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## Possible Psychological Effects of Ultrasound Scanning on Women

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### ABSTRACT

*Questionnaires were designed and given to 30 female subjects to investigate the possible psychological effects caused by the use of ultrasound scanning. The answers were analyzed in a numerical way and correlation tests were run to explore the relations among various factors. No significant correlation was found between any pair of the four selected factors. Further interviews with the subjects and detailed qualitative study of the answers provided answers for the results, and suggested that the possible psychological effects introduced by the ultrasound scanning, if any, were very limited.*

Ultrasound Scan is very frequently used in people's everyday life, especially for some medical purpose. The use of this new technology, which was first introduced in the early 1980's, turned out to be much wider than many once expected in the first ten years of the invention of this device. These days, the use of Ultrasound Scan, especially the B type Ultrasound Scan, covers a great range: imaging the organ and tissue inside humans' bodies, identifying the gender of fetus before it is born, and monitoring the unborn babies' growing to detect any possible fetal disorders, etc. (University

of Michigan Health System, 2001)

With so many uses of the Ultrasound Scan, many individuals are in great favor of this modern technology and are advocating increasing the use of it. To their point of view, Ultrasound Scan is considered a very effective way to diagnose lots of diseases which can help the doctors to make decisions before treatment; a measure that gives an idea of their baby, and enables them to be better prepared for the birth of the new life. It is also a good way to keep track of the growth and development of the fetus so that precautions can be taken with respect to possible treatment that may be necessary. As a consequence, Ultrasound Scan has been enjoying a growing market in the health industry, and many medical professionals agree that the importance of this technology cannot be overstated. Even some politicians agree. In Australia, for example, the committee of public health in congress was in favor of expanding the use of Ultrasound Scan in public and private health businesses, and provided more funds for such a project than the industry expected. (Loff et al., 2000)

On the other hand, there have also been some concerns associated with the use of Ultrasound Scan. One of the concerns is that the technology so far may not be as reliable as many people believe

it to be. It is, indeed, just a tool for people to know more about their own bodies. The scanning could yield ambiguous or even wrong results. Since not everyone has much experience with this tool and the information it provides, in some cases one has to rely on blindly the technology; so if it malfunctioned, or the scanned result was misinterpreted, the outcome could be unpredictable.

Another issue regards the illegal use of ultrasound scanners. Abuse of the technology could affect the sex ratio of newborn babies. In certain cultures, sometimes people have a preference for their babies' gender. Many of them may abort their baby if they know the fetus is not the gender they expected. Such phenomenon is particularly prevalent in the less developed countries and regions. In many of them, an important reason for using Ultrasound Scanning is that people there believe only the male can carry on the family line. Therefore, if the ultrasound identifies their baby's gender as female, they are very likely to conduct abortion. In this sense, as argued by opponents of the use of ultrasound scan, the technology has been turned into a tool that helps killing girls.

Yet another concern is that ultrasound scanning may raise medical and psychological issues. For example, more and more pregnant women go to scan their baby's gender and growth frequently. They might not fully realize the purpose and all the side effects of ultrasound scan. (McFadyen, 1998) Indeed, ultrasound scanning could be harmful to their health, especially for those being scanned frequently. (Moore, 1999) Moreover,

when they more and more depend on ultrasound scan, they could lose their own confidence. Some of them may even develop some kind of psychological dependence. This paper focuses on these possible psychological effects.

## METHOD

### Subjects

Thirty women from the local community were each given a questionnaire designed by the author. These women's age ranged from twenty to forty five years old. It was not known whether a subject had used ultrasound scanning or not before the questionnaires were returned and analyzed.

### Apparatus

Different forms of questionnaires with the same content were used. The questionnaires were in forms of telephone interview, paper-based questionnaire sheet, and email to the subjects. All of them had the same eight questions. The questions were:

- If the subject had used ultrasound scanning before;
- If so, for what purposes the subject used ultrasound scanning in the most recent case;
- How many times had the subject used the scanning during the case;
- Whether the subject felt safe or not about being scanned;
- Whether the use of ultrasound scanning was requested by the subject (or recommended by the doctors);
- If the subject knew the side effects of

- being scanned;
- If the subject trusted the result of ultrasound scanning; and
- If they would request the use next time.

An original copy of the questions in the questionnaire is enclosed in the appendix.

**Procedure**

There were two steps of data taken in this research.

The first part was the administration of the questionnaires in different forms.

Those subjects whose answers were “No” about the first question were not required to answer the other questions. For the other subjects, all of them answered every individual question. This process took about 5 minutes for those who did the questionnaire on the phone or on a paper-based one. There is no information about how long the process took for those who answered via email.

