



## A Narrative Review for Clinical Applications of Magic

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Magic is an art form that has been traced back 1000 years ago. Previous studies have been conducted to investigate the positive effects magic could bring on human beings. Herein, we organize studies on the positive effects and the use of magic tricks in aspects of performing, witnessing, discovering the secrets of magic, and finally, in educational settings. We discovered that magic not only benefits well-being with physical and mental improvement but also works well as a therapeutic use for hospitals, pediatric settings, and rehabilitation for patients with functional loss. With research on the human mind developing rapidly, magic could also be a great study tool for exploring human cognition and perception. We conclude that magic has already brought about a great number of promising effects in various settings. Therefore, in this manuscript, we discuss how performing and perceiving magic tricks could bring positive effects on researchers and human beings.

Key words: Magic, performing magic trick, watching magic performance

### INTRODUCTION

From a modern perspective, magic is a performance art full of deception. However, performing or watching magic tricks can promote well-being.<sup>1,2</sup> A magic trick usually includes an effect and a method. This effect is more related to the spectators' point of view. For example, in a trick, when magicians place a coin in their hand, they close their hand and the coin disappears. The disappearance of the coin is the effect of the trick.<sup>3</sup> Spectators were not only amazed when they perceived the magical effect, but their eye movements and cognitive neural activities, including memory and attention, were enhanced.<sup>4</sup> With additional design and construction of the effects, they thus provide even more useful ones. In clinical use, humor, psychological skill, and communication aids are used as tools for therapy.<sup>5</sup> Moreover, improved well-being and self-esteem are observed during a magic therapy program performed by Julie DeJean and David Copperfield.<sup>6</sup> If assisted by a clown or game interactions,

magic can also provide psychological support for pediatric or hospitalized children.<sup>6,7</sup> In addition, Wiseman and Watt also cover many of the same effects mentioned above in the literature.<sup>8</sup>

Aside from the effect, which focuses on the perspective of a magician, there is the method of the magic trick. In the magic show of disappearing coins, the magician may steal the coin by the other hand. The secret move or the unknown procedure performed by the magician to produce an effect is often termed "sleight" or "sleight of hand."<sup>3</sup> "Sleight of hand" means "quick fingers," which stands for cunning, clever or slyness. With the practice of sleight of the hand, hand motor function improved due to improvements in motor learning tasks.<sup>9</sup> It is not difficult to imagine the implementation of magic tricks in physical and hand motor therapies. Evidence also suggests that combining learning with the game can promote the internalization of children's learning strategies and increase children's

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motivation to learn.<sup>10</sup> Application of magic-themed therapies to children with unilateral spastic cerebral palsy or attention deficit has yielded good feedback.<sup>10,11</sup> Therefore, it has been shown that magic has a positive impact on physical, cognitive, social, and emotional health in the academic framework of well-being and health.<sup>12</sup> In addition to sleight of hand, creating a new magic effect or figuring out a magic trick can enhance divergent thinking.<sup>13</sup> Wiseman and Watt provide guidelines for research on these issues, emphasizing the necessity for more systematic and controlled research<sup>1</sup> to analyze the advantages of using magic for the development of cognition across the lifespan.<sup>14</sup> In recent years, the charm of magic has spread quickly due to the rise of social media networks. In addition to artistic and recreational purposes, magic is also increasingly used by clinical medical personnel. Magic is also an indispensable research tool in the research methods of neuroscience, life science, and psychology. Although there were many references and research papers, respectively, demonstrating the applications of magic in medical science, we still want to integrate the concept of magic applications and detail its positive impact on human being through this narrative retrospective review for professionals and readers interested in applications of magic. This was our main purpose for writing this article.

## SURVEY METHODOLOGY

Literature on the use of magic in advancing medicine and human health was searched by (1) using PubMed Central® at the US National Institutes of Health's National Library of Medicine, (2) using Google Scholar (<https://scholar.google.com.tw/>) for scholarly literature, (3) checking the information and materials cited in the literature exploring the application of magic in the past 40 years (from 1983 to 2021), (4) searching for books related to the application of magic. The unpublished reports and conference abstracts were excluded from this article. In total, we collected 45 references related to magical applications, including original research articles, review articles, books, and graduate theses. We categorize these references according to the category of our predrafted articles (performing magic tricks and watching magic performances). The literature obtained from PubMed and Google Scholar for each category and the numbers of the original research article, review article, personal report or experience, book, and graduate thesis owned by each category. Since magic is an activity in which there is a close interaction between the performer and the audience, it also has different influences and inspirations on the performer and the audience. Therefore, this article will explain the effects of magic on performers and those who watch magic tricks, respectively.

