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Monography

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Ю. В. Соколов
Т. Н. Рыбина

ЭЛЕМЕНТНЫЙ СОСТАВ КРОВИ ЧЕЛОВЕКА И РОЛЬ РЕДКОЗЕМЕЛЬНЫХ ЭЛЕМЕНТОВ В ОЦЕНКЕ ЗДОРОВЬЯ

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The text examines the role of chemical elements (including rare earth elements) in the human body and the importance of their balance for health and life expectancy. It describes a method for early diagnosis and risk assessment of serious diseases (primarily cardiovascular and oncological diseases) – the YUVS method (patent RU No. 2567336), developed by scientists at the “Spectrum” laboratory. In the course of the study, using inductively coupled plasma mass spectrometry (ICP MS), the elemental composition of the blood of more than 3,000 people (67 chemical elements) was analyzed. Two groups of indicator elements were identified: group B1 (europium, terbium, erbium, thulium, lutetium, and chromium) – their content in the blood is higher in healthy individuals and decreases in the presence of diseases; group B2 (vanadium, barium, palladium) – conversely, their concentration increases in the presence of pathologies. Based on the B1/B2 ratio, the YUVS coefficient has been calculated, which allows assessing the health status and assigning a person to one of three risk groups.

The results show a link between the balance of indicator elements and the body’s resistance to diseases and potential life expectancy (more than 90 years in individuals with a favourable profile). The potential of studying the elemental composition of blood for early diagnosis, risk assessment, disease prevention, and personalization of medical care is emphasised.

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С59 **Элементный состав крови человека и роль редкоземельных элементов в оценке здоровья** : монография / Ю. В. Соколов, Т. Н. Рыбина. – Чебоксары : Среда, 2026. – 80 с.

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В тексте рассматривается роль химических элементов (включая редкоземельные) в организме человека и значение их баланса для здоровья и продолжительности жизни. Описывается метод ранней диагностики и оценки риска развития серьёзных заболеваний (прежде всего сердечно-сосудистых и онкологических) – метод ЮВС (патент RU № 2567336), разработанный учёными лаборатории «Спектр». В ходе исследования с помощью масс-спектрометрии с индуктивно связанной плазмой (ИСП-МС) был проанализирован элементный состав крови более 3000 человек (67 химических элементов). Выделены две группы индикаторных элементов: группа В1 (европий, тербий, эрбий, тулий, лютеций и хром) – их содержание в крови выше у здоровых людей и снижается при наличии заболеваний; группа В2 (ванадий, барий, палладий) – их концентрация, напротив, повышается при наличии патологий. На основе соотношения В1/В2 рассчитан коэффициент ЮВС, позволяющий оценить состояние здоровья и отнести человека к одной из трёх групп риска.

Результаты демонстрируют связь между балансом индикаторных элементов и устойчивостью организма к заболеваниям, а также потенциальной продолжительностью жизни (свыше 90 лет у лиц с благоприятным профилем). Подчёркивается перспективность изучения элементного состава крови для ранней диагностики, оценки рисков, профилактики заболеваний и персонализации медицинской помощи.

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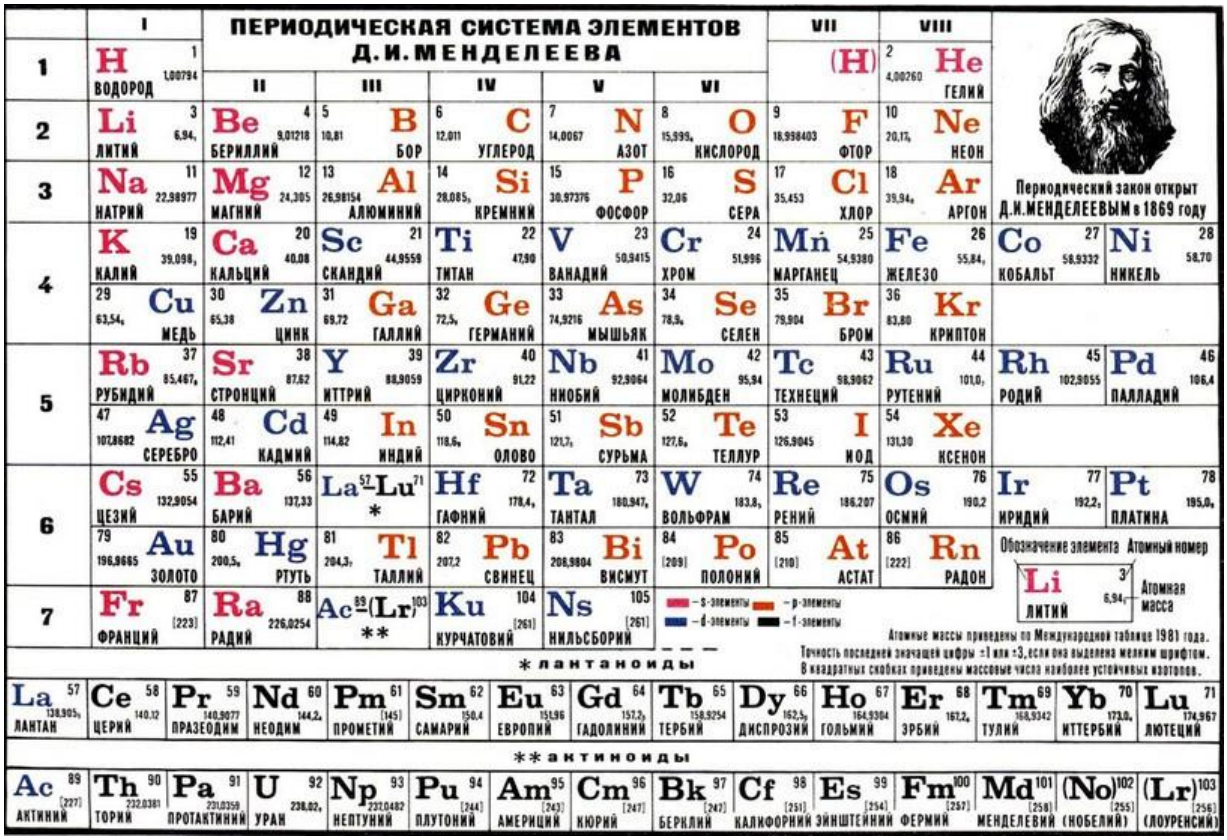
The human body is a complex biochemical system involving all chemical elements of the periodic table. They perform a variety of functions – from tissue formation to the regulation of metabolic processes. A person's elemental status defines the qualitative and quantitative content of chemical elements in the human body; this indicator allows one to assess elemental imbalances and, consequently, health risks.

The concentrations of chemical elements in various human organs and tissues do not necessarily remain constant over a lifetime. Accurate data on the content of most elements are scarce or non-existent.



The content of chemical elements in the human body changes with age, fluctuating towards either accumulation or dispersion, i. e., deficiency.

One of the main factors contributing to the declining adaptive capabilities of the human body is a disrupted elemental homeostasis. In this regard, the most optimal methodology for health protection is pre-nosological diagnosis and the timely correction of functional disorders. The obvious advantage of this strategy is that corrective intervention can be performed relatively easily, since, at the early stages of maladaptation processes, the body still possesses most of its protective resources.

In 2014, after many years of preparatory experimental work, the scientists at the Spectrum laboratory confirmed the validity of a method for early prediction and risk assessment of fatal (cardiovascular and oncological) diseases – the "Method for diagnosing diseases using indicator elements", or the "YUVS Method"*. In the scientific literature, it has also become known as the "YUVS Diagnostic Method". *Patent RU No. 2567336 dated 6 October 2015, application No. 2014118321 dated 7 May 2014.

The facilities of the independent Spectrum Laboratory for Spectral Research, which specialises in analysing a wide range of chemical elements (67 chemical elements) by employing a modern and highly sensitive method of inductively coupled plasma mass spectrometry (ICP-MS) and an Elan DRC-e mass spectrometer (registration number 26441-04 dated 23 September 2009), were used to conduct a study on the blood of more than 3,000 people to determine the presence, deficiency, or absence of all known elements, including rare ones. This made it possible to obtain completely unique clinical material.

Among all 67 analysed chemical elements, exactly five heavy rare-earth elements (europium, terbium, erbium, thulium, and lutetium) were identified as playing a key role in the studied biomaterial – blood samples from people both with and without cardiovascular diseases (CVD) and oncological diseases (OD), which are the most common conditions significantly reducing life expectancy.

This analysis enabled the scientists to identify two special groups of elements with a pronounced content in the blood of healthy people and those with cardiovascular and oncological diseases.

The first group includes these five lanthanides from the rare-earth element group (europium, terbium, erbium, thulium, and lutetium) and chromium, which in human blood serve as indicators of the presence, absence, or predisposition to CVD and OD. Their content is higher in the blood of healthy individuals and lower in those with cardiovascular and oncological diseases.

Of all the chemical elements, it is precisely the content of europium, terbium, erbium, thulium, lutetium, and chromium that becomes deficient in the presence of diseases, as they can be considered a potential reserve for the entire organism, which begins to be depleted once OD or CVD has been diagnosed.

The second group comprises three elements (vanadium, barium, and palladium) that behave in the opposite way: their blood content increases in the presence of diseases and remains relatively low in healthy individuals.

For clarity, the researchers assigned the first five rare elements to group B1 and the other three elements to group B2.

$$Y = B1 / B2$$

By dividing the first value by the second one (B1/B2), the researchers derived a coefficient that clearly demonstrated the difference between the positive and negative elements affecting health. The higher the B1 value and the lower the B2 value, the higher the individual's health coefficient.

The resulting coefficient was named the YUVS coefficient and became fundamental in determining how healthy a person was; it also allowed all examined individuals to be divided into three main groups.

By analysing the graph results, we came to the following conclusion:

The study demonstrated that healthy people have a longer life expectancy i. e., they live for more than 90 years, which is associated with the fact that the set of heavy rare-earth elements or indicator elements (B1) increases the body's resistance to various types of diseases due to their values.

Below are graphical materials showing the content of all 67 chemical elements in the blood of healthy people, as well as those with cardiovascular and oncological diseases.

The impact of various factors on the human and animal body has a diverse effect on life processes, including the metabolism of trace elements. Currently, increasing attention is being paid to the relationship between diseases of various etiologies and the content of chemical elements in the human body, particularly in the blood.

A deficiency of elements in the body acts as a triggering mechanism for pathogenesis.

The pharmacological and biological properties of rare-earth elements are being intensively studied; however, many aspects of their influence on biological objects remain unclear to date. Rare-earth elements are necessary for the normal functioning of the body and are capable of influencing various biological processes. As effective complexing agents, they bind with many organic ligands (carbohydrates, amino acids, oxyacids, nucleotides, phosphatides, and vitamins). Rare-earth elements are present in every living cell, but when the body begins to fall ill, these elements start to deplete, leading to a deficiency.

Some rare-earth elements (REEs) are used for medical purposes due to their specific properties.

REEs possess antimicrobial and anticoagulant properties, which can potentially be used in medicine.

Modern science increasingly confirms that human health depends on a delicate balance of chemical elements. A deficiency or an excess of even trace concentrations can lead to serious metabolic disorders and trigger pathogenesis.

Studies of the elemental composition of blood open up new opportunities for:

- ✓ early disease diagnosis;
- ✓ risk assessment;
- ✓ preventive medicine;
- ✓ a personalised approach to treatment.

The method for assessing the elemental status and the YUVS coefficient demonstrates the viability of a field in which biochemistry, spectral analysis, and clinical medicine combine to provide a deeper understanding of the mechanisms of health and longevity.

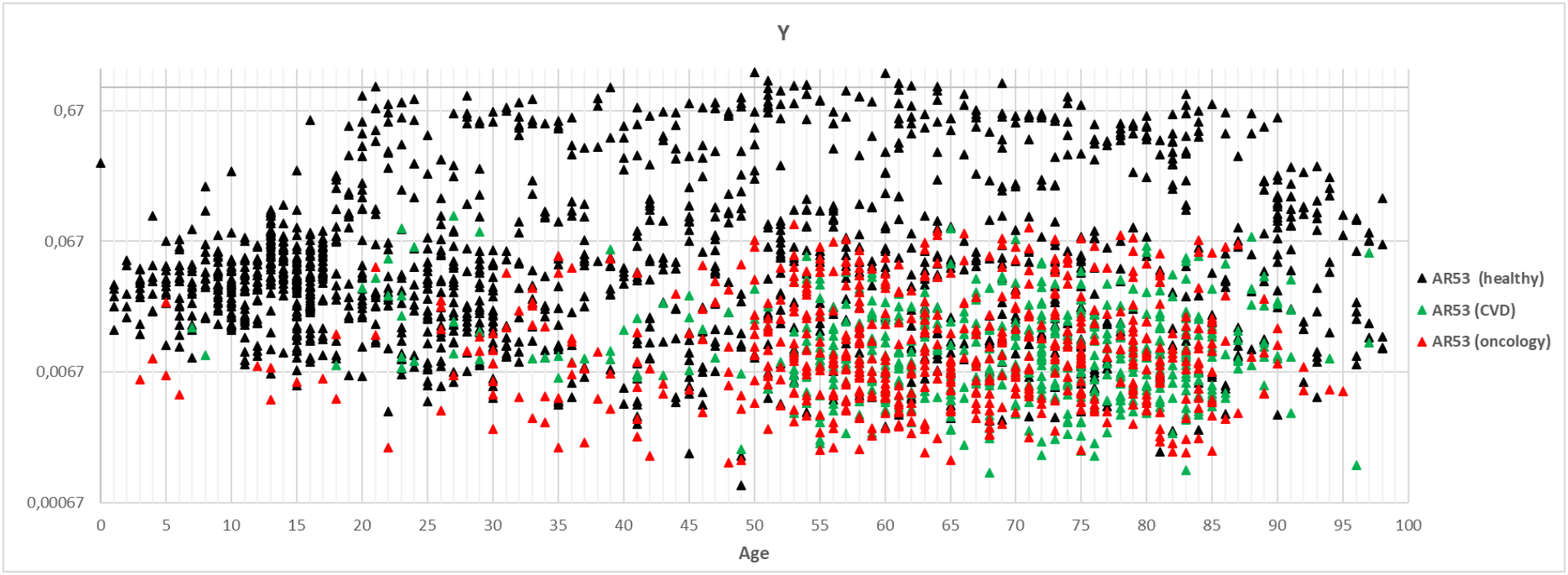
Chemical elements form the foundation of human physiological activity. Macronutrients form tissues and support basic bodily functions, micronutrients regulate metabolism, and rare-earth elements may play a much more important role than previously recognized.

The study of the elemental composition of blood is becoming one of the promising areas of modern medicine. The analysis of rare and ultratrace elements can help in the early detection of pathological processes, the assessment of biological age, and the prediction of risks for serious diseases.

Further research in this area will provide a deeper understanding of the relationship between elemental balance, the body's resilience, and human life expectancy.

The balance of all elements is critically important for health: a deficiency or excess can lead to serious disorders. Further studies will help to better understand the role of each element and develop new approaches to disease prevention and treatment.

