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THE EFFECTS OF DIFFERENT VISUAL PRESENTATION FORMATS IN A MEDICAL DILEMMA SITUATION

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ABSTRACT

The presentation and perception of risk are of great importance in the field of prenatal screening tests. These risks must be balanced against the risk of harm caused by diagnostic investigations and this often means that patients and professionals are faced with difficult judgments. Related studies have revealed that visual presentation such as graphics, illustration and pictures affect perceived risk, attitude and behaviour. We developed 9 different graphical formats for the dilemma situation which were applied in this research to investigate the effectiveness of a range of graphical designs on risk communication strategies, especially in the dilemma decision making process. Interviews and questionnaire methods were applied in this research. According to the results of the interviews, we found that: 1. an oral format was used mostly in Taiwan to avoid treatment debate; 2. graphical tools were useful, but not widely used in Taiwan. By using a t-test and a chi-square test, this study tried to find out if risk perception and different ages affect the choices of the screening tests in a dilemma decision making process. The findings were: 1. the average risk perception of the 9 communication tools were between medium to high, and women's recognition varied significantly; 2. there was no significant difference between the choices of high-risk and low-risk perception; 3. there was significant difference ($p<0.05$) between two age groups in terms of ratio data format, abstract image format, discrete concrete image format, and sequential concrete image format ($P<0.05$), and very significant difference in text format, histogram format, and proportion data format ($p<0.01$).

Keywords：visual presentation format, dilemma decision making, risk communication

Ⅰ. INTRODUCTION

As people's cognitions have changed, medical treatment has combined "doctor-centered" and "patient-centered" methods. This change does not imply the degradation of the doctors' function in medical treatment, rather it means doctors treat patients more equally (Henbest and Stewart, 1989), thus exchanging information freely and providing the best therapies. Actually, even in the equal relationship, the information exchange between doctors and patients is still affected by the knowledge and edu-

cational level of the patients. If the patient cannot understand the risk information, or the doctor cannot communicate with the patient in common language, their relationship is not really equal. When patients are confronted with difficult medical decisions, health care providers and decision aids both play a critical role in informing patients about the risks and benefits of treatment (Fagerlin, et al., 2005). Complex information must be organized to help patients understand the options and how to act on the results, particularly in time limited circumstances (Hinshaw, et al., 2006). When people are trying to understand and make decisions about risk, they tend to see various aspects of the risk in visual formats (Lundgren and McMakin, 1998).

Presenting the risks of fetal abnormality to pregnant women is important in counseling prior to offering prenatal screening tests in Taiwan. These risks must be balanced against the risks of harm caused by diagnostic investigations and this often means that patients and professionals are faced with difficult judgments. In Taiwan, older pregnant women were encouraged to adapt amniocentesis testing to see if their babies were healthy, but amniocentesis testing may cause abortion in 0.5% of cases. In order to understand the influences of different risk presentation format on interviewees' recognition and decision making, this research aimed to survey pregnant women's recognition of different presentation tools in a dilemma decision making situation.

Ⅱ. DIFFERENT VISUAL PRESENTATION FORMATS ON A DILEMMA DECISION MAKING PROCESS

Providing patients with objective and useful information in this area is not easy. In order for patients to be effective participants in the decision making process, they need information in a format that they understand and are comfortable with. Visual presentation such as graphics, illustration and pictures can help patients understand risks easily and affect perceived risk and the decision-making process and behaviour. Current recommendations for communicating information about uncertain future events emphasize the importance of presenting data in a balanced manner that avoids framing effects, provides baseline risk information and uses graphic risk displays whenever possible (James and Stephen, 2008). Research about the communication of risks had shown that the context and format in which risks were presented affect people's perceptions and their subsequent decisions (Timmermans, 2005). It is now understood and accepted that for graphic and information design to be accurate and visually attractive is not enough, it must also reach the emotions of the viewer.

A table format can be easily memorized or understood, and can reduce the cultural and language gaps. Relevant contents can be connected by colours, sizes, shapes and alignments to make them comparable (Lundgren and McMakin, 1998). Figure 1 was adopted from the concept of a decision tree. This flow diagram can help the viewer to easily understand the possible results of two different treatment options (James and Stephen, 2008).

