

## Study on the Improvement of Laws Related to the Electromagnetic Wave of Mobile Phones

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### [Abstract]

Countries around the world have already taken direct and indirect measures to warn of the harmful effects of mobile phone electromagnetic waves. On the other hand, in the Republic of Korea the installation of Wi-Fi has been expanded without restrictions by location, and there is a widespread atmosphere of protesting human rights violations even if young students cannot use mobile phones, ignoring problems caused by the use of mobile phones. Human brain cells are increasingly exposed to electromagnetic waves of mobile phones as the penetration rate of smartphones grows. In order to solve the long-lasting question of whether electromagnetic waves from mobile phones will harm the human body, many studies are being conducted in various countries around the world, and the recently published findings have warned of the potential for harm.

The labeling of electromagnetic waves alone is not sufficient to raise awareness about the dangers of electromagnetic waves. It is necessary that the Republic of Korea organize and operate a national electromagnetic wave research center in line with its status as an IT powerhouse, along with the revision of the Radio Wave Act, which directly warns the public about the hazards of mobile phone electromagnetic waves and can directly impose obligations on the mobile phone industry.

▶ **Key words:** Electromagnetic Wave of Mobile Phones, Specific Absorption Rate, Electromagnetic Wave Human Body, Protection Standards, Industrial Disaster

### [요 약]

이미 세계 여러나라는 핸드폰 전자파의 위험성을 경고하며 조치를 실시하여왔다. 반면 우리나라는 휴대폰 사용으로 인한 문제보다 학생들조차 핸드폰을 사용하지 못하게 하면 인권침해라고 항의하는 분위기이다. 인간의 뇌세포도 핸드폰 전자파에 더 많이 노출되고 있어 인체의 유해가능성에 대해 세계 여러나라에서 연구하고 있으며 최근의 연구한 발표결과들은 강력히 경고하고 있다. 현재 국내의 전자파 등급표시로는 국민에게 경각심을 불러일으키기에는 너무나 부족하다. IT 강국이라는 명성에 발맞추어 국립 전자파연구센터를 조직·운영하고 일반대중에게 핸드폰 전자파의 유해성을 경고하고 업계에 직접적인 의무를 부과할 수 있는 전파법제의 개정이 필요하다고 생각된다.

▶ **주제어:** 휴대폰 전자파, 전자파 인체흡수율, 전자파인체보호기준, 전파법, 산업재해

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## I. Introduction

Mobile phones have been essential parts in the daily life of modern people. As the flow of numberless information and processing of it rapidly penetrated into our lives, many doubts have been raised as to whether the radio frequency from these devices was harmless to health. Electromagnetic waves are the flow of electromagnetic energy produced by periodic fluctuations of electric and magnetic fields. Electromagnetic waves are classified in the increasing order according to the frequency, or the number of waves per second: radio waves, infrared rays, visible rays, ultraviolet rays, x-rays, and gamma rays. Radio waves mainly refer to electromagnetic waves with a frequency of 3,000 GHz or less. Sunlight, infrared rays, and ultraviolet rays are also classified as electromagnetic waves. However, there are numerous sources of radio waves around our daily lives, including antennas for broadcasting and communication, mobile phone terminals, radar, and medical devices for thermal treatment. The International Agency for Research on Cancer (IARC) has already defined electromagnetic waves as "a potential carcinogen" in 1999. When using a mobile phone, the face and head should be close enough from the source of electromagnetic energy, and this is a significant problem. The wave emitted from the mobile phone has the same as the microwave from the microwave oven, though the intensity is different.

In this paper, we introduce the hazards of electromagnetic waves radiated from mobile phones, examine the problems of current Radio Wave Acts, and suggest improvement measures.

## II. Electromagnetic hazards of mobile phones

### 1. Characteristics of Electromagnetic Waves in Mobile Phones

Electromagnetic waves are a type of energy radiation in which an electric field and a magnetic

field are combined with each other, and are largely divided into two sub-categories, i.e., ionizing radiation and non-ionizing radiation. Examples of ionizing radiation include ultraviolet rays, X-rays, and gamma rays. Since the center frequency of these radio waves reaches millions of THz, it has enough energy to modify the human DNA or destroy cell molecules. On the other hand, examples of non-ionizing radiation include visible light, mobile phone electromagnetic waves, TV and monitor lights.

