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## The Medical Malpractice Transformation in the Internet of Medical Things Era

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**Abstract.** The Internet of medical things brought changes to the practice of medicine. The change is due to the inclusion of elements of devices and networks in medical services. The device and network elements in medical devices have many vulnerabilities that can lead to losses experienced by patients when they receive medical services. Therefore, this study will examine how these changes then have an impact on losses that in criminology are considered medical malpractice. A qualitative explanatory approach to both primary and secondary data is then used by researchers to support the argumentation. The results showed that the argument for the possibility of other perpetrators besides doctors who could then be interpreted as committing crimes that cause harm to patients was proven to be good from the responsibility of other human beings (electromedicine) as guarantors of device safety and reliability; manufacture and distributor of devices both from the prototype process, to use in health care facilities; and providers and hackers in the network used by healthcare devices. The impact can be seen in the discussion

**Keywords.** medical malpractice, corporate crime, professional crime, cybercrime, vulnerabilities device

### 1. Background

All regions of the world have a specific medical problem - the medical malpractice problem. The problem became a crisis in the United State of America in the 1970s (Robinson, 1986). Another source explained that the crisis occurred between the 1950s and 1980s (William, 2012). On the other hand, some parties explained that medical malpractice has been lasting for more than 3 decades (Hogan, 2003; Yackee, 2009; Noland, 2018). In India, many patients began to sue doctors since the promulgation of the Consumer Protection Act in 1986 (Murthy, 2007). In 2003, Japan had the worst period for doctors due to the same problem, medical malpractice (Hiyama, et. al, 2008). On the other hand, in Indonesia, Guwandi (2007: 7-10) explains the malpractice committed in Indonesia included overdose administrations in 1923, errors in administering medicine in 1938, and abortions committed by dr. B in 1960, post-surgical case due to the applied procedure by dr. TFL, and many more.

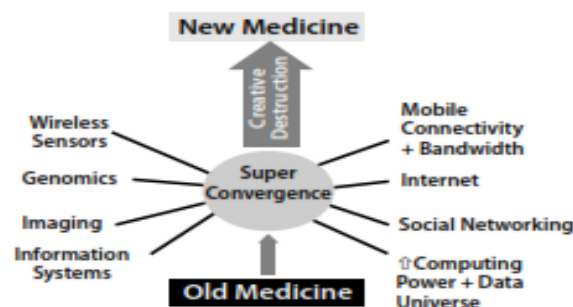
Based on the law, medical malpractice refers to an action or behavior that does not meet the professional competence standard. Thus, the action damages the patients and can be proven by the patient ([dictionarylaw.com](http://dictionarylaw.com)). The malpractices of doctors to promote excellent practices

and skills are compared with the same function and type of doctor (Black Law Dictionary, 2010). The Black Law defines malpractice as professional negligence. Based on the health perspective, cited by Black's Medical Dictionary (2010), malpractice refers to inappropriate and inadequate behaviors; and inappropriate medical treatment based on the standardized skills and expected treatment from qualified doctors. This problem, in English terms, is equal to medical negligence (Black Medical Dictionary, 2010). Medical negligence includes any professional error, lack of skill and loyalty, illegal behavior, amoral medical practice toward the patient, patient injury and misery, and mortality (Miller-Keane, 2003). This negligence deviates from the standard and causes injuries or deaths (Hogan, 2003; Chilea & Kassai, 2016).

Medical malpractice, based on the criminology dimension, refers to an object of criminology study with a different definition. For example, based on the perpetrator dimension, the criminology study defines medical malpractice as a crime committed by doctors. The crime indirectly is correlated to the medical practices, including the other medical staff's participation in the medical action. Medical malpractice is a professional crime of a doctor as a profession. This crime is also called White Collar Crime, WCC, (Sutherland cited by Lanier & Henri, 1998). Mustofa (2010) explains that WCC is not merely based on disadvantaged actions but is based on the features of the perpetrators, high social status individuals, or professional individuals.

Practices of medicines change along with science and technology development. For example, within the context of the industrial revolution, practices of medicines develop in terms of practical mechanisms by applying information and technology. In this context, with the industrial revolution of medicine and medicine services, many things have been changing since the 1800s (Jg, 1960). Hamman, cited by Jg (1960), explains that the changes occur due to the technological advancement of practices of medicines, especially dealing with the management of disease types and disease transmission, starting from the new medicine invention and new procedure type implementation. Topol (2015) explains that the 4.0 industrial revolution also occurs in the medicine field, for example, the Internet of Medical Things (IoMT). In 2012, Topol revealed the old medicine changes, before the IoMT, compared to the medicine fields during the industrial revolution, IoMT. Figure 1 shows the descriptions of the medicine changes.

