories of sickness*. Yale: Yale University Press, 1987
- Tanenbaum SJ. What physicians know. *N Engl J Med* 1996;329:1268-71
- van Bemmel JH, Musen MA, eds. *Handbook of medical informatics*. London: Springer, 1997 www.mihandbook.stanford.edu/handbook/home.htm (accessed 26 August 2005)

2 Is a consultation needed?

People with health concerns no longer have to become patients by consulting a health professional. Electronic health (eHealth) tools provide access to many resources that may satisfy their requirements. This article describes ways that patients can investigate health issues before, or instead of, a consultation.

As a professional, Ms Patel (see box opposite) can access health resources on the internet at work and at home. She may subscribe to a mobile internet service provider through her telephone or palmtop computer. Internet access is not restricted to affluent people in western societies. In the United Kingdom, the 2003 national statistics omnibus survey showed that 48% of households have home internet access, and the figures from the United States are even higher (60% of households have access). Internet cafes can be found worldwide, and library services often provide time online for free. The public can pay for “push technologies” from publishers that supply health alerts, but most people search for the information they need.

Using a search engine

Internet search engines are software tools that index and catalogue websites. People with little or no prior knowledge of a subject, but with some experience of searching the internet, often use search engines to begin an inquiry.

If Ms Patel types “breast cancer and family” into a search engine (such as Google), in 0.23 seconds she may be overwhelmed by more than 5 million websites dealing with the topic. She will be helped by the fact that the search engine has sorted each “hit” by the number of other websites to which it is linked. The list is ordered, and so Ms Patel can start near the top of the list by reading the brief descriptions, or she may use “advanced search” options to narrow the initial search. Advanced searches allow specific phrases, languages, and times to be defined. This reduces the hits to a more manageable number. The most popular sites will probably be those whose content matches patients’ preferences for appearance, or those that contain the information patients’ are looking for. The most popular sites do not necessarily have features that are the markers of quality preferred by health professionals. If the site does not answer patients’ questions, it may provide links to other sites that can. Alternatively, patients can return to the search list and start again.

Patient orientated health portals

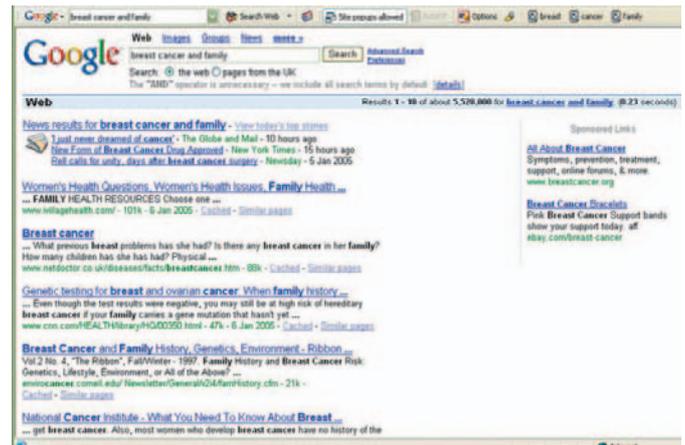
These are specialised search engines with additional features such as access to frequently asked questions about health or email facilities. Individual clinicians, clinics, practices, hospitals, and health maintenance organisations provide portals to their own and other resources.

National and local health services (for example, the NHS in the UK) often provide access to such resources for patients. These portals may link to specific services provided by that health service, such as lists of local cancer genetics clinics.

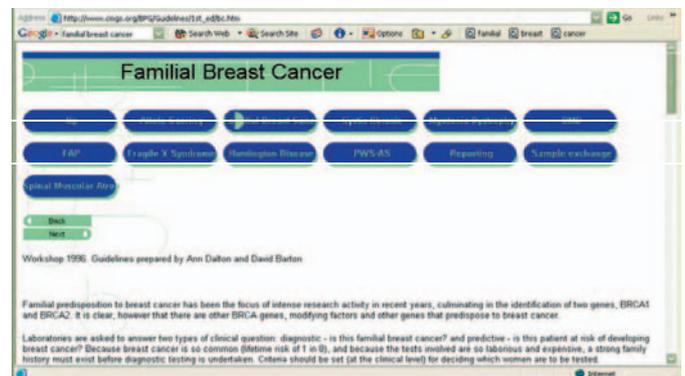
Other portals are provided by independent bodies. Many have international links and are funded by charities. They vary in quality. Some are quality assured, and when they are not, tools are available to allow patients to assess the portal.

