Abstract

**Purpose:** As artificial intelligence (AI) has currently used in many ways related to nurses, there is an ultimate need to consider the ethical values of AI in healthcare. Thus, the present study first investigates several types of AI-based technologies and robotics applied to nursing, such as supportive, cooperative, and collaborative robots. Moreover, several ethical guidelines and requirements for AI, ethical issues and concerns of AI, especially nursing ethical considerations, are explored based on the principles of biomedical ethics and the nursing code of ethics.

**Method:** We searched for existing scientific literature using the keywords “AI or Robot or Nurses”, “AI or Robot and Ethics” in PubMed until March 2022. Next, we reviewed the articles related to ethical issues and considerations in AI-based technologies, especially in the field of healthcare. In addition, a web-based search about robotics in nursing was conducted to find out their specific roles.

**Results:** The direction of ethical discussion of AI has changed from Roboethics, which emphasizes robot’s behavior and the responsibility of robots, to ethics for humans, such as developers and users. There are many ways AI is helping to overcome health care challenges, such as diagnosis, precision medicine, and prediction models. For the safety of human-robot interaction, ethics of caring need to be discussed in close proximity for nurses, patients, or both. Therefore, AI needs to consider patient safety first, do no harm and aggravate the patient’s condition, sufficiently provide to treat diseases and improve patients’ health conditions, and the service needs to be distributed equally without prejudice and discrimination regardless of medical problems.

**Conclusion:** As AI has incredible potential to empower people and widely benefit current and future generations, AI ethics needs to be further discussed in a direction in harmony with the development of related industries. Nurses should understand AI applications and their implications for nursing research and practice to improve patient care and clinical outcome. In addition, careful ethical considerations and engagement with nurses in implementing and evaluating AI-based technologies in healthcare are critical to the best clinical decisions and developing reliable innovations.

**Keywords:** Artificial Intelligence (AI), Roboethics, Biomedical Ethics, Morality, Nursing Codes of Ethics

1. Introduction

Artificial Intelligence (AI) has recently made tremendous progress in many areas; healthcare, including medicine and biomedical research, might receive significant benefits from AI-based technologies [1]. In fact, AI in healthcare isn’t new; it’s progressively used in various ways involving nurses. Moreover, the unpredicted challenges for healthcare caused by the Coronavirus Disease 2019 (COVID-19) pandemic have made that AI moves to rapid advances and has changed the way of our life with numerous benefits, including healthcare landscapes [2][3][4][5][6][7][8]. Today, AI tools and technologies play critical roles in managing every stage of the COVID-19 crisis, including detection, prevention, responses and recovery [9]. Under these conditions,
there is an ultimate need to consider AI's ethical values, and it is essential, not optional. Thus, ethics has been discussed side by side with the technical development of robots or AI. Therefore, the present study described the ethical issues of AI in the recent hyper-connected era, especially nursing ethical considerations.

As the number of industrial robots and AI systems continues to increase over the last 10 years, the ethical principle and regulations of robotics and AI have become priority issues worldwide[10]. Generally, the ethics of robotics is considered the first prescriptive approach in AI-based technologies. Since robot ethics(roboethics) was coined by Gianmarco Verugio[11], AI ethics have been widely discussed with an increasing number of related publications[12][13]. The direction of AI ethics initially emphasizes the responsibility of the robot itself, and then it has changed from machine ethics to ethics for humans such as developers and users. In fact, we need to consider the relationship between humans and robots in more depth rather than impose responsibilities on robots by simply thinking of robot ethics as human-centered.

