INFORMATION OVERLOAD AND ITS EFFECTS ON HEALTHCARE PERSONNEL

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CERTIFICATE OF APPROVAL

This is to certify that the Master's Capstone Project of

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INFORMATION OVERLOAD AND ITS EFFECTS ON HEALTHCARE PERSONNEL

has been approved

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ABSTRACT

STATEMENT OF THE PROBLEM

This project is about information overload and its effects on healthcare workers. When the sources of information are multiple and varied, adverse effects may occur. This project will explore the nature of these effects. The specific goal of the project is to create a survey to explore the perceived degree of information overload along with coping skills used by healthcare personnel. The following survey was developed after farming an original research question of information overload and its effects on the employees of hospitals and clinics. The survey was validated by a group of physicians and nurses.

BRIEF DISCUSSION OF WORK PERFORMED

A select group of physicians and nurses were brought into a medical clinic and piloted the survey. Their job was to validate the questions. Their comments and observations were incorporated into the survey and were presented to the advisor of the project. Another group was given the survey and they were timed on the survey. This survey is going to be available to any institution that would like to perform a test to find out whether information overload is real in their institution and implement solutions to nullify the effects of information overload.

SUMMARY OF RESULTS

Development of questionnaire of survey was done by the author of this presentation with the guidance of the advisor. After the survey was developed it was presented to a group of healthcare workers for validating the survey. The group consisted of three physicians

and three nurses and one office manager. The physicians felt the questions in the survey were appropriate and no changes needed.

CONCLUSIONS

The review of the literature has indicated the growing problem of information overload is real and is probably causing stress among healthcare workers. The literature also shows various effects according to the institution. We proposed some solutions to help the healthcare workers overcome the deleterious effects of information overload.

INTRODUCTION

Nature of problem

"**Information overload**" (also known as infobesity or infoxication) is a term popularized by Alvin Toffler in his bestselling 1970 book Future Shock[1]. It refers to the difficulty a person can have understanding an issue and making decisions that can be caused by the presence of too much **information.** According to the Free Online Dictionary [2] information is defined as knowledge derived from study, experience, or instruction. It is also defined as knowledge of specific events or situations that has been gathered or received by communication; intelligence or news; a collection of facts or data. Informatics is defined as the sciences concerned with gathering, manipulating, storing, retrieving and classifying recorded information. As an informatician, I value information, but I wonder if its huge growth is overwhelming every discipline in society. Is it possible that productivity is taking a hit?

HISTORY

Thanks to the rise of the Internet, information is far more accessible than ever before. It's more connected to other pieces of information and more open to debate. Organizations — and even governmental projects like Data.gov[3] — are putting more previously inaccessible data on the Web than people in the pre-Internet age could possibly have imagined. But this change raises another, more ominous question: Is this deluge overwhelming our brains? In his new book, "Too Big TO Know" David Weinberger[4], a senior researcher at Harvard's Berkman Center for Internet and Society, attempts to answer that question by looking at the ways our newly interconnected society is

transforming the media, science and our everyday lives.[4]In an accessible yet profound work, he explains that in our new universe, facts have been replaced by "networked facts" that exist largely in the context of a digital network. As a result, Weinberger believes we have entered a new golden age, one in which technology has finally caught up with humans' endless curiosity, and one that has the potential to revolutionize a wide swath of occupations and research fields We live in a knowledge economy where we have to realize the value of information as well as the nature of it. Movement from agriculture to an industrial and then to a knowledge economy has been rapid and explosive, where everything moves on information. Paul Hamp of the Harvard Business Review wrote an article called "Death by information Overload"[5]. In it, he identified areas of difficulties in workflow because of information overload for workers and wonders if a multi-pronged approach to deal with overload of information might help. He states, "The secret is to manage the beast while still respecting it for the beautiful creature it is."

RATIONALE

Human activity in different fields is generating information at enormous, increasingly faster rate which is resulting in overload of information.