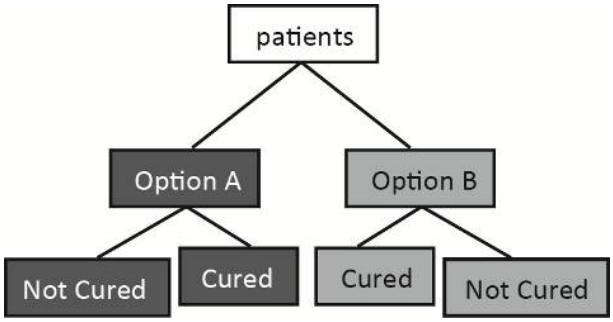


Figure 1 The flow diagram

Figure 2 is designed to show the differences between 2 types of data and it is easy for viewers to compare the data but not the overall relationship. The left hand panel in figure 2 is a standard bar chart showing the entire dataset, and the right bar chart magnifies the differences between the two options so they can be seen more clearly (James and Stephen, 2008).

Figure 3 uses human images to show the results of choosing different treatment options. In general, an image format may attract more attention and be easily understood (Sevilla, 2002), but Timmermans et al. found that fewer patients would choose surgery when an image format risk communication is adopted, as compared to other presentation methods (Timmermans, et al.,

2004). This latter result suggests that image format presentation may not be better than other presentation formats. As mentioned in previous studies, compared to abstract icons, females prefer concrete ones because they think they are easier to understand (Fig 4).

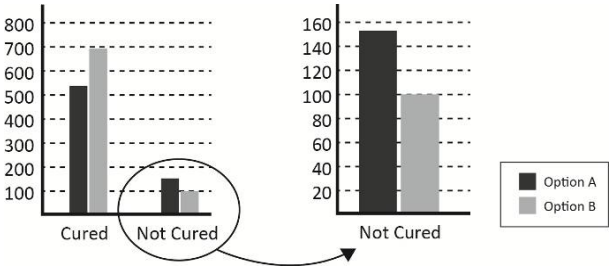


Figure 2　An augmented bar chart

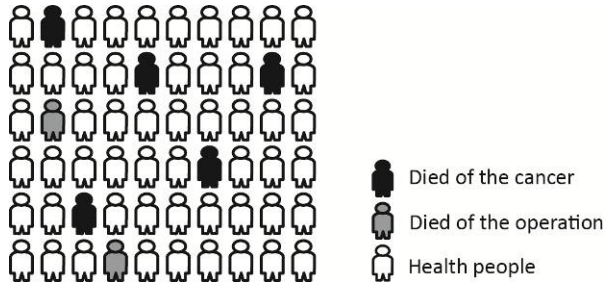


Figure 3　An image format with concrete icons

Proportions are easy to judge in this icon array because the part-to-whole information is available visually. Because the square icons are touching each other, so it can be easily arranged as a block and, it is possible that they are visually processed as areas rather than as discrete units (Fagerlin, et al., 2005).

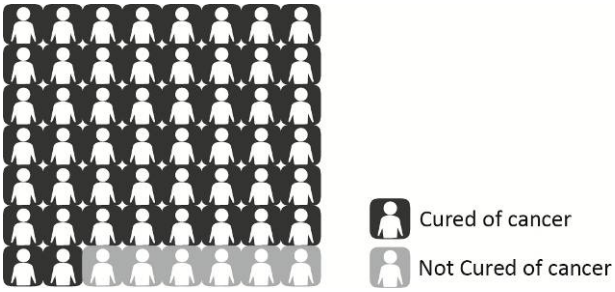


Figure 4　Sequential concrete image format

In the medical domain, “patient decision aids” are tools designed to communicate the best available evidence on treatment or screening options to patients (Holmes-Rovner, et al., 2007). It is important to transmit the information most effectively and efficiently, and information designers seek to combine skills in these fields to make complex information easier to understand.

Ⅲ. RESEARCH METHODS

3.1 Risk communication tools

According to the secondary research and using communication samples collecting methods, we developed 9 different formats for communication in dilemma situations and further confirmed these through graphical and medical professionals (see table 1). These 9 formats adopted the same information of the risk for pregnant women to conceive babies with Down syndrome, and the chance of amniocentesis causing abortion. We put these two comparative data together to see if the dilemma situation format would affect their choices, including text format, ratio data format, proportion data format, histogram format, pie chart format, abstract image format, discrete concrete image format (the icons are not touching each other), sequential concrete image format (the icons are arranged as a block and touching each other), and a composite format.