The most well-known roboethics principle is the Three Laws of Robotics <Table 1>, introduced by Isaac Asimov in 1942 and designed to prevent the possibility of being used by humans in a way that harms humans[14]. Asimov added a ‘Zeroth Law’ in 1985, implicating that humanity is placed over the fate of one individual. Later, the alternative Asimov’s laws have proposed on accountability, responsiveness, and control to emphasize the responsibility for robot behavior lies on humans[15]. As the application of robots has become diversified in various fields and the frequency of human-robot contact has increased in the mid-2000, the human-robot relationship became highly interested[16]. As a result, the World Robot Declaration was announced in Fukuoka, which focused on the co-existence of robots and human beings[17]. Besides the technological development of the robot itself, the management and ethics for the benefit of human beings have developed into the discussion. Since the declaration, there have been various discussions on robot ethics, with the main content being the peaceful co-existence of human beings and robots. Especially the ‘Robotics Research Roadmap’ suggested by the European Robotics Research Network(EURON) in 2007, emphasized the ethics of robot designers, manufacturers, and users, preparing legal and institutional devices to protect humans from robots[18]. As ethical discussions on the development of the intelligent robot become highly necessary, guidelines for AI development have been announced by international organizations and major countries. In Japan, the Draft AI R&D Guidelines were published concerning the principles of collaboration, transparency, controllability, safety, security, privacy, ethics, user assistance, and accountability. In addition, OECD reported the Digital Economy Outlook 2017, providing an overview of converging trends, policy and regulation developments, data on the digital economy, and the effect of digital transformation on economies and societies[9]. The OECD AI principles adopted in May 2019 are innovative and trustworthy and respect human rights and democratic values. With the growing worldwide movement to establish an AI ethical, legal system, several ethical principles are summarized in <Table 1>.

Table 1. Principles and policies of robotics and roboethics.

<table>
<thead>
<tr>
<th>Asimov’s laws of robotics[14]</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>First law</strong></td>
</tr>
<tr>
<td>A robot may not injure a human being or, through inaction, allow a human being to come to harm</td>
</tr>
<tr>
<td><strong>Second law</strong></td>
</tr>
<tr>
<td>A robot must obey the orders given it by human beings except where such orders would conflict with the first law</td>
</tr>
<tr>
<td><strong>Third law</strong></td>
</tr>
<tr>
<td>A robot must protect its own existence as long as such protection does not conflict with the first or second law</td>
</tr>
<tr>
<td><strong>Zeroth law</strong></td>
</tr>
<tr>
<td>A robot may not harm humanity or, by inaction, allow humanity to come to harm</td>
</tr>
</tbody>
</table>
**Fukuoka world robot declaration - expectations for next-generation robots (2004)**[17]

Next-generation robots will be partners that coexist with human beings

Next-generation robots will assist human beings both physically and psychologically

Next-generation robots will contribute to the realization of a safe and peaceful society

**The EURON robotics roadmap (2007)**[18]

<table>
<thead>
<tr>
<th>Human dignity and human rights</th>
<th>Autonomy and individual responsibility</th>
</tr>
</thead>
<tbody>
<tr>
<td>Equality, justice and equity</td>
<td>Informed consent</td>
</tr>
<tr>
<td>Benefit and harm</td>
<td>Confidentiality</td>
</tr>
<tr>
<td>Respect for cultural diversity and pluralism</td>
<td>Social responsibility</td>
</tr>
<tr>
<td>Non-discrimination and non-stigmatization</td>
<td>Responsibility towards the biosphere</td>
</tr>
</tbody>
</table>

**OECD draft council recommendation on AI (2019)**[9]

**Section 1: principles for responsible stewardship of trustworthy AI**

1.1 Inclusive growth, sustainable development and well-being

1.2 Human-centered values and fairness

1.3 Transparency and explainability

1.4 Robustness, security and safety

1.5 Accountability

**Section 2: national policies and international cooperation for trustworthy AI**

2.1 Investing in AI research and development

2.2 Fostering a digital ecosystem for AI

2.3 Shaping an enabling policy environment for AI

2.4 Building human capacity and preparing for labour marker transformation

2.5 International cooperation for trustworthy AI

In the ethics of the industrial field, global IT companies began to emphasize the principles and ethics in AI development after the early AI chatbot ‘Tay’ revealed the dangers and discarded it due to racist remarks. In 2016, IEEE published the Asilomar AI principles, the 23 guidelines for R&D of AI development which are subdivided into three categories: Research, Ethics and Values, and Longer-Term Issues[19]. In addition, Google has established seven principles with the goal of bringing the benefits of AI to people and society[20]: be socially beneficial, avoid creating or reinforcing unfair bias, be built and tested for safety, be accountable to people, incorporate
privacy design principles, uphold high standards of scientific excellence, and be made available for uses that accord with these principles. For the review process, any team, such as new products, research, and partnerships, can request formal AI principles review to check if they confirm the AI principles.