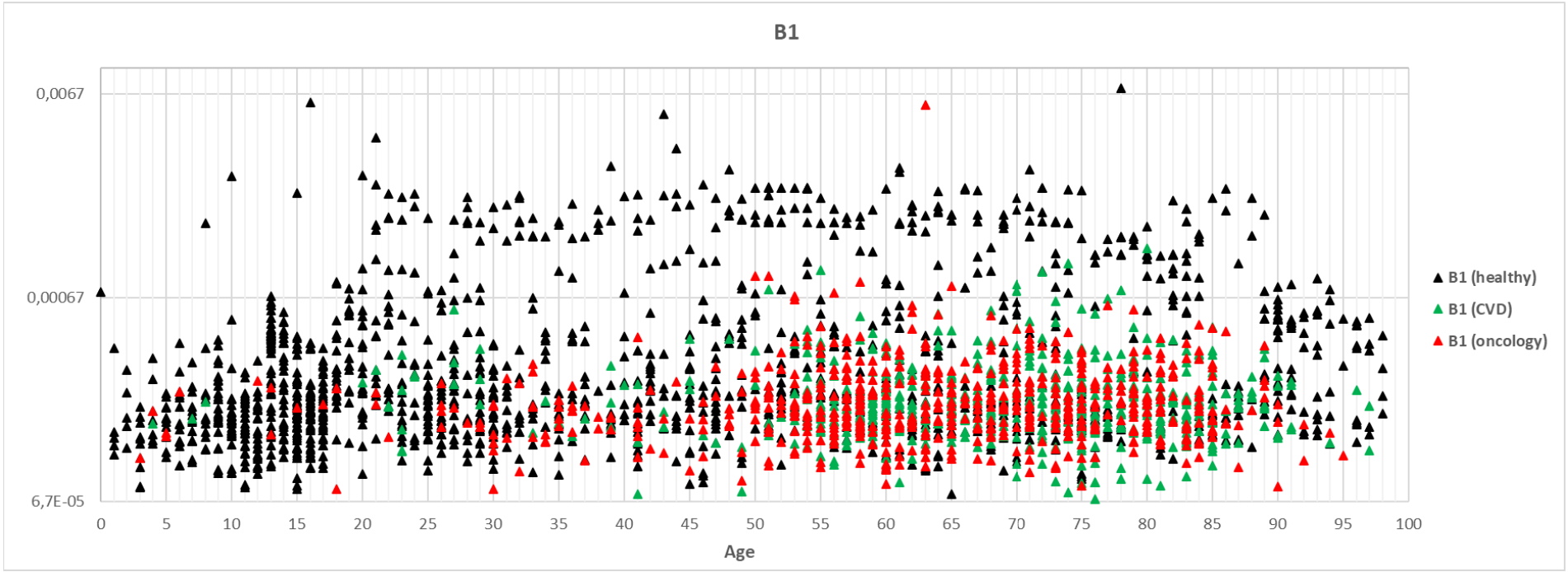
Research has shown that the content of the five rare-earth elements (europium, terbium, erbium, thulium, and lutetium) as well as chromium in the blood of healthy people is statistically significantly higher compared to patients suffering from various diseases, including oncological ones. At the same time, the opposite pattern is observed for elements such as vanadium, palladium, and barium: their blood concentration is higher in patients with diseases than in healthy individuals.

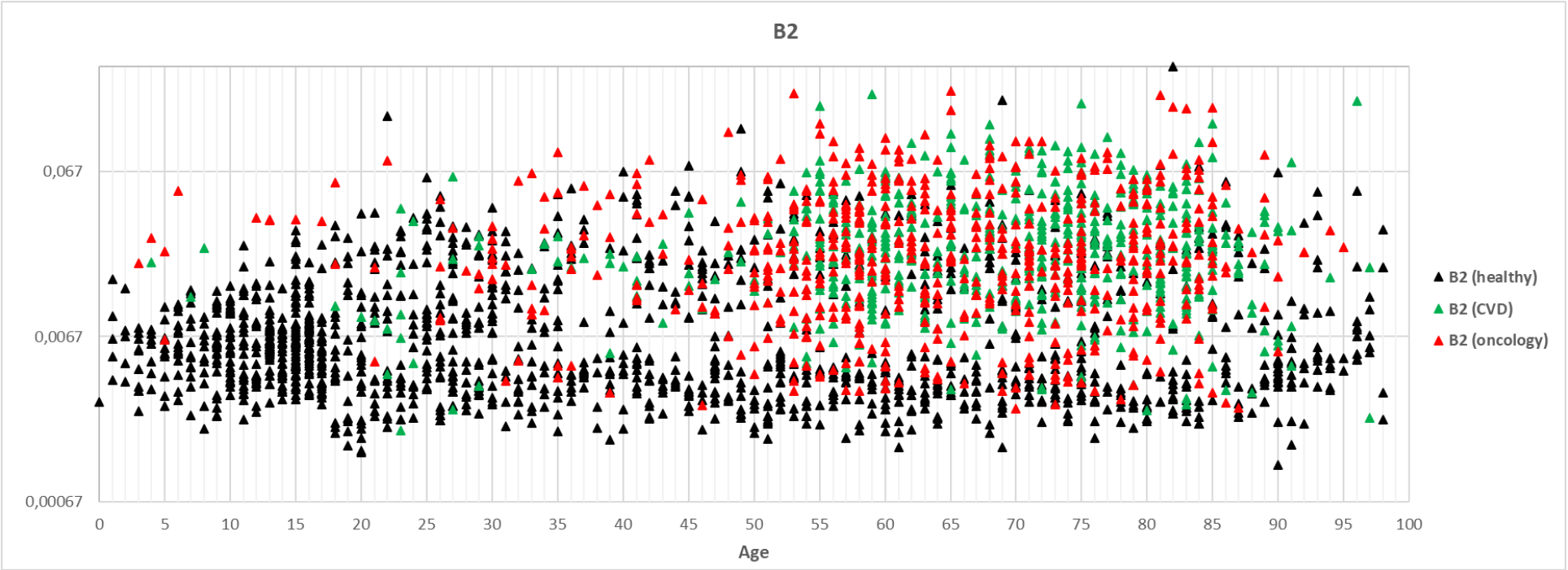


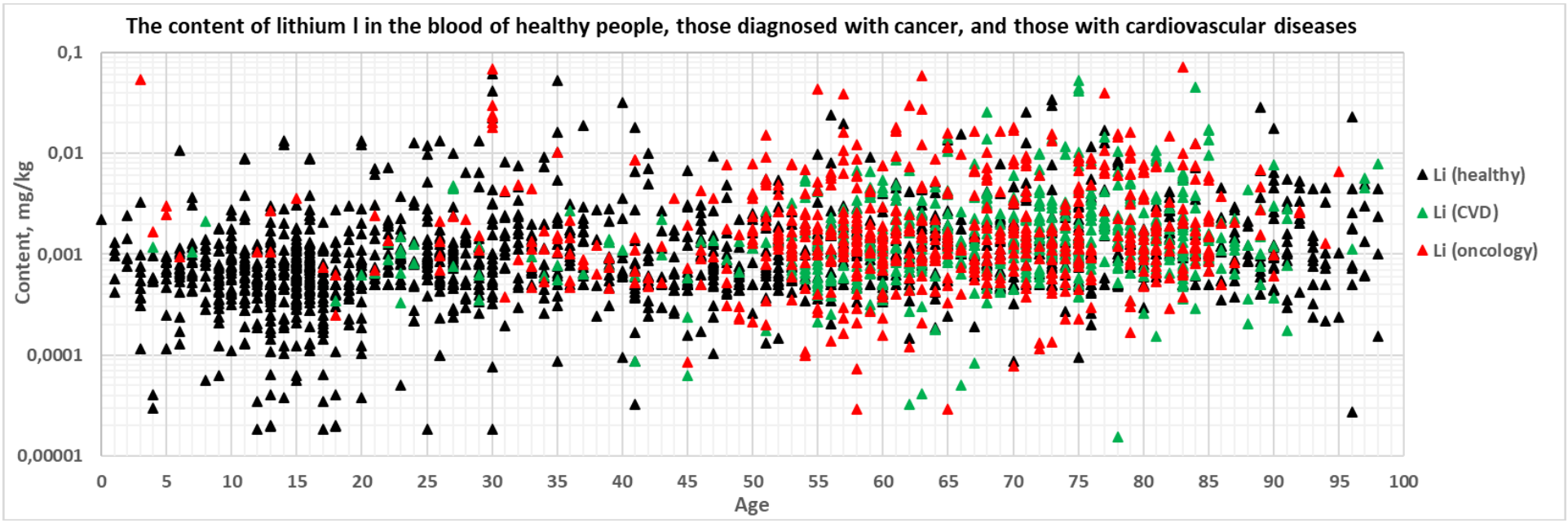
$$B1 = 10^{-3} * 3 * Cr + 5 * (Eu + Tb + Er + Tm + Lu + Ta)$$

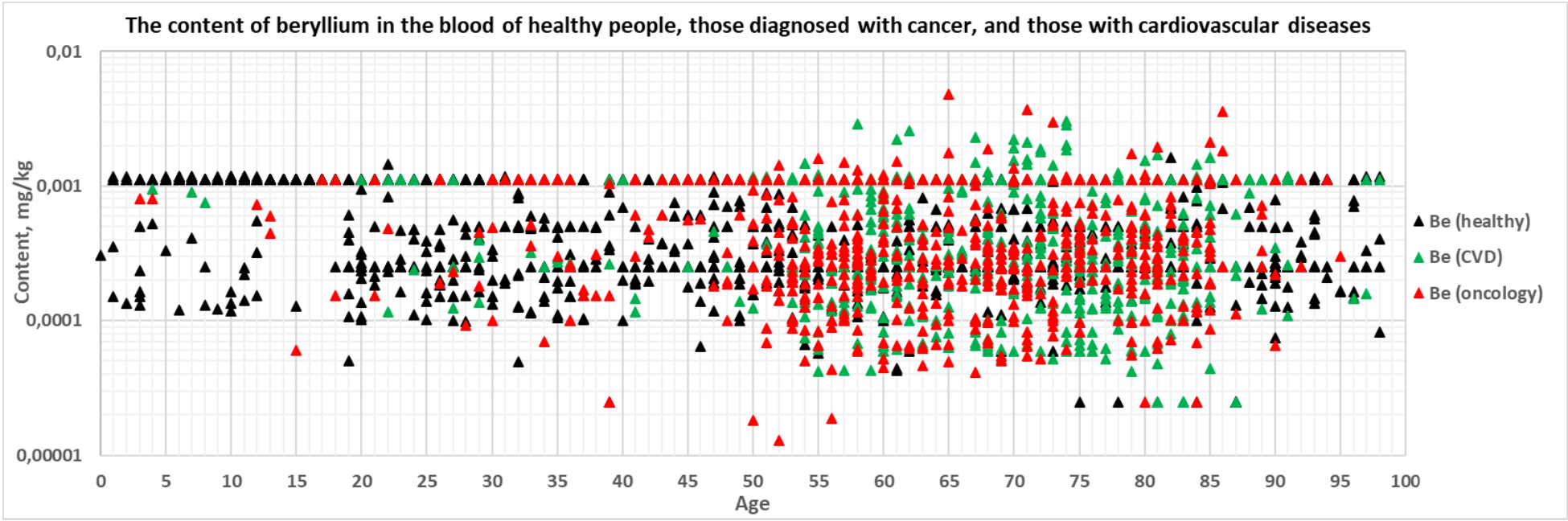
$$B_2 = 10^{-1} * (V + 4 * Ba) + 5 * Pd$$

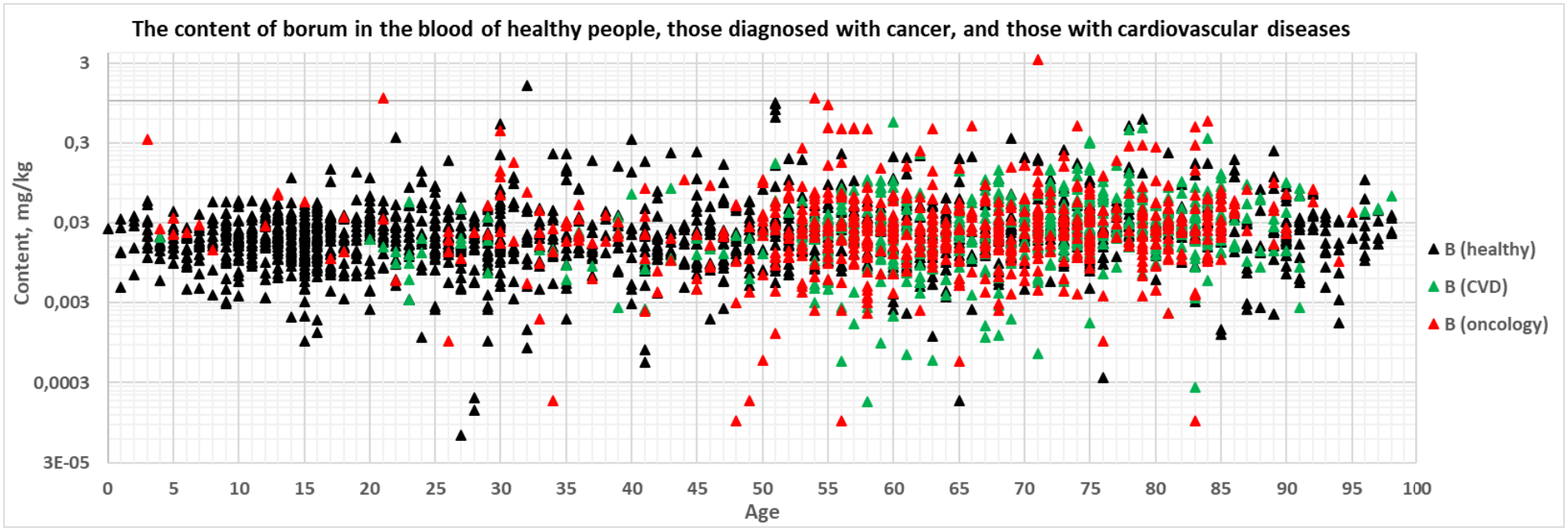
$$Y = B1 / B2$$

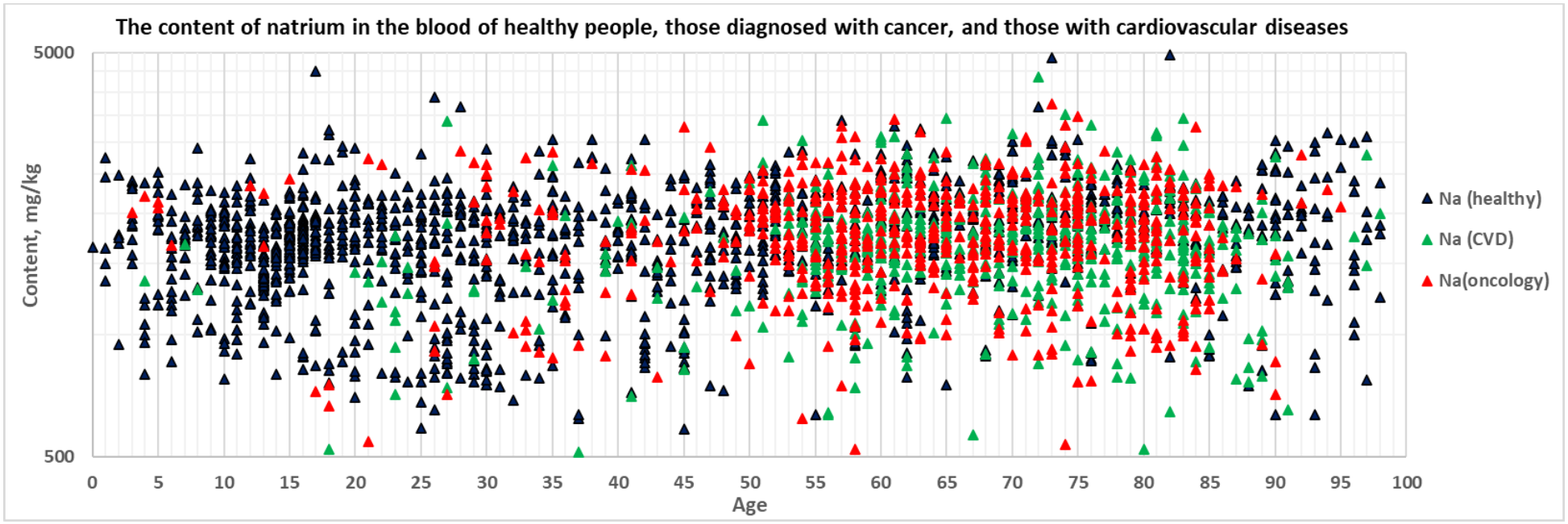

B1
0,0067
0,00067
6,7E-05
0
5
10
15
20
25
30
35
40
45
50
55
60
65
70
75
80
85
90
95
100
Age
B1 (healthy)
B1 (CVD)
B1 (oncology)