3.2 In-depth Interviews

Based on the literature review and the data we collected, there were two main themes in our semi structured interviews: 1. the ways and the tools for doctors to communicate with their patients; 2. the medical professional’s opinions and suggestions about visual presentation formats. We adopted purposive sampling to interview medical professionals of different positions in National Taiwan University Hospital, Taichung Hospital, Department of Health, Executive Yuan, R.O.C. and China Medical University. A total of 8 interviewees were carried out in this research, including 1 hospital director, 1 adviser doctor, 1 obstetrician/ gynecologist, 1 intern, 1 nursing department chief, 1 nursing supervisor, 1 case manager and 1 secretary. The details of the interviewees are listed in Table 2, some of them were interviewed more than one time because of their work

Table 1 9 different formats of risk communication tools

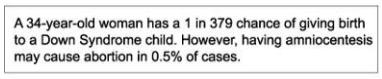
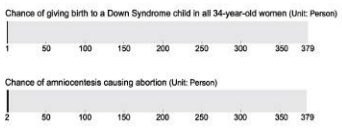
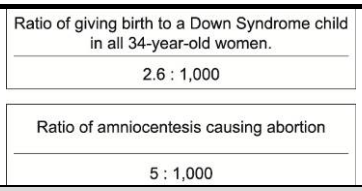
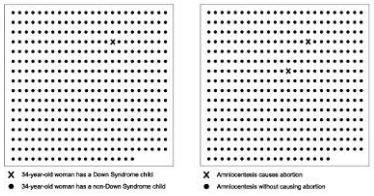
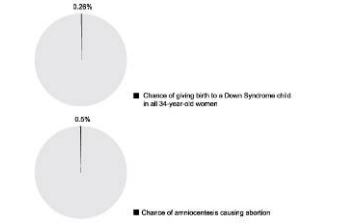
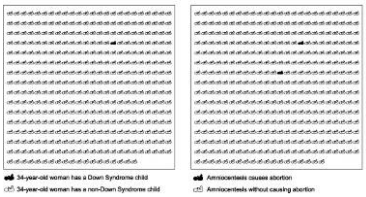
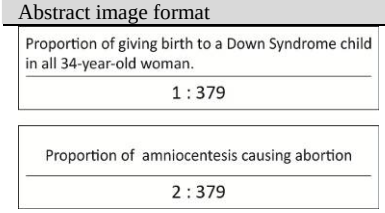
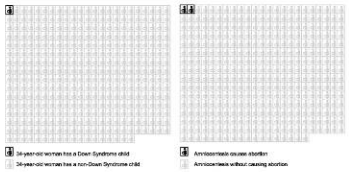
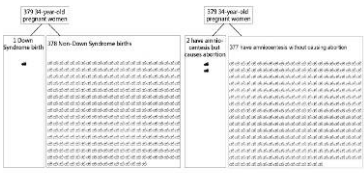
		
text format	histogram format	ratio data format
		
Abstract image format	pie chart format	discrete concrete image format
		
proportion data format	sequential concrete image format	composite format

Table 2 Details of 8 interviewees

Unit	Code	Position	Date (yy/mm/dd)	Location (City)
National Taiwan University Hospital	A1	Department of Obstetrics & Gynecology	08/Jan/28	Taipei
China Medical University	B1	Intern	08/July/12	Taichung
Taichung Hospital, Department of Health,R.O.C.	C1	Director	08/Aug/07	Taichung
	C2	Adviser doctor	08/Sep/26 08/Dec/29	Taichung
	C3	Secretary	08/Sep/26 08/Dec/29 09/Jan/22	Taichung
	C4	Nursing department chief	08/Sep/26	Taichung
	C5	Nursing supervisor	08/Dec/29 09/Jan/22	Taichung
	C6	Case manager	08/Sep/26 09/Jan/22	Taichung

ing skills and willingness to cooperate. Each interview time was about 2 hours. After arranging the interview time and location, we e-mailed interviewees the themes and reference materials. Interviewers would explain the research objectives in the first meeting time to make sure interviewees fully comprehended our research and gave useful opinions.