The energy of such radiation is not high enough to affect the molecular structure of matters. Electromagnetic radiation emitted from a mobile phone is a representative non-ionizing radiation and thus is not as high in frequency as ionizing radiation; however, energy sufficient to increase the internal temperature of the substance may be accompanied with it. Mobile phone calls generally communicate wirelessly with base stations using electromagnetic waves that are away hundreds of meters or more. The receiving function of the other party's voice signal and the transmitting function of the own voice signal operate simultaneously during a call. When making a call using a mobile phone, the device must be placed on the ear; it is an important problem that electromagnetic waves are illuminated to the head of the human body when transmitting voice data, and as a result, a significant amount of brain cells in the head directly absorb the energy of the electromagnetic waves.

Most of the human body is composed of water, and brain cells are almost the same. Water is made up of molecules with a chemical structure of H<sub>2</sub>O. Considering two hydrogen atoms as a positive pole and an oxygen atom as a negative pole, water molecules can be modeled as dipoles with +/- polar terminals, like a magnet with N-S poles. In the principle of heating food in a microwave oven, we can find clues as to why brain cells are dangerous when directly exposed to electromagnetic waves in mobile phones. That is, water molecules inside the microwave oven vibrate rapidly due to

electromagnetic waves and collide with neighboring water molecules, and the heat generated by this process is strong enough to cook food. In other words, since human face skin, eyes, ears, and brain cells are directly exposed to the external energy of mobile phone electromagnetic waves, there are still concerns about whether there is thermal damage as in the case of food in the microwave oven, or whether there is a possibility of diseases from it such as cancer through hormone secretion or sympathetic nerve stimulation.

## 2. Specific Absorption Rate (SAR)

Specific absorption rate (SAR) refers to the amount of energy absorbed by electromagnetic waves from a specific area when a specific part of the human body is exposed to electromagnetic waves. This is the physical quantity defined as the power absorbed with respect to the unit mass of the body tissue, and the unit is W/kg. By measuring the absorption rate of electromagnetic waves for a specific body tissue of 1g or 10g, the SAR value for the entire body in general can be estimated using the average value. However, in the case of mobile phones, it is common to measure only the head part independently because of the specific configuration in their usage being close to the ear. The SAR values of the head portion of the electromagnetic wave of a mobile phone are different among manufacturers, and even products of the same manufacturer vary greatly by model. When the corresponding value is low, the amount of energy of electromagnetic waves absorbed by brain cells also decreases.

## 3. Domestic Research Results

The World Health Organization (WHO) is one of the representative organizations that have proposed exposure control and exposure limit standards in relation to the protection of electromagnetic waves. In addition, the International Commission on Non-Ionizing Radiation Protection (ICNIRP) and the Institute of

Electrical and Electronics Engineers (IEEE) standards, which are currently being adopted by many countries by establishing human protection standards, are based on scientific evidence. Most human exposure standards currently adopted worldwide are based on these two standards, i.e., ICNIRP standards and IEEE C95.1. [1] .

Orange™, a European mobile carrier, reported in a 2009 study that men could have a serious effect on sexual function if they carry a cell phone in their pants pocket. In 2004, conducted by 12 research teams from 7 countries of the EU, a four-year study was reported to reveal that cell DNA is damaged when exposed to electromagnetic waves in a cell phone, causing serious diseases such as cancer.

The French government issued a law prohibiting the use of cell phones in kindergartens, elementary schools, and middle schools to secure the health of children on July 12, 2010. In particular, because they are vulnerable to the electromagnetic wave of mobile phones, mobile phone advertisements targeting children under the age of 14 are also prohibited. Similarly, the Federal Radioactive Protection Agency in Germany encourages children to use landline phones if possible. The UK already included a warning in 2001 on all cell phone sales that could lead to health risks if used excessively.