Figure 1 The transformation of the old to new medicine field (Topol, 2012)



With the Figure, Topol mentions a significant convergence that was impossible to happen. However, in the reality, convergence happens due to digital technology readiness. The indications of the readiness include the inventions of smartphones, bandwidth, connectivities, social networks, digital storms with larger and unlimited computing powers, a large number of cloud servers, biosensors, sequencing genome, imaging capability, and health information systems. All these indications encourage the creation of new medicine. The term, *new medicine*, refers to IoMT (Topol, 2015). IoMT describes the digitalization process of medical instruments,

in the form of software and hardware, and network connectivity (Topol, 2015; Lobo, 2017). Lobo (2017) explains that IoMT integrates technology, medical instrument, and application to provide medical services for patients.

Medicine services with IoMT become a new chapter in practices of medicines. The changes provide significant influence, based on the aspects of effectiveness, efficiency, security, and patient safety. The development of health efforts with IoMT encounters challenges and problems, starting from reliability, error (Chakraborty, Mathew, and Vasilakos, 2019); security (Chakraborty, Mathew, and Vasilakos, 2019; Ahmed, Farahmandi, Iskander & Mishra, 2018); and vulnerability due to design and maintenance limitation (Wirth, 2019). The reliability, security, and error are still under acceptable thresholds of trustworthiness. Chakraborty, Mathew, and Vasilakos emphasize the importance of an increased tolerance or threshold.

From the evidence of the problem, the researchers found the challenges that delayed the practices of medicines and the artificial intelligence technology problems on medical tools. The delay or postponement of the practices of medicine led to patient fatalities, starting from disabilities and even deaths. In this condition, the practice may turn into malpractice. However, malpractices are not always committed by doctors but also due to the malfunctioned medical instruments, the applied treatment, and the unauthorized network operation implementation by doctors.

Malpractices during this IoMT shift due to the influence of medicine service system. The system changes included robotic surgery with various instruments and the participation of various individuals. In this system, the participation comes from the doctors and the electro-medical staff to promote maintenance, repair, test, and calibrate the health instruments. On the other hand, the instruments in this context refer to the hardware or the robot, the software, and the network or the internet. This participation and the implementation of various tools and instruments may have malpractice potential. In this case, the malpractice is not only committed by doctors but also by the other participating parties or components. The vulnerability of medical tools occurs due to limited internet connections, potential attacks by hackers, or malware (Copeland, 2018; Global healthcare connected wearable devices market report 2019; Wazid, et. al, 2019). Potential computer viruses, for example, *wannacry* ransomware, could interrupt hospitals' and doctors' service performance. Ransomware makes electronic medical record data inaccessible or locked due to the effect of the ransomware (Wirth, 2017; Wirth, 2018). Wajid et al (2019) also identified another malware attack, the *botnet malware*, i.e Mirai. This identification of the malware put the malware as a dangerous attack. The botnet malware destroys the principles of secrecy, integrity, originality, availability, and resources from the system. The malware may increase the number of severe injuries and deaths by interfering with the medical tool software (Brody et al., 2018). The attacks on the software could influence the medical tool hardware. The malware influence the functions of the software that lead to increased fatality during crucial surgery.

From the background, the researchers attempted to identify the medical malpractice changes before and after the IoMT era. The obtained research results would be useful as a reference for the formation of IoMT medical malpractice realizations.