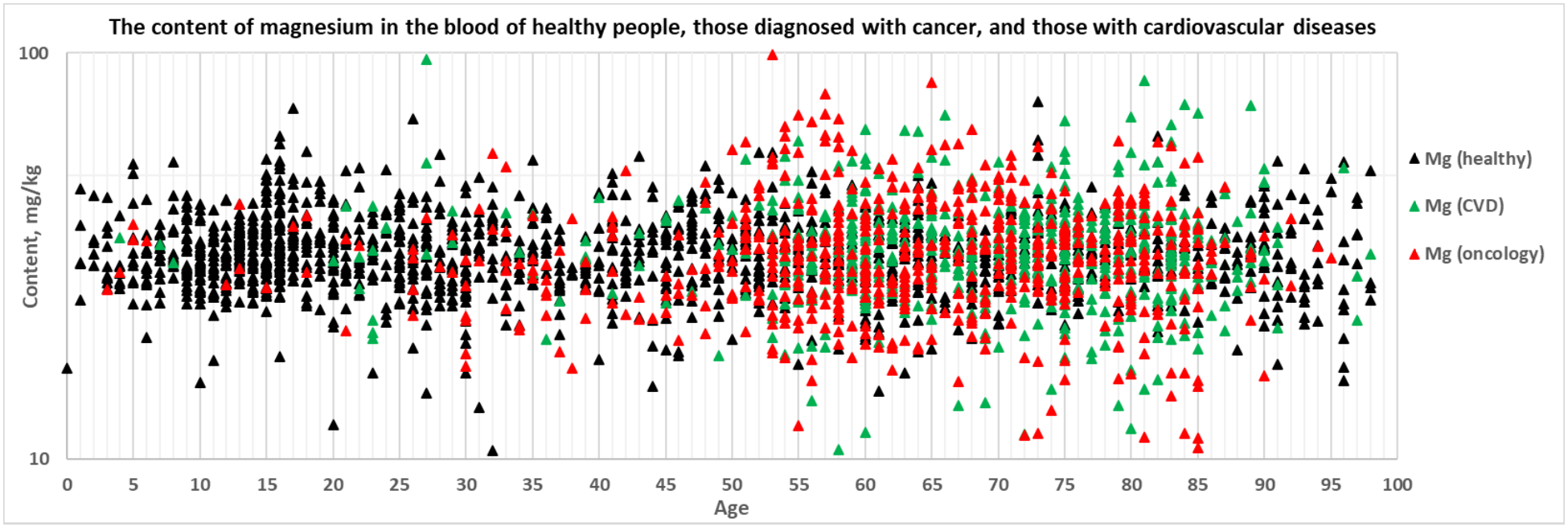

B2
0,067
0,0067
0,00067
0
5
10
15
20
25
30
35
40
45
50
55
60
65
70
75
80
85
90
95
100
Age
B2 (healthy)
B2 (CVD)
B2 (oncology)

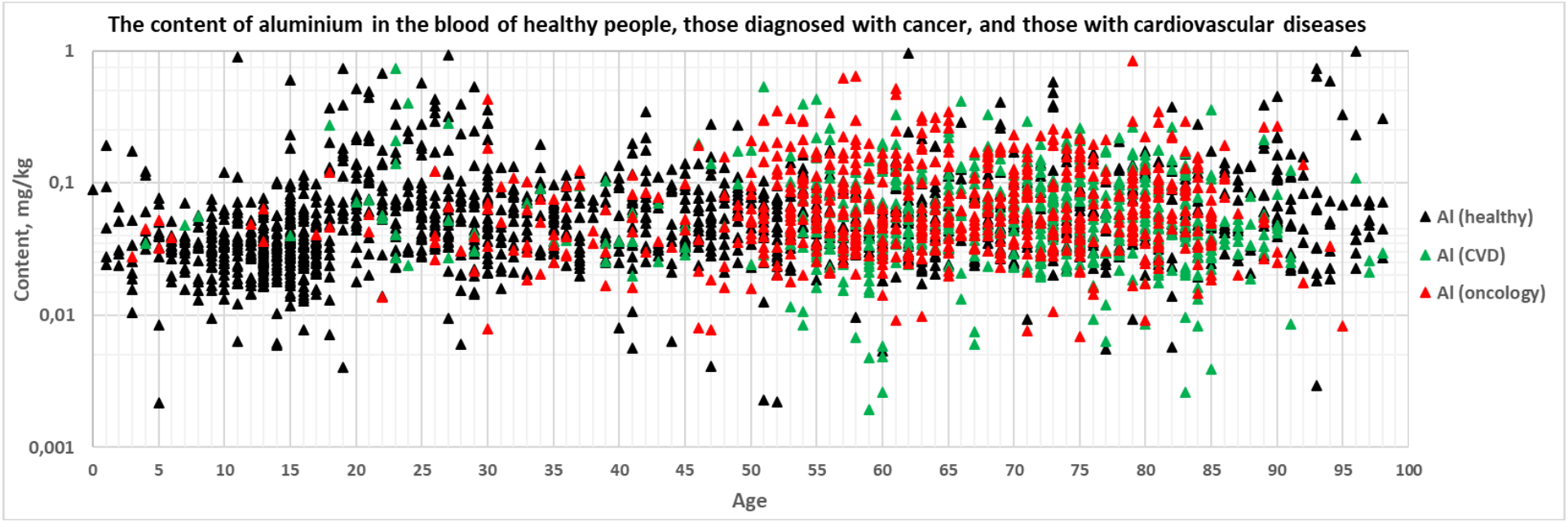

The content of lithium l in the blood of healthy people, those diagnosed with cancer, and those with cardiovascular diseases
Content, mg/kg
0,1
0,01
0,001
0,0001
0,00001
0
5
10
15
20
25
30
35
40
45
50
55
60
65
70
75
80
85
90
95
100
Age
Li (healthy)
Li (CVD)
Li (oncology)

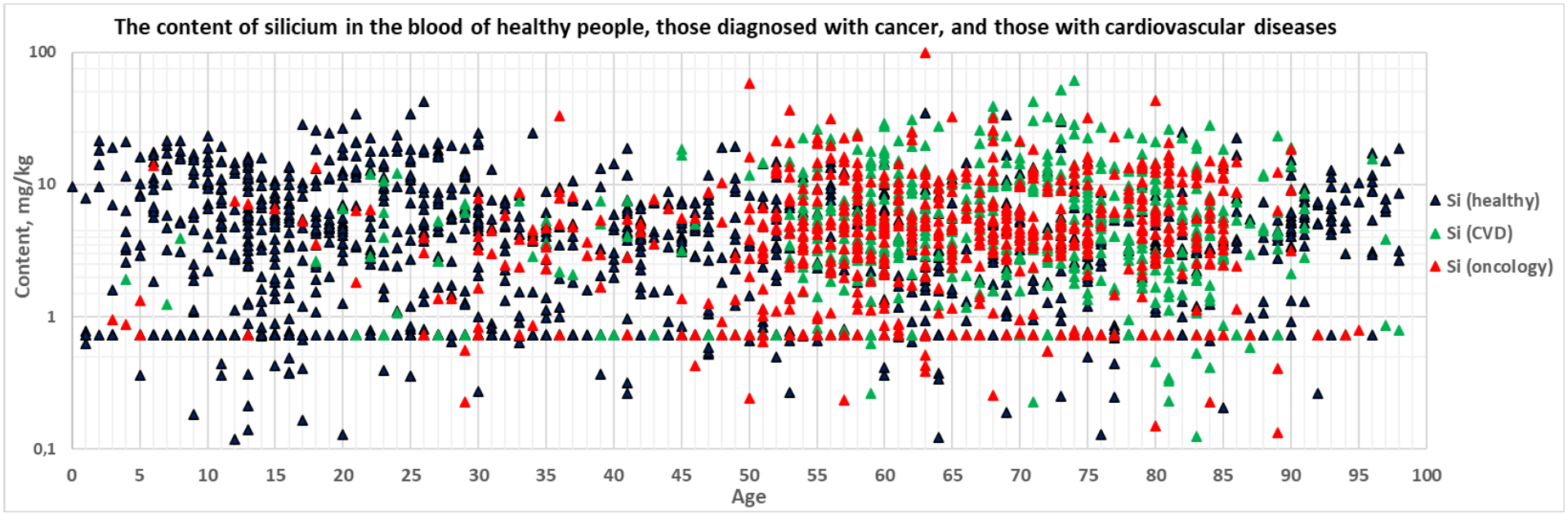

The content of beryllium in the blood of healthy people, those diagnosed with cancer, and those with cardiovascular diseases
Content, mg/kg
0,01
0,001
0,0001
0,00001
0
5
10
15
20
25
30
35
40
45
50
55
60
65
70
75
80
85
90
95
100
Age
Be (healthy)
Be (CVD)
Be (oncology)

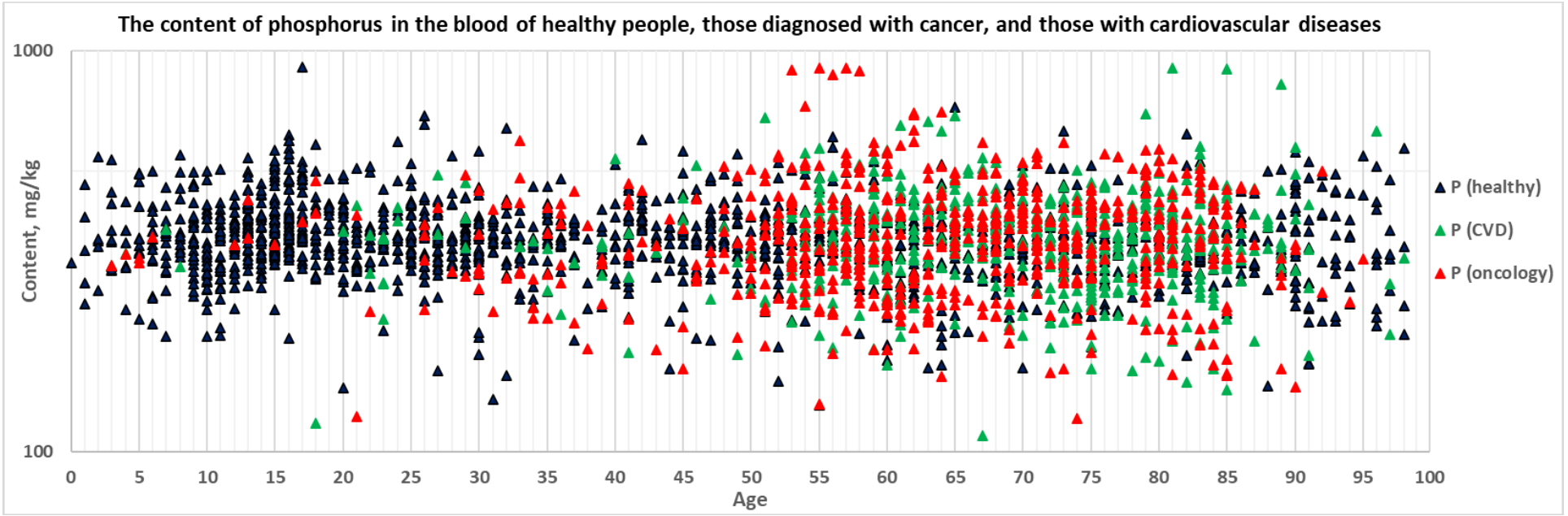

The content of borum in the blood of healthy people, those diagnosed with cancer, and those with cardiovascular diseases
Content, mg/kg
3
0,3
0,03
0,003
0,0003
3E-05
0
5
10
15
20
25
30
35
40
45
50
55
60
65
70
75
80
85
90
95
100
Age
B (healthy)
B (CVD)
B (oncology)

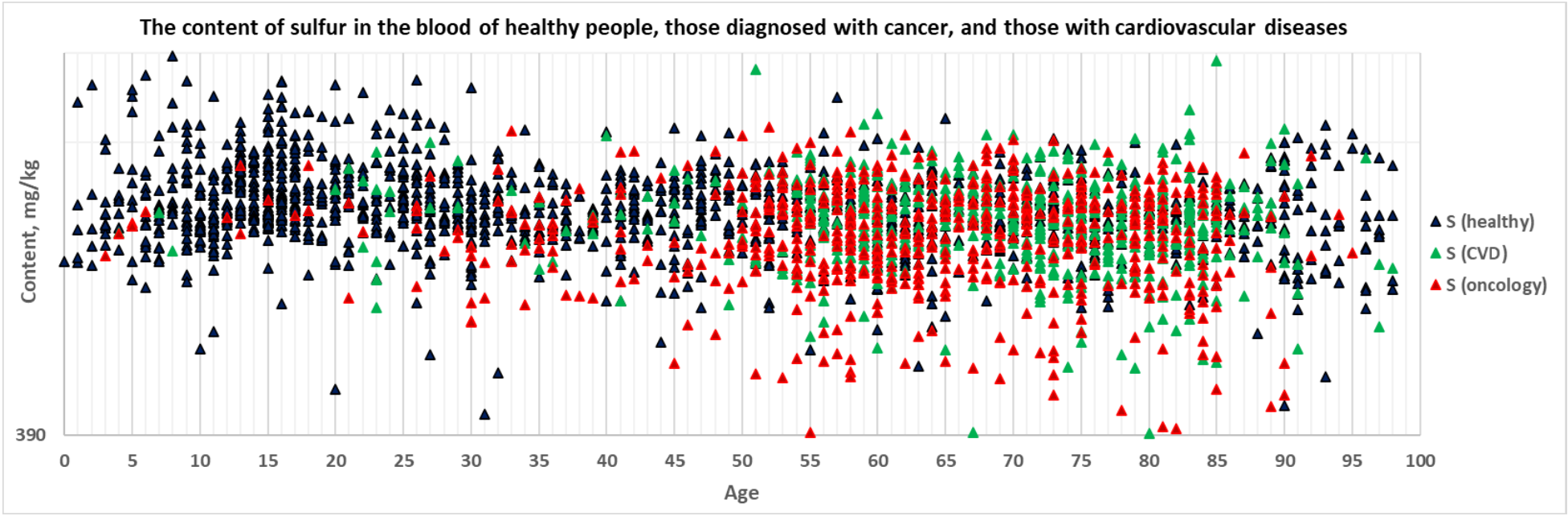

The content of natrium in the blood of healthy people, those diagnosed with cancer, and those with cardiovascular diseases
5000
500
Content, mg/kg
0
5
10
15
20
25
30
35
40
45
50
55
60
65
70
75
80
85
90
95
100
Age
Na (healthy)
Na (CVD)
Na(oncology)

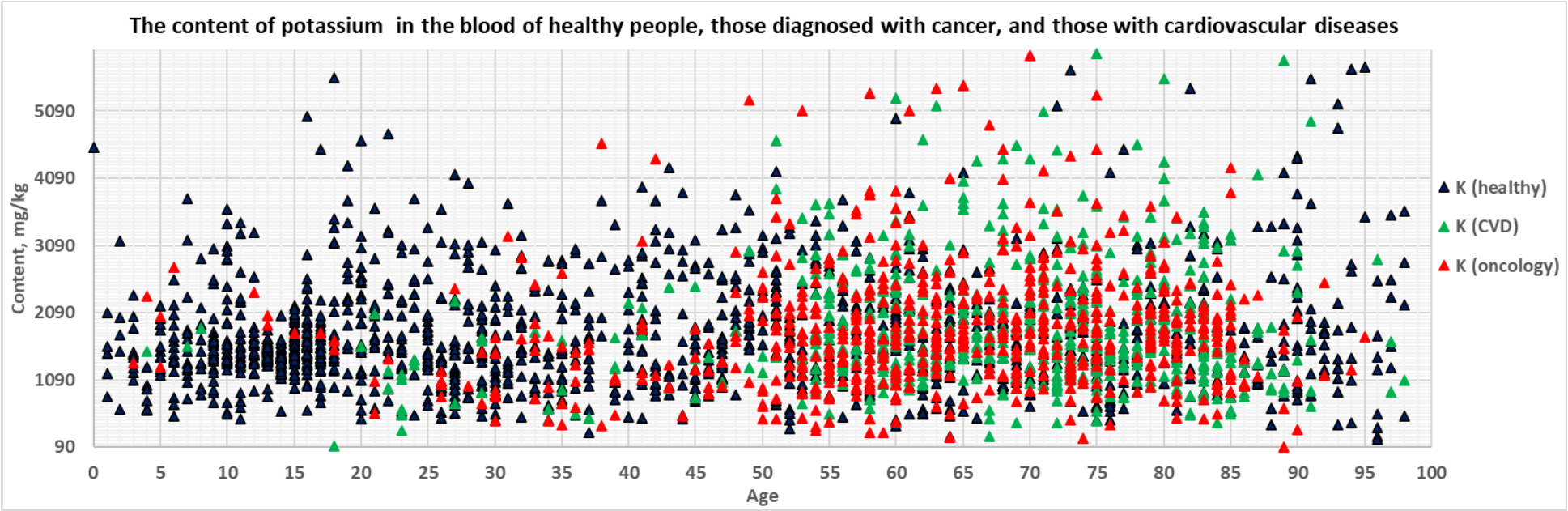

The content of magnesium in the blood of healthy people, those diagnosed with cancer, and those with cardiovascular diseases
100
10
Content, mg/kg
0
5
10
15
20
25
30
35
40
45
50
55
60
65
70
75
80
85
90
95
100
Age
Mg (healthy)
Mg (CVD)
Mg (oncology)

