

# Information overload within the health care system: a literature review

Amanda Hall & Graham Walton, Information Management Research Institute, Northumbria University, Newcastle upon Tyne, UK

## Abstract

There is a widespread view held by health clinicians that their work effectiveness is impaired by 'information overload.' Building upon a previous work by Wilson, a review of the literature was undertaken to look for the evidence of this. It was found that the literature, particularly in the context of the clinical environment, was limited. This review explores the diverse overarching theories of information overload, effects of the phenomenon that are perceived to occur and proposed solutions to this problem. Many of the papers noted an information explosion but only three authors explicitly attempted to measure both the quantity and the complexity of this information. It was also found that the typology of the information studied was severely limited with most studies exploring information such as guidelines, access to journals, research findings and other knowledge intensive areas. Solutions proposed seem to concentrate on technological means rather than exploring the use of humans either in management of information or as a step in the filtering process.

## Introduction

In 2001, Wilson<sup>1</sup> wrote a personal perception of information overload and its implications for health services. Drawing primarily on the business sector his conclusion was that information overload was primarily caused by modern business practices resulting from 'downsizing'. His argument is persuasive but there is a need for wider investigation of the issue and its causes. This paper has been written to find the evidence to inform the widespread view held by health clinicians that their work effectiveness is being impaired by 'information overload'. An overview will be provided of information overload: the concept,

definitions, causes, and effects. There will then be a review of work that has been published on information overload within the health context.

## Methodology

The following databases were used to establish and identify the literature: PubMed, ASSIA, ERIC, LISA, British Medical Journal, Web of Knowledge, AMED and CINAHL. No date restriction was put on the search so that a longitudinal 'map' of the subject area could be obtained. As this review is focused primarily on information overload for the clinician, articles that refer to patient information overload were automatically rejected when the reference lists were obtained. To broaden the range of articles available for review, the search criteria were extended to include knowledge management in health and information seeking; it was thought

Correspondence: Amanda Hall, Information and Management Research Institute, School of Informatics, Northumbria University, Lipman Building, Newcastle upon Tyne NE1 8ST, UK. E-mail: amanda.hall@northumbria.ac.uk

that these related concepts could be sources of further information. An additional search was made using LISA, ERIC, CINAHL, PubMed and AMED for the term 'clinical librarianship.' These approaches resulted in a total of 114 articles for possible inclusion within this review. Twenty-three of this final total deal with information overload within the context of health care. A larger number could have been anticipated with the issue's high profile within the National Health Service.<sup>2</sup> Both Tidline<sup>3</sup> and Bawden<sup>4</sup> in general have noted the relatively low level of literature about the concept of information overload in their reviews.

### General overview of information overload

An early paper by Wilson<sup>5</sup> argued that 'information overload' is not a clear concept, and probably does not need to be; it is a phantom. Tidline<sup>3</sup> writing in the 1990s described the concept as a myth in that it 'could be described as a story of vague origin, developed in response to change from an industrial to an information based economy.' Exploration of the major reviews of literature surrounding information overload<sup>1,3,4,6-9</sup> shows a variety of beliefs about the causes of, and the theoretical background to, information overload. This disparity in views is interesting within the context of the limited (in number) of citations. This section of the review will aim to identify the strands of theoretical discussion that have arisen to explain the concept.

#### Information overload defined

Bawden<sup>6</sup> identified what could be the first mention of information overload in literature, by quoting Ecclesiastes; 'of making many books there is no end; and much study is a weariness of the flesh'. Wurman<sup>10</sup> identified the first modern writer on this issue as George Simmel, a sociologist writing at the turn of the century. Wurman wrote that Simmel described the concept as:

'a phenomenon of urban life where people shield themselves from indiscriminate suggestibility to protect themselves from an overload of sensations, which results in an incapacity ... to react to new situations with the appropriate energy.'