## **2. Method**

This qualitative exploratory research attempted to answer the medical malpractice changes. The primary data sources were literature studies, interviews, and case analyses. The literature study focused on finding empirical findings about medical device changes, from

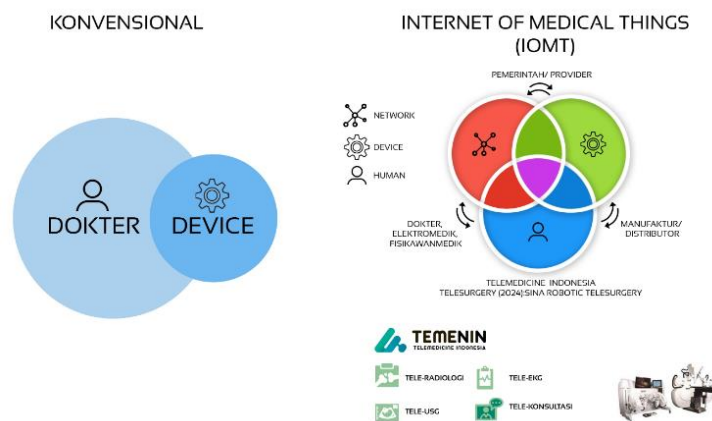
doctor-assisted orientation to artificial intelligence features and networks for advanced operating. The researchers interviewed the respondents to review the process of granting permission until the implementation of the devices or tools in health services. On the other hand, the case study was useful to support the contributing data of medical tool changes in terms of the function and operational mechanism as the medicine service change determinants.

### 3. Results and Discussion

#### 3.1. The medicine service transformation

The medicine service transformation refers to the changes of the old medicine service or conventional service into IoMT service. The focus of this part is - the health service change from humans to medical devices or tools. In this era, the IoMT devices have been significantly changing in terms of the computation capability or the artificial intelligence and the network as inseparable matter from IoMT practices of medicines. Figure 2 illustrates the changes.

Figure 2. The health service transformation from conventional medicine service to IoMT



Source: processed research data from various sources

The figure explains that conventional medicine service only involves doctors and devices. In this medication, the doctors have greater roles than the devices. The responsibility, in this model, refers to the central obligation of the doctors to provide medicine services. Thus, medical devices are only useful to support medical actions or procedures. On the other hand, based on the IoMT device model in this era, the model applies artificial intelligence and networking elements. These elements make the medical devices could promote diagnostics and therapies that fundamentally change the medicine services.

The existence of IoMT is very useful and brings significant challenges to medicine services. The challenges include the direct effects on the quality of the practical results of the doctors, including interrupted services due to malfunctioned devices. These malfunctions may occur due to device errors or sabotaged devices.

#### 3.2. The Transformation of Conventional Medical Malpractices to IoMT

The conceptual changes in health services, as explained previously, bring changes to medical malpractices. The changes occur due to the penetration of device and network elements that bring various components, such as professions, institutions, corporations, individuals, etc. The referred professions include electro-medical staff and medical physics experts; institutions

and corporations of health service facilities, manufacturers, distributors, government, network providers, and people. In this case, the external problem potential of the health system exists due to cyber hacking attacks by hackers. The changes and the collected data by the researchers described the implementation of the IoMT era should not consider any medicine failures happening due to the doctors. In this research, the researchers summarized the medical malpractice before and after IoMT based on the perspectives of law, health, and criminology to understand.

### 3.3. Medical Malpractice before IoMT

The legal terminology defines medical malpractice as a human error committed by doctors since doctors carry out the professions based on the loads, field competencies, and disadvantages suffered by the medicine service recipients (Dictionary.law.com; Black Law Dictionary, 2010; Black's Medical Dictionary, 2010); medical negligence (Black's Medical Dictionary, 2010); professionalism error due to lack of skills, illegal practices and amoral practices with potencies to make other individuals suffering, injured, and died, and/or all of those potencies (Miller-Keane, 2003); and standard deviation with potentials to injuries or mortality (Hogan, 2003; Chilea & Kassai 2016). Thus, the legal field considers four matters for practices of medicine to be deemed malpractices, such as *Duty*; *Dereclition*; *Damage*; and *Direct relationship* (Guwandi, 2009; Chilea & Kassai 2016). These matters are important conditions to meet. Barnet in 1968<sup>1</sup> illustrated the implementation of all four elements (Guwandi, 2009).