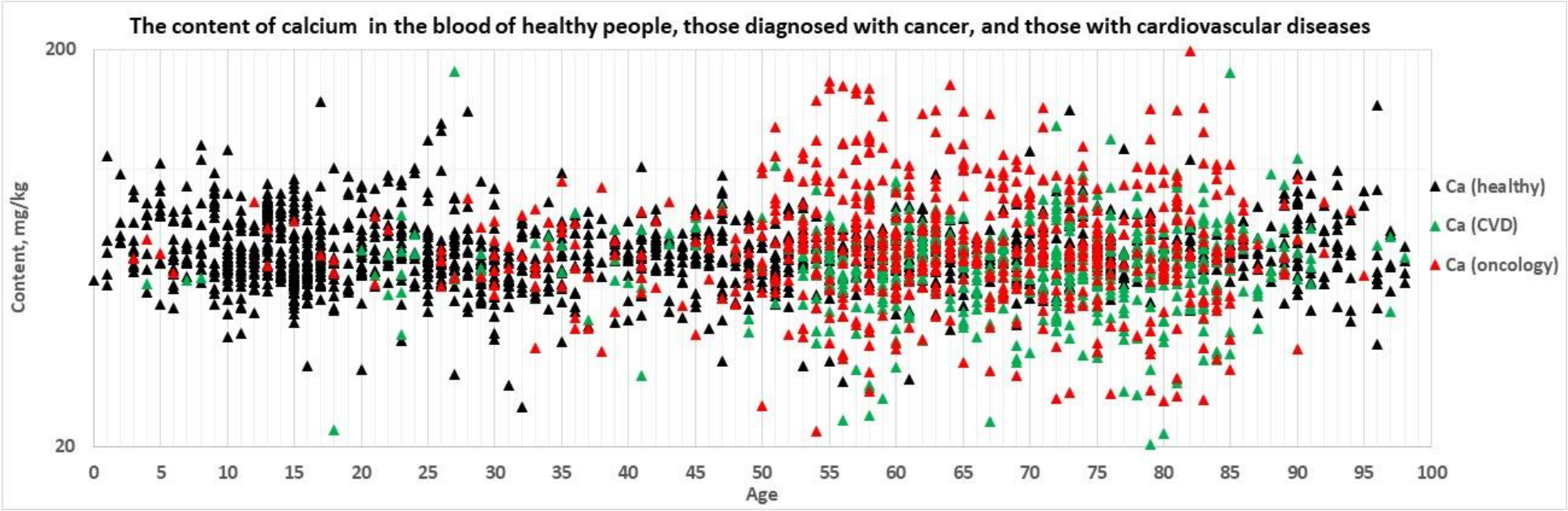

The content of aluminium in the blood of healthy people, those diagnosed with cancer, and those with cardiovascular diseases
Content, mg/kg
1
0,1
0,01
0,001
0
5
10
15
20
25
30
35
40
45
50
55
60
65
70
75
80
85
90
95
100
Age
Al (healthy)
Al (CVD)
Al (oncology)

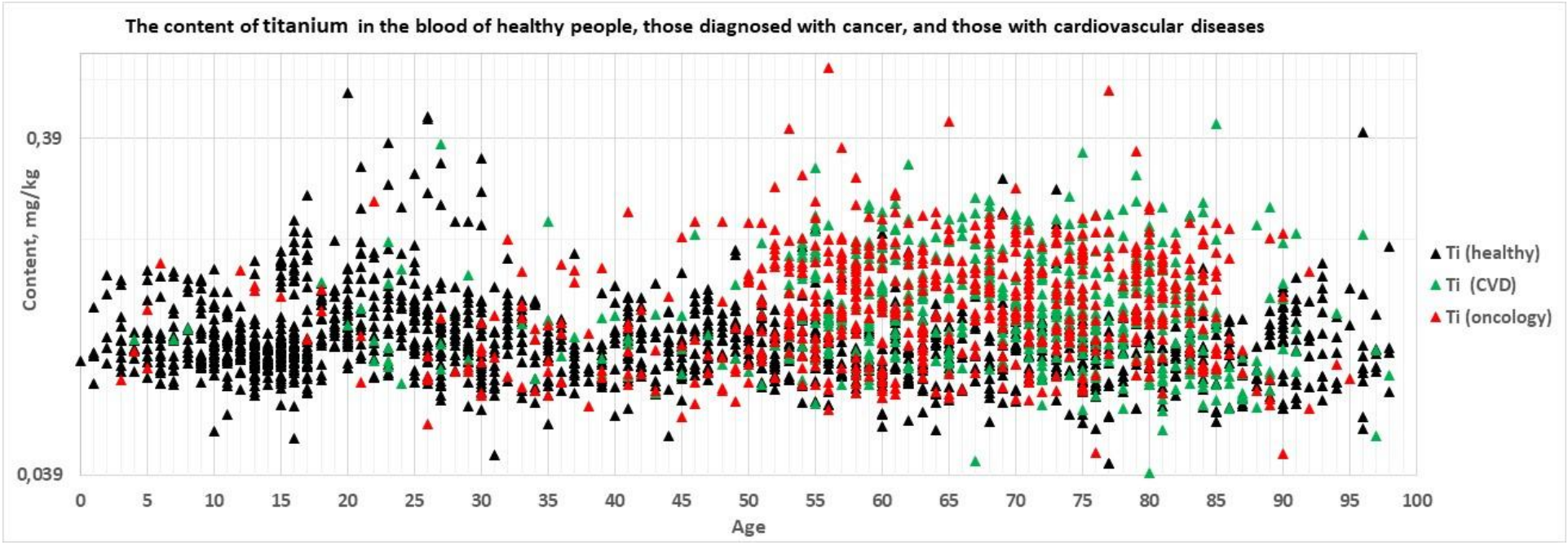

The content of silicium in the blood of healthy people, those diagnosed with cancer, and those with cardiovascular diseases
Content, mg/kg
100
10
1
0,1
0
5
10
15
20
25
30
35
40
45
50
55
60
65
70
75
80
85
90
95
100
Age
Si (healthy)
Si (CVD)
Si (oncology)

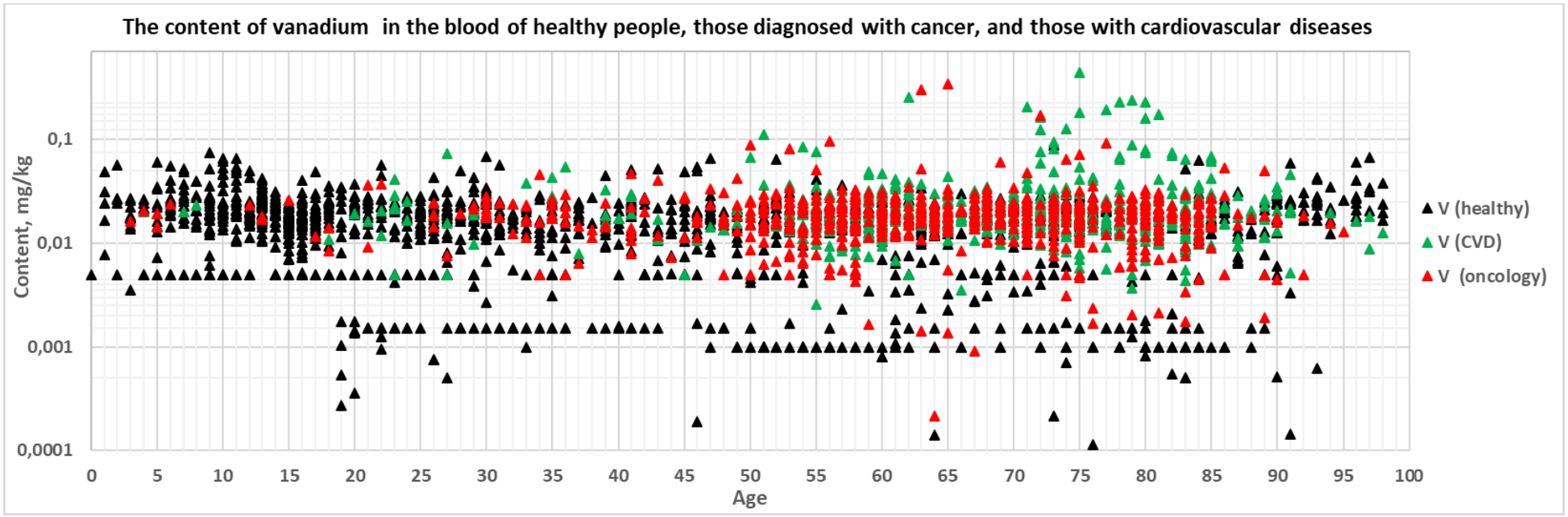

The content of phosphorus in the blood of healthy people, those diagnosed with cancer, and those with cardiovascular diseases
1000
100
Content, mg/kg
0
5
10
15
20
25
30
35
40
45
50
55
60
65
70
75
80
85
90
95
100
Age
P (healthy)
P (CVD)
P (oncology)

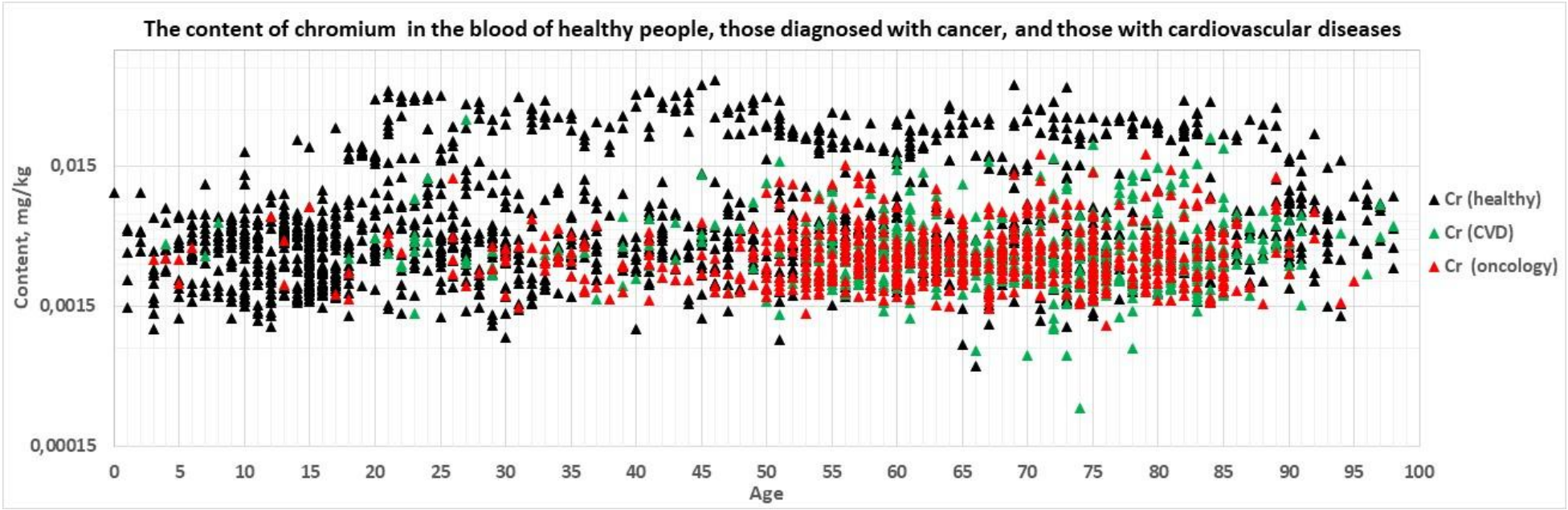

The content of sulfur in the blood of healthy people, those diagnosed with cancer, and those with cardiovascular diseases
Content, mg/kg
390
0
5
10
15
20
25
30
35
40
45
50
55
60
65
70
75
80
85
90
95
100
Age
S (healthy)
S (CVD)
S (oncology)

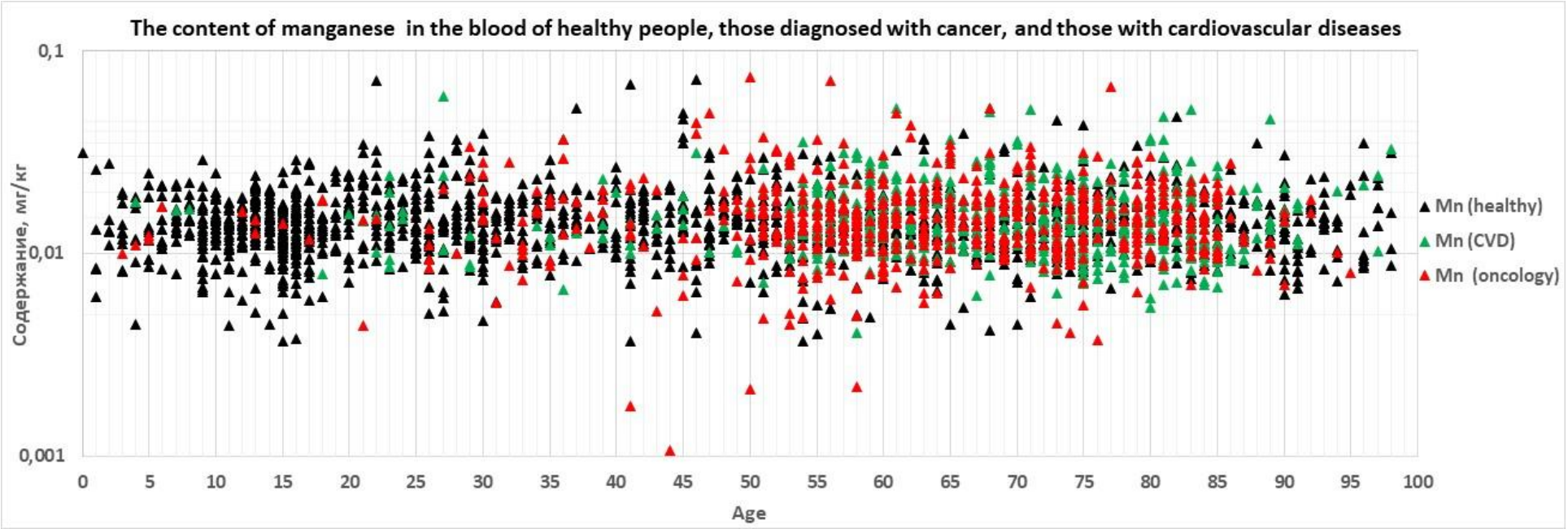

The content of potassium in the blood of healthy people, those diagnosed with cancer, and those with cardiovascular diseases
Content, mg/kg
5090
4090
3090
2090
1090
90
0
5
10
15
20
25
30
35
40
45
50
55
60
65
70
75
80
85
90
95
100
Age
K (healthy)
K (CVD)
K (oncology)