For example, in a report released in Nature magazine by the US National Academies in 2009[6], the authors introduced us to the era of petabyte science. They refer to geneticists as running through much of DNA in a week and churning out multiple sequences, thereby contributing to enormous information. Also, astronomers survey the sky via telescope and gather data on more than two million objects in the sky. Scientific literature

is providing research that results in a data glut. They indicate that an investigators ability to amass huge amounts of data which has accelerated data growth enormously. Thus, this report indicates how every branch of human endeavor is resulting in information overload.

In Healthcare settings that are institutionalized there are noisy conditions and cognitive overload which impair effective communications. If the right information that is not overwhelming but available easily at the point of care would lead to effective patient care. Dave Sackett, the father of evidence based medicine, said that to keep up with internal medicine, one has to read 17 articles a day for 365 days and that was 20 years ago. [7]

Today a variety of search engines and CDSS clinical decision support systems are available, and the explosion of articles contributed daily is overwhelming physicians and other healthcare workers.

MATERIALS AND METHODS

Manifestation

For physicians, retrieving patient related literature is hampered by the large size of medical literature. Technology with new computer systems is helping the retrieval, but physicians lack the time or skills needed to be effective with such systems. Simpler ways of determining the needs of the physicians and develop methods to formulate systems that can figure out needs of the physicians automatically are needed.

It does seem that it affects the physician performance and patient safety as per Beasley's "Information Chaos in Primary Care: Implications for Physician Performance and Patient Safety"[8].

In primary care where the resources are meager and investment into expensive information systems that can scan through the vast databases is not available. Another factor of many of the healthcare settings is the amount of data that leads to cognitive overload. It seems that the mental workload impacts the cognitive load and thereby decreases the performance[9].

Knowledge Pyramid, proposed by Russell Ackoff, which has data at the bottom and wisdom at the top with information and knowledge in the middle, has become standard in business environment[7].

It was our belief that there was too much to know and we need to fill all that into our heads. This belief when extended to information age and the filters that removed data in the pre-information age do not work in the digital age where the filters only reduce the

clicks to get to the data, resulting in a glut of data and information. Clay Shirky described this phenomenon: “there is no such thing as information overload –only filter failure’[10].

Effects

The effects on the medical education are obvious. In Australia, this was looked at universities and it was shown that case based learning, producing effective functionality of the physicians when they come out of training. On 21st century medical education, Hudson Birden and Sue Page wrote good examples of how to meet the growing challenges in training the doctors that have resulted from information overload from traditional curriculum. They were talking about innovations in learning environment and trans-disciplinary education to nullify the effects of information overload[11]

Accumulation of Healthcare data is growing enormously and Big Data is already a big challenge to handle. With the growth of EMRs, scientific health data is being generated and with the implementation of interoperable systems and analysis of the big data, we hope to derive some solutions of the existing health problems in society. A the same time, we will be contributing to the information overload and integrity of the data, accessibility of the data and stewardship of the data will be increasingly important to get the right data for the right purpose.

Public Health practitioners are faced with situations where they have to make critical decisions from information that is enormous and growing, need to have an interactive digital knowledge management systems. When that information is imprecise and overwhelming it can lead to public harm or at least slow down the intended good for the public.

PREVALENCE

As the growth of information in every aspect of life increases, it's bound to lead to information overload and affects society detrimentally rather than constructively. There are several EMRs that employ push technology to distribute information that has multiplication of an information paradox where clinicians are overwhelmed with information but unable to get knowledge when they need it. It may be useful to have a chief knowledge officer.

In the field of healthcare business, it's going to affect the corporations and its workers to deal with growing data and needs of learning to deal with them. Case in point is ICD-10 and its learning and implementation. The number of billing codes is going to be tripled. In Healthcare economics, the data generated for billing and administration of healthcare services can be huge and maintenance of this data could be a tremendous burden economically. Another significant way it can affect the healthcare business world is by increasing stress and decreasing productivity.

SOLUTIONS

Different solutions are proposed for different disciplines.