In this research, the researcher provided an example of medical malpractice or conventional malpractice in Indonesia, cited from Guwandi (2007:7-10). In the case of Djaimun, in 1923, the malpractice was an overdose. Then, the malpractice case of Raad van Justitie in 1938, in the form of medicine error, was committed. The other malpractice cases were in 1960, an abortion committed by Blume. A doctor, Fong Lang, 1968, committed post-surgical malpractice. In 1985, a baby named Wong received a medicine error in the form of an injection committed by an obstetrician. In 1987, Pluit's case indicated a malpractice of plastic surgery. In 1988, Chandra's case happened as a malpractice of plastic surgery. The indication was anaphylactic shock. Uzair, in 1981, committed intra-operative malpractice. In 1982, Mrs. Samsiah, experienced malpractice due to a gauze remnant after a surgical procedure. Mrs. Masaulina and Ngatemi, in 1983, experienced curette malpractice. Cahyadi, in 1984, experienced malpractice in the form of anesthesia. From the cases, most malpractices happened due to negligence and error in applying practices of medicine. The malpractices, based on the legal terminology, indicated the practical impacts that made patients at disadvantage. From the legal perspective, the malpractices also had a causal correlation. Here are some examples of malpractices committed by doctors.

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<sup>1</sup> Barnet's case occurred between Barnet V. Chelsea & Kensington Hospital. The case position illustrated the chronology in which three-night watchmen, after drinking tea, were feeling nausea and vomiting. Thus, they visited Kensington hospital. However, that night, the doctor was sick and could not check the patient. Thus, the doctor asked the patient to see other doctors. An hour later, one of them returned to the hospital with a worsening condition and finally died. The post-mortem evaluation found an arsenic toxication. In this case, the wife of the patient sued the doctor and the hospital because they neglected the obligation to check the patient. The court finally declared that the doctor and the hospital could not be blamed because **no direct correlation** between the death and the undone medical check. This matter happened when the doctor did not promote the checkup. The interesting part, in this case, was the neglect ion do not check the patient was equalized with committing a crime.

"In 2007, a doctor in Banda Aceh committed malpractice. The perpetrator was dr TWM, Sp. Og, committing procedural malpractice of caesar surgery on the deceased Mrs. Ry. The caesar surgical operation left a piece of gauze inside the mother's womb. This negligence led to infection so the stitches were not cured. After promoting a USG procedure, the medical treatment found a piece of gauze with a dimension of 20x10 cm. The procedure also found adhesions on the uterine, intestine, bladder, and womb. The justice at all levels and the judicial review applied criminal punishment for the perpetrator (The Supreme Court Decision Number. 113\_PK\_Pid\_2012)."

The case showed the aspect of duty dealing with caesarian surgical procedures. The dereliction dealt with the negligence - forgetting to take the gauze. The damaging aspect dealt with the infection and the adhesions of the uterine, intestine, bladder, and womb; and the three-month infection on the stitches. The direct relationship dealt with the gauze remnant that led to infection and adhesion.

Medical malpractice, based on a criminology perspective, is different, for example, the perspective of White Collar Crime or professional crime. A doctor may be subjected to violating the procedure if the doctor does not provide medical service for patients, for example, the doctors do not promote any prearranged practice based on the schedule. This problem violates the duty aspect. If the doctors or a doctor cannot fulfill the prearranged practice, the doctors must provide substitutive doctors (Article 14 of the Ministerial Regulation of Health Ministry 1052/2011). An expert, Prof. Muhammad Mustofa, explains the primary measurement of malpractice is the disadvantage suffered by patients.

"People may have difficulties finding the malpractice indicators but the primary indicator is a disadvantage, the disadvantage suffered by patients. The disadvantage may include inefficiency. The measuring point of this problem is a bioethical violation. Therefore, if the patient does not receive an excellent advantage, the action is considered a crime. The medium between crime and ethics is Sutherland.

The example, based on the legal terminology that requires four elements, seems to have differences. This matter becomes the realization of ethical violation. Clinard, cited by Mustofa (2010), explains that ethical violation is a crime. Mustofa (2010) also explains that professional crime assumes negligence as a crime because a profession must have a standard of professional code. Thus, the law and the terminology assume conventional medical malpractice is a pure crime committed by doctors due to the practical implementation. However, based on criminology, malpractice may have a certain motif or background.

A motif refers to an intention to reveal the objective of a certain behavior. This motif perceives a crime differently based on the law and criminology. A law perceives the result of different actions while criminology sees a crime as an integrated object, including the motif of committing a crime. Clark & Marshal, cited by Hitcher (1930), define motif as the encouraging intention to behave. Clark & Marshal also explain that motifs cannot be changed into action. Thus, a motif is an essential element of a crime under the study of criminology. The researchers described the difference between medical malpractice based on legal and criminology perspectives as shown in this figure.