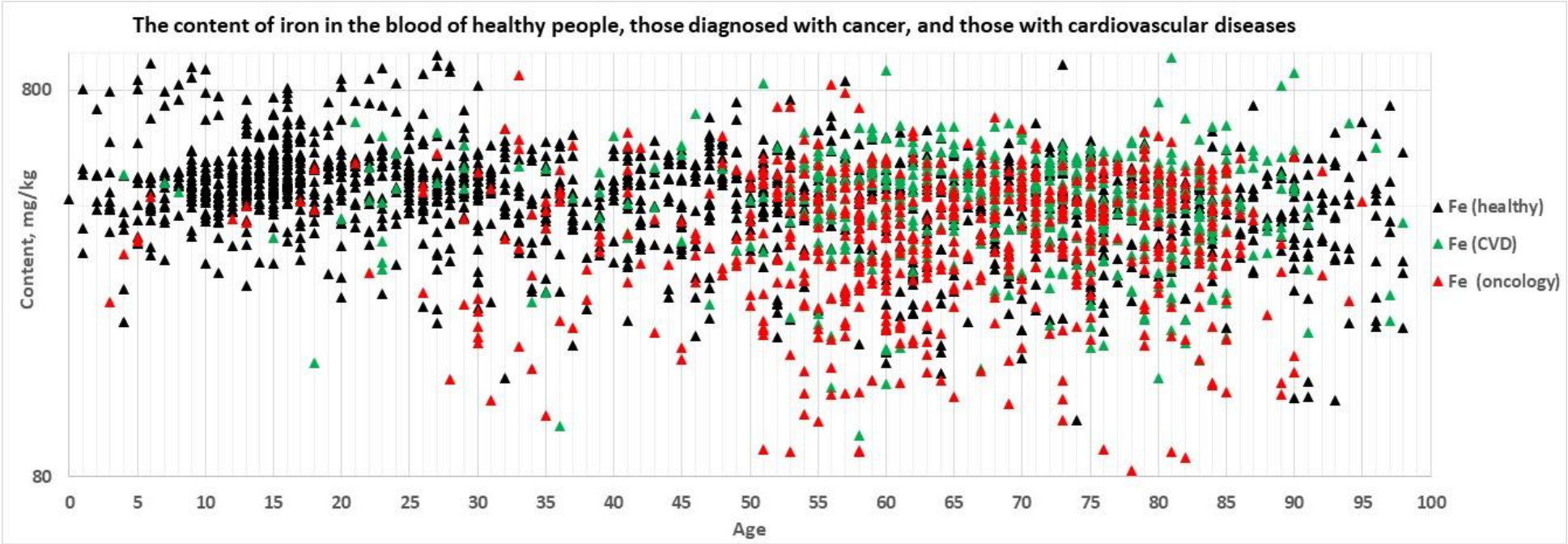

The content of calcium in the blood of healthy people, those diagnosed with cancer, and those with cardiovascular diseases
Content, mg/kg
200
20
0
5
10
15
20
25
30
35
40
45
50
55
60
65
70
75
80
85
90
95
100
Age
Ca (healthy)
Ca (CVD)
Ca (oncology)

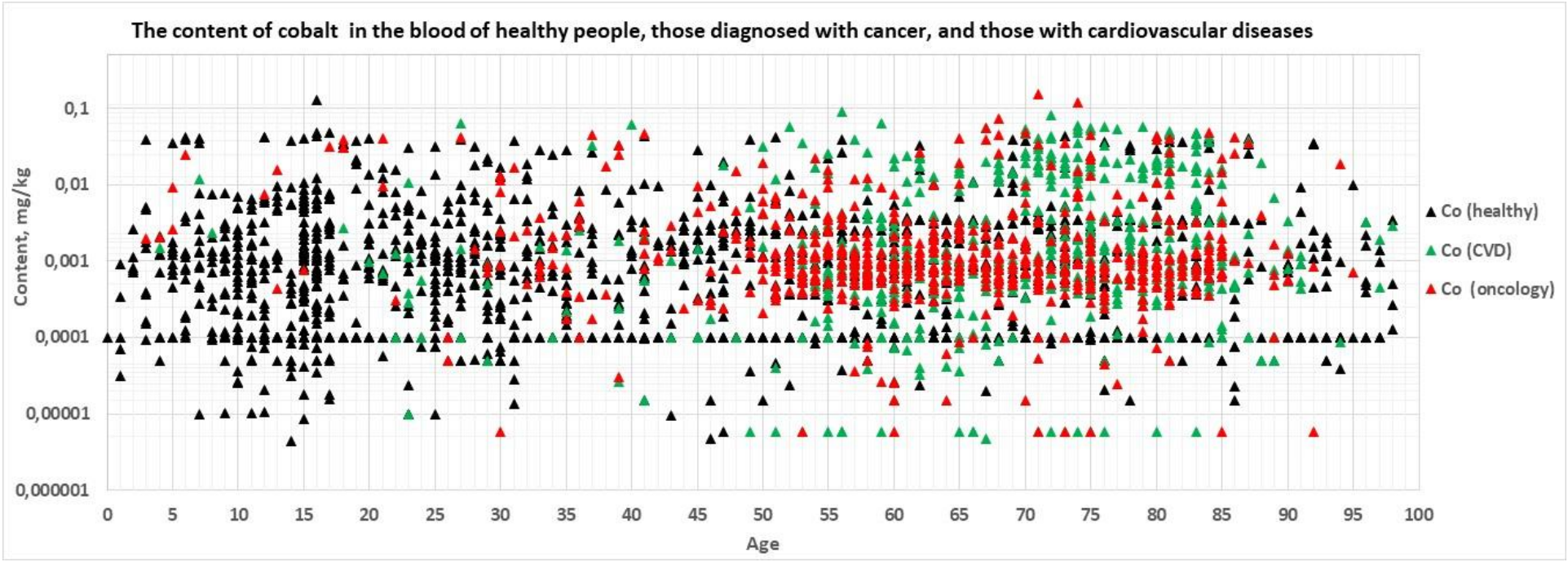

The content of titanium in the blood of healthy people, those diagnosed with cancer, and those with cardiovascular diseases
Content, mg/kg
0,39
0,039
0
5
10
15
20
25
30
35
40
45
50
55
60
65
70
75
80
85
90
95
100
Age
Ti (healthy)
Ti (CVD)
Ti (oncology)

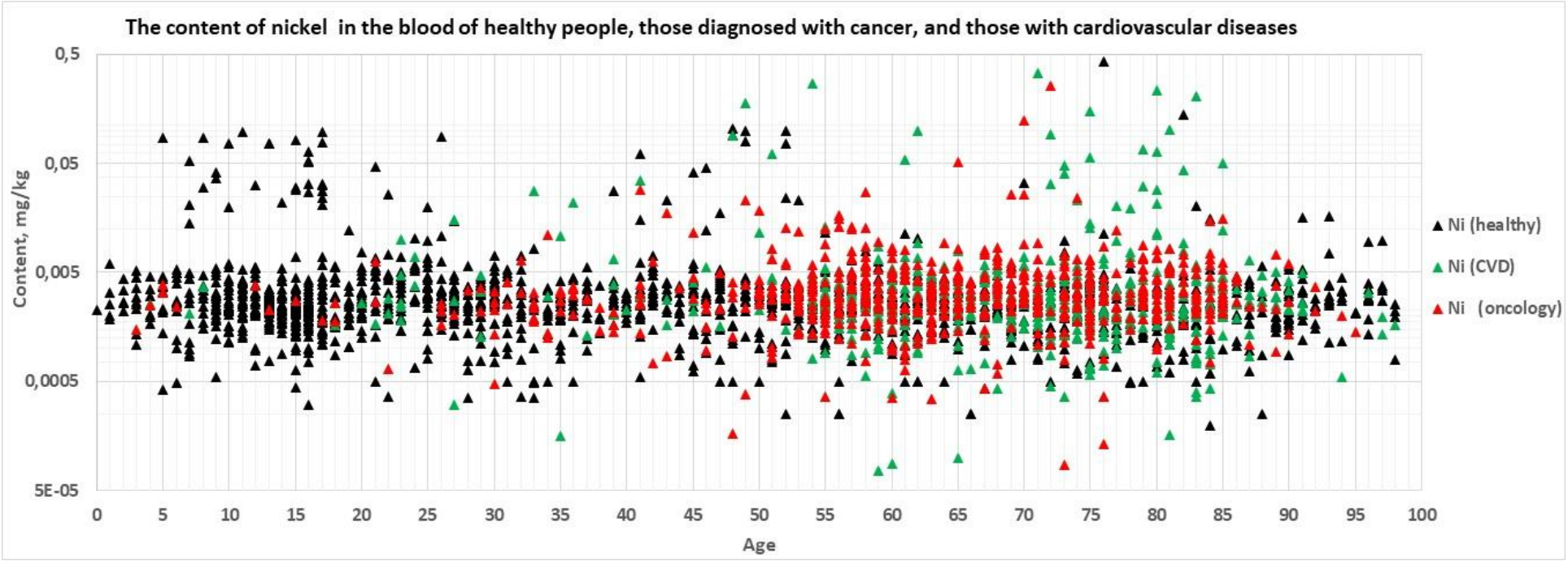

The content of vanadium in the blood of healthy people, those diagnosed with cancer, and those with cardiovascular diseases
Content, mg/kg
0,1
0,01
0,001
0,0001
0
5
10
15
20
25
30
35
40
45
50
55
60
65
70
75
80
85
90
95
100
Age
V (healthy)
V (CVD)
V (oncology)

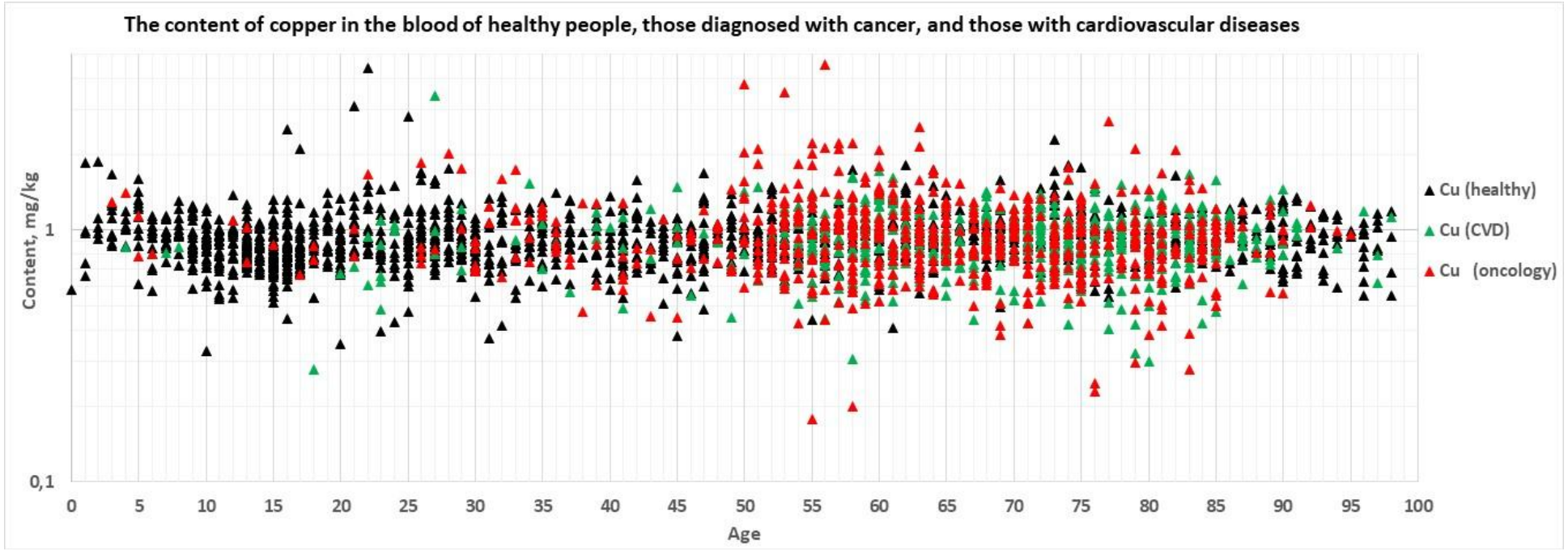

The content of chromium in the blood of healthy people, those diagnosed with cancer, and those with cardiovascular diseases
Content, mg/kg
0,015
0,0015
0,00015
0
5
10
15
20
25
30
35
40
45
50
55
60
65
70
75
80
85
90
95
100
Age
Cr (healthy)
Cr (CVD)
Cr (oncology)

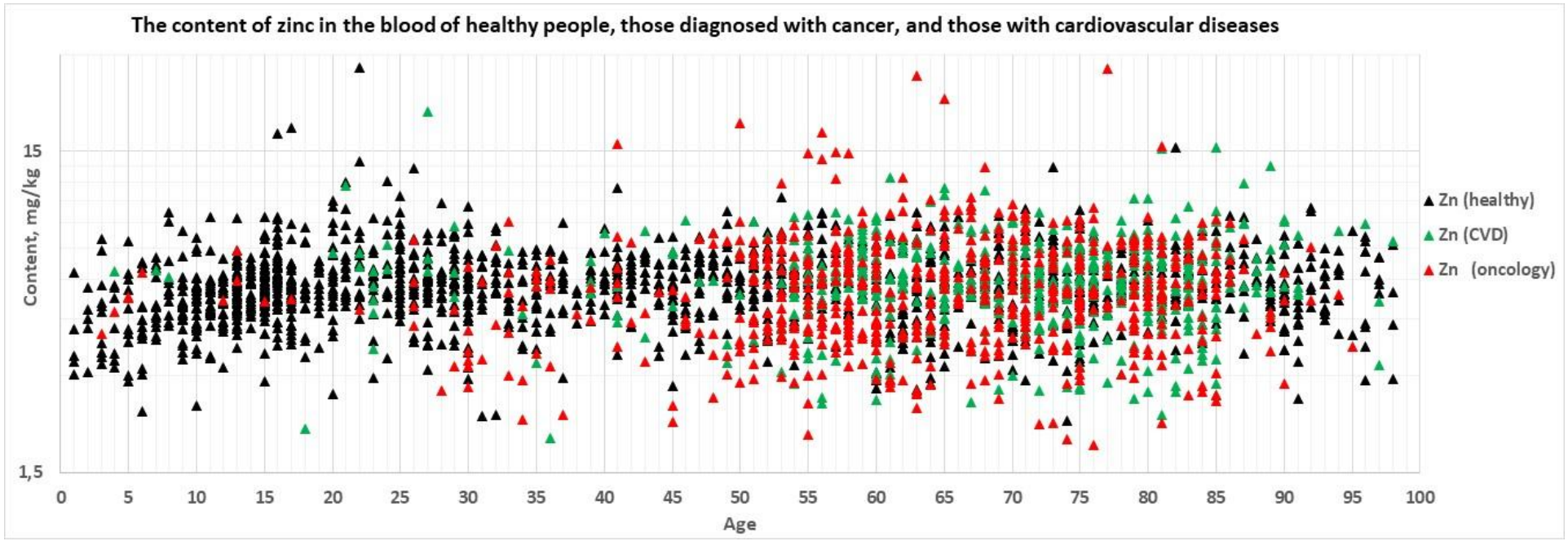

The content of manganese in the blood of healthy people, those diagnosed with cancer, and those with cardiovascular diseases
0,1
0,01
0,001
Содержание, мг/кг
0
5
10
15
20
25
30
35
40
45
50
55
60
65
70
75
80
85
90
95
100
Age
Mn (healthy)
Mn (CVD)
Mn (oncology)

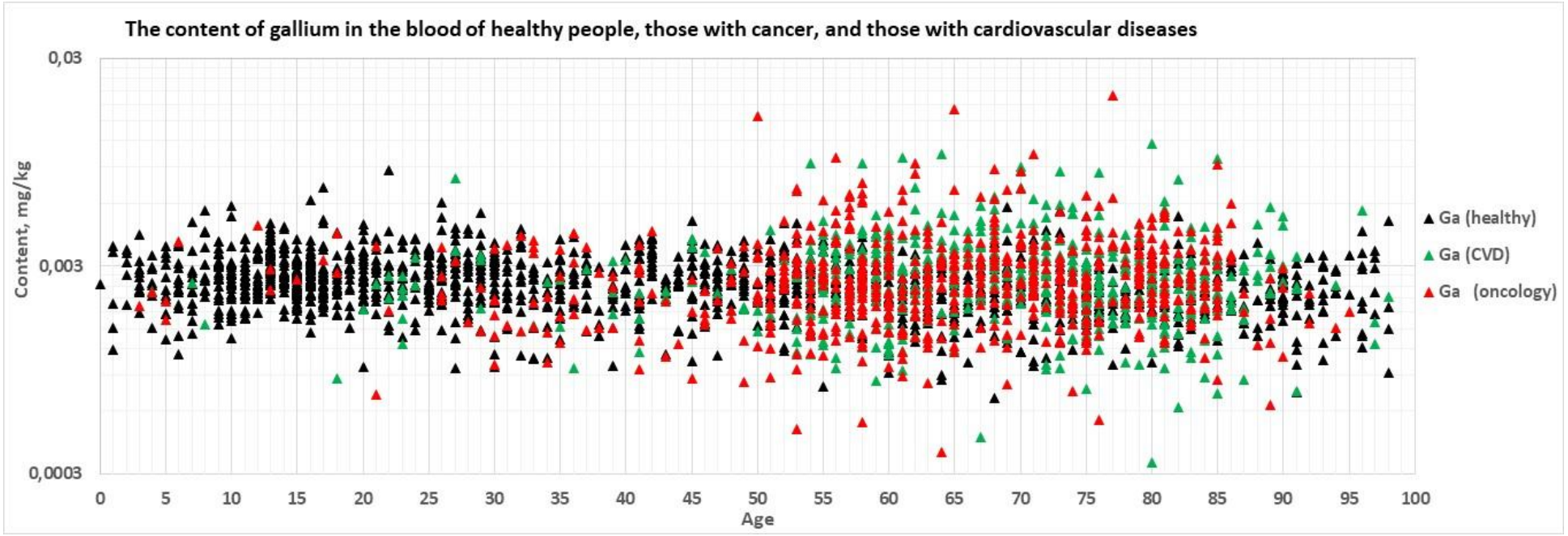

The content of iron in the blood of healthy people, those diagnosed with cancer, and those with cardiovascular diseases
800
80
Content, mg/kg
0
5
10
15
20
25
30
35
40
45
50
55
60
65
70
75
80
85
90
95
100
Age
Fe (healthy)
Fe (CVD)
Fe (oncology)