Many physicians are beginning to use Information systems to scan the updated information and present to them what they need at the point of care.

For example "up to date' presents search engine that can be incorporated into their EMRs and physicians can search when they are in a patient chart and relevant information can be presented right there.

Also they have a selection of order sets based on Evidence based medicine. For physicians using the right information for patient related problems is major need and

Rebitzer “analyzed empirically and theoretically how computer based decision support influences the acquisition of new knowledge by physicians when they are coping with information overload.”[12]

Many CME continuous Medical Education programs now insist on proving that physicians are acquiring and using updated knowledge before issuing credit for CME hours.

Figuring out the needs of physicians and developing systems to help was done by LM Braun who performed an experimental analysis, and the results led them to conclude that knowledge types which can be ordered according to their appropriateness.[13].

Many a setting in healthcare has an abundance of tools of communication in the form of To-do notes, cheat sheets and stick-on notes lying around. This is cognitive overload in everyday settings. Cognitive overload is prevalent in health care settings and AV Cicourel studied cognitive overload in healthcare settings and making communications better in healthcare delivery systems is warranted.[14]

Meditative practices from several regions of the world have talked about silent mind and intellectual excellence and more on these solutions are anecdotal and need further evaluation. Sages and spiritual practitioners have a clear and more often silent mind resulting from their practices, and there may lurk some of the solutions to the problem of Information overload.

DESCRIPTION OF PROCEDURES EMPLOYED IN THE PROJECT

1 Development of a survey that can be used in Healthcare settings.

2 Validating the survey with a group of healthcare workers

3 Another group of healthcare workers were timed as they took the survey.

The Survey

Information Overload and Its Effects on Healthcare

Section 1. Information overload (also known as infobesity or infoxication) is a term popularized by Alvin Toffler in his bestselling 1970 book Future Shock[16]. It refers to the difficulty a person can have understanding an issue and making decisions that is caused by the presence of too much information. In the following questionnaire we will explore your views on the prevalence of information overload in your daily work routines in healthcare as well as the sources of information that you must cope with.

1. Do you think that information overload is a problem for healthcare workers

2.Do you encounter these sources of information on a typical day at work? (Please answer *yes* or *no* to each.)

Other people (in person) yes no

Other people by telephone yes no

Electronic health records yes no

Electronic knowledge sources, such as the internet yes no

Electronic communications, such as email or text messages yes no

Workplace written or electronic policies and procedures yes no

Pagers yes no

Loudspeaker announcements yes no

Monitoring devices yes no

Other (please specify) _____

3.Information Overload is enhanced partly by having multiple electronic devices. Do you use multiple electronic devices during a typical day at work? (Please answer *yes* or *no* to each.)

Cell or wireless phones, including smartphones yes no

If yes, how many different cell or wireless phones do you use? _____

Desktop phones yes no

If yes, how many different desktop phones do you use? _____

Pagers yes no

If yes, how many different pagers do you use? _____

Tablet computers yes no

If yes, how many tablet computers do you use? _____

Desktop or laptop computers yes no

If yes, how many desktop or laptop computers do you use? _____

4.Does having these devices influence your ability to work efficiently?

Section 2: Effects of information on you

1. Do you have control over when you use an information source?

2.Have you ever made errors because of having too much information?

3. Do you have problems paying attention to your work because you are distracted by the sources of information?

4.Does having multiple sources of information and electronic devices increase your work stress?

5. Does having multiple sources of information and electronic devices prevent you from staying focused on tasks?

Section 3: Actions you may take

1. Do you ever take breaks from information sources and electronic devices in order to reduce stress at work?
    a. Yes
    b. No
2. Do you ever practice mental exercises such as mindfulness, guided imagery, or deep breathing in order to reduce stress at work?
    a. Yes
    b. No
3. Do you exercise in order to reduce stress at work?
    a. Yes
    b. No
4. Do you ever take naps at work in order to reduce stress?
    a. Yes
    b. No
5. What other actions do you take to reduce stress at work?