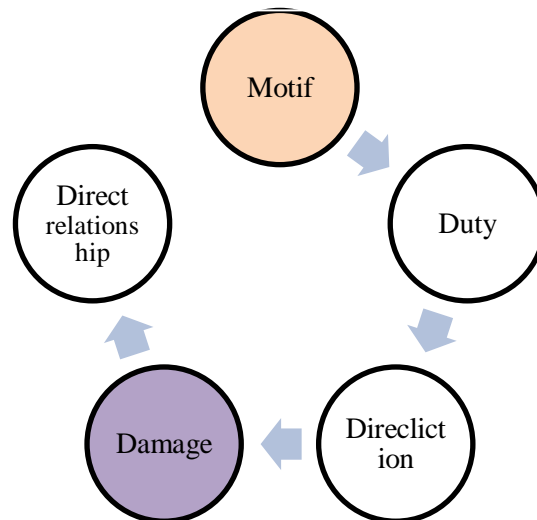


Figure 3 the medical malpractice conditions from the perspectives of legal and criminology

Remark: damage refers to a primary indicator of medical malpractice based on criminology

In the figure, medical malpractice deals with professional crime. The crime might not exist previously due to a practical process of a certain profession without any deviating intention. However, during the practice, the actor may forget to apply standard procedures. Therefore, motif, for criminology, does not exist.

On the other hand, within the context of White Collar Crime, medical malpractice condition includes ethical violation. Ethical violation refers to professional individuals without any reprehensibility. This action, the reprehensibility, of medical malpractice is explained by an ethical violation.

### 3.4. IoMT Medical Malpractice

Technological development with excellent device and network utilization skills in medicine field have positive and negative implications. The positive impacts include the possibility to cover the gaps between the device, the network, and the medicine service with some innovations, such as robotic telesurgery. On the other hand, the negative impacts, of the implementation of robotic telesurgery, were unequal services. The innovation could be only enjoyed by certain people due to specific charged cost by a patient, higher than the manual surgical cost (Mirbagheri, et.al, 2019; Xia & Lu, 2020; Tompkins, et.al, 2022; Di Franco, et. al, 2021). Beside that, the robotic assistant matter has some weaknesses and challenges, such as: 1) the operational grant, the doctor responsibility, and the corporation and the hospital (Usluogullan, Tiplamaz, & Yayci, 2017); 2) the absence of certification and credential standard institution; 3) the framework and the standard (O'Sullivan, et. al, 2019); 4) the surgical security from high risk complication after tracheotomy surgery for 10% (Usluogullan, Tiplamaz, & Yayci, 2017; O'Sullivan, et. al, 2019; Lydiatt & Sewell, 2017); high infectious organ chamber found on Robotic gastrectomy arm (Lundberg, Stoltzfuz & El Chaar, 2019); cyber attack (Bernal et al., 2020); 5) expensive operational cost (Jeong, 2017; Roh, Nam & Jung, 2018; Acevedo et al, 2019); 6) surgical training provided by robotic corporation (Usluogullari, Tiplamaz, & Yayci, 2017); 7) required surgical instrument branded "da vinci" with minimum



Figure 4 the bibliographical analysis results of robotics-medical surgical malpractice



After analyzing the bibliography, the researchers found two specific articles about medical malpractice prosecution in robotics surgery, Nik-Ahd (2019) and Ravin et al. (2022). These articles found the increased medical malpractice with the highest specialization found in obstetricians and genealogists. The researchers also found medical malpractices from 2000 to 2017 on urology surgery with robotics devices, published by Intuitive Surgical [Da Vinci] (Nik-Ahd, 2019). Ravin et al (2022), the researchers found malpractices due to robot-assisted surgery from 2006 to 2021. The researchers found that the study of Nik-Ahd et al (2019) did not clearly explain the cases but the article only explained the causes of the prosecution. On the other hand, Ravit et al explained their findings. The following table shows the explanation.

Table 1 the malpractice characteristics comparisons with the implementation of robotic surgery

		2006-2013 (n=16)	2014-2021 (n=45)
Sex types	Male	10	12
	Female	6	33
Specialist	Urology	9	7
	General surgery	4	13
	Obstetricians and genealogists	3	22
	orthopedic surgery	-	1

	laryngeal surgery	-	1
	Not specific	-	1
Procedure of	hysterectomy	1	19
	prostatectomy	7	5
	Hernia recovery procedure		4
	splenectomy	2	
	The heart bypass	1	
	Other procedures: colectomy, curettage, removal of the pericardial mass, appendectomy, urethral implant	5	
	Court sentence	Defense (overtreatment)	11
Misdiagnoses/diagnosis failures		5	4
Injuries, results, damage amount awarded		-	6

Source: the processed data by the researchers obtained from Ravin et al (2022)

Table 2 shows the details of medical malpractices with robotic-assistances as crimes.