Taken together, the direction of ethical discussion of AI has changed from Roboethics (machine ethics), which emphasizes robot’s behavior and the responsibility of robots, to ethics for humans, such as developers and users. As AI has incredible potential to empower people and widely benefit current and future generations, AI ethics needs to be further discussed in a direction in harmony with the development of related industries.

2. AI-based Technologies and Robotics applied to Nursing

2.1. Types of robots used in healthcare

Caring is an essential quality in building trust with each other and is central to nursing. Nurses are responsible for patient care, collecting data, making nursing care plans with critical and clinical decision-making skills, etc. There are many ways AI is helping to overcome health care challenges, such as diagnosis, precision medicine, and prediction models. AI-based robotics can be divided into medical and assistive robotics (more relevant to nursing). Assistive robots/devices constitute mobile and body assistants, patient transfer, and monitoring patients[21]. Recently, semi-autonomous AI robots and drones were deployed for immediate response in hospitals to deliver food and medication, clean and sterilize, and add healthcare workers. In addition, there are companion robots and medical facility logistics robots, and it has been actively commercialized and used in various fields in the last 10 years. Some examples of AI-based robots applied to nursing were summarized in <Table 2> and <Table 3>. Although AI-based robots in this paper were applied to nursing, other healthcare professionals, such as physicians, were also users of these technologies.

One of the earliest nurse robotics was a social robot named ‘Pearl’ in 2002, which had two primary functions; remind about routine activities and guide through the environment[22]. According to ISO 8373, a nursing robot has a certain degree of autonomy to assist clinical staff with performing tasks[23]. A recent review paper identified 133 robotic systems in nursing care and classified them according to the technical and data-derived hierarchical classifications of the use care[24]. First, the technical classifications for human-robot interaction were divided into 7 classes: Supportive, Cooperative, Collaborative, Wearable robotics, Responsive, Cobotic and intelligent auxiliary devices, and Teleoperated devices. The three main categories (Supportive, Cooperative, and Collaborative) covered almost 80% of the projects[24], and the examples of each category were listed in <Table 2>. Supportive robots can assist in the performance of the task to held nurses and patients, like TUG, BUDDY, and AuRoRoll[25][26][27]. Cooperative robot systems share the control between the human and the robot, and examples are Care Robot Yurina, ROBERT, and Kasper[28][29][30]. In the category of Collaborative (human and robot perform the part that better suits them), Kinova Jaco and Liocan were classified[31][32].

Table 2. Examples of AI care robots of the technical classification in nursing.

<table>
<thead>
<tr>
<th>Robot</th>
<th>Function and role</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>TUG</td>
<td>Autonomous mobile robot to transport carts and compartments within hospitals</td>
<td>[25]</td>
</tr>
<tr>
<td>BUDDY</td>
<td>Emotional robot has multiple functionalities at home (monitoring and reminding)</td>
<td>[26]</td>
</tr>
<tr>
<td>AuRoRoll</td>
<td>Wheelchair capable of navigating autonomously with camera-based sensor module</td>
<td>[27]</td>
</tr>
<tr>
<td>Care robot Yurina</td>
<td>Care robot to effectively help life, carry and transfer patients, and used as an electric wheelchair</td>
<td>[28]</td>
</tr>
</tbody>
</table>
In addition, robotic systems can be classified according to the fields of application, or use cases, which indicates the most desirable way. There are 12 classes in the use case classification: Companion robot, Logistics, Therapy, Personal aids and assisting devices, Mobility support, Rehabilitation, Telepresence, Transfer robot, Toy robot, Teaching robot, Telediagnosis, and Cleaning. They were mapped and deduced into the four categories: Peripheral activities of nursing, Systems which increase autonomy of the patient, Systems that closely involve both patient and nurse, and Tele applications. In the first category of ‘Peripheral activities of Nursing’, the robotic projects support the nurses away from patients to focus on more essential tasks. Three classes (Logistics, transport of patients/transfer robot, and cleaning) belonged to this category. Logistic robots perform logistics chores, like HOSPI, MOXI, and Care-O-Bot. Transport of patients/transfer robots can be used to lift and transport patients, and cleaning robots perform cleaning chores. The second category of ‘Systems which Increase Autonomy of the Patient’ is designed to assist the patient without the involvement of the caregivers. It covers the highest percentage of 54% in the use case classification, belonging companion robots, therapy support, personal aids and assisting devices, mobility support, and toy robots. Like Mario and Maggie, the companion robot is a robot to build real or apparent companionship with patients by reducing feelings of isolation and loneliness. The well-known robots Paro and Milo are used in the therapy session. Personal aids and assisting devices can provide help with an activity of daily life care, mobility support help patient to move, including standing up and walking, and toy robots entertain the users. The third category is ‘Systems which Closely Involve both Patient and Nurse’ with two classes of rehabilitation and teaching robots. ‘Tele Applications’ is the last category, including telepresence using remotely controlled robots and diagnostic systems/telediagnosis for remote diagnosis. One-third of classes belong to three use cases: Companion robots, Logistics, and Therapy support, and the selected examples of robot systems are listed in Table 3. As some robots can be used for many functions at other use cases, a single robot system may support and help more than one use care.