Validating the survey with a group of healthcare workers

When a survey is "validated" it means the researcher has received from another researcher that the instrument is measuring what it was designed to measure. we will follow the following method to get the kinks out of our survey. We will find someone who will act as a respondent and give the final copy of the survey via internet to the selected individual. Any questions from this individual will be indicative of the defects of the survey. We will modify all items that were mentioned. We will do the same process with a couple of more and then finish the validation of survey.

There are no black and white rules when it comes to assessing the reliability and validity of questionnaires. As we thought the best way to achieve our study objects of understanding the effects of information Overload on health care personnel is by using questionnaires, we needed to determine what type and level of validation is sufficient for our purposes. Validating these questions is challenging as they are evaluating the

subjective measures, but a “test-retest” concept can be employed to establish the reliability, meaning they can produce the same results when administered again. We will consider this. We will also try to establish the degree to which these questions reflect reality by attending to the internal validity, that a subject will respond to the similar questions in a similar way and external validity, that we have the ability to make generalizations about a populations based on that of sample tested.

The venue for this validation survey was a primary clinic .A group of healthcare workers were gathered. The group consisted of three physicians, three nurses and one office manager. The questions were presented to the group and they validated them.

Another group of healthcare workers were timed as they took the survey

Again the venue was the clinic. This time a different group of healthcare workers took the survey and they were timed. The group consisted of four physicians, two of them practiced in the clinic and two were hospitalists and the other members of the group were four nurses and one office manager. Everybody finished the survey in less than five minutes except for the office manager who took seven minutes.

DISCUSSION

Discussion of Findings

A review of literature suggests that the phenomenon of information overload is perceived by healthcare workers and it could get worse in the future with big data proliferation. There should be measurement of this growth and its probable effects on the healthcare workers. A reasonable approach is to develop a questionnaire like the one we developed and conduct the survey in each healthcare setting and customize some of the solutions elucidated in this presentation.

Significance

In “Learning to Fly in a world of Information Overload” Geoff Parcell ,a Master Practitioner of Neuro Linguistic Programming , ponders over the questions like why can’t we use the knowledge we have more effectively? Why can’t we always find the knowledge we need for our work?[11] In this project, these are some of the questions that will were explored with emphasis on whether or not the phenomenon of Information overload is making healthcare work stressful, thus causing a decline productivity and requiring skills to cope ..For example, in a report released in Nature magazine by the U.S National Academies in 2009[15], the authors introduce us to the era of petabyte science. They refer to geneticists as running through much of DNA in a week and churning out multiple sequences, thereby contributing to enormous information.[16]

Also, astronomers survey the sky via telescope and gather data on more than two million objects in the sky. Scientific literature is providing research that results in a data glut. They indicate that an investigators ability to amass huge amounts of data which has

accelerated data growth enormously. Thus, this report indicates how every branch of human endeavor is resulting in information overload.

Mindfulness is where you focus the mind one task at a time, so that the task gets full attention and having the culture of multitasking and there by dealing with several pieces of information due to information overload, is eroding into the quality of care for the patient.[12]

Relation to Findings of Other Investigators:

As per Weksler's the use of mobile electronic devise with many healthcare apps contribute to cognitive overload, these devices when not used properly lead to impairment of multitasking and lowers the performance, as the spread of personal electronic devices is an epidemic proportions it is causing an epidemic of distraction.[17] As per Danilov and Tyler in "Brainport/; An alternative Input to the brain" Brainport is a computer to brain interface (CBI) technology done non-invasively. It is promoting the delivery of missing sensory information and also to decrease the risk of sensory overload, thru additional sensory channels. In contrast to this current technology Virtual Reality which is the conventional CBI technology, designed to provide additional information thru existing sensory channels and overloads the brain.[18]

SUMMARY AND CONCLUSIONS

The review of the literature revealed that the phenomenon of information overload is present in healthcare settings and seems to become a tsunami with the growth of mobile portable devices.