Table 2 the Violation of robotics-surgical malpractice cases

Violations, n (%)	2006–2013	2014–2021
Surgical negligence	12 (75%)	37 (82.2%)
Misdiagnoses/Diagnosis failures	4 (25%)	21 (46.7%)
Postponed procedure	3 (18.8%)	16 (35.6%)
Infection	4 (25%)	15 (33.3%)
The issue of informed consent	3 (18.8%)	14 (31.1%)
Monitoring failure	6 (37.5%)	14 (31.1%)
Requiring additional surgery	7 (43.5%)	8 (17.8%)
Failed to refer	–	7 (15.6%)
Non the candidates for robotic surgery	2 (12.5%)	6 (13.3%)
Calibration failure/robotic operation failure	–	5 (11.1%)
Inappropriate Position	–	3 (6.7%)
Pre-surgical activity failure	2 (12.5%)	2 (4.4%)
Lack of training	4 (25%)	2 (4.4%)
Negligence of credential	2 (12.5%)	1 (2.2%)
Manufacturing problems	2 (12.5%)	1 (2.2%)
Pre-operational prophylaxis failure on venous thrombosis	3 (18.8%)	–
Total of n	59	169

Source: the re-processed data from Ravin et al. (2022)

Remark: in malpractice, the researchers found many violations

The table, based on Ravin et al (2022), shows the most committed violation type is surgical negligence while the opposite is the manufacturing problem. The details of the violation deal with the malpractice paradigm change in this IoMT era, such as the postponed failure, monitoring failure, additional operation requirement, non-robotic surgical operation candidate, calibration failure/robot operation failure, lack of training for the doctors, and manufacturing problem. On the other hand, based on Nik-Ahd et al. (2019), the researchers found two-related cases of robotic operational failure. The problems should not only address by the doctors but also by the responsible parties. For example, postponed surgery or operation might occur due to robotic failures to prepare for the operation. In this case, the medical engineering, the electro-medical staff, should have been the most responsible party because this staff prepared the device, including the robot to use by the doctors. In dealing with manufacturing problems, the manufacturers should take responsibility. From the explanations of the cases, the robotic-assisted operation may involve broader behaviors of medical malpractice in this IoMT, besides the doctor.

### **3.6. Examples of malpractice cases on radiotherapy devices in Indonesia**

Dealing with the radiotherapy case, the researchers used the research results from Oxford, Universitas Indonesia, and the Alliance of Indonesia's Medical Physicians, funded by Oxford, published in 2021. The results showed the radiotherapy of a linear accelerator, LINAC, with a focus on the multi-leaf collimator subsystem.<sup>2</sup> The researchers found 59.02 + 1.98% mechanical error and 57.14%+0.78% spare parts that should have been replaced. These matters influenced the downtime in Indonesia, longer than 7 times than in English, with a median score of 52.5 hours per device or tool. The researchers found two devices at B and F hospitals that contributed to the downtime rate. The category of spare part absence refers to a C-typed mistake, contributing to 97% of the LINAC downtime. Furthermore, this finding confirmed that the LINAC system was vulnerable to mechanical errors and downtime of radiotherapy. Besides that, the respondents from the hospitals explained that the downtimes occurred due to waiting for the spare parts and the engineer's arrival from the vendors, the distributors, or other manufacturers to repair (Peiris et al., 2021).

From the case, the delayed delivery of the spare parts and electro-medical from the vendor confirmed the interview results of the electro-medical corporations. The researchers concluded the indirect influence of the monopolized process, the maintenance dependency, and the downtime caused by the radiotherapy device that put patients at disadvantage due to the device malfunction or delayed process of the radiotherapy service. The disadvantages were also equal to crimes or malpractices. The impacts of the radiotherapies had biological natures, such as heredity problems. The impacts of the hereditary problems were indirectly observable in the exposed individuals or future generations. The effects included different eye colors, short limbs, and incomplete limbs. The genetic defects in the population, as the result of various causes, included radiation among 1 out of 200 live birth with genetic defects based on a statistical expression. Besides that, the indirect effect was radiation. This radiation influenced the somatic effects, such as cancer. In this case, radiation became one of the contributors to cancer. Four out of 10 population may suffer from cancer in their life. This matter is caused by the dose-based radiation level. On the other hand, the somatic-non-stochastic effects include burning radiation, hair loss, sterility, vomiting, and diarrhea (Symonds et al., 2019).