In addition, we sequentially reviewed the literature collected on the effects of magic on performers and audiences in rehabilitation medicine, psychology, and child development. A search of all references was conducted from May 2021 to August 2021, and article writing was completed in December 2021, with a final draft in February 2022.

## PERFORMING MAGIC TRICK

### Dexterity training tool

When performing magic tricks, multiple parts of the body are involved. To produce an effect, which is the core of magic tricks, magicians would perform a secret move called sleight of hand. For example, in the trick of vanishing a coin, magicians must take the coin out with the right hand while closing the left hand's fingers without "flashing" (a term used to describe the secret of the trick exposed or failed). This sleight requires the fingers to block part of the movement at the appropriate angle and timing. Therefore, practice is essential to improve fluency and thus enhance the deception of the trick. Magicians spend a lot of time rehearsing these types of movements,<sup>15</sup> and with the continuous practice of fake actions, not only does the presentation of the trick improve but magicians' occipito-parietal visuomotor systems tend to be more flexible than normal people, which are more capable of using visual information to drive actions.<sup>16</sup> The sleight of hand or pantomime actions used by magicians are unfamiliar to most people. It was reported that when engaging in an unfamiliar or new task, such as sleight of hand, motor learning has progressed, which is essential for motor skills development.<sup>9</sup> Because motor skills could be promoted during the learning and practice of the process of magic tricks, there are several applications for magic tricks where learning new motor tasks are needed. For expertise or occupations that require a high level of fine hand movement, learning magic tricks could be a great tool for dexterity training. Shields mentioned in his article that, like the sleight of hand, fine needle biopsy of intraocular tumors requires a high degree of concentration and fine-to-finger movement and requires years of practice to achieve.<sup>17</sup> Ralph Millard, also a surgeon who has been nominated as one of "10 Plastic Surgeons of the Millennium," is a great example of implementing sleight of hand magic into his surgical training. He practiced magic tricks on the train involving sleight of the hand to improve dexterity, which he believed had a great influence on his career as a plastic surgeon.<sup>18</sup>

### Improvement of clinical skill

In addition to improving the motor skill in magic, performing magic tricks can also improve the skills of the doctor.<sup>19</sup> Especially in clinical pediatrics, magician tricks such as

misdirection and forcing skills are commonly used techniques. Dr. Pitt MB uses the magician's technique of approaching the audience to calm anxious children. Learning the magician's thinking and acting patterns can improve the ability of medical staff to connect with patients.<sup>20</sup> In conclusion, applying the skills used by magicians, namely misdirection, pattern, and force, can successfully build rapport with patients and increase their willingness to be examined and treated.

### **Application of occupational/psychological/physical therapies**

In addition to improving motor skills, practicing magic tricks is often used in the treatment of diseases, such as occupational and physical therapies. In 1981, Project Magic was co-founded by David Copperfield and Julie DeJean, which gave rise to Magic-themed therapy. The project innovatively applied magic to the rehabilitation of individuals with disabilities, including physical therapy, psychotherapy, and community therapy. In 1985, Kevin Spencer worked with physical therapists, occupational therapists, and speech therapists to treat patients by using simple magic techniques. They believed that magic can be used to improve motor skills and boost self-esteem, and such concepts have been used and promoted throughout the world. A program like "Rehabracadabra" was also established for occupational therapists to incorporate magic and other creative therapies. Some therapists have learned about the potential of magic applications in assessing and treating visual dysfunction, and using magic to improve patient attention during treatment. Psychotherapy is another application of magic. Magic can be used in child psychotherapy to effectively advance therapeutic goals, including developing rapport with the medical staff and patient, building the patient's motivation for treatment, and strengthening the patient's ability to change behavior.<sup>21</sup> In addition, a psychotherapy program combining magicians and occupational therapists who teach magic to patients with schizophrenia, recurrent paranoid psychosis, and bipolar affective disorder, and the result indicated that all kinds of magic were beneficial to patients.<sup>22</sup>

### **Promote divergent thinking**

Research has shown that people think differently when they experience magic-created fantastic or impossible events.<sup>13</sup> Richard Wiseman also confirmed by measuring children Guilford's Alternate Uses Test, Dweck's Implicit Theories of Intelligence Scale, and Rosenberg's Self-Esteem Scale after the intervention of teaching them one magic trick.