3.3 Questionnaire survey

A questionnaire was applied to this research to measure the differences and the effects of various presentation formats on cognition, and whether risk perception and age differences would affect the choices of the screening tests in the dilemma decision making process. As this questionnaire presented the same risk data, it used 9 arrangements to prevent learning effects. A total of 89 questionnaires were distributed to female interviewees, and 80 valid samples were returned.

Ⅳ. RESULTS AND DISCUSSIONS

4.1 Interview with the medical professionals

From the interviews, we could understand how medical professionals communicate with their patients and the use of communication tools. We note the summaries of our interviews below:

1. Oral/data format was used mostly in the hospitals we

interviewed:

To avoid treatment debate, it is necessary to explain the patient's condition carefully. Doctors will explain the risks mostly in oral format before an operation and patients will be asked to sign a letter of consent to show their agreement. On the letter of consent, they may use words, statistics and tables to describe the operation risks.

"We use oral format mostly when we communicate with our patients", said A1.

"Doctors will quote the statistics from a professional journal research to communicate risks with their patients and their families, and mostly in oral format", said B1.

2. Graphical tools are useful, but not widely used:

During the medical treatment, visual images are used for health promotion, health education, patient management, and security management. Graphic tools could promote communication between doctors, doctor and patients, and patients. All interviewees agreed that graphical communication tools could help patients understand medical information, some of them already had some graphical tools, but these were not used widely at the moment.

"At present, the hospital conducts the health education in multiple modes. During disease management and for knowledge, the case manager also gives the patients some information based on their requirements. The visual mode is frequently adopted. ", said C2.

3. Graphical tools can help medical professions communicate with their patients:

Currently, the hospital has selected diversified health education schemes to help patients understand their health conditions. The National Health Bureau had offered residents many preventative measures to help them understand their health conditions and most hospitals only used these leaflets, pamphlets or posters to communicate with their patients. For disease management and understanding, the case manager also gave the patients some information based on their requirements. Most case managers adopted different tools to communicate with their patients, such as models, documents, tables and pictures etc.

"The doctor-patient interaction is mainly conducted in verbal form, in most cases; the doctor can obtain a lot of information from their communication. However, some visual tools are effective when communicating with the foreign women. Therefore, we hope that some effective health education tools applicable in Taiwan can be developed." said C1.

4.2 Analysis of the choices of the 9 risk communication tools

This study found that the average values of the 9 tools were 3-4 (medium to high). A Chi-square test showed that P <.05, this suggested that women's recognition of communication tools varied significantly among the 5 choices of "very high", "high", "medium", "low", and "very low". The choice of "high" was most selected for the 9 communication tools. Analysis of the Chi-Square test frequencies showed that: 1. for text format, "high" was the most selected; 2. for ratio data format, "high" was the most selected, followed by "medium", as selected by 23 subjects; 3. for proportion data format, "high" was the most selected, followed by "medium", as selected by 22 subjects; 4. for histogram format, "high" was the most selected, followed by "medium", as selected by 21 subjects; 5. for pie charts, "high" was the most selected, followed by "low", as selected by 21 subjects, and "medium", as selected by 18 subjects; 6. for abstract image format, "high" was the most selected, followed by "medium", as selected by 25 subjects; 7. for discontinuous concrete image format, "high" was the most selected, followed by "medium", as selected by 22 subjects; 8. for continuous concrete image format, "high" was the most selected, followed by "medium", as selected by 27 subjects; 9. for multiple selections, "high" was the most selected, followed by "medium", as selected by 17 subjects (see Table 3).

According to the literature review and research findings, different presentation methods would affect patients' recognition of risk, making patients over-estimate or under-estimate the possibility of risks. A text format might make patients over-estimate the risk, while pie charts might lead to under-estimate We further defined

the women's risk perception into a "high risk perception" group and a "low risk perception" group from the results of Likert 5-point scale.

4.3 The differences between risk perception and the choices of the screening tests in the dilemma decision making process

In the first part of the questionnaire, a Likert 5-point scale was used to measure risk perceptions of the 9 different risk communication tools, and we further categorized the results into a "high-risk perception" group and a "low-risk perception" group; in the second part, 9 different formats of dilemma decision making were developed based on the first part of the questionnaire, and we further asked the interviewees if they would accept amniocentesis or not? By the test of homogeneity of proportions, we found that there was no significant difference between risk perception and the dilemma decision making. This meant that the "high-risk" and the "low-risk" group both tended to accept amniocentesis (the range of acceptance is from 65.6% to 72.1%). The text format was most selected to accept amniocentesis testing (72.1%), followed by discrete concrete image format (71.4%), and composite format was least selected (65.6%).