Miller<sup>9</sup>, writing in 1978, chose to discuss a concept called 'information input overload' which he defined as occurring 'when a *living system at a given level* is presented with more information than it can *readily process*'. While acknowledging that overload may also occur when changes occur in the intensity or meaning of information, he concentrated upon the effect of increasing the rate of information input. He postulated that if information inputs impinge more rapidly upon a system they will eventually overload its capacity to transmit information and thus efficient information processing breaks down. The theme of the expansion of available information from various sources is followed through in much of the literature. Hanka explicitly relates information overload to the mismatch between the neural capacity of the human brain and the rate of expansion of human knowledge and in his particular field, medical knowledge management.<sup>11</sup>

Bawden<sup>6</sup> sums the concept up by suggesting that 'information overload occurs when information received becomes a hindrance rather than a help when the information is potentially useful'. Another perspective is that the problem of information overload is not so much as an actual overload but as symptom of the failure to create 'high quality' or 'value added information' from the large amounts of information available.<sup>8</sup> Marcusohn<sup>7</sup>, in his comprehensive 1995 review of the subject, put forward a conceptual model of information load, which took account of three major factors:

- Environmental Information Complexity, i.e. nature of the information presented, the organizational setting (i.e. the environment, design of the organization, nature of the relationship, frame of reference);
- Individual Processing Capacity, i.e. sensory system, attention and memory;
- Individual Needs and Desires, i.e. motivation, time available and effort.

Wilson<sup>1</sup> defines information overload at the individual level:

'a perception on the part of the individual (or observers of that person) that the flow of information associated with work tasks is greater than can be managed effectively, and a perception

that overload in this sense creates a degree of stress for which his or her coping strategies are ineffective.'

And at the organizational level:

'situation in which the extent of perceived individual information overload is sufficiently widespread within the organization as to reduce the overall effectiveness of management operations.'

### Causes of information overload

Bawden<sup>4</sup> identified several factors that contribute to the perception of information overload. He summarized these factors into four groups:

- More diverse and increasing amounts of available information;
- Effect of new information and communication technologies;
- Changing nature of work with the new emphasis on interdisciplinary and collaborative work which both require greater communication;
- End users now search for information rather than an intermediary.

Reuters<sup>12</sup>, in their study, confirmed the above but also included wider environmental factors such as downsizing, deregulation and globalization. White and Dorman<sup>13</sup> identified the 'collapse of the information float' (time that information spends in the communication channel) as a critical effect of new communication technologies. The authors contend that more information is 'available' simply due to the fact that there is less time between a request and that request being fulfilled. Within the health care context, information overload has been attributed to a number of factors such as; the rising number of journals and guidelines to be read and digested<sup>11,14-16</sup> and large amounts of patient data.<sup>17</sup>

### Effects of information overload

The study by Reuters<sup>12</sup> identified that the reported effects of information overload were stress and tension within the work environment, longer working hours, decrease in social life, tiredness and illness and a degradation in personal relationships. Other writers<sup>18,19</sup> have noted effects on

the quality of decisions made. Sparrow<sup>20</sup> noted that 'managers can feel as if they are drowning in a sea of information'. In the clinical arena, Weed<sup>21</sup> noted that when faced with information overload clinicians often fell back on often imprecise (implied) 'clinical judgement.' Fuat *et al.*<sup>22</sup> in their investigation of barriers to accurate diagnosis of heart failure in primary care found that 'overload with information was seen as a common cause of stress.' More worryingly, perhaps, the same project team also found that most participants were not familiar with existing guidelines about the diagnosis and management of heart failure possibly due to what they described as 'guideline fatigue'.<sup>22</sup> Cohn<sup>23</sup> argued that clinicians have feelings of guilt and inadequacy when they realize that they may not know as much about a subject as someone else.

Work performed in the business sector by Hwang<sup>18</sup> and Iselin<sup>19</sup> suggests that a major effect of information overload is to reduce the quality of decisions reached. Iselin<sup>19</sup> found that as information diversity rose within a specific decision making process so did the information overload effect. He describes this information overload effect as a fall in the quality of decision-making. Hwang<sup>18</sup> took account of information processing ability, i.e. once the capacity of that is reached then processing will begin to decrease. The possibility of clinical errors caused by little time to preview and process data was reported by Zeng.<sup>17</sup>

### Information overload and the clinical environment

Evidence-based medicine or practice is based on the idea that current valid evidence should be used to support clinical decisions.<sup>24</sup> The issues underlying information overload are therefore critical to the health sector.