The Korea Electronics and Telecommunications Research Institute (ETRI) published the results of research on the human effects of electromagnetic waves on mobile phones on May 12, 2012. The results showed that the more children use mobile phones, the more likely they get attention deficit hyperactivity disorder (ADHD). ETRI and Dankook University Medical School jointly conducted this experiment on 2,000 students enrolled in 31 elementary schools and 10 cities in Korea for 4 years from January 2007 to December 2010.[2]

Choi Eun-chang, chairman of the Korean Society for Head and Neck Oncology, proclaimed, "There is still a medical disagreement, but some head and neck cancers, including salivary gland cancer, may

be related to the electromagnetic waves of mobile phones." [3]

Research has shown that electromagnetic waves in cell phones accelerate the hearing nerve tumor (a type of brain tumor in the ear's hearing nerve). This was the first study to investigate the correlation between cell phone use and brain tumor size in Koreans. Since many people use mobile phones in close proximity to their ears, electromagnetic waves can penetrate directly into the brain, and the possibility of harmful effects is constantly being raised. Otolaryngologist Moon In-suk's team from Severance Hospital studied 119 patients with hearing nerve tumors for 20 years, from January 1991 to December 2010, having a history of patients' cell phone use, ear frequently used for cell phone calls, tumor size and location, etc. In the results of the study, the average tumor size of 64 patients (regular users) who used a mobile phone more than once a week was 8.1 cm<sup>3</sup>, whereas the tumor size of 55 people who used phones less than that was 2.71 cm<sup>3</sup>. Among the patients using the mobile phone continuously, the tumor size of the patients in the group using more than 20 minutes per day was 11.32 cm<sup>3</sup>, and the group using the mobile phone less than that was 4.88 cm<sup>3</sup>. The tumor tended to occur mainly on the ear (more than three-quarters) used for cell phone calls. Professor Moon In-suk said, "Electromagnetic waves created from a mobile phone penetrate into the brain at a depth of 4 to 5 cm and increase the tissue temperature by 0.1 degrees," and said, "Electromagnetic energy can stimulate tumor cells in the resting period to pass into the fission phase, and it is possible to denature tissue proteins, causing the tumor to grow." He also mentioned, "Therefore, if you have a tumor, you should abstain from using cell phones," These findings were published in the world-renowned American medical journal of Oncology Biology. [4]

#### 4. Position of World Health Organization

The World Health Organization (WHO) defined electromagnetic waves of mobile phones as possible

carcinogens in May 2011. The results of this study suggested that people who used cell phones for more than 10 years had twice the incidence rate of brain cancer than those who did not. The results of the study that people who have used mobile phones for more than 10 years have twice the incidence of brain cancer than those who do not were suggested as the grounds for the argument. WHO categorizes substances of interest into five groups according to their potential possibility of carcinogenic properties. [5]

Group	Description	Number of Substances
Group 1	Carcinogenic to humans	108
Group 2A	Probably carcinogenic to humans	64
Group 2B	Possibly carcinogenic to humans	271
Group 3	Not classifiable as to its carcinogenicity to humans	508
Group 4	Probably not carcinogenic to humans	1

Source: International Agency for Research on Cancer (IARC) June 2012 report

Electromagnetic waves generated by mobile phones belong to Group 2B, and other representative materials belonging to the same group include carbon and lead. This means that the electromagnetic wave of a mobile phone is cancerous, so it is about the same level of danger of eating burnt food and eating imported food with lead content.

Dr. Jonathan Samet, a professor at the University of Southern California in the United States who participated in WHO's research, said that there is a good chance that cancer will occur in the electromagnetic waves of Group 2B, and that there is a need to closely monitor the relationship between cell phones and cancer in the future. [6]

### III. Domestic and foreign trends related to electromagnetic waves of mobile phone

#### 1. Domestic recognition of electromagnetic waves of mobile phones as industrial disaster [7]

It was the first time that the Korea Workers' Compensation and Welfare Service recognized mobile phone electromagnetic waves as the cause of the disaster and recognized it as an industrial disaster. This is of great significance in that despite the much debate over the potential carcinogenic effects of electromagnetic waves, the relationship between electromagnetic waves in mobile phones and brain tumors has been acknowledged.

The outline of the case is as follows. Born in 68, male "Y" worked as a repair company for communication equipment of "K" company for about 22 years, and the main task was to repair the communication line of a landline phone. After having been diagnosed with brain tumors in 2016, he died at the age of 49 in 2017. The following is the basis for the specific judgment of the Korea Workers' Compensation and Welfare Service where the brain tumor of "Y" was recognized as an industrial accident. First, he joined the company in 1997 and continued to use the mobile phone, and the cumulative time for using the mobile phone was found to be at least 440 hours and up to 1800 hours. Second, the work order for him was mainly on a mobile phone. Third, there is a possibility that the risk of brain tumors has increased due to exposure to extremely low-frequency magnetic fields and lead while working around communication lines. Fourth, his age was younger than the average age of brain tumor (glioblastoma) onset. Fifth, there was no family and individual history of the disease. Based on these grounds, in April 2019, the Korea Workers' Compensation and Welfare Service decided that the brain tumor of "Y" was an occupational disease, and finally approved an industrial accident.