The second part involved further interviewing at some of the subjects about the detail in their answers. This part was conducted in a face-to-face way by the researcher. It took about 10 minutes for each selected subject in this part.

Once all the data were collected, qualitative answers to certain questions were converted into quantitative scores so that a numerical analysis could be run. Those questions whose answers were then represented by numerical scores, and their conversion rules were given in table 1.

Table 1. The conversion matrix for some of the questions

Question	Yes	No
Feel Safe about it?	1	0
Requested the use?	1	0
Know side effects?	1	0
Request next time?	1	0

Once the scores were obtained for each subject, a phi-coefficient correlation test was performed, using the converted dichotomous scores, for each pair of the following factors:

- if the subject felt safe about the scan;
- if one requested the scan voluntarily;
- if the subject was aware of the possible side effects; and
- if one would prefer to request the use of ultrasound scan in the future.

Since the topic concerned in this case study should not be simply stated as a yes-or-no question, no hypothesis was explicitly stated prior to the running of the statistics. Instead, some qualitative conclusions were reached using the quantitative results as clues.

**RESULTS**

Out of the 30 subjects who participated in this study, 10 individuals answered “no” to the first question, and they were then excluded from the further interview and analysis. The other 20 answered all the questions in the questionnaire. The original answers were enclosed in the appendix.

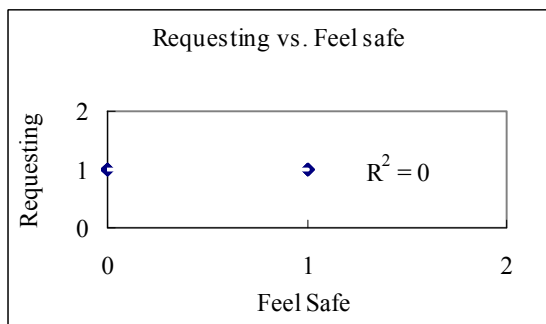
The converted scores (using the matrix above) of the four selected items for each subject were listed in table 2.

Table 2. The converted scores

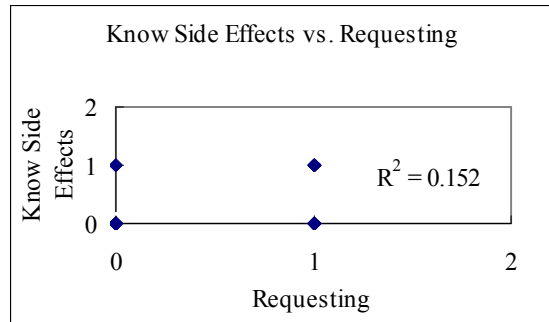
Feel safe	Requesting	Know Side Effect	Request Again
1	0	0	1
1	1	0	1
1	1	1	1
1	1	1	1
1	0	0	1
1	0	1	1
1	0	0	1
1	1	1	1
1	0	0	0
1	1	0	1
1	0	0	1
1	1	1	1
1	1	0	1
1	0	0	1
1	1	0	1
1	0	1	0
1	1	1	1
1	0	0	1
1	0	0	1

Phi-coefficient correlation tests were run for each pair among the above four items. Each pair of data was also plotted in a y-x style. Note that due to the dichotomous property of the numerical value (only 0 and 1) for each item, there were only 4 possible points on each plot, and many data points would overlap each other. The R2 value of each individual pair's correlation test was also given in the graph.

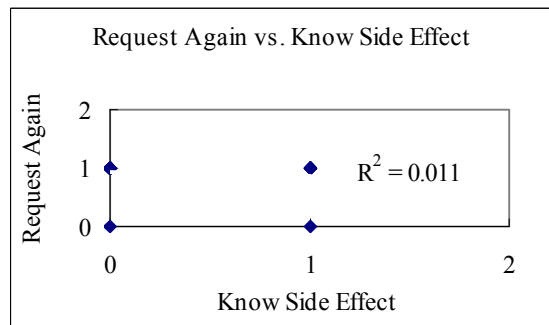
Graph 1.



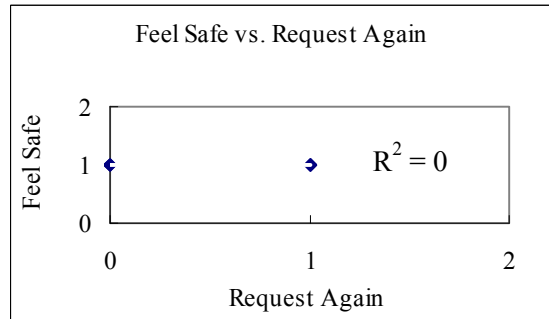
Graph 2.