Patients make sophisticated use of multiple sources of information. In one study, half of the users of the database of

Ms Amulya Patel is a 48 year old accountant whose mother has recently died of breast cancer. Ms Patel wonders about her own level of risk, and uses the internet to search for patient resources



Google search results for “breast cancer and family”



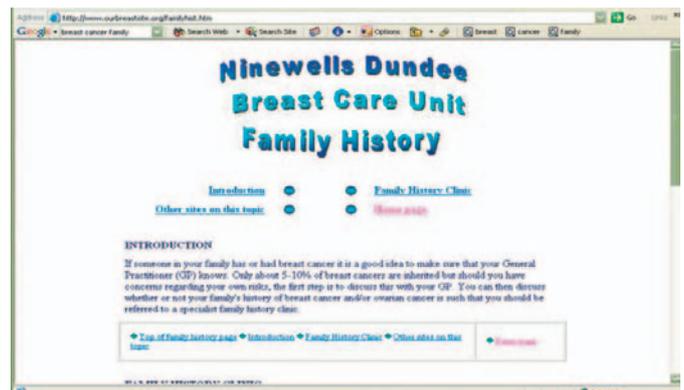
An example of a Google hit—sites chosen by patients usually have immediate facts, such as women have a one in eight lifetime risk of developing cancer



NHS Direct is a health portal aimed at the public

patient experience (DIPEX) who were interested in breast cancer accessed internet resources to obtain second opinions on a range of problems. They sought support and information from patients who had similar issues, obtained information about tests and interventions, and identified questions to ask doctors if necessary.

Many portals link to other websites, and they may direct the person to other resources such as books, multimedia resources, or patient support groups



A relevant health service resource accessed through a portal



DIPEX allows patients (like Ms Patel) to read, listen, or watch patients facing similar problems to their own



Two examples of quality assured portals

Direct access to medical literature

Some health portals link directly to websites that present medical literature intended for professional use. Patients like those in Ms Patel's situation may have gone straight to such resources because they have heard that they will probably contain the information they are seeking. Ms Patel could access primary data sources, such as the *BMJ* or the *Journal of Medical Genetics*, directly. Sometimes journals provide free access to all their content, others make only article abstracts or brief summaries available.

Most patients will have difficulty in interpreting medical journals (as is the case for many doctors). Risk may be described in absolute or relative terms as percentages, rates, multiples, and over different time periods. Because of the complex nature of the articles and papers in medical journals, many people prefer professional help to translate the information that they have found.

Mediated access to medical literature

Several journals have patient orientated summaries that highlight one of their recent scientific papers in a broader context and translate the content into a more readable format. The *New England Journal of Medicine* and *JAMA* are notable in this regard, although subscriptions are needed to access many of these services. Therefore, they may be available only if accessed by the health professional on the patient's behalf.

Jargon may make the information resource impenetrable to non-professionals, and some professionals



Patient summaries in journals can be helpful

ABC of health informatics

Some clinics make questionnaires and guidelines available on their website, but people can find them difficult to interpret. The questionnaire opposite prompts Ms Patel to ask her relatives about the causes of death of other members of her family. She finds that, in addition to her mother, two maternal aunts had breast cancer.

Examples of familial breast cancer management guidelines

Breast Cancer UK Cancer Family Study Group guidelines for referral and screening mammography*

- One relative with breast cancer diagnosed at < 40 years
- Two relatives with breast cancer diagnosed at 40-49 years
- Three relatives with breast cancer who were diagnosed at 50-60 years
- One relative with breast cancer diagnosed at < 50 years, and one or more relatives with ovarian cancer diagnosed at any age, or one relative with breast and ovarian cancer

American College of Medical Genetics/New York State Department of Health candidates for consideration for BRCA1 and BRCA2 testing†

- Three or more affected first degree or second degree relatives on the same side of the family, regardless of age at diagnosis, *or*
- < 3 Affected relatives, but patient diagnosed at ≤ 45 years, *or*
- A family member has been identified with a detectable mutation, *or*
- One or more cases of ovarian cancer at any age, and one or more members on same side of family with breast cancer at any age, *or*
- Multiple primary or bilateral breast cancer in patient or one family member, *or*
- Breast cancer in a male patient, or in a male relative, *or*
- Patient is an increased risk for specific mutation(s) because of ethnic background—for example, Ashkenazi Jewish descent—and has one or more relatives with breast cancer or ovarian cancer at any age