It is prudent to develop a survey by each healthcare setting to know whether information overload is prevalent in their setting and if it does, what are the effects and solutions. In this project we developed a questionnaire to help institutions to elicit information from their workers whether information overload is existing in their life and if so how are they dealing with it.

REFERENCES

1. Toffler Alvin. *Future Shock*. New York, Bantam Books, 1970. Print.

2. www.thefreedictionary.com

3. http://www.healthdata.gov

4. Weinberger, David. *Too Big To Know: Rethinking Knowledge Now That the Facts, Experts Are Everywhere, and the Smartest Person in the Room is the Room.* New York: Basic, 2011. Print.

5. Hemp, P. "Death by Information Overload." *Harvard Business Review* 87.9 (2009): 82+. Web. 6 Jan. 2014. Pubmed id 19736853

6. US National Academies. "Information Overload." *Nature* 551st ser. 460.7255 (2009): n. pag. Web. 6 Jan. 2014. Pubmed id 19641545

7. Davidoff, Frank, et al. "Evidence based medicine." *BMJ: British Medical Journal* 310.6987 (1995): 1085.

8. Beasley, JW, TB Wetterneck, J. Temte, JA Lapin, P. Smith, AJ Rivera-Rodriguez, and BT Karsh. "Information Chaos in Primary Care: Implications for Physician Performance and Patient Safety." *Journal of the American Board of Family Medicine* (n.d.): n. pag. Nov.-Dec. 2011. Web. 6 Jan. 2014. Pubmed id 22086819

9. Galy, E., M. Cariou, and C. Melan. "What Is the Relationship between Mental Workload Factors and Cognitive Load Types?" *International Journal of Psychophysiology* 83.3 (2012): 269-75. *Http://www.sciencedirect.com/science/article/pii/S016787601100300X*. Science Direct, Mar. 2012. Web. 6 Jan. 2014. Pubmed id 22008523

10. Johnson, Clay A. *The Information Diet: A Case for Conscious Consumption.* Beijing: O' Reilly Media, 2012. Print.

11. Birden, Hudson, and Sue Page. "21st Century Medical Education." *Australian Health Review* 31.3 (2007): 341-50. *Www.publish.csiro.au*. Australian Health Review, 2007. Web. 6 Jan. 2014. Pubmed id 17669055

12. Rebitzer, JB, M. Rege, and C. Shepard. "Influence, Information Overload, and Information Technology in Health Care." *Adv Health Econ Health Serv Res* (2008): 43-69. Web. 6 Jan. 2014. Pubmed id 19548513

13. Braun, LM, F. Wiesman, HJ Van Den Herik, and A. Hasman. "Avoiding Literature Overload in the Medical Domain." *Stud Health Technol Inform* (2006): 497-502. Web. 6 Jan. 2014

14. Cicourel, AV. "Cognitive Overload and Communication in Two Healthcare Settings." *Commun Med* 1.1 (2004): 35-43. Web. 6 Jan. 2014. Pubmed id16808687

15. Parcell, G. ""Learning to Fly" in a World of Information Overload." *Bull. World Health Organization* 83.10 (n.d.): 727-28. Web. 6 Jan. 2014. Pubmed id16283046

16. Goodwin, K. "Information Overload? As Genetic Testing Kits Sold Directly to Consumers Gain Popularity, Medical Professionals and Lawmakers Wonder If More Regulation Is Needed." *State Legislature* 34.8 (2008): 30-33. Web. 6 Jan. 2014. Pubmed id16385646

17, Weksler ME, Weksler BB. The epidemic of distraction. Gerontology. 2012;58(5):385-90. doi: 10.1159/000338331. Epub 2012 May 10. PubMed PMID: 22572729

18. Danilov, Y., and M. Tyler. "Brainport: An Alternative Input to the Brain." *J. Integr. Neurosci.* 4.4 (2005): 537-50. Web. 6 Jan. 2014. Pubmed id16385646