### Quantity and complexity

Many of the health orientated papers reviewed mention the problems of the information/knowledge explosion in health care. Hunt and Newman<sup>14</sup> calculated the number of articles published on an annual basis in the lupus and rheumatology specialities. Hibble<sup>15</sup> measured the

amount of clinical guidelines found in UK primary care and found that there were 855 guidelines, weighing 28 kg and measuring 68 cm high. The background work for the development of a knowledge management system for primary care also quantified the amount of information arriving across the desk of a GP in the UK; typically this would be 26 inches tall or have a monthly weight of 2 kg<sup>11,25</sup> It would appear that there was little consideration of the *quality* of the information within these measures. In contrast to this, Lyons and Khot<sup>26</sup> noted that despite perceptions of an abundance of information, most of the available information was of poor quality. Imhoff<sup>16</sup> noted that as well as the *amount* of information and data growing, it is also growing in complexity.

### Typology

Information typologies that contribute at the broadest level to the rich tapestry of information overload are wide. Miller's<sup>9</sup> work seems to suggest that anything that the organism processes is information. Similarly, Kaye<sup>27</sup> states that:

'Information has a much wider scope than we envisage in our professional activities. It is not merely a necessary adjunct to personal, social and organizational functioning, a body of facts and knowledge to be applied to the solution of problems or to support actions. Rather, it is a central and defining characteristic of all life forms, manifested in genetic transfer, in stimulus-response mechanisms, in the communication of signals and messages and, in the case of humans, in the intelligent acquisition of understanding and wisdom.'

In the Reuters report<sup>12</sup> information was defined for their purposes as 'written reports, newspapers, magazines, internal memos and electronic information including e-mails, fax messages, databases and the Internet.

These broad perspectives are not so clear-cut within the literature concerning information overload in the clinical environment. Hanka *et al.*<sup>11</sup> described the information measured in his research in the late 1990s as 'various governmental

guidelines, circulars from drug companies, warnings of adverse effects of drugs, etc.' Other writers<sup>15,21,24,28-34</sup> note the importance of the dissemination of research based guidelines and information for evidence-based practice. A brief survey of the information needs and seeking literature within the clinical environment shows that the focus is on information such as access to journals, research, guidelines and other 'factual' sources of material.<sup>35-37</sup> One focus<sup>14</sup> has narrowed down on journal articles however, Stefanelli<sup>29</sup> points out that the current model of shared care between a professional team 'depends critically on the ability to share *patient-specific information* and medical knowledge easily among care providers'.

### Solutions offered

As predicted by Bawden's<sup>4</sup> summary of solutions in the general sector, the literature about suggested solutions within the clinical area divides into four areas; technical, individual strategy, organizational strategy and human agent intervention.

Technical solutions focus on the creation of software/hardware solutions to the storage and dissemination of information/knowledge. Carlson and Abidi in particular focused on the creation and uses of decision support services where these systems drew on research and evidence-based information.<sup>34,38,39</sup> Hanka *et al.*<sup>11,25</sup> developed an *electronic* knowledge management system which aims to provide knowledge and information on a 'just in time' basis. This is similar to the approach taken by Hunt and Newman<sup>14</sup> who called for the construction of expert systems that delivered relevant information to the physician at the point of need. Zeng's<sup>17</sup> solution was specific to the design and use by doctors of electronic *patient* records systems. Coirea's<sup>40</sup> work in studying the communication behaviours in a hospital setting emphasized the role of communication technology rather than information technology in supporting information exchange.