Table 3. Examples of AI care robots of the use case classification in nursing.

<table>
<thead>
<tr>
<th>Robot</th>
<th>Function and role</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>HOSPI</td>
<td>Autonomous mobility vehicle robot to help provide medical support inside the hospital</td>
<td>[33]</td>
</tr>
<tr>
<td>MOXI</td>
<td>Diligent robotics to assist hospital staff with routine activities</td>
<td>[34]</td>
</tr>
<tr>
<td>Care-O-Bot</td>
<td>Mobile robot to help people in the home</td>
<td>[35]</td>
</tr>
<tr>
<td>Mario</td>
<td>Caring service robot for loneliness, isolation, and dementia in older persons</td>
<td>[36]</td>
</tr>
<tr>
<td>Maggie</td>
<td>Personal social robot to talk to users, entertain and train cognitive functions</td>
<td>[37]</td>
</tr>
<tr>
<td>Paro</td>
<td>Interactive therapeutic robot to stimulate patients with dementia and other complex cognitive disorders.</td>
<td>[38]</td>
</tr>
<tr>
<td>Milo</td>
<td>Humanoid robot for the education of children with autism at home</td>
<td>[39]</td>
</tr>
</tbody>
</table>

In the recent report regarding robotic systems for nursing care, they analyzed and classified 133 robotic systems based on a technical point (expanded from Haddadin S & Croft E) and a
use case classification[24]. Proximity and autonomy were considered for the interaction of robotics with the patient or caregiver and the degree of independent robot action, respectively. One of the primary roles of the nurse in care is to assist the patient. In triangular interaction among patients, nurses, and robots, active collaboration is required and needs to be developed for future prospects. In addition, the issue of care needs to be addressed broadly because of the increase in the elderly population with the nursing shortage. Although robotic systems in nursing care are of great interest to overcome the future challenges, the safety of human–robot interaction and ethics of caring need to be discussed in close proximity for nurses, patients, or both.

3. Nursing Ethical Considerations in AI and Robotics

3.1. Roboethics and levels of morality

With new technological developments and increases in robotic and AI capabilities, several organizations have been inspired to develop new principles and manifest[41]. In addition, Frank Pasquale has proposed four New Laws of Robotics in 2020, expanding the influential Asimov’s laws[42].

- Robotic systems and AI should complement professionals, not replace them.
- Robotic systems and AI should not counterfeit humanity.
- Robotic systems and AI should not intensity zero-sum arms races.
- Robotic systems and AI should always indicate the identity of their creator(s), controller(s), and owners(s).

The book reflects current implementation trends today, such as shattering privacy rights by centralized control of governments, undermining workplace protections, and ignoring diversity, which considers the morality of human actors[42]. The morality of robotics is distinguished into three levels[17][43].

- **Operational morality**: the moral significance and responsibility lie totally in the robot designer and user.
- **Functional morality**: an ethical robot has the ability to make moral judgments without direct top-down instructions from humans, and the designers can no longer predict the robot’s actions and their consequences.
- **Full morality**: the robot is so intelligent that is fully autonomously selecting its actions, and it is fully responsible for them.

As autonomy and ethical sensitivity are embedded in a robot, the more autonomy required, the more morality(ethical sensitivity) to increase the robot’s level of morality[44].

3.2. Principles of biomedical ethics and nursing code of ethics

According to Gallup, nurses are consistently rated highest in honesty and ethics[45]. Since Florence Nightingale founded the ‘Nightingale Pledge’ having a reputable and ethical profession, the ethical principles in nursing guide contemporary nursing. As a modification of the Hippocratic Oath, there are four main principles of ethics, which ultimately optimize daily nursing practice, patient care, and outcome.