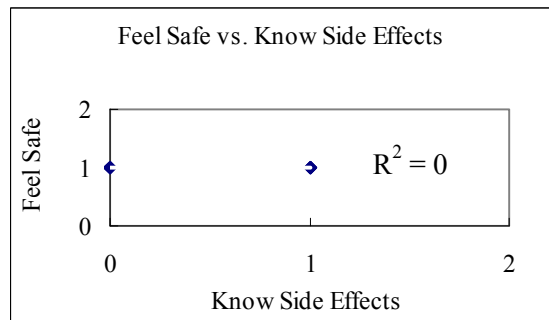
Graph 3.



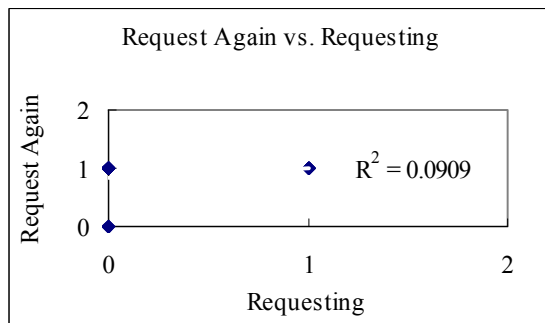
Graph 4.



Graph 5.



Graph 6.



The Phi-Coefficient correlation Phi values for all these 6 correlations were listed in table 3. (Note that the Phi-Coefficient correlation has the same mathematical formula as Pearson correlation. The computer program used by the researcher didn't distinguish one from the other, and used R2 in the generated graphs to represent the actual Phi square values.)

Table 3. Phi-coefficient Phi values

Pair (identified by graph #)	Phi
1	0
2	0.39
3	0.10
4	0
5	0
6	0.30

Six phi-coefficient correlation tests for the data revealed that there were no significant correlations between any of the six pairs constructed from the following four facts: if an individual subject felt safe about the scan, if the subject requested to be scanned voluntarily, if one was aware of the possible side effects, and if the subject would prefer to use it in the future.  $\Phi = 0 \sim .39, n = 20, p > .05$ , tow tails.

## DISCUSSION

After putting the data together and using the statistical results, some findings were reached.

First, regardless of whether or not an individual subject had knowledge about possible negative effects, the subject would always feel safe of being scanned. The result could be seen from the insignificance of the correlation statistic. This fact could be partially explained by the results of further interviews with some of the subjects. For those who were not aware of possible side effects, all of them took it for granted that the scan was safe. For those who did know some possible side effects of the scan, they did not only know the existence of the side effects, but also knew how small the chances were that such effects could happen, so they still felt safe when they were not scanned too frequently.

A second finding was that even though people felt safe about being scanned, they generally wouldn't voluntarily request to be scanned unless they were pregnant. (This fact could be seen from the original answers. No statistical analysis was run for this situation because the purpose item had more than two answers and it was impossible to assign a score to each of the answers.) On the other hand, interviews indicated that when a subject was feeling sick or under a routine physical check, she would not ask for a scan, although the subject was willing to be scanned if the doctor recommended so. Some of the subjects being interviewed mentioned that the feeling of being scanned made them

feel that there was something “wrong”, or at least unusual, in their bodies. Therefore, they would not often ask for it, and they would trust the doctor’s perception of whether a scan was necessary. On the other hand, pregnant women knew what was going on in their bodies. They were concerned about their fetus so they liked to have the fetus scanned on a regular basis to keep track of the growth of the baby. Some of them would even request a scan when doctors didn’t indicate that it was necessary. This could be interpreted as some kind of psychological dependence, and this could cause those women to rely too much on ultrasound scan, theoretically. However, the fact was that the pregnant women would always take the advice from their doctors not to scan too frequently. This indicated that even though the high tech scan was getting more and more trust from women, doctors were still dominant authorities.

One more interesting finding was that almost all the subjects indicated they would ask to be ultrasound scanned if they felt it was necessary. Different subjects reported different reasons. Some of them got positive ideas about the scan through their previous successful experience. Behaviorally speaking, this formed positive images towards the technology, acting as a reinforcer that promoted future use. Some other subjects knew other scanning tools have greater side effects than Ultrasound Scan, such as x-ray scan and CT. Therefore, those subjects would prefer ultrasound scanning for screening purpose to see if there was anything requiring the use of more serious and

more harmful scans, such as CT. Among a total number of 20 subjects, only two individuals indicated otherwise. One of them disliked high-tech, so the dislike for the scan was a generalized effect and had nothing to do with the scan itself; the other subject only trusted the result of the scan when the result was good. If she were afraid of any possible bad outcome found by the scan, she would not try it again, if possible.