Table 3 Statistics of women's selection among the 9 risk communication tools

	Mean	SD	low risk			high risk		Total
			1 very low	2 low	3 medium	4 high	5 very high	
text format	3.69	1.051	4	7	15	38	16	80
ratio data format	3.35	1.080	5	12	23	30	10	80
proportion data format	3.52	1.073	4	9	22	30	14	79
histogram format	3.32	1.167	7	12	21	28	12	80
pie chart format	3.04	1.115	7	21	18	28	5	79
abstract image format	3.30	1.048	5	12	25	30	8	80
discontinuous concrete image format	3.23	1.085	5	16	22	28	8	79
continuous concrete image format	3.32	.955	3	12	27	31	6	79
composite format	3.34	1.102	6	13	17	36	8	80

Table 4 Crosstabs of risk perceptions and amniocentesis choices

	perception	amniocentesis		Total	P
		accept	deny		
text format	high risk	60.3%	25.0%	85.3%	.545
	low risk	11.8%	2.9%	14.7%	
	total	72.1%	27.9%	100%	
histogram format	high risk	53.1%	17.2%	70.3%	.071
	low risk	15.6%	14.1%	29.7%	
	total	68.7%	31.3%	100%	
ratio data format	high risk	51.6%	21.0%	72.6%	.626
	low risk	17.7%	9.7%	27.4%	
	total	69.3%	30.7%	100%	
abstract image format	high risk	52.5%	18.0%	70.5%	.147
	low risk	16.4%	13.1%	29.5%	
	total	68.9%	31.1%	100%	
proportion data format	high risk	51.6%	27.4%	79.0%	.248
	low risk	16.1%	4.9%	21.0%	
	total	67.7%	32.3%	100%	
pie chart format	high risk	44.8%	13.4%	58.2%	.085
	low risk	23.9%	17.9%	41.8%	
	total	68.7%	31.3%	100%	
discrete concrete image format	high risk	49.2%	17.5%	66.7%	.554
	low risk	22.2%	11.1%	33.3%	
	total	71.4%	28.6%	100%	
sequential concrete image format	high risk	51.9%	22.2%	74.1%	.692
	low risk	16.7%	9.2%	25.9%	
	total	68.6%	31.4%	100%	
composite format	high risk	50.7%	22.4%	73.1%	.291
	low risk	14.9%	12.0%	26.9%	
	total	65.6%	34.4%	100%	

Table 5　Crosstabs of ages and amniocentesis choices

	ages	Amniocentesis		P
		accept	Deny	
text format**	≦33	58.0%	42.0%	
	≧34	85.7%	14.3%	.006**
histogram format**	≦33	54.0%	46.0%	
	≧34	82.9%	17.1%	.006**
ratio data format*	≦33	54.0%	46.0%	
	≧34	75.0%	25.0%	.047*
abstract image format*	≦33	54.0%	46.0%	
	≧34	77.8%	22.2%	.023*
proportion data format**	≦33	52.0%	48.0%	
	≧34	80.0%	20.0%	.008**
pie chart format	≦33	58.0%	42.0%	
	≧34	77.8%	22.2%	.056
discrete concrete image format*	≦33	60.0%	40.0%	
	≧34	80.6%	19.4%	.043*
sequential concrete image format*	≦33	54.0%	46.0%	
	≧34	79.4%	20.6%	.017*
composite format	≦33	55.1%	44.9%	
	≧34	74.3%	25.7%	.072

*P<.05, ** P<.01

Since Down syndrome and amniocentesis testing has been advocated for many years in Taiwan, so the public has a basic understanding of it. That may be the reason why most of our interviewees perceive the risk as higher, and tend to accept the amniocentesis testing. Besides this, as we can find from table 4, most interviewees perceive the risk of text format is higher than others (85.3%), followed by proportion data format (79.0%); and pie chart format is lowest in these 9 different formats (58.2%).