- **Autonomy**: The patients have the right to make self-determination and decision-making.
- **Beneficence**: Kindness and charity require for the benefit and welfare of others.
- **Justice**: An element of fairness in all medical and nursing decisions and care considered regardless of the individual’s economic status, ethnicity, gender, etc.
- **Non-maleficence**: Nurses must do not harm intentionally, ensure the safety of the patients, avoid risk or negligent care, and minimize them.
These ethical principles are fundamental in nursing, given their roles as caregivers. Revised by the most significant change in 2015, the nurse’s code of ethics currently contains 9 provisions(interpretative statements), which can provide more specific guidance of nursing practice, consisting of the fundamental values and commitments(provisions 1-3), boundaries of duty and loyalty(provisions 4-6), and extended duties beyond patient interaction(provisions 7-9)[46]. As they demonstrate the respect of dignity, diversity, and rights of individuals, nurses learn the importance of morality and ethical behavior in nursing practice, continuing the knowledge throughout their careers.

The 4 principles of biomedical ethics have some limitations for solving complex ethical concerns related to AI; they need to be discussed and systematized before they become mature, focusing on the triangular relationship among AI, nurses, and patients. Based on the principle of autonomy, AI provides sufficient information to patients and obtains consent from them, and proper communication with healthcare workers is necessary. AI needs to consider patient safety first and do not harm and aggravate the patient’s condition. In addition, AI sufficiently provides to treat diseases and improve patients’ health conditions, and the service needs to be distributed equally without prejudice and discrimination regardless of medical problems.

### 3.3. Ethics guidelines for trustworthy AI

In 2018, the European Commission set out the vision for AI to support ‘ethical, secure and cutting-edge AI made in Europe’, with the aim of promoting Trustworthy AI[47]. AI systems need to be human-centered to improve human welfare and freedom. Therefore, the resolution focuses on the aspects of the roboethical framework, such as human-centered and embedded values in technology, decision-making, transparency and explainability of algorithms(the European Parliament(2019)). To maximize the benefits and prevent/minimize the risks of AI systems in a rapid technological change, trustworthy AI is the foundational ambition of the European Commission. There are three components of Trustworthy AI.

- **Lawful**: it should be lawful, complying with all applicable laws and regulations.
- **Ethical**: it should be ethical, ensuring adherence to ethical principles and values.
- **Robust**: it should be robust, both from a technical and social perspective, since, even with good intentions, AI systems can cause unintentional harm.

All three components are necessary to achieve and secure Trustworthy AI, ideally working them in harmony and overlapping in their operation. Fundamental human rights are the basis for ethical principles, and ethical reflection can help understand the development and use of AI systems. As a basis for Trustworthy AI, fundamental rights are ‘Respect of Human dignity, Freedom of the individual, Respect for democracy, justice and the rule of law, Equality, non-discrimination and solidarity, and Citizen’s rights’, which are legally obligatory in Europe. Four ethical principles, based on fundamental rights, are ‘Respect for human autonomy, Prevention of harm, Fairness, and Explicability’ specified as ethical imperatives. Therefore, to achieve Trustworthy AI, the principles must be translated into concrete requirements, and seven requirements of Trustworthy AI are summarized in <Table 4>. All of these requirements are equally important with mutual relationships and are applicable throughout the AI system’s life cycle to developers, deployers and end-users, and the broader society.

<table>
<thead>
<tr>
<th>Table 4. Seven requirements of trustworthy AI[47].</th>
</tr>
</thead>
<tbody>
<tr>
<td>Human agency and oversight</td>
</tr>
<tr>
<td>Technical robustness and safety</td>
</tr>
<tr>
<td>Privacy and data governance</td>
</tr>
</tbody>
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### 3.4. Ethical concerns and embedded ethics in healthcare

