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**EXPLORING THE PERSUASIVE EFFECTS AND NEURAL ACTIVITIES OF
MESSAGE FRAMING ON A HOME-BASED PROGRAM FOR CHILDREN WITH
DISABILITIES**

Chiu-Ping Chen

Postgraduate Programs in Management, I-Shou University, Kaohsiung, Taiwan

Email: k87794washington@yahoo.com.tw

Dong-Jenn Yang

Postgraduate Programs in Management, I-Shou University, Kaohsiung, Taiwan

Email: alimama@isu.edu.tw

Chih-Chung Wang

Rehabilitation Department, Kaohsiung Medical University Chung-Ho Memorial Hospital,
Kaohsiung, Taiwan

Email: nicetherapy@yahoo.com.tw

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Abstract: *For children with disability, studies have showed that if parents work with the therapists to do home-based programs, the training effects would be augmented. How to design persuasive messages to increase parents' motivation and cooperation with home-based program is an important issue. Besides gain- and loss-framed message, this paper is the first to include two-sided message to explore the persuasive effects. Moreover, this paper tries to predict the relationship between parents' performance and neural activities from the point of neuroimaging. It would be helpful to understand what parents' real reaction and design the persuasive message to increase parents' motivation and cooperation with home-based programs.*

Keywords: advertising appeal, advertising effectiveness, communication, marketing research, integrated marketing communication, innovation adoption

According to World Health Organization (Chan, & Zoellick, 2011; World Health Organization, 2009), the number of childhood disabilities (0-14 years) is about 95 million (5.1%). Among them, 13 million (0.7%) has been diagnosed with severe disability which means they are totally dependent. Other children with mild or moderate disabilities are not better at all. They also have difficulties with their daily life such as low school performance, and restricted social engagement. Moreover, when they grow up, they still have to deal problems with disabilities such as less employment, and decreased social participation (Maulik, & Darmstadt, 2007).

In 2006, United Nation announced the "The United Nations Convention on the Rights of Persons with Disabilities" which aims to make sure that in regard to their dignity, all persons with disabilities should have the same human rights and living life as usual people. Article 7 further addressed the needs of children with disabilities which not only stressed the rights and freedom but needed services

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(United Nation, 2006). This raised the global awareness and understanding toward disability so more and more countries start to take the national action to help children with disabilities. Local government and communities also enforce the measures such as subsidiary support to address the needs of children with disabilities and their parents. The role of parents has long been considered within school and medical systems, especially parental involvement. Research has showed that parent involvement and cooperation are beneficial for children progress such as better language development and improved daily living skill (Drahota, Wood, Sze, & Van Dyke 2011). To reach better training effects, parents need not only work with the therapists in the hospitals but also perform home-based program. Hence, the therapists may want to design the persuasive message to increase parents' motivation to perform the home-based program.

Previous studies have found that the persuasive effects of healthy behavior may be related to framing or the functions of behavior (O'Keefe, & Jensen, 2007). Their results show that gain-framed message, emphasizing the benefits or positive outcomes, is persuasive with protective behaviors such as vaccination while loss-framed message, focusing on the cost or negative outcome is persuasive with detective behavior such as breast self-examination. Most of those studies focus on the inherent function of the behavior. However, according to the prospect theory, the communicative effect of framing is more likely rely on people's risk perception, not the risk characteristics of the health behavior (Tversky, & Kahneman, 1981). Moreover, besides gain-and loss-framed message, seldom study has examined the effects of two-sided message on health behaviors. The purpose of this study is

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from the risk perception to explore the persuasive effects of gain-framed, loss-framed, and two-sided message on home-based program.

Not just self-report, researchers have also tried to apply neuroimaging methods such as magnetic resonance imaging (fMRI) and specific event-related brain potentials (ERP) to investigate the neural activities with message framing (Kessels, Ruiters, Brug, & Jansma, 2011). The results show that amygdala and medial prefrontal cortex (MPFC) would increase activation during message processing. However, whether the recommended behavior can be predicted by brain activities caused by message framing is still unknown. This paper intends to review studies to see what kind of framing can produce stronger brain activity, and how those brain activities predict home-based program performance of parents.