#### 2. Lawsuits related to electromagnetic waves in the United States [8]

##### 2.1 Reynard v.NEC Corp, et al.(filed in 1992)

This is the first lawsuit to legally claim the harmfulness of electromagnetic waves generated by mobile phones. It is noteworthy in this case that not only NEC, a mobile phone manufacturer, but also GTE, a telecommunications company, were claimed for damages as a joint defendant.

Plaintiff Reynard claims that his wife's brain cancer was caused by exposure to electromagnetic waves from a cell phone, or that she had exacerbated existing brain cancer, and filed a lawsuit in Florida court under the Florida Wrongful Death Statue. In response, the defendant pleaded that no scientific or medical causal relationship was found between exposure to electromagnetic radiation and the plaintiff's wife's brain cancer, and that brain cancer had already developed before the use of the cell phone.

This lawsuit has the nature of a lawsuit for compensation for illegal acts against human damage. So, it is necessary to prove the plaintiff's causal relationship, but the plaintiff is required by the Florida state law but-for test (488 So.2d 630, 631 (Fla.4th DCA 1986) or Daubert principle (113 S.Ct.2786, 125 L. Ed. 2d 469 (1993)) failed to prove any causal relationship. More specifically, the plaintiff did not adequately prove that she would not have had brain cancer or live longer if she did not use a cell phone. Consequently, the court rejected the plaintiff's claim and cited the defendant's dismissal, and the plaintiff was defeated. These results are thought to have raised the question of whether it is necessary to review the validity or limitations of the Daubert principle on scientific evidence in litigation, because the evidence of the causal relationship between mobile phone electromagnetic waves and cancer occurrence is insufficient.

## 2.2 Sara Dahlgren v. Audiovox Communication Corp. et al.

Plaintiff Sara Dahlgren filed a lawsuit against a cell phone manufacturer against the Washington DC Supreme Court. This is characterized by a group action for consumer protection, not a lawsuit against personal damage caused by electromagnetic waves. The reason is that the civil lawsuit against common personal injury is a common civil lawsuit; on the other hand, the consumer protection lawsuit is a special lawsuit because it has the advantage of reducing the burden of proof by the traditional legal system to some extent.

The plaintiff claimed that consumer rights were violated for the following reasons. First of all, the supplier did not disclose to the consumer that there was disagreement about the safety of electromagnetic waves and that the safety was not completely secured. Also, they are profiting from these actions despite not providing enough information on how to reduce the exposure of electromagnetic waves (earphones, speakerphones, etc.). In other words, the plaintiff's claim is that it is unfair to make profits by using it without fulfilling the obligation to provide sufficient information to consumers.

The lawsuit had been ongoing for a long time since 2002, but some rulings were dismissed from the plaintiff's claim in July 2010. First of all, it was said that the non-disclosure of information on the safety controversy is not an essential issue since it is already well known. In addition, plaintiffs cannot sue for the general public and can only sue for personal deception. Also, it is said that allegations of fraudulent profits are possible only for manufacturers of cell phones purchased by plaintiffs (Motorola, Audiovox). However, the judgment as to whether the two companies really made a profit was deferred. In addition, the ruling concluded that the Cellular Telecommunication Industry Association (CTIA), which was filed as a joint defendant, was not a merchant and therefore was not eligible for a consumer protection lawsuit

filed by the plaintiff. However, in the ruling, the plaintiff was not in violation of jurisdiction because the plaintiff lived in Washington, DC, even if she did not purchase a cell phone in Washington, DC, so that she could file a complaint.

## 2.3 Sub-conclusion

In the above-mentioned US cell phone electromagnetic wave litigation, the plaintiff filed a lawsuit of various personalities for various reasons, but there has never been a case of winning. The most decisive reason for this is that the plaintiff who is responsible for proving the harmlessness of electromagnetic waves in mobile phones has failed to prove it. There is another important reason that, as long as the FCC's emission standards for mobile phones are complied with, at least the lawsuit against illegal acts cannot be accepted. The debate over the inadequacy of the FCC's standards for human protection is that it applies Preemption's law of filing with the federal court under federal law. Besides, from the point of view outside the lawsuit, it is also possible that the lawsuits related to mobile phone electromagnetic waves were indirectly caused by the fact that it was frequently agreed to be canceled by negotiations between the parties before the court's judgment.