Other studies concentrate on strategies to support an individual in dealing with information overload. Royce<sup>41</sup> argues that individual information literacy skills are critical to good information use. He also argues that the *medium* of delivery is irrelevant to information overload, i.e. the

medium used can affect the rate of development of overload but not necessarily the fact that it develops at all. Another approach<sup>42</sup> suggests that individuals should look to techniques such as improved time and load management to solve information overload rather than look for technological solutions. A relatively recent manifestation of overload e-mail has prompted an identification of further strategies.<sup>43</sup>

Wilson<sup>1</sup> stresses the role of the organization in information overload but does not prescribe a solution. Other writers stress that the efficient use of information and knowledge depends not just on technology, either as storage or delivery, but that there is the correct organizational structure in place to take advantage of that knowledge/information. In health care this is the move away from the old hierarchical structure of health care delivery towards a more team orientated structure.<sup>29,30,44,45</sup> Sorrels-Jones<sup>44,45</sup> explores the implications this will have for various clinical groupings but especially for nurses. A specific organizational tool to enable organizations to deal with information overload is described by McKinley.<sup>46</sup> McKinley explored the use of environmental scanning within rehabilitation organizations and suggested a four step approach to the concept:

- Select and search;
- Cull;
- Analyse;
- Negotiate action.<sup>46</sup>

Casey<sup>2</sup> describes the NHS gateway project that seeks to enhance information flows both to and from the centre. This project requires that all Department of Health (DoH) communications pass through a set of gateway controls. These controls are designed to control the volume of new government targets, planning requirements and guidance. Hunt suggested that the lack of time during working hours was a factor in determining how overloaded individuals felt.<sup>14</sup> The issue of overload has been considered to justify the creation of a 'Chief Knowledge Officer' post within each organization.<sup>47</sup>

Various potential benefits of using a human agent in mediating the problems of the information intense workplace that is the National Health Service have been described.<sup>48</sup> Although not

explicitly dealing with information overload, it is proposed that the librarian was in a prime position to work with clinicians by reprocessing and rerouting information to others in the hospital community. Childs<sup>49</sup> argues persuasively that clinical librarianship can be seen as an attempt to solve the twin problems of information overload and the implementation of evidence-based practice. A survey is underway to quantify the level of this type of activity within the NHS.<sup>50</sup> The National electronic Library for Health (NeLH)<sup>51</sup> was designed to solve the so called 'information paradox' with its aims to supply high quality evidence-based information when and where clinicians need it.

## Conclusion

Many of the definitions around information overload given in this review focus on the quantity of information available and the processing (in) ability of the human brain to handle this mass of information. Reich and Rosenthal<sup>52</sup> illustrate the impact of only one element of this overload. There are 7 million pages of information added to the world wide web every day. They go on further to state it is librarians' 'mission ... to transmit today's intellectual, cultural, historical output to the future'. The work referred to in this article points to librarians having a pivotal role around managing the overloaded health information outputs. To counter individuals' finite processing capability some solutions offer filters either through electronic desktop products or through human agents such as clinical librarians or knowledge officers or the combination of electronic/human services such as that offered by the NeLH. The personal contribution of the librarian is important as the use of electronic methods on their own to ease information overload can have the reverse effect.

A fundamental concern for the librarian is that there is very little evidence on the nature and impact of information overload in the health setting. This endorses the perception<sup>3</sup> that information overload is a myth or a vague story. This lack of an evidence base about the substance of the concept calls into question the solutions that have been designed to remedy the situation of overload.

Librarians will need to explore information overload in health to assess its implication and impact on future services.