Compared with the art intervention group, the people who learned magic had better health status both in physical and psychological well-being. Magic intervention is brief and easy to communicate happiness between people. The promising

effect of this result suggested that learning magic should be incorporated more into children learning.<sup>13</sup>

### **Clinical application in pediatrics**

Since children are very interested in learning magic, the integration of learning sleight of hand into the treatment method can significantly improve motor skills in children undergoing therapy. Magic could be integrated into games or themed camps, suitable for pediatric counseling related to motor function.<sup>23</sup> Disorders in children, such as unilateral spastic cerebral palsy (USCP, or "hemiplegia") or hemiparesis, are recorded to apply magic treatment strategies or magic camps in therapeutic programs.<sup>11,24</sup> These disorders are neurological conditions that result in paralysis of one side of the body due to abnormal damage to the brain or muscle weakness. The magic therapy program can improve the ability of the hands and improve the child's ability to perform daily tasks.<sup>1</sup> It was also noted that participants in the program perceived it helpful for their affected hand/arm and recognized their improvement. Moreover, providing a virtuous cycle of improvement can lead to more engagement and effort, leading to even more improvements.<sup>11,24</sup> In interpreting the possible mechanism of magic therapy; according to the underlying principle of rehabilitation, more practice is better. In addition, in constraint-induced movement therapy, structured exercises can improve motor function. Therefore, the effects of this rehabilitation can be expected.<sup>25</sup> In children with attention-deficit/hyperactivity disorder, there is a significant improvement in cognitive abilities among these participants. After intervention with the magic-themed MAGNITIVE program, children's sustained attention, selective attention, stability of variation in attention, and mental flexibility all increased. In a brief overview, practicing magic tricks could improve hand motor skills, effectively benefiting the training of expertise with the fine hand skills demanded. In therapy, it shows great results and the potential to revive the function of patients.<sup>10</sup>

## **WATCHING MAGIC PERFORMANCE**

### **A study tool for perception and cognition**

Misdirection is a common technique used by magicians. Magicians use gaze or body changes to control the spectator's attention. The entertaining, informative, interesting, and engaging nature of magic tricks can not only support the beneficial effects of education but also further support the changes and development of the spectator's cognition, emotion, and memory.

Therefore, the effect of watching magic performances can be used to study the neural functions of cognition, attention, and memory of the spectator.

### **Attention (visual movements)**

Misdirection is a technique commonly used by magicians. The success of the magic trick depends on the audience's attention being misled by subtle deviations in the "method."<sup>24</sup> To achieve invisibility during the performance, the magician knows that only a small part of the information will be paid attention to and enter his consciousness through the eyes of the audience.<sup>26</sup> People often miss key actions because of attentional blindness; while in eye-tracking experiments, if attention is properly boosted, participants were able to discover the magician's secret to hallucinating the audience.<sup>27</sup> The main factors affecting the effectiveness of misdirection are eye gaze and attention. Past studies have shown that social cues will have an impact on the allocation of visual attention when watching a Cups-and-Balls Routine.<sup>28</sup> The study also found that autistic patients need more time to pay attention to the magician's face, and are less likely to follow the gaze because of their social cues and attention allocation barriers.<sup>29</sup> Misdirection of magic tricks could be a great study modality for visual attention and eye movement. Magic tricks often provide a lively environment, and participants' attention can be manipulated through the magician's facial expressions or body language.<sup>4</sup> Hence, magic can get the expected behavior of the participants in a very short time. In addition, Magicians often use humorous language or behavior to distract participants.<sup>30</sup> The naturalness of the presentation could also be an additional factor to enhance the deception, which is worth investigating.<sup>31</sup>

### **Epistemic emotions/brain belief system**

If a magic trick is successfully performed, the spectator would feel a sense of violation of their expectations, arousing emotions like curiosity and surprise. To elicit exploration or curiosity, a stimulus should be novel and attractive, and magical events have proven to be a great tool for triggering public interest by creating impossible events.<sup>32</sup> These emotions are closely related to psychological epistemic states, including surprise, curiosity, and interest.<sup>33</sup> Research showed that both adults and children with these emotions may increase the level of knowledge engagement. Using magic can make education-related videos entertaining, informative, and interesting, and thus has a significant impact on viewers' knowledge engagement and knowledge absorption.<sup>34</sup> In addition to educational effects, magic has also been used in studies related to epistemic emotions.<sup>33</sup> Previous studies have applied magic tricks to analyze changes in curiosity and brain function. The results of the study showed that when curiosity is stimulated, it is accompanied by an increase in brain activity of the ventral striatum.<sup>35</sup> In addition, magic has also been applied to study the changes and mechanisms of the brain after the violation of expectations. It was shown that cognitive control

loops, such as the dorsolateral prefrontal cortex and anterior cingulate cortex of the brain, are activated when observed events strongly conflict with expected outcomes.<sup>36</sup> In addition, scientists have found that people who watch magic tricks have activation in their caudate nucleus bilaterally, left inferior frontal gyrus, and left anterior insula when they see unexpected outcomes, whereas magicians present only the activation of parietal areas of the brain.<sup>37</sup> In conclusion, with the increase of research on epistemic emotions, researchers understand that "Magic Curiosity Arousing Tricks" has excellent properties, enough stimulation, and exploitability.<sup>35</sup>

