

令和7年度 北海道大学大学院医理工学院 修士課程 課題論文（共通課題）

課題1及び課題2に答えよ。

課題1

かつて、医学分野において権威のある **Lancet** という学術誌において、日本人が放射線診断装置によって被ばくする線量によって、発がんのリスクが増加していることを指摘する論文^[1]が発表され、日本国内で大きな議論が起こった。その背景として、日本には人口当たりの放射線診断装置が他国に比べて圧倒的に多いということも一因となっていることが考えられる。下の図は各国の人口100万人当たりのCT保有台数を示す図である。

放射線診断分野のみならず、放射線治療、核医学分野などにおいても、各国の事情は異なっていると考えられる。医療機器の発展と普及に関して、放射線の便益とリスクの観点から自身の考えを600字以上800字以内で述べよ。

[1] Amy Berrington de Gonzalez and Sarah Darby, Risk of cancer from diagnostic X-rays: estimates for the UK and 14 other countries. *Lancet*, 363, 345-351, 2004.

著作権保護のため図は省略しています。出典を参照してください。

（出典：OECD Health Statistics 2022(<https://data.oecd.org/healtheqt/computed-tomography-ct-scanners.htm>) Computed tomography (CT) scanners に掲載されたデータを元にグラフ作成)

Examinee's number	
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Essay Examination (Common topic) for Master's Program
Graduate School of Biomedical Science and Engineering, Hokkaido University
(2025 enrollment)

Answer the following questions 1 - 2.

Question 1

Read the following paragraph and answer the question.

About 20 years ago, the Lancet, a prestigious journal in the medical field, published an article that pointed out the increased risk of cancer in Japan due to radiation exposure from diagnostic radiology equipment^[1], causing a big debate in Japan. The background of this controversy may be due in part to the fact that Japan has far more diagnostic radiology equipment per population than any other country. The figure below shows the number of CTs owned per million people in each country. The situation in each country is considered to be different not only in the field of diagnostic radiology, but also in the fields of radiation therapy and nuclear medicine.

Question

Describe your thoughts, in 40-50 lines, on the development and wide-spread use of medical equipment from the viewpoint of benefits and risks of radiation.

[1] Amy Berrington de Gonzalez and Sarah Darby, Risk of cancer from diagnostic X-rays: estimates for the UK and 14 other countries. Lancet, 363, 345-351, 2004.

Due to copyright protection, the figure has been omitted. Please refer to the source.

(Taken and generated a graph based on: *OECD Health Statistics 2022* (<https://data.oecd.org/healtheqt/computed-tomography-ct-scanners.htm>) Computed tomography (CT) scanners)

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課題2

2025年問題とは、日本の人口構成の変化により発生するさまざまな社会問題である。日本の人口は2010年から減少を続け、2025年には約800万人いる団塊の世代（1947～1949年生まれ）が後期高齢者（75歳以上）になり、国民の5人に1人が後期高齢者という超高齢社会を迎える。

後期高齢者になると病気やけがのリスクが高くなり、他の世代より医療費や介護費が多く必要になる。平均寿命が延びると認知症も増え、2025年には高齢者（65歳以上）の5人に1人が認知症になると予測されている。同時に少子化と労働人口減少も進み、医療従事者や介護従事者の不足、医療費や介護費を補助する国家財政の不足が予測され、社会全体への重大な影響が懸念される。

これらの2025年問題に対して、医理工学分野における研究や技術が貢献できる対策方法を、具体的に600字以上800字以内で論述せよ。

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Question 2

“The 2025 problem” is a variety of social problems caused by changes in Japan's population structure.

Japanese population has continued to decline since 2010, and by 2025, approximately 8 million baby boomers (born between 1947 and 1949) will be in the late-stage elderly (75 years or older). We are entering a super-aging society where one in five people will be a late-stage elderly person.

As people reach the later stages of their senior years, they are at higher risk of illness and injury, and require more medical and nursing care costs than other generations. As average life expectancy increases, dementia also increases, and it is predicted that by 2025, one in five elderly people (aged 65 and over) will have dementia. At the same time, the declining birth rate and declining working population are expected to lead to a shortage of medical and nursing care workers, as well as a shortage of national finances to support medical and nursing care costs. These factors raise concerns about significant impacts on society as a whole.

In 40 - 50 lines, write a concrete essay on how research and technology in the field of biomedical science and engineering can contribute to “the 2025 problem”.