## References

- 1 Wilson, T. D. Information overload: implications for healthcare services. *Health Informatics Journal* 2001, **7**, 112–7.
- 2 Casey, A. Information overload and the NHS. *Nursing Management* 2003, **10**, 8–9.
- 3 Tidline, T. The mythology of information overload *Library Trends* 1999, **47**, 485–506.
- 4 Bawden, D. Information overload. London: LITC publications, 2001.
- 5 Wilson, C. E. Information discrimination: a human habit. *Canadian Journal of Information Science* 1976, **1**, 59–64.
- 6 Bawden, D., Holtham, C. & Courtney, N. Perspectives on information overload. *Aslib Proceedings* 1999, **51**, 249–55.
- 7 Marcusohn, L. M. The information explosion in organisations. *Swedish Library Research/Svensk Biblioteksforskning* 1995, **3**, 25–41.
- 8 Simpson, C. W. & Prusak, L. Troubles with information overload—moving from quantity to quality in information provision. *International Journal of Information Management* 1995, **15**, 413–25.
- 9 Miller, J. G. Living Systems. New York: McGraw-Hill Co, 1978.
- 10 Wurman, R. S. Information Anxiety. London: Pan Books, 1991.
- 11 Hanka, R. & Fuka, K. Information overload and 'just-in-time' knowledge. *The Electronic Library* 2000, **18**, 279–84.
- 12 Reuters. Dying for Information? An Investigation Into The Effects of Information Overload in the UK and Worldwide. London: Reuters Business Information, 1996.
- 13 White, M. & Dorman, S. M. Confronting information overload. *The Journal of School Health* 2000, **70**, 160–1.
- 14 Hunt, R. E. & Newman, R. G. Medical knowledge overload: a disturbing trend for physicians. *Health Care Management Review* 1997, **22**, 70–5.
- 15 Hibble, A., Kanka, D., Pencheon, D. & Pooles, F. Guidelines in general practice: the new Tower of Babel? *British Medical Journal* 1998, **317**, 862–3.
- 16 Imhoff, M., Webb, A. & Goldshmidt, A. Health informatics. *Intensive Care Medicine* 2001, **27**, 179–86.
- 17 Zeng, Q., Cimino, J. J. & Zou, K. H. Providing concept-orientated views for clinical data using a knowledge-based system. *Journal of the American Medical Informatics Association* 2002, **9**, 294–305.
- 18 Hwang, M. I. & Lin, J. W. Information dimension, information overload and decision quality. *Journal of Information Science* 1999, **25**, 213–8.
- 19 Iselin, E. The impact of information diversity on information overload effects in unstructured managerial decision making. *Journal of Information Science* 1989, **15**, 163–73.
- 20 Sparrow, P. R. Strategy and cognition: understanding the role of management knowledge structures, organizational memory and information overload. *Creativity and Innovation Management* 1999, **8**, 140–8.
- 21 Weed, L. L. New connections between medical knowledge and patient care. *BMJ* 1997, **315**, 231–5.
- 22 Fuat, A., Hungin, A. P. S. & Murphy, J. J. Barriers to accurate diagnosis and effective management of heart failure in primary care: qualitative study. *BMJ* 2003, **326**, 196–8.
- 23 Cohn, M. Politics, pragmatism and the information overload. *Australian Family Physician* 1996, **25**, 660–1.
- 24 Deshpande, N., Publicover, M., Gee, H. & Khan, K. S. Incorporating the views of obstetric clinicians in implementing evidence-supported labour and delivery suite ward rounds: a case study. *Health Information and Libraries Journal* 2003, **20**, 86–94.
- 25 Hanka, R., O'Brien, C., Heathfield, H. & Buchan, I. E. WAX ActiveLibrary: a tool to manage information overload. *Topics in Health Information Management* 1999, **20**, 69–82.
- 26 Lyons, J. & Khot, A. Infopoints: managing information overload: developing an electronic directory. *BMJ* 2000, **320**, 160–4.
- 27 Kaye, D. The nature of information. *Library Review* 1995, **44**, 37–48.
- 28 Kidd, M. Coping with information overload—an IT solution to a major problem for general practitioners. *Informatics in Healthcare—Australia* 1996, **5**, 148–52.
- 29 Stefanelli, M. The socio-organizational age of artificial intelligence in medicine. *Artificial Intelligence in Medicine* 2001, **23**, 24–47.
- 30 Stefanelli, M. Knowledge management to support performance-based medicine. *Methods of Information in Medicine* 2002, **41**, 36–43.
- 31 Woolf, S. H., Grol, R., Hutchinson, A., Eccles, M. & Grimshaw, J. Clinical guidelines: potential benefits, limitations, and harms of clinical guidelines. *BMJ* 1999, **318**, 527–30.
- 32 Rodrigues, R. J. Information Systems: the key to evidence-based practice. *Bulletin of the World Health Organization* 2000, **78**, 1344–51.
- 33 Snyder-Halpern, R., Corcoran-Perry, S. & Narayan, S. Developing clinical practice environments supporting the knowledge work of nurses. *Computers in Nursing* 2001, **19**, 17–23.
- 34 Abidi, S. S. R. & Abidi, S. R. A case for supplementing evidence based medicine with inductive clinical knowledge: towards a technology-enriched integrated clinical evidence system. In: *IEEE Symposium of Computer Based Medical Systems*. Bethesda, USA, 2001, pp. 5–10.
- 35 Bryant, S. L. The information needs and information seeking behaviour of family doctors: a selective literature review. *Health Libraries Review* 2000, **17**, 83–90.
- 36 Murray, J., E. Carey & Walker, S. The information needs and information seeking behaviour of medical research staff. *Health Libraries Review* 1999, **16**, 46–9.