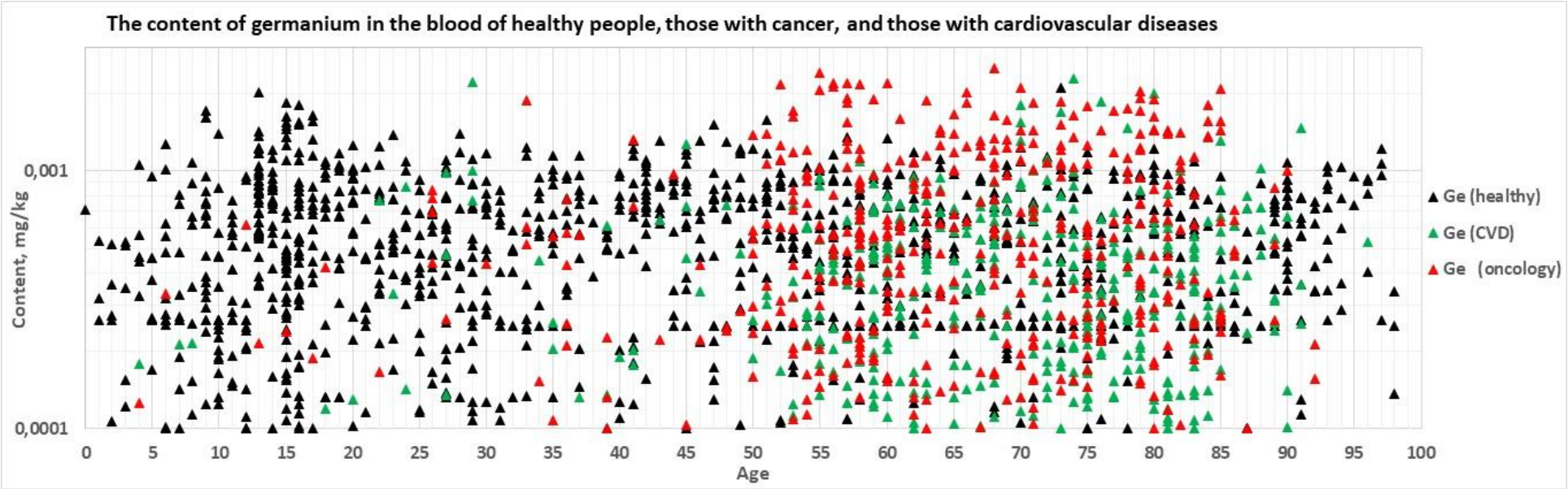

The content of cobalt in the blood of healthy people, those diagnosed with cancer, and those with cardiovascular diseases
Content, mg/kg
0,1
0,01
0,001
0,0001
0,00001
0,000001
0
5
10
15
20
25
30
35
40
45
50
55
60
65
70
75
80
85
90
95
100
Age
Co (healthy)
Co (CVD)
Co (oncology)

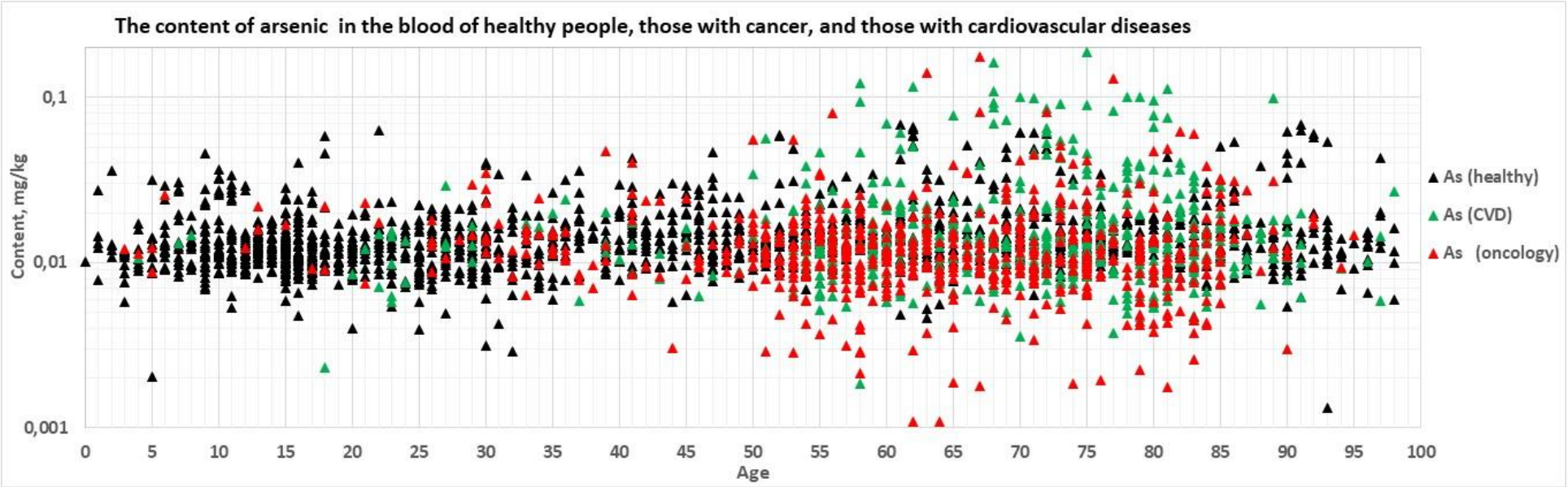

The content of nickel in the blood of healthy people, those diagnosed with cancer, and those with cardiovascular diseases
Content, mg/kg
0,5
0,05
0,005
0,0005
5E-05
0
5
10
15
20
25
30
35
40
45
50
55
60
65
70
75
80
85
90
95
100
Age
Ni (healthy)
Ni (CVD)
Ni (oncology)

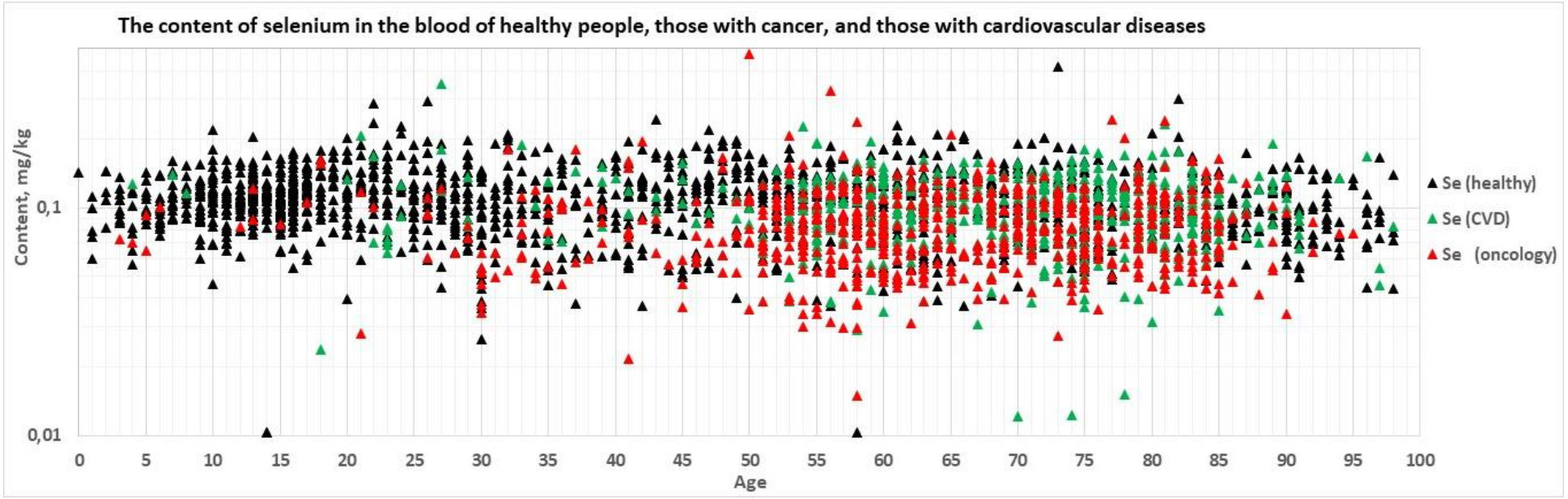

The content of copper in the blood of healthy people, those diagnosed with cancer, and those with cardiovascular diseases
Content, mg/kg
1
0,1
0
5
10
15
20
25
30
35
40
45
50
55
60
65
70
75
80
85
90
95
100
Age
Cu (healthy)
Cu (CVD)
Cu (oncology)

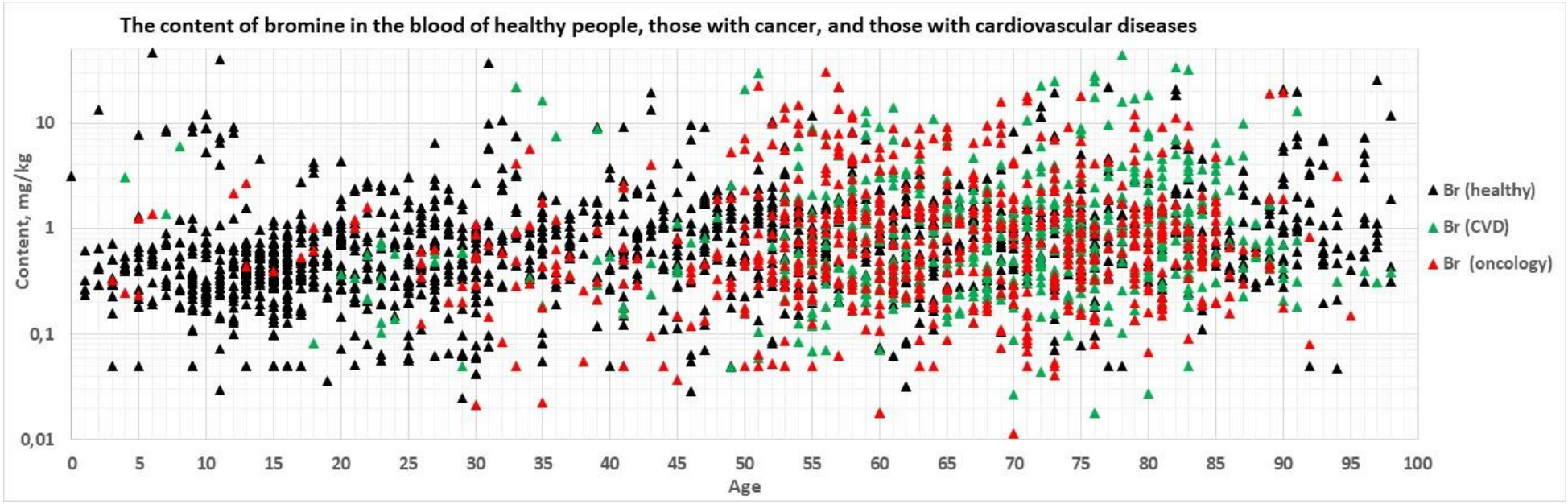

The content of zinc in the blood of healthy people, those diagnosed with cancer, and those with cardiovascular diseases
Content, mg/kg
15
1,5
0
5
10
15
20
25
30
35
40
45
50
55
60
65
70
75
80
85
90
95
100
Age
Zn (healthy)
Zn (CVD)
Zn (oncology)

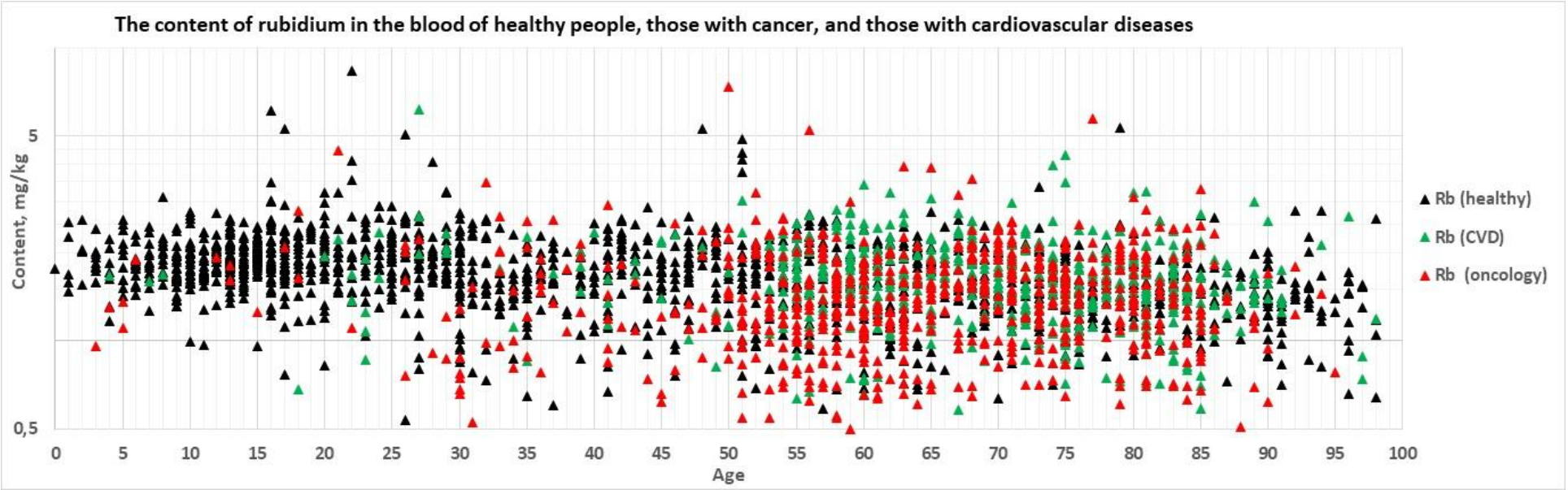

The content of gallium in the blood of healthy people, those with cancer, and those with cardiovascular diseases
0,03
0,003
0,0003
Content, mg/kg
0
5
10
15
20
25
30
35
40
45
50
55
60
65
70
75
80
85
90
95
100
Age
Ga (healthy)
Ga (CVD)
Ga (oncology)