Due to the increase number of children with disabilities, it is important to encourage parents to do home-based program to increase practicing chances. Practitioners need to design the persuasive message to prompt home-based program. Hence, this paper would discuss the persuasive effects of message framing from self-report and neuroimaging studies.

THEORETICAL PERSPECTIVE

Message framing

Gain-and loss-framed message

Parental involvement is very important for children with disabilities because it can increase skill

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acquisition and school attendance, participate in social life and promote functional independence (Chan & Zoellick, 2011; Krishnamurthy & Srinivasan, 2011). Both school system and medical system need parents to be involved in their children's school life and medical treatment. In school system, local governments would implement the measures such as Individuals with Disabilities Education Act (IDEA) (U.S. Department of Education, 2012), and Special Educational Needs and Disability Act 2001 (Department for Education, 2012) to enforce the schools provide parents parental counseling and training, and necessary information about IEP (Kamens, 2004). As medical system, parents are members of transdisciplinary team with rehabilitation field. From early intervention to rehabilitation, parent education and cooperation has been proved to have beneficial effects for children with disabilities, such as improved daily living skill (Drahota et al., 2011), improved motor abilities and skill development (Lindsay, Adams, McDougall, & Sanford, 2012)etc.. Since parent participation has so many advantages, it would be necessary to persuade them to work collaboratively with the rehabilitation team.

Besides face to face communication, message may be the alternative one to communicate. Within the domain of health related information, the structure and content of messages has received attention in the studies about persuasion, communication and decision making. According to prospect theory, people' perceptions would be changed by message framing, gain-framed and loss-framed, even the information is equivalent (Tversky & Kahneman, 1981).

The empirical work of Kahneman and Tversky further proves that people treat risks differently

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within gain-and loss-framed messages. In the public health decisions, when the messages are framed as death (loss-framed), participants prefer greater losses than certain losses. When the messages are framed as saving lives, people choose the conservative one to save lives. It looks like people are more willing to avoid risks when considering gains and certain outcomes, where seeking risk when considering loss or uncertain outcomes (Kahneman & Tversky, 1979; Tversky & Kahneman, 1981). Later studies have also showed that message framing has different impact on health decisions such as AIDS, natural gas explosion and other disease problems (Levin & Chapman, 1990; Li & Adams, 1995).

When the message emphasizes gains, people tend to avoid risk. When the message stresses the importance of loss, people tend to take the risk. Based on prospect theory, Rothman and Salovey propose that the effect of message framing may be related to the functions of healthy behaviors (Rothman & Salovey, 1997). There are three types of healthy behaviors: prevention, detection and recuperation. In terms of preventive behaviors, such as vaccination and condom use, are used to prevent future healthy problems which are minimal risky, gain-framed messages would be more persuasive (Gerend, & Cullen, 2008). The other one is detective behaviors such as mammography and breast self-examination. People may find their illness so detective behaviors are risky and loss-framed messages would be more persuasive (Schneider, 2006).

Although studies have been followed the prospect theory and the function of health behaviors to examine the message framing effects, the results are inconsistent (O'Keefe, & Jensen, 2006).

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Researchers think it may be people's perception of risk or uncertainty, not the risky characteristic of the health behavior influences the impact of message framing (Ruiter, Smerecnik, & de Vries, 2010). Vaccine was supposed to be a preventive behavior so gain-framed message would be more effective. But the result of Abhyankar and his colleagues showed that loss-framed message was more effective when people considered the side-effects of the vaccine (Abhyankar, O'Connor, & Lawton, 2008). Another study of West Nile Virus vaccine had the same results. When participants were worried about the risk of the vaccine, loss-framed was more effective than gain-framed message (Bartels, Elo, & Rothman, 2004). It seems like what people perceives of the risk or uncertainty determines the message framing effects.