4.4 The differences between ages and the choices of the screening tests in the dilemma decision making process

According to the related literature, the probability of chromosome disease will increase with the pregnant woman's age. Bureau of Health Promotion, Department of Health, R.O.C. (Taiwan) indicated that the probability of chromosome disorder in all screening test of women older than 34 (49.3%) was twice that of women younger than 34 (24.66%) (Bureau of Health Promotion, Department of Health, Taiwan, 2008). In Taiwan, we often use the data for 34-year-olds as the baseline for the group with higher risk of having babies with Down Syndrome in official documents (Bureau of Health Promotion, Department of Health, Taiwan, 2008). That was the reason why we divided all the interviewees into 2 groups by the age 34 (age≦33, age≧34). According to table 5, there was a significant difference ($p<0.05$) between these two groups in ratio data format, abstract image format, discrete concrete image format, sequential concrete image format ($P<0.05$); and very significant difference in text format, histogram format, proportion data format ($p<0.01$) in adopting amniocentesis testing. The range of accepting amniocentesis testing in group ages ≦33 was from 52.0% to 60.0% , discrete concrete image format (60.0%) was most selected, followed by text format (58.0%), pie chart format (58.0%), and proportion data format (52.0%) was the least selected one. In group age≧34, the range was from 74.3% to 85.7%, text format (85.7%) was most selected, followed by histogram format (82.9%), and composite format (74.3%) was the least selected one.

V. CONCLUSION

Medical decision-making is a complex and difficult process, especially in a dilemma situation. In Taiwan, the numbers of foreign spouses has increased, but not all of them can understand and read our language. Graphical tools might be one of the choices to make dialogues between doctors and foreign spouses easier. By the opinions of our interviewees, there are more and more medical professionals affirming the usefulness of graphical tools, but they still focus on the attractive outline design of posters, DMs or leaflets. Actually, graphical design could make complex data easy to understand, help communication between doctors and pa-

tients, let patients understand their own health conditions and make appropriate medical decisions.

Similar to previous related research, we found that different visual tools would affect people's risk perception, but we also found that people perceived risks would not affect their choices of amniocentesis testing, but ages would. The reason why women over and under 34-year-old had significant differences of their choices of amniocentesis testing was mostly because of the long-term guidance of Down syndrome and Amniocentesis testing in the official documents in Taiwan. They often use the data of 34-year-olds as the baseline for higher risk of having babies with Down syndrome. That's why women aged higher than 34-year-old tend to accept amniocentesis testing, but women aged lower than 33-year-old wouldn't. We supposed that women aged lower than 33-year-old made their choices mostly by the format itself, so the results of acceptance and denial in the testing were comparatively equal. From this research, we found that any instructions provided to people at any time or any place would affect their decision making. When trying to communicate the treatment options with patients, we should take their lifestyles, backgrounds, or even social phenomena into consideration to provide balanced value-neutral and most helpful information for them to make appropriate decisions.

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不同視覺表現方法對醫療兩難情況的影響

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摘　要

風險的呈現與與理解在產前篩檢領域是十分重要的，而風險同時必須要權衡到診斷調查時亦可能造成的傷害，這也顯示了醫生與患者常需面臨到的困難決策。相關的研究則顯示了視覺化，像是：圖形，插圖和圖片的呈現方式，會影響到人們對於風險的理解、態度與認知。本研究發展了九種兩難狀況的呈現工具，並藉由訪談法及問卷調查法，探求醫療兩難決策的過程中，視覺設計對於風險溝通策略上的影響力。藉由訪談法，本研究發現：1. 台灣的醫療機構最常使用口語的方式進行溝通，主要是爲了避免醫療糾紛；2. 台灣的醫療機構並未大量使用視覺設計工具。而藉由對問卷資料進行 t 檢定及單因子變異數分析，本研究希望了解在兩難決策過程中，風險認知及年齡是否會影響篩檢的選擇。問卷調查結果發現：1. 受測樣本對本研究發展的九種風險工具的認知，平均介於中等風險到高風險之間，且樣本在風險認知的選擇上，具有顯著差異；2. 高風險認知及低風險認知的族群，在篩檢與否的選擇上並無差異；3. 兩組年齡的族群在比率數據式、抽象圖像式、不連續具象圖像式、連續具象圖像式 ($P<0.05$) 有顯著差異；而在文字式、直方圖表式、比例數據式有非常顯著差異 ($p<0.01$)。

關鍵詞：視覺設計工具、兩難決策、風險溝通