### **Memory**

Magicians often manipulate the memories of spectators to create miracles. Memory-related principles exist in the misdirection technique mentioned above. Magicians can enhance magic effects by asking participants to recall events and highlight information.<sup>38</sup> They can also deceive participants by manipulating memory distortion to prevent observers from recalling the true sequence of events.<sup>31</sup> Memory distortion includes presenting false information after the fact, using misleading questions, and erroneously remembering full episodes. In a previous study, it was found that people's memory of the event is often distorted by social cues, even though people's perception of the event is real, especially the influence of positive social underlying conditions.<sup>39</sup> In short, through the process of applying magic to research, scientists gain a deeper understanding of the science of memory.

### **Pediatric therapy (anxiety/mental state improvement)**

The magic tricks are full of humor and laughter, so they have been used in clinical pediatrics, including reducing anxiety and improving mental state. The Open Heart Magic program was founded in 2003 by child development experts and magicians. It is an innovative not-for-profit children's organization that creates and equips magic healing programs for pediatric therapeutic approaches. The program utilizes performances as well as up-close magic teaching to interact with patients and their families. Implementing such measures can provide children with opportunities for choice and control, facilitate their social interaction and enhance their self-esteem and confidence. For therapists, it is easy to observe the positive feedback and treatment effects of child patients by implementing the magic treatment program, although the results of magic treatment cannot be quantified and qualitative.<sup>40</sup>

Another use of magic-related humor therapy is clown humor therapy. A cross-sectional quantitative study showed

that treatment with a clown's magic tricks could reduce blood pressure, pain, and stress-related nonverbal behavior in children.<sup>7</sup> In children with respiratory diseases, clown magic therapy was also effective in reducing diastolic blood pressure, respiratory rate, and body temperature.<sup>41</sup> Although the results of both studies did not clarify the direct relationship between magic tricks intervention and the effects of treatment, clown-themed magic tricks are still an effective strategy for turning the mental and physical state of children into a positive state.

MagicAid, a nonprofit organization established in 2017 by medical students at Stony Brook University in the USA, aimed to use the art of magic to provide therapeutic interventions.<sup>42</sup> They deliver 1-on-1 magic therapy for patients, including their families. "The magic therapist," mostly medical student volunteers who are new to magic, must undergo 21-h sessions to learn about magic therapy and practice.<sup>42</sup> Trained members provide "magic rounds" where they perform magic therapy for hospitalized pediatric patients, spending approximately 10 min with individual patients at the bedside.<sup>6</sup> MagicAid members have found that magic tricks may reduce patient anxiety about treatment, improve mood in hospitalization, develop motor and cognitive skills, and promote social interaction with families. In 2019, a randomized controlled study was conducted to evaluate the potential effect of magic interventions to alleviate anxiety in pediatric patients and nurses. Subjects ranged from 5 to 16 years old patients, and their families and medical professionals were eligible to participate in the program. The intervention started with MagicAid members performing three or four magic tricks, then teaching them one of the performances that affected them. The results of the study showed that the magic intervention significantly reduced anxiety in pediatric patients and caregivers, and this benefit lasted for 1 h. Magic has huge potential to reduce anxiety for patients and caregivers, clinical application is feasible.<sup>6</sup>

In addition to this, magic interventions have also been used to manage strong-willed children in dental chairs and to provide psychological support for children with cancer.<sup>43</sup> Magic intervention not only shortens the time required to perform dental procedures but also makes it easier for pediatric patients to take dental X-rays. The researchers believe that the Magic intervention can distract children from dental procedures and thereby keep them away from anxiety and fear. The function of the right hemisphere of the brain is related to nonverbal behavior, submissive, and emotion. Magic tricks may stimulate children's curiosity and imagination, and increase activity in the right brain hemisphere, which explains why magic works in these children.<sup>44</sup> Therefore, magic can improve communication skills, interpersonal relationships, and compliance, and increase the chance of recovery from the disease in children with cancer.<sup>45</sup>

## CONCLUSION

In this review, we explore the beneficial effects of magic from performing, witnessing, and finally discovering the secret of magic. Studies that have applied magic tricks tend to show positive effects on people. For participants who functioned well, magic tricks could act as a dexterity training tool, a great study tool to study the minds of humans. Meanwhile, it could also be a therapeutic method for improving mental state and motor skills, especially in pediatric settings.

## Data availability statement

Data sharing is not applicable to this article as no datasets were generated or analyzed during the current study.

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## Conflicts of interest

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