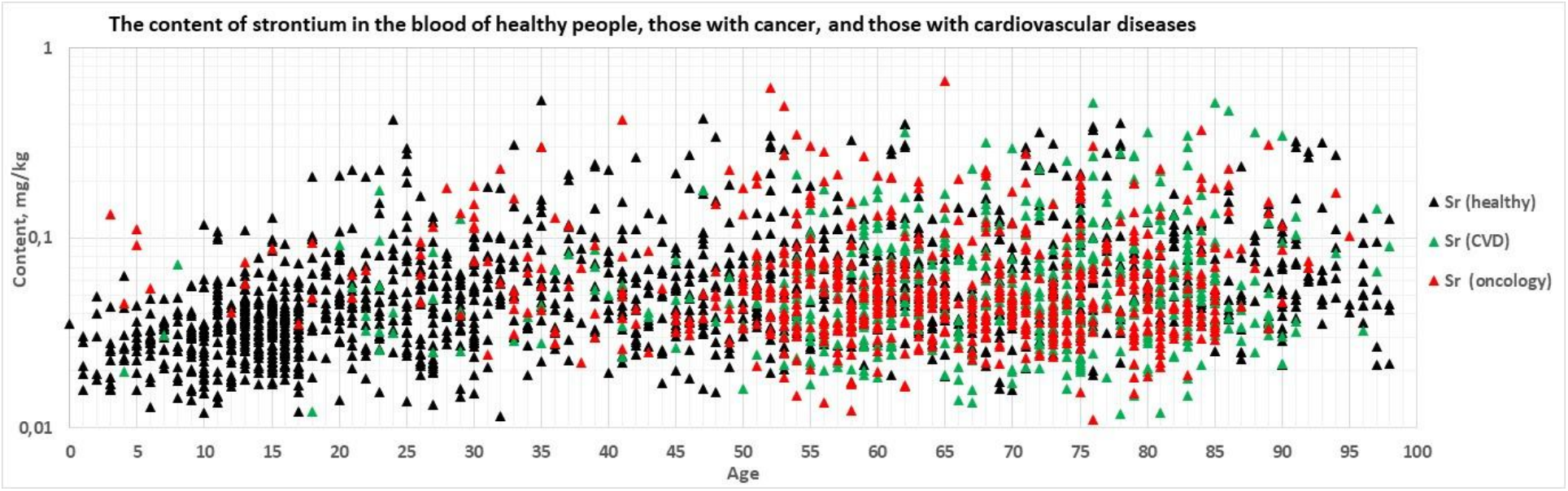

The content of germanium in the blood of healthy people, those with cancer, and those with cardiovascular diseases
Content, mg/kg
0,001
0,0001
0
5
10
15
20
25
30
35
40
45
50
55
60
65
70
75
80
85
90
95
100
Age
Ge (healthy)
Ge (CVD)
Ge (oncology)

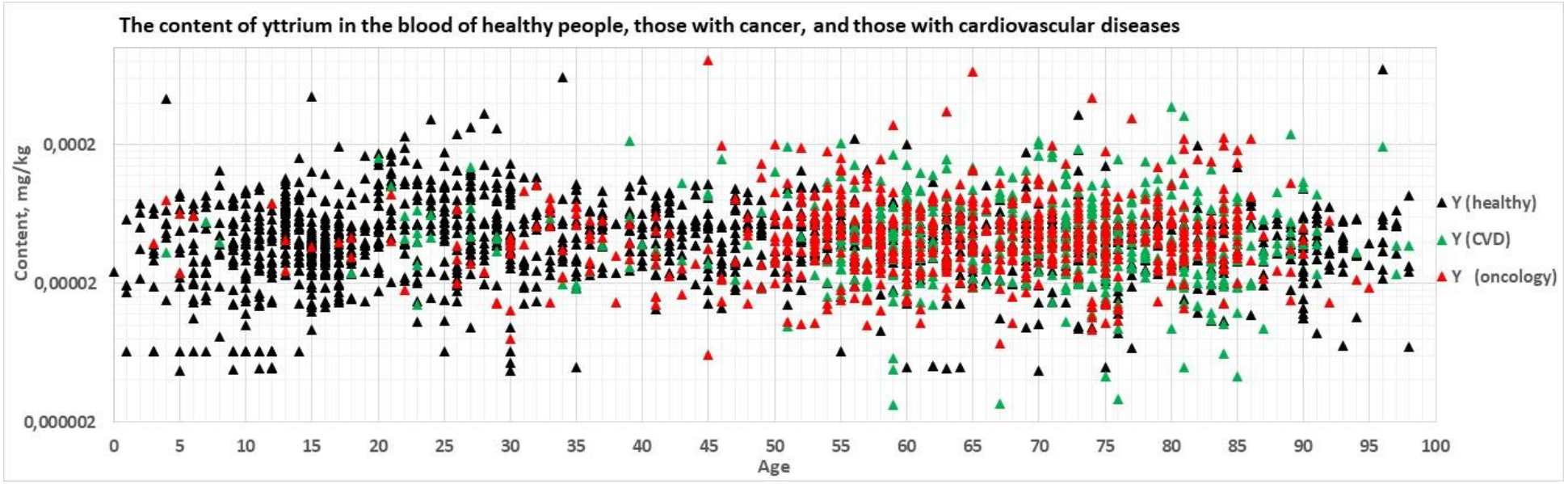

The content of arsenic in the blood of healthy people, those with cancer, and those with cardiovascular diseases
Content, mg/kg
0,1
0,01
0,001
0
5
10
15
20
25
30
35
40
45
50
55
60
65
70
75
80
85
90
95
100
Age
As (healthy)
As (CVD)
As (oncology)

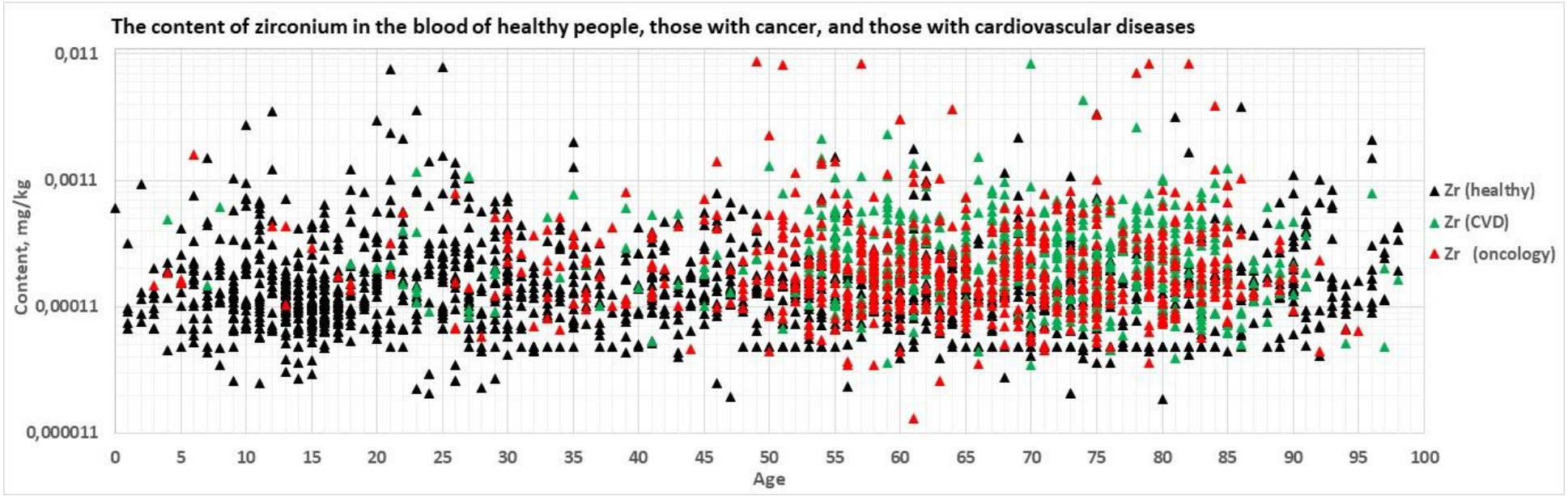

The content of selenium in the blood of healthy people, those with cancer, and those with cardiovascular diseases
Content, mg/kg
0,1
0,01
0
5
10
15
20
25
30
35
40
45
50
55
60
65
70
75
80
85
90
95
100
Age
Se (healthy)
Se (CVD)
Se (oncology)

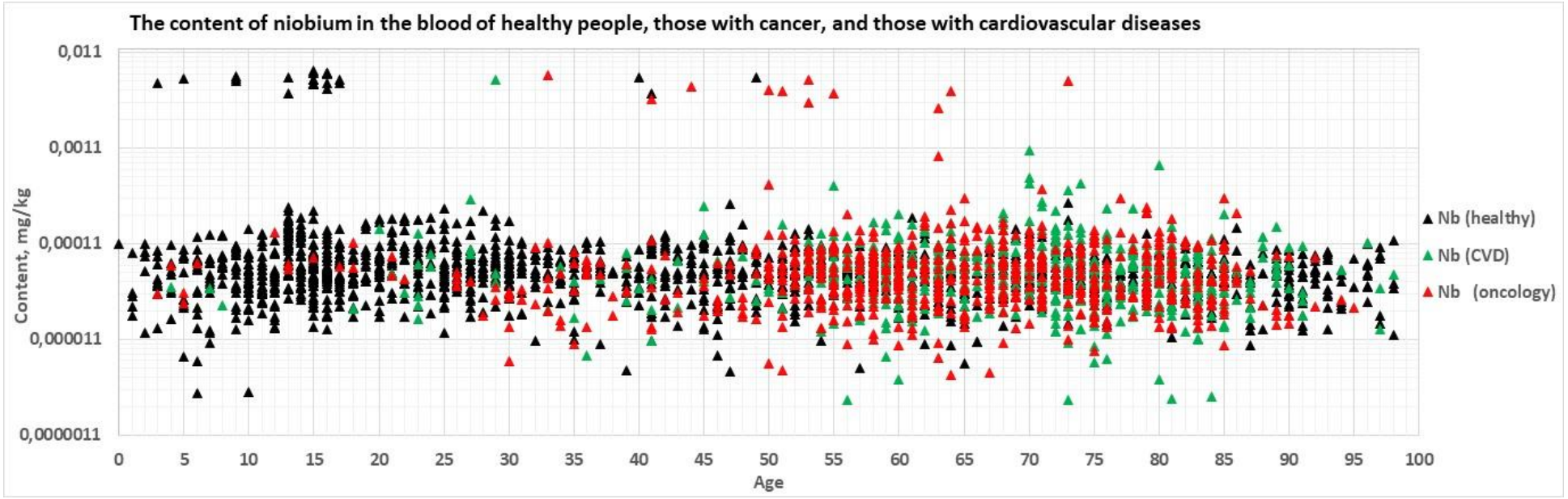

The content of bromine in the blood of healthy people, those with cancer, and those with cardiovascular diseases
Content, mg/kg
10
1
0,1
0,01
0
5
10
15
20
25
30
35
40
45
50
55
60
65
70
75
80
85
90
95
100
Age
Br (healthy)
Br (CVD)
Br (oncology)

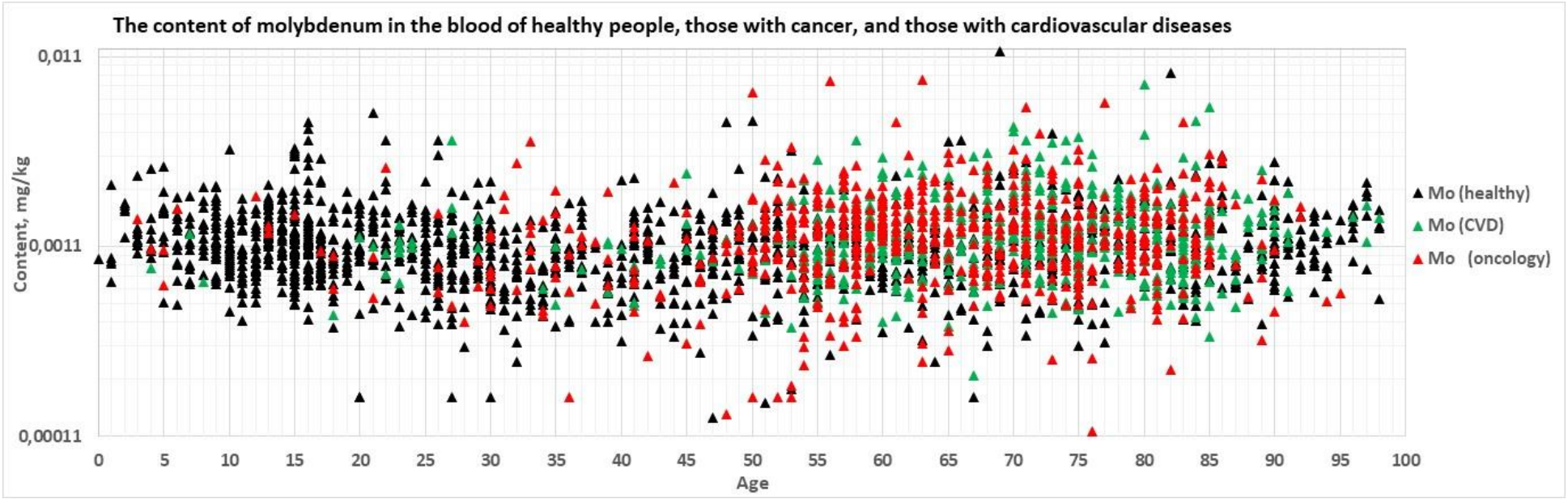

The content of rubidium in the blood of healthy people, those with cancer, and those with cardiovascular diseases
Content, mg/kg
5
0,5
0
5
10
15
20
25
30
35
40
45
50
55
60
65
70
75
80
85
90
95
100
Age
Rb (healthy)
Rb (CVD)
Rb (oncology)

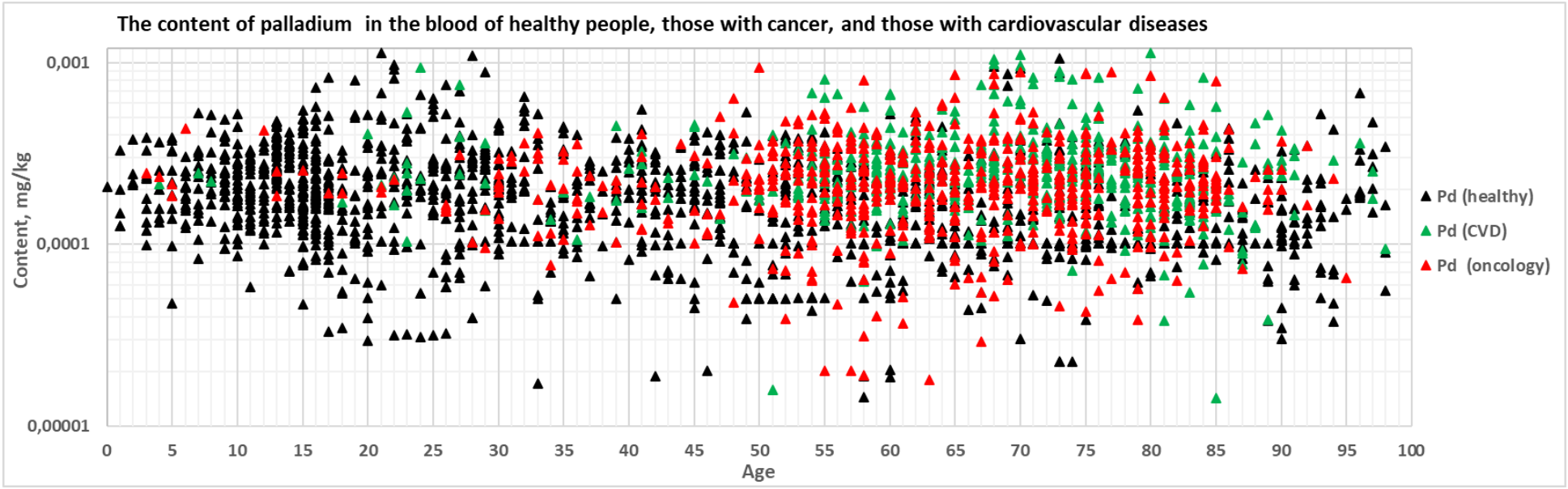

The content of strontium in the blood of healthy people, those with cancer, and those with cardiovascular diseases
Content, mg/kg
1
0,1
0,01
0
5
10
15
20
25
30
35
40
45
50
55
60
65
70
75
80
85
90
95
100
Age
Sr (healthy)
Sr (CVD)
Sr (oncology)