For children with disabilities, rehabilitation is a complex process. Besides inpatient rehabilitation, the therapists would teach parents home-based program to generalize the skill to home environment and increasing practice chances. Studies have proved the beneficial effects of home-based program (Dawson, et al., 2010). However, whether it can reach the desirable effects is uncertain because it is a long-time effort. Parents have to have persistence and patience to do home-based program to help their children practice repeatedly which may takes months or years to obtain daily living skills. Parents may perceive home-based program uncertain. Moreover, home-based program is mainly provided by parents. Parents may worry that they don't have appropriate abilities to follow therapists' instructions such as wrong teaching strategies. This may delay their children's development so parents may think perform home-based program risky. For parents of children with disabilities, home-based program is

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perceived as risky and uncertain. Based on prospect theory, people tend to take the risk or uncertainty when considering loss. Hence, loss-framed message would be more persuasive than gain-framed message to persuade parents to do home-based program.

Proposition 1: Loss-framed message would have strong persuasive effects than gain-framed message to facilitate home-based program.

Two-sided message

Although message framing effects has been discussed extensively in healthy behavior, only few mentioned the impact of two-sided message which includes gain-framed and loss-framed information at the same time. Two-sided message has much more information than one-sided message, consumers would use central route to process the information elaborately (Petty & Cacioppo, 1986). Within elaboration likelihood model, attitude due to central route is relatively enduring and more likely toward positive. This is especially true when information is highly relevant and important (Petty, Priester, & Brinol, 2002). The empirical evidences have supported that if the advertisements has negative (loss-framed) message, its communication effects is stronger than no negative (loss-framed) message (Eisend, 2007a). Neuroimaging studies also have the same results. Two-sided messages can increase the activities of anterior insula, concentration and emotion, and left dorsolateral prefrontal cortex, judgment and decision making, to push consumers consider the message more and process elaborately (Krawitz, Fukunaqa, & Brown, 2010). In terms of health behavior, we hypothesize that if the communication message has gain- and loss-framed message, parents would think that home-based

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program is worth to follow and then increase their motivation.

However, how much should negative (loss-framed) information include in the message to reach the persuasive effect? Optimal arousal theory further proposes that forty percent of negative (loss-framed) information with low to moderate importance may obtain the beneficial effects. In this way, two-sided message is relatively novel so it can increase receivers' positive affect and help them reach optimal arousal level to evaluate the product or service (Crowley, & Hoyer, 1994; Eisend, 2006).

Due to the relevance and importance of home-based program, parents would choose central route to process providing message by therapists. If the message contains gain- and loss-framed information at the same time, because it is relatively complex, it would attract parents' attention, increase their arousal level and process the message elaborately. They would feel that the therapists are reliable and believable because of increasing credibility. Those positive affects would lead to positive attitude (Eisend, 2007b). Hence, if the practitioners want to prompt home-based programs, it is better to design two-sided message with forth percent of loss-framed information to persuasive parents perform home-based program.

Proposition 2: Two-sided message with forty percent loss-framed information has better persuasive effect than loss-framed message to promote home-based program.

Neural activity

Most message framing studies use self-report measures such as attitude, information acceptance, behavioral intention, and behavioral frequency to examine the communication effects. This may be

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contaminated by response bias (Cialdini, & Goldstein, 2004), social desirability, and changing situations (Booth-Kewley, Larson, & Miyoshi, 2007). To solve those difficulties, marketing researchers has integrated self-report measures with neuroimaging techniques which are known for neuromarketing today (Lee, Broderick, & Chamberlain, 2007).

Even in message framing, functional magnetic resonance imaging (fMRI) and specific event-related brain potentials (ERP) have been used to monitor neural activities during message processing (Kessels et al., 2011). Falk and his colleagues used fMRI to examine the activity of self-related processing area, medial prefrontal cortex (MPFC) with sunscreen use. The activity of MPFC was highly related to the attitude, behavioral intention and the use of sunscreen (Falk, Berkman, Whalen, & Lieberman, 2011). Falk et al. used fMRI to record smokers' neural responses while watching the message. This study also measured the level of carbon monoxide, a biological measure of recent smoking, before and 1 month after exposure to the message to see the communication effects. The results showed that successful quitting was positively related to the activity of medial prefrontal cortex and associated with decreasing carbon monoxide which meant the activity of MPFC during a message exposure predicted the behavior change (Falk, Berkman, Harrison, Mann, & Lieberman, 2010). There were other brain areas, including medial precuneus, posterior cingulate cortex, being responsible for self-related processing, and supplementary motor areas, being related to motor planning, associated with quitting smoke. Those areas worked in a coordinated manner to increase the message effects to prompt the participants perform the recommended behaviors (McClernon, Kozink,

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Lutz, & Rose, 2009).