*Eccles D, Evans D, Mackay J. Guidelines for managing women with a family history of breast cancer. *J Med Genetics* 2000;37:2-3-9

†American College of Medical Genetics. Genetics susceptibility to breast and ovarian cancer assessment, counselling and testing guidelines, 1999

Teleconsultation

If the person finds an electronic resource that covers their query, then no consultation may be needed. Often, however, general information will need to be supplemented by knowledge of a person's situation. Ms Patel may email her general practitioner or follow a website link to a specialist in the genetics of familial breast cancer. The advantages of email include asynchronous interaction (patients and doctors can submit and receive responses at their convenience), easy exchange of follow-up information, patient education (by attaching leaflets or links to websites), and automatic documentation of consulting behaviour or service requests. Regulation of teleconsultation varies between countries, and guidelines are available. Security and confidentiality issues must be overcome, and there is increasing pressure to do so. Biometric methods, such as logging in using fingerprints or voice recognition, may be a solution in the medium term. Webcams or other video messaging techniques allow real time, albeit virtual, face to face consultations. To provide teleconferencing, doctors may have to alter their daily schedules.

Summary

Before seeing a doctor, Ms Patel found useful information about familial breast cancer. The information prompted her to ask questions of her family, and she found a strong familial history of breast cancer. She sought professional advice. A computer literate person who wants to find out about a health issue may find a satisfactory answer online, but those who become patients will probably need the expertise from doctors that they trust to interpret data for them.

SAMPLE CANCER FAMILY HISTORY QUESTIONNAIRE

• Name _____

• Date _____

• Age _____

• Ethnic Background [Certain ethnic groups have an increased risk for specific kinds of cancer.] _____

• Do you have any specific concerns about cancer in yourself or your family? _____

• Do you or any members of your family have a history of cancer? _____

	Yes/No	Type of Cancer (if known)	Age at Diagnosis (if known)	Living/Deceased
yourself				
your mother				
your father				
your sisters and brothers				
your half sisters and half brothers				
your children				
your mother's sisters and brothers				
your father's sisters and brothers				
your nieces and nephews				
your mother's parents				
your father's parents				

Risk assessment sheet obtained from the internet

Further reading

- National Statistics Office. Internet access: households and individuals, 2002 www.statistics.gov.uk/pdffdir/inta1202.pdf
- Pagliari C, Sloan D, Gregor P, Sullivan F, Detmer D, Kahan JP, et al. What is eHealth (4): A scoping exercise to map the field. *J Med Internet Res* 2005;7:e9 www.jmir.org/2005/1/e9/ (accessed 6 September 2005)
- Gagliardi A, Jadad AR. Examination of instruments used to rate quality of health information on the internet: chronicle of a voyage with an unclear destination. *BMJ* 2002;324:569-73
- Meric F, Bernstam EV, Mirza NQ, Hunt KK, Ames FC, Ross MI, et al. Breast cancer on the world wide web: cross sectional survey of quality of information and popularity of websites. *BMJ* 2002;324:577-81
- Charnock D, Shepperd S, Needham G, Gann R. DISCERN: an instrument for judging the quality of written consumer health information on treatment choices. *J Epidemiol Community Health* 1999;53:105-11
- Ziebland S, Chapple A, Dumelow C, Evans J, Prinjha S, Rozmovits L. How the internet affects patients' experience of cancer: a qualitative study. *BMJ* 2004;328:564-9
- Gaster B, Knight CL, DeWitt D, Sheffield J, Assefi NP, Buchwald D. Physicians' use of and attitudes towards electronic mail for patient communication. *J Gen Int Med* 2003;18:385-9
- Sands Z. Help for physicians contemplating use of e-mail with patients. *J Am Inf Assoc* 2004;11:268-9
- Finch T, May C, Mair F, Mort M, Gask L. Integrating service development with evaluation in telehealthcare: an ethnographic study. *BMJ* 2003;327:1205-9

3 Why is this patient here today?

Defining the reason for a patient's consultation may seem straightforward, but often deeper consideration is required. Information tools are less important in this phase of the consultation than other phases, but may augment the interpersonal skills of the doctor. At this early stage an open question like "How can I help you today?" and attention to non-verbal cues are more likely to be productive than launching into a closed question and answer session.