Rapid development and evolution of AI and robotics in healthcare certainly have the potential to help nurses improve the efficiency and quality of care\cite{48,49,50}. Even though AI-based technology promises a number of positive benefits, the new ethical issues and challenges have been identified, which are rooted in inherent inefficiency and unpredictability, creating unintentional harmful behaviors\cite{51,52}. The issue of risk has previously been considered, and it distinguishes three key types associated with evolution, multiplication risk (uncontrolled population growth due to high reproduction rates), maladaptation risk (unwanted harmful features of behaviors), and domination risk\cite{51}. As these risks of harm result from the control problem of semi/autonomous robotic systems, meaningful human control is necessary to mitigate and avoid safety risks. Thus, the risk of harm needs to be evaluated, and the precautionary measures are required to include: Centralized, externalized reproduction, Advanced prediction system, and Value loading\cite{53,54}. To maintain control, mitigate risks, and take precautions, careful ethical and methodological guidelines, as well as the relevant form of responsibility, need to be fully established for maximizing the benefits of AI. The ethical concerns surrounding AI and robotics have resulted in the explosive establishment of ethical principles by various public and private organizations worldwide\cite{52,55}. Ethical considerations in AI developers are particularly important in the development of AI-based healthcare settings, which interact with patients directly or indirectly. A recent paper proposed an ‘embedded ethics’ approach, referring to the ongoing practice of integration of ethics into the entire AI development process\cite{52}. This approach aims to anticipate and address any ethical and significant issues by collaboratively working and integrating ethics into development. Through the integration modes, practices, requisite expertise and training, embedded ethics will help to understand the ethical, social, and political dimensions of AI technologies.

### 4. Discussion

This paper summarized the recent development of AI-based technologies and robotics specially applied to nursing, and the following ethical requirement proposed by several organizations. As AI and robotics continue to mature, nurses and other healthcare workers need to participate in the development and evaluation process. Thus, they have a responsibility to ensure the safety of technology in order to be used safely, ethically, and positively affect healthcare. In a recent scoping literature review paper regarding AI-based technologies in nursing, none of the articles addressed the AI implementation or AI operational phase concerning the specific ethical research consideration, apart from stating an IRB approval in two-thirds of articles\cite{8}. In addition, they stated the lack of comprehensive evaluation of clinical nursing. To meet the ethical standards and promote ethical integrity, the core values of nursing need to be supported in AI-based technology. Although AI-based robotics performance is adequate, it might introduce unpredicted problems; thus, nurses need to play a vital role in guidelines on the safe adoption of the innovation and actively engage in using new technologies.

Since the COVID-19 pandemic, nurses have interacted remotely to deliver care, and AI is transforming the nurse’s roles in care delivery\cite{56,57,58,59}; AI can support non-nursing tasks.
and reduce the burden on nurses to spend more time with patient’s care. In healthcare, AI is typically defined as tools, such as machine learning, deep learning, neural networks, and natural language processing that transforms clinical data into knowledge autonomously. Therefore, nurses should possess an understanding of AI applications and their implications for nursing research and practice to improve patient care and clinical outcome. Nurses play an essential role in collecting data and must understand the relationship between data and AI technology or AI tools[60]. In addition, for the best clinical decisions using AI-based technologies in healthcare, careful ethical considerations and engagement with nurses in its implementation and evaluation are critical in developing reliable innovations. Nurses’ contribution and active participation in all stages of AI development are crucial in maximizing potential benefits and minimizing its risks in terms of nursing and patient outcomes. Therefore, including these efforts and the use of AI technologies in healthcare, further research should be conducted to reinforce nursing professionalism and improve patient outcomes for the quality of nursing.

5. References

5.1. Journal articles


5.2. Books


5.3. Additional references

6. Appendix

6.1. Authors contribution

<table>
<thead>
<tr>
<th>Initial name</th>
<th>Contribution</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lead Author</td>
<td>MK</td>
</tr>
<tr>
<td></td>
<td>- Set of concepts ✓</td>
</tr>
<tr>
<td></td>
<td>- Design ✓</td>
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<td></td>
<td>- Getting results ✓</td>
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<td></td>
<td>- Analysis ✓</td>
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<td>- Make a significant contribution to collection ✓</td>
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<td>- Final approval of the paper ✓</td>
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<td>- Corresponding ✓</td>
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<td>- Play a decisive role in modification ✓</td>
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<td></td>
<td>- Significant contributions to concepts, designs, practices, analysis and interpretation of data ✓</td>
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<td></td>
<td>- Participants in Drafting and Revising Papers ✓</td>
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<td></td>
<td>- Someone who can explain all aspects of the paper ✓</td>
</tr>
<tr>
<td>Corresponding Author*</td>
<td>BH</td>
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