Prospect theory assumed that people's perceptions could be changed by framing, risk-averse with gain-framed and risk-seeking with loss-framed. De Martino, et al. used fMRI to support this perspective. They found out that participants tend to choose "sure" option when expose to gain-framed message, while preferred "gamble" option when expose to loss-framed message. When participants' options matched the framing, their amygdale increased activation (De Martino, Kumaran, Seymour, & Dolan, 2009). This meant that the increased activity of amygdale was driven by the combination of a decision and the framing. Amygdala was important in value-related prediction and learning. Hence, the framing would incorporate with the option assessment to exert control over the risk perception to make the decision (Paton, Belova, Morrison, & Salzman, 2006).

Other studies employed specific event-related brain potentials (ERP) to measure the differential effects of positive and negative images. The results indicated that negative images with loss-framed messages caused higher late positive potential amplitude (LPP) than positive images because of strong emotional feelings. Moreover, the LPP responses were corresponded to the emotional brain area such as amygdala which indicated that loss-framed messages can increase participants' attention and lead to decision-making (Hijack, Macnamara, & Olvet, 2010; De Martino, et al., 2006). Those studies provided evidences that behavioral change could be predicted by neural activity during exposure to persuasive message.

In decision-making task, amygdale is responsible for processing the positive or negative

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emotional information provided by framing, while MPFC is correlated to the behavioral tendency yielding by framing. To make the decision, amygdale and MPFC have to work with each other. MPFC has to combine signals from amygdale to estimate the motivational value of options, and then integrates and evaluates the predicted outcomes to guide the future behaviors (Schoenbaum, Roesch, & Stalnaker, 2006). Home-based program is relatively risky and uncertain, loss-framed information would catch parents' attention and increase their arousal level to process which increase the signal activities of amygdale. Those signals then transmit into MPFC to be integrated to evaluate the value of outcome and decide whether it is worthy to perform the home-based program.

Proposition 3: For parents of children with disabilities, loss-framed message would produce stronger activities of amygdale and MPFC.

CONCLUSION

Research has showed if parents work collaboratively with the medical professionals such as home-based program, it would facilitate development and promote functional independence of their children. Because home-based program is totally depended on parents' performance, if they cannot do it right, their children may get injury. Moreover, parents have to work for a long periods of time, whether it can reach the desirable effects seems uncertain. Based on prospect theory, when people perceive that the behavior is risky and has uncertain outcome, loss-framed message would be more persuasive than gain-framed message (Lindsay et al., 2012). Neuroimaging studies have also provided evidence that amygdale and MPFC would increase more activation during loss-framed message

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processing than gain-framed message (Falk et al., 2010; Falk et al., 2011).

However, fear-appeal research has suggested that too much negative information may cause greater sense of threat, resulting in defensive reaction (Ruiter, Abraham, & Kok, 2010). Two-sided message which has forty percent loss-framed message would help people reach appropriate arousal level and change their attitudes toward positive (Eisend, 2006). Moreover, two-sided message has more information than one-sided message so people tend to process the information thoroughly and elaborately, leading to positive attitude (Petty, & Cacioppo, 1986). Hence, practitioners may want to design two-sided message to promote home-based program.

This paper is a conceptual paper. Future study would follow the framework to do the empirical study. The empirical study would integrate self-report with ERP to examine the relative persuasive effects of gain-framed, loss-framed and two-sided messages. Furthermore, the study would assess the behavioral frequency of home-based program with long-term follow-up to investigate whether the framing effects can cause long-term behavioral change.

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