From these basic findings, it was concluded that the possible psychological effects (such as dependence) caused by the ultrasound scan, if any, was very limited. One major reason was that the absolute authority of doctors almost always overrode such effects. Therefore, women should still feel safe to use the technology, as long as they follow the instruction of the doctors.

There were also various limitations to this study. The sample size was not large enough. The study focused on women, so the results might not be generalized to men without caution.

As for the statistics used in the study, some of the questions had answers in form of “yes” and “no”. Those answers were represented by number 1 and 0 so that a correlation test could be run. It had been considered that a five-point scale (1 to 5) instead of this two-point scale (0 to 1) might be used for some of the variables, so that the data might be better for running the correlations, because doing so could introduce more position for the data points to sit on the plot and the shape of the distribution could be seen better. Also, this would allow the running of point-biserial, Spearman, or even Pearson

correlation tests, which were generally considered more powerful than the phi-coefficient correlation test. However, this alternative method was not used because the uncertainty introduced in the data taking would undermine its statistical advantage. It could be hard to design a precise scale to examine the attitude of the subjects towards these same questions, and every subject might respond differently to the five-point scale even for the same level of attitude. The scores for the same factor between different subjects could be un-comparable. There could be too much randomness caused by this alternative. Therefore, the two-point dichotomous scale was chosen by the researcher to maintain this “inter-subject” reliability.

University of Michigan Health System. (2001) Ultrasound Scan During Pregnancy, <http://www.med.umich.edu/1libr/tests/testu01.htm>, University of Michigan Health System, 2001.

#### APPENDIX

A copy of the questionnaire was enclosed. Original answers from all the subjects were also attached.

#### REFERENCE

- Loff, Bebe & Cordner, Stephen. (2000) Pregnant women bear Australia's government's handling of scan scam, *Lancet*, 01/22/2000, 355(9200), 298.
- Moore, Amy Slugg. (1999) Ultrasound scans may affect cell division, *Medical Economics*, RN, 62(10), 92.
- McFadyenl, Anne. (1998) Do pregnant women realize the purpose of the ultrasound scan? *Women's Health Weekly*, *British Medical Journal*, 09/21/98, 16



Appendix I. The questions in the questionnaire used in the study

1. Have used ultrasound scanning before?  
Yes/No  
If your answer is “no”, please skip the following questions and return the questionnaire;  
If your answer is “yes”, then in the most recent case:
2. For what purposes did you use ultrasound scanning?
3. How many times did you use the scanning during thatcase ?
4. Do you feel safe about being scanned?  
Yes/No
5. Did you request the use of ultrasound scanning (if this was the case, choose Yes) / or the use of the scan was recommended by the doctors (if this was the case, choose No)?  
Yes/No
6. Are you aware of any side effects of being ultrasound-scanned?  
Yes/No
7. Do you trust the result of ultrasound scanning? Why or why not?
8. Do you think you will request the use of ultrasound scan next time, when you have a choice?

## Appendix II. Original answers from the subjects who had used ultrasound scan

Subject	For what purpose	Frequency	Feel safe?	Requesting	Know side effect	Trust the result or not, and why	Request again
1	disease	1	yes	no	no	yes, doctor said	yes
2	pregnant	5	yes	yes	no	yes	yes
3	pregnant	4	yes	yes	yes	yes, why not	yes
4	pregnant	8	yes	yes	yes	yes, I have babies before.	yes
5	disease	2	yes	no	no	yes, the result is right	yes
6	physical check	6	yes	no	yes	sometimes yes, sometimes no	yes
7	pregnant	4	yes	no	no	yes	yes
8	pregnant	5	yes	yes	yes	yes	yes
9	physical check	2	yes	no	no	no, don't believe high tech	no
10	pregnant	5	yes	yes	no	yes, my friend told me so	yes
11	physical check	3	yes	no	no	yes	yes
12	physical check	2	yes	no	no	yes, I have to.	yes
13	pregnant	5	yes	yes	yes	yes	yes
14	pregnant	6	yes	yes	no	yes, high tech	yes
15	disease	>10	yes	no	no	yes	yes
16	pregnant	4	yes	yes	no	yes	yes
17	physical check	3	yes	no	yes	yes, if the result is good	no
18	pregnant	5	yes	yes	yes	yes	yes
19	disease	1	yes	no	no	yes	yes
20	physical check	2	yes	no	no	yes, good result, why not believe	yes