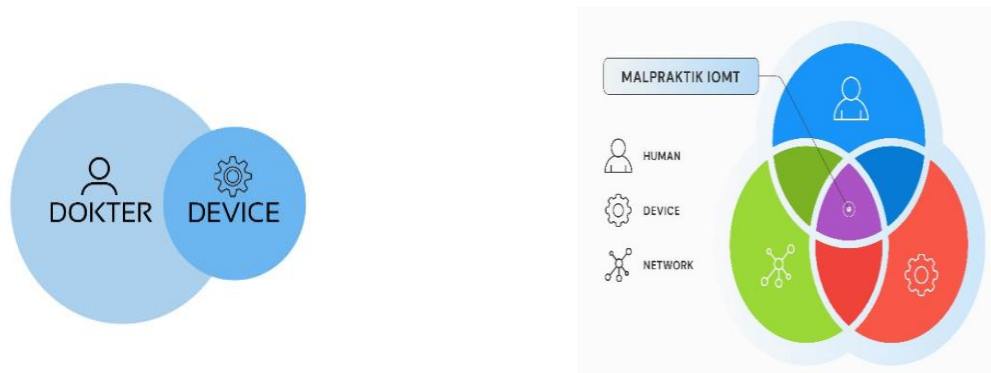
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<sup>2</sup>The applied tool was based on the cancer-therapy procedure.

### 3.7. The medical malpractice transformation in the IoMT era

In this research, the researchers differed the conventional medical malpractice by providing this illustration.

Figure 5 The Conventional medical malpractice transformation to IoMT  
**The Conventional Medical Malpractice** **Cybermedic**



The transformation of conventional medical malpractice transformation to IoMT was observable from some health workers. The workers seemed to have tendencies to put the patients at a disadvantage if the workers were incompetent or neglected their professions. Other components of human aspects are electromedical and medical physicians. Besides that, the equal domination among humans, device, and network in the practices of medicine led to malpractice. The evidence was the manufacturer or device distributors, health service facilities, hackers, and telecommunication service providers.

The medical malpractice of IoMT is known as cybermedic. The researchers formulated the concept of cybermedic based on the medicine service of IoMT, involving the doctors, the health staff, the artificial intelligence-based devices, and the remote-operated networks. These elements provided vulnerability that caused non-maximum potentials and failures of practices of medicine promotion due to human, device, and network factors, including patient disadvantages.

Human, availability, and competence variable; device permission variables; maintenance and calibration; and cost management determined the medical malpractice in this IoMT era. On the other hand, the network was found to have some vulnerabilities. The same thing was observable in telecommunication that might bring disadvantages. Based on the context of criminology, disadvantages refer to the standard of malpractice.

## 4. Conclusion

The results showed the broader construction of medical malpractice in this IoMT era besides doctors. The perpetrators included the electromedical with the responsibility for the device reliability, the medical physicians as the medicine-device therapy operator, the manufacturer and the distributor responsibility for the device reliability - including cost, patient access to receive the health service, the monopoly of the given care, the maintenance and calibration; the telecommunication provider with the responsibility to repair the device network; and the health service facility as the part of a corporation. All parties contributed to malpractice

occurrence, including hackers as the cybercriminal perpetrators. These hackers utilized the vulnerabilities of the system.

Besides that, the researchers emphasized the key aspects to determine malpractice from a criminology perspective. The key aspects were the disadvantages suffered by patients. The elemental difference of the medical malpractice formulation is based on the legal law. was originally based on four elements. They were duty, dereliction, damage, and direct relationship. However, there was another important element, motif, as the additional element based on the criminology perspective.

Medical malpractice in this IoMT era, known as cybermedic malpractice, has the fundamental concept of medicine service from offline service to online service with a high technological device with artificial intelligence. These superiorities allow remote procedures by utilizing networks. However, these superiorities had some vulnerabilities that might be used by criminals. Thus, the implementation of IoMT might put patients at disadvantage.

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