If the doctor knows Mr Evans (see box opposite), he will already have noticed the sad expression on the patient's face when he went to the waiting room to call him in to the consultation. The slow, hesitant speech with which Mr Evans talks of his headache is another item of non-verbal information indicating a possible diagnosis of depression.

Mr Edward Evans is a 49 year old, recently unemployed, pharmaceutical company representative who presents with headaches. He also has symptoms of early morning waking and erectile dysfunction

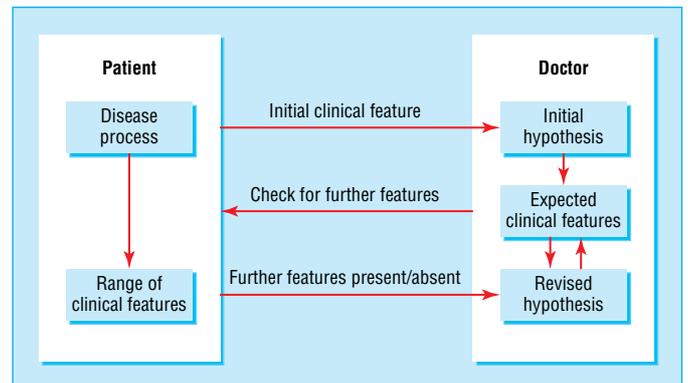
Diagnostic process

Mr Evans has come to see his general practitioner (GP) because of headaches, sleep disturbance, and sexual difficulties. These problems need to be considered in detail. The symptoms are common in general practice, and most experienced doctors and nurse practitioners will have an approach to assessment with which they are comfortable. Experienced doctors use hypothetico-deductive reasoning methods when assessing patients' problems. An initial clinical feature, headache perhaps, prompts a doctor to recall an "illness script" derived from his or her experience and education that seems to explain a patient's problems. The doctor hypothesises that the diagnosis is, in this case, possibly depression, and tests this hypothesis by asking further questions, examining the patient, or doing laboratory tests to confirm or rule out the diagnosis.

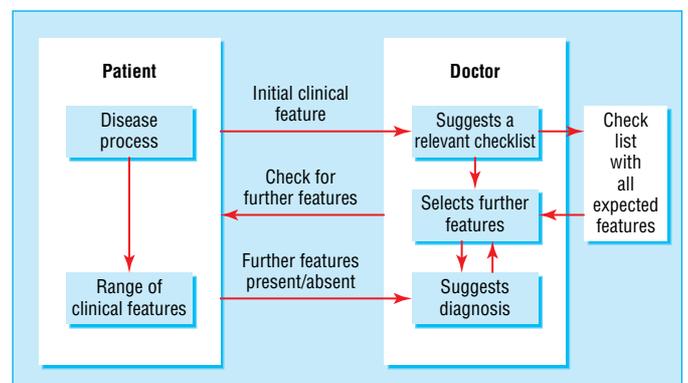
Less experienced doctors may use a checklist or, when an unusual presentation occurs, they may return to inductive reasoning learnt as an undergraduate or trainee. This more exhaustive process involves taking a complete history, carrying out a full systematic examination, and then developing a differential diagnosis list. The process may be made more efficient by using a reference folder that contains checklists describing a clinical examination for headache, for example. These checklists or protocols may be stored on desktop computers or other devices. Another option is to access an information source like the *BMJ's* 10 minute consultation series, which may provide a framework to assess the problem.

Medical history

Each consultation has been likened to a "single frame in a long running cine film." GPs have repeated opportunities to understand their patients' problems. Until this visit, Dr McKay had not seen Mr Evans for about a year. Then, Mr Evans had been made redundant and was having difficulty sleeping. During the current visit, Dr McKay notes from the electronic record that Mr Evans saw another partner in the practice a month ago for tiredness. In the United Kingdom, almost all of a patient's hospital medical records are copied to their GP and this forms a record "from the cradle to the grave." Some data can be lost when patients move practices if a different computer system is used, although in the UK a process for transmitting



The hypothetico-deductive process used by skilled decision makers when assessing patients



Inductive process using a checklist of symptoms. This way of assessing patients' problems is used by doctors who have less experience or experienced doctors who are dealing with an unfamiliar problem