## IV. Problems and Improvements

### 1. Problems

#### 1.1 Purpose of the Radio Wave Act

It is stated that the purpose of the Radio Law is to contribute to the promotion of radio-related fields and the promotion of public welfare by promoting matters related to efficient use and management of radio waves and promoting the development of radio-related technologies (Article 1 of the Radio Law). Therefore, it can be seen that the main purpose of the Radio Law is to promote the use of radio waves and related technology development, rather than to detect the dangers of radio waves and regulate their use.

### 1.2 Electromagnetic wave human body protection standards (Decrees of the Ministry of Science and ICT)

The purpose of the Radio Law is mainly to use radio waves and develop technologies. However, it does not mean that there are no regulations on human body protection. Article 47-2 (1) of the Radio Wave Act states the following: The Minister of Science and ICT shall consider and inform the human body protection standards, electromagnetic wave intensity measurement standards, electromagnetic wave absorption rate measurement standards, measurement equipment, and measurement methods in consideration of the effects of electromagnetic waves generated by wireless facilities on the human body. Since mobile phones are also electrical facilities that send or receive radio waves, mobile phones correspond to wireless facilities according to the definition of wireless facilities mentioned above. According to the published electromagnetic wave body protection standard, the electromagnetic wave absorption rate standard for the human head or body part for the general public is 1.6 W/kg. These values are equivalent to the most stringent international standards (US standards); however, the reason why the figure of 1.6 is appropriate is not explained.

Apart from the standards for the protection of electromagnetic waves, Article 44-3 of the Radio Regulations states: The Minister of Science and ICT should prepare measures to establish and promote comprehensive protection measures on the effects of electromagnetic waves on the human body in order to minimize the effects of electromagnetic waves on the human body, equipment, and wireless facilities and to create a safe radio wave environment.

It is unclear what specific measures have been prepared so far. However, it is certain that mobile phones can be manufactured, imported, or sold without special sanctions, provided that only the electromagnetic wave protection standards that have been announced are passed.[9]

## 2. Improvements

### 2.1 Supervised management from the Ministry of Science and ICT to the Ministry of Environment

The cases in the United States are regulated by the Federal Communications Commission (FCC), not the Federal Environmental Protection Agency (EPA), by telecommunications law as well: the electromagnetic wave management system is focused on ex-post regulation, not a precautionary system that regulates the pollutants they emit.[10]

If the concept of 'Electromagnetic Pollution', which can be subject to the right to claim pollution control under the environmental law, is introduced, the environmental right can also be a constitutional basis for establishing laws regarding the regulation and the exercise of rights for electromagnetic waves in mobile phones.

Currently, the Ministry of Science and ICT of Korea manages the Radio Wave Act and has established human body protection standards by Decrees of the Ministry of Science and ICT; in addition, the Korea Broadcasting and Communications Promotion Agency is passively promoting public information on how to use mobile phones, such as website disclosure, broadcasting production, and publicity flyers.

It is necessary to manage these management systems actively and systematically by the Ministry of Environment.

### 2.2 Obligation to attach electromagnetic warnings (included in the Radio Wave Act)

Aside from the electromagnetic wave labeling system specified in Article 47-2 of the Radio Wave Act, a warning message stating that electromagnetic waves in mobile phones may be harmful must be attached. The warning should include the statement that the World Health Organization has defined electromagnetic waves as mobile phones as carcinogens. In particular, it should also be included that there is a high possibility of cancer or attention deficit hyperactivity disorder when children and adolescents use it for a long time.

Furthermore, it is necessary to attach a post that recommends to reduce the talk time of the mobile phone, to send a text message or use the speakerphone function instead of the call, to the mobile phone store. Earphones or headsets must be provided with the mobile phones sold. You should be warned that you can reduce the risk of exposure to electromagnetic waves by using earphones or headsets during calls.