- 37 Rasch, R. F. R. & Cogdill, K. W. Nurse practitioners' information needs and information seeking: implications for Practice and Education. *Holistic Nursing Practice* 1999, **13**, 90–7.
- 38 Carlson, B. Technology offers an answer to 'information overload'. *Managed Care* 1996, **5**, 45–9.
- 39 Abidi, S. S. R. Knowledge management in healthcare: towards 'knowledge driven' decision-support services. *International Journal of Medical Informatics* 2001, **63**, 5–18.
- 40 Coiera, E. & Tombs, V. Communication behaviours in a hospital setting: an observational study. *BMJ* 1998, **316**, 673–6.
- 41 Royce, J. Surviving information overload: lessons from the reading reluctance research. *School Libraries Worldwide* 1997, **3**, 39–45.
- 42 Denning, P. J. Internet time out: technology won't solve information overload: new commitment management practices will. *Communications of the ACM* 2002, **45**.
- 43 Davidhizar, R., Shearer, R. & Castro, B. A dilemma of modern technology: managing e-mail overload *Hospital Material Management Quarterly* 2000, **21**, 42–7.
- 44 Sorrels-Jones, J. Knowledge workers and knowledge-intense organizations, part 3: implications for preparing healthcare professionals. *Journal of Nursing Administration* 1999, **29**, 14–21.
- 45 Sorrels-Jones, J. Knowledge workers and knowledge-intense organizations, part 1: a promising framework for nursing and healthcare. *Journal of Nursing Administration* 1999, **29**, 12–8.
- 46 McKinley, C. & Reeves, R. K. SCAN: a survival tool for information overload. *Journal of Rehabilitation Administration* 1997, **21**, 45–57.
- 47 Gray, J. A. M. Where's the chief knowledge officer? *BMJ* 1998, **317**, 832–40.
- 48 Keeling, C. & Lambert, S. Knowledge management in the NHS: positioning the healthcare librarian at the knowledge intersection. *Health Libraries Review* 2000, **17**, 136–43.
- 49 Childs, S. Clinical librarianship. In: Walton, G. & Booth, A. (eds.) *Exploiting Knowledge in Health Services*. London: Facet Publishing, 2004, pp. 89–98.
- 50 Survey of UK Clinical Librarianship 2004. Available from <http://www.le.ac.uk/li/lgh/library/clinsurvey.htm> (accessed 19 March 2004).
- 51 Gray, J. A. M. & de Lusignan, S. National electronic Library for Health (NeLH). *BMJ* 1999, **319**, 1476–9.
- 52 Reich, V. & Rosenthal, S. Preserving Today's Scientific Record for Tomorrow. *BMJ* **328**, 61–2.

Copyright of Health Information & Libraries Journal is the property of Blackwell Publishing Limited and its content may not be copied or emailed to multiple sites or posted to a listserv without the copyright holder's express written permission. However, users may print, download, or email articles for individual use.