### **2.3 Obligation to explicitly explain the SAR value (included in the Radio Wave Act)**

The SAR value of the product must be described in the mobile phone sold or rented, apart from displaying the electromagnetic wave rating on the mobile phone. It should be pointed out that the physical meaning of the SAR value must be explained verbally during the sale and rental of mobile phones, and that the lower the SAR value, the less harmful it is to the human body. For a mobile phone with a wireless charging function, the SAR value for electromagnetic waves generated in the wireless charging mode must be separately described.

### **2.4 Obligation to attach posters in cell phone stores (included in the Radio Wave Act)**

It should be legally mandated that posters to prevent electromagnetic waves be placed inside cell phone stores. The main content of the poster includes: (1) When making a call, we should try to use the mobile phone a little away from our face alternately in both ears. Preferably, it is better to use earphones. (2) We should avoid using mobile phones as much as possible in basements, elevators, tunnels, subways, etc., since the strength of electromagnetic waves in these areas are relatively significant. (3) We should refrain from leaving our mobile phones at bedside when we sleep

### **2.5 Active promotion and development of promotional materials**

Currently, the Korea Broadcasting and Communications Promotion Agency, under the Ministry of Science and ICT, is passively

conducting public relations activities using homepages, broadcasting production, and promotional flyers. Therefore, it is necessary to actively develop promotional materials that explain the meaning and importance of the SAR value or inform the potential danger of electromagnetic waves in mobile phones. In addition, the promotional material should include the following recommendations for minimizing electromagnetic exposure: Minimizing talk time using mobile phones; Using text messages instead of calls; Using earphones or headsets during calls; Refraining from using mobile phones when moving in tunnels, subways, and elevators. In addition, it is necessary to actively promote activities in cooperation with the Ministry of Education in using effective advertising methods such as the use of advertisement time for 9 o'clock TV news.

### **2.6 Organization activities of specialized research institutes**

Research to identify the harmfulness of electromagnetic waves in mobile phones is highly unlikely to expect fair research results because the interests of related industries are complicatedly involved. It is said that a research institute in Korea has conducted research to examine the effects of mobile phone electromagnetic waves on mice where the results tend to appear differently depending on the source of the research grant. Another difficulty in researching mobile phone electromagnetic waves is that after long research, meaningful results can be obtained. Thus, it is necessary to have an independent professional research institute at the national level to continuously conduct long-term research. The government so far mentions only that the current SAR standards are the world's most stringent standards, the same as the United States. Rather than just following the advanced nations always, the Republic of Korea should also take a leading role in establishing international standards for SAR by actively conducting prior research with problem



consciousness, in line with the reputation of being an ICT powerhouse.

## V. Conclusion

Countries around the world have already taken direct and indirect measures to warn of the harmful effects of mobile phone electromagnetic waves. The UK has reported a significant increase, especially among the 15-24 year olds who use mobile phones, in the incidence of adolescent cancer that has increased by 40 percent over the past 16 years. In the United States, the hazards of mobile phones were reported in court after John McCain's death. Based on the study that cell phone electromagnetic waves increase the chances of miscarriage by a factor of three, pregnant women in particular warned against leaving Wi-Fi in their bedrooms. On the other hand, in the Republic of Korea the installation of Wi-Fi has been expanded without restrictions by location, and there is a widespread atmosphere of protesting human rights violations even if young students cannot use mobile phones, ignoring problems caused by the use of mobile phones. Human brain cells are increasingly exposed to electromagnetic waves of mobile phones as the penetration rate of smartphones grows. In order to solve the long-lasting question of whether electromagnetic waves from mobile phones will harm the human body, many studies are being conducted in various countries around the world, and the recently published findings have warned of the potential for harm.

The labeling of electromagnetic waves alone is not sufficient to raise awareness about the dangers of electromagnetic waves. It is necessary that the Republic of Korea organize and operate a national electromagnetic wave research center in line with its status as an IT powerhouse, along with the revision of the Radio Wave Act, which directly warns the public about the hazards of mobile phone electromagnetic waves and can directly

impose obligations on the mobile phone industry. Article 35 of the Constitution of the Republic of Korea clearly states, "Every citizen has the right to live in a healthy and pleasant environment." There is a need to find a way to use the cell phone with minimal damage to the human body. Clear actions of the Government should be taken on the use of mobile phones including the strengthening of the electromagnetic wave regulation standards of the mobile phone, restrictions on use in public places such as libraries and hospitals, and provision of guidelines for the safe use of individual citizens.

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