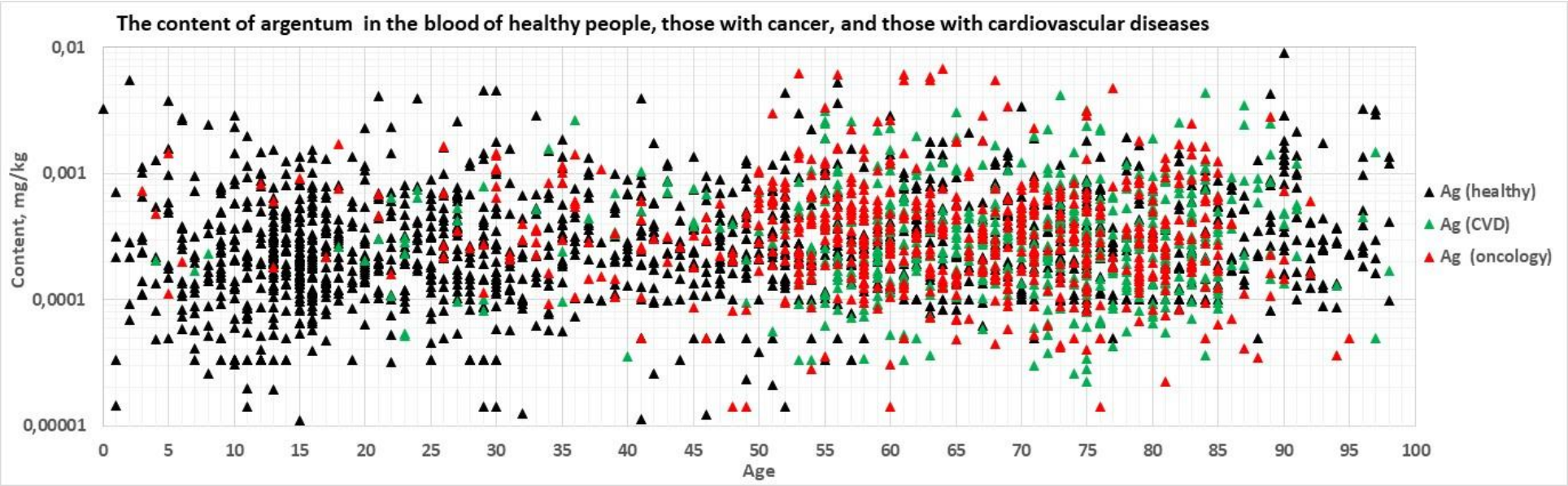

The content of yttrium in the blood of healthy people, those with cancer, and those with cardiovascular diseases
Content, mg/kg
0,0002
0,00002
0,000002
0
5
10
15
20
25
30
35
40
45
50
55
60
65
70
75
80
85
90
95
100
Age
Y (healthy)
Y (CVD)
Y (oncology)

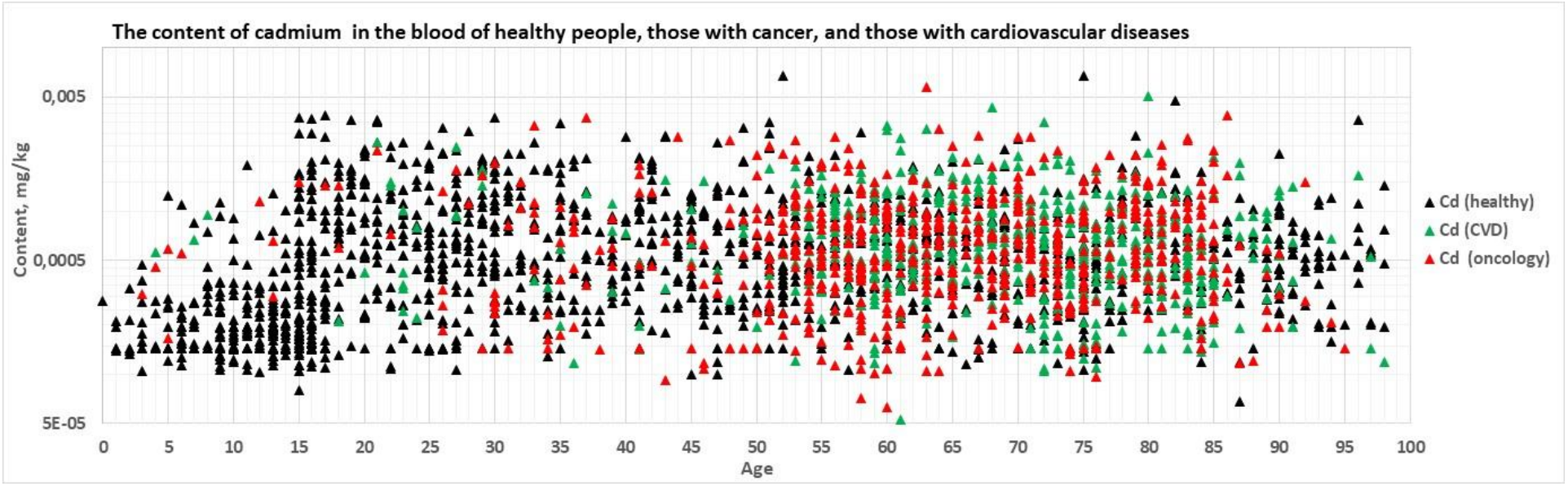

The content of zirconium in the blood of healthy people, those with cancer, and those with cardiovascular diseases
0,011
0,0011
0,00011
0,000011
Content, mg/kg
0
5
10
15
20
25
30
35
40
45
50
55
60
65
70
75
80
85
90
95
100
Age
Zr (healthy)
Zr (CVD)
Zr (oncology)

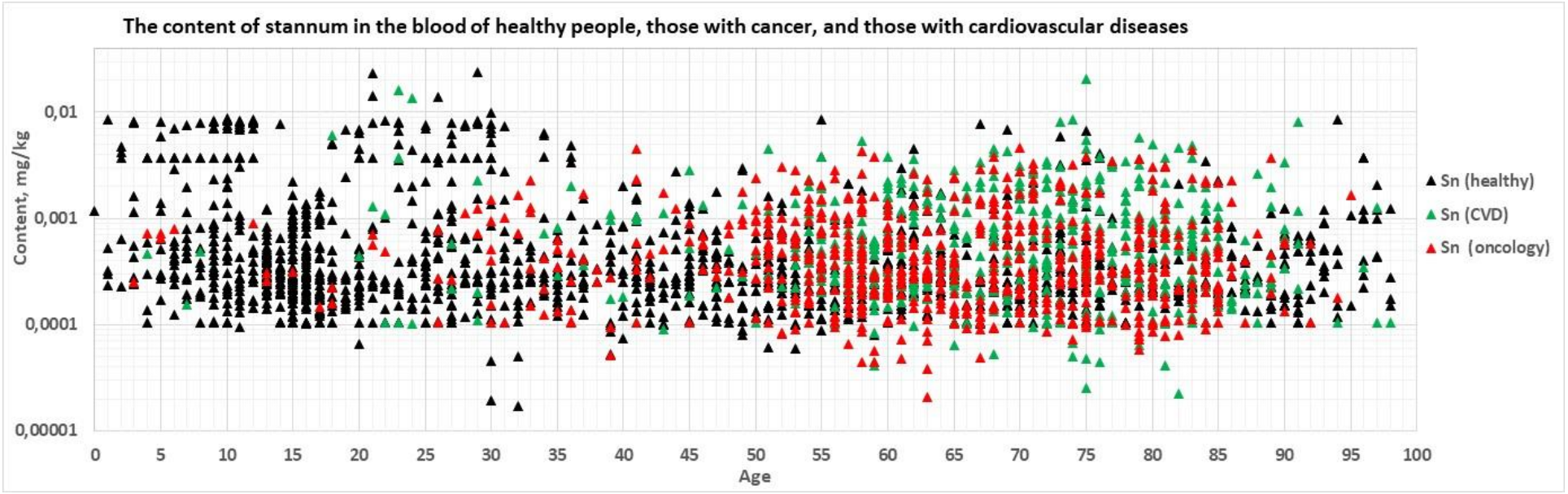

The content of niobium in the blood of healthy people, those with cancer, and those with cardiovascular diseases
0,011
0,0011
0,00011
0,000011
0,0000011
Content, mg/kg
0
5
10
15
20
25
30
35
40
45
50
55
60
65
70
75
80
85
90
95
100
Age
Nb (healthy)
Nb (CVD)
Nb (oncology)

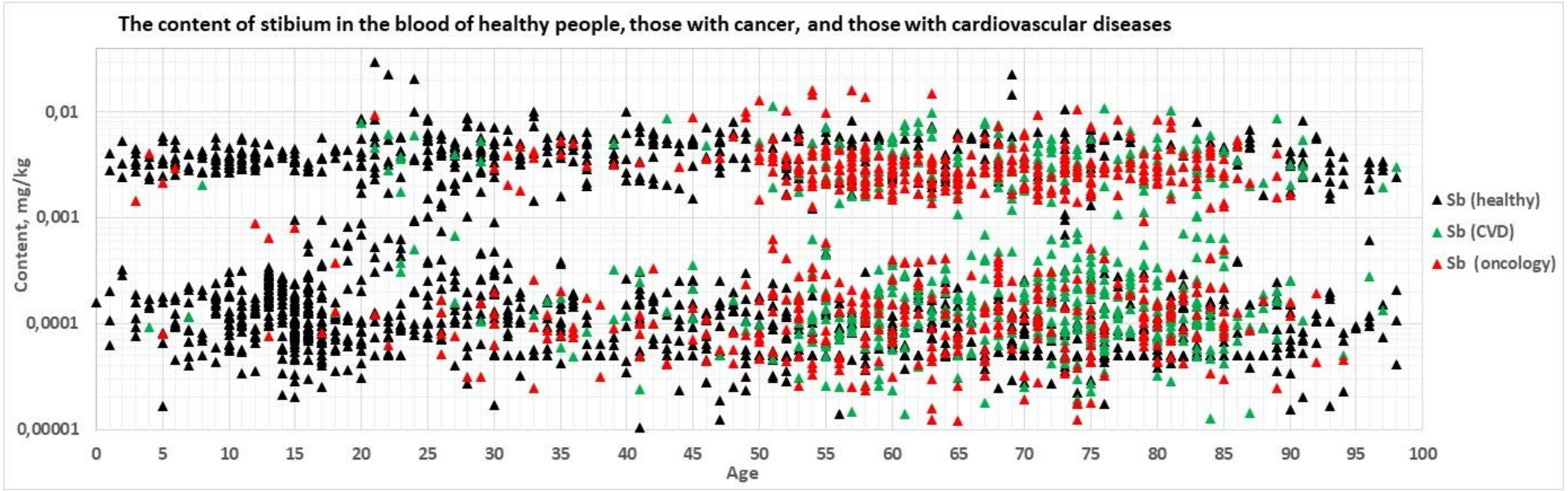

The content of molybdenum in the blood of healthy people, those with cancer, and those with cardiovascular diseases
0,011
0,0011
0,00011
Content, mg/kg
0
5
10
15
20
25
30
35
40
45
50
55
60
65
70
75
80
85
90
95
100
Age
Mo (healthy)
Mo (CVD)
Mo (oncology)

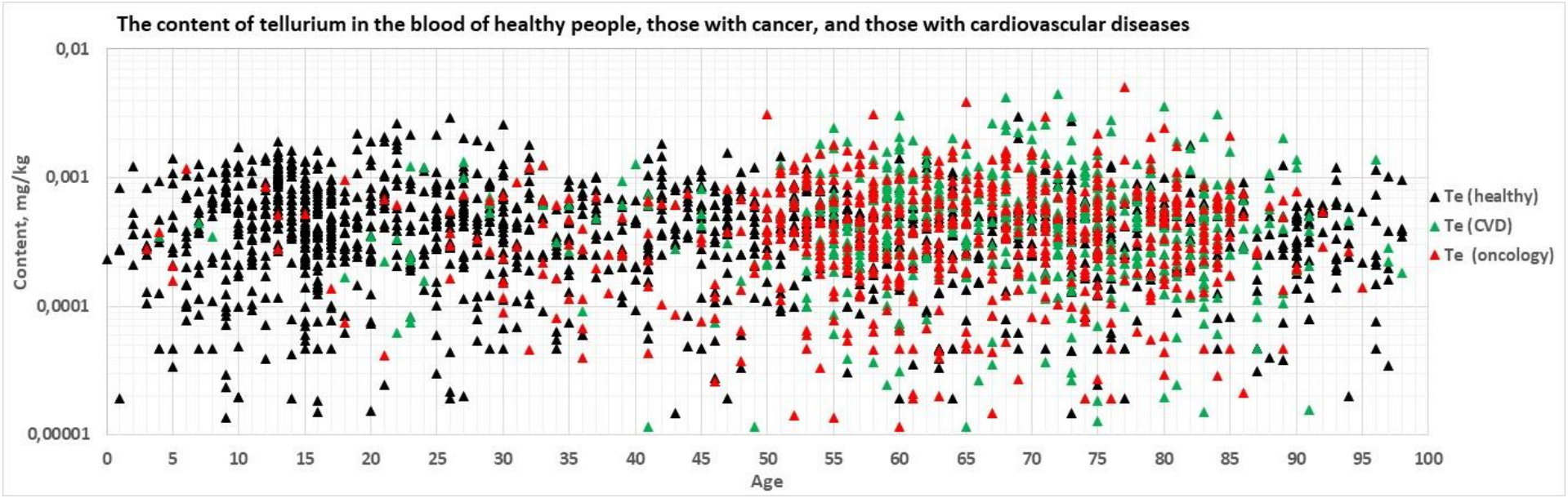

The content of palladium in the blood of healthy people, those with cancer, and those with cardiovascular diseases
Content, mg/kg
0,001
0,0001
0,00001
0
5
10
15
20
25
30
35
40
45
50
55
60
65
70
75
80
85
90
95
100
Age
Pd (healthy)
Pd (CVD)
Pd (oncology)

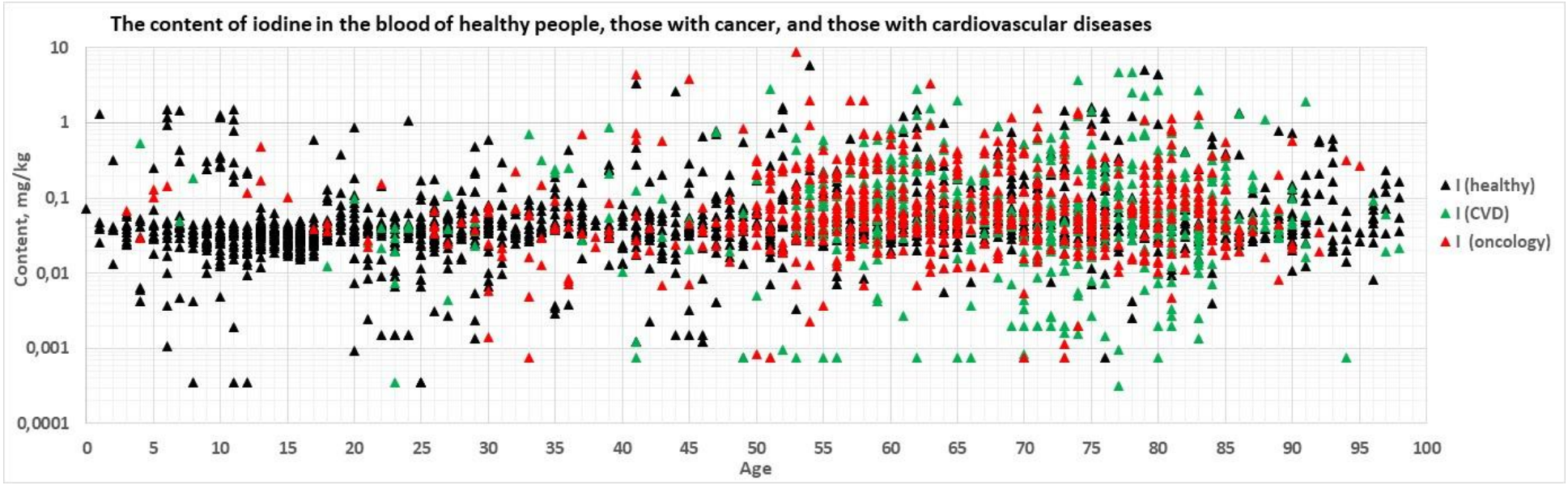

The content of argentum in the blood of healthy people, those with cancer, and those with cardiovascular diseases
Content, mg/kg
0,01
0,001
0,0001
0,00001
0
5
10
15
20
25
30
35
40
45
50
55
60
65
70
75
80
85
90
95
100
Age
Ag (healthy)
Ag (CVD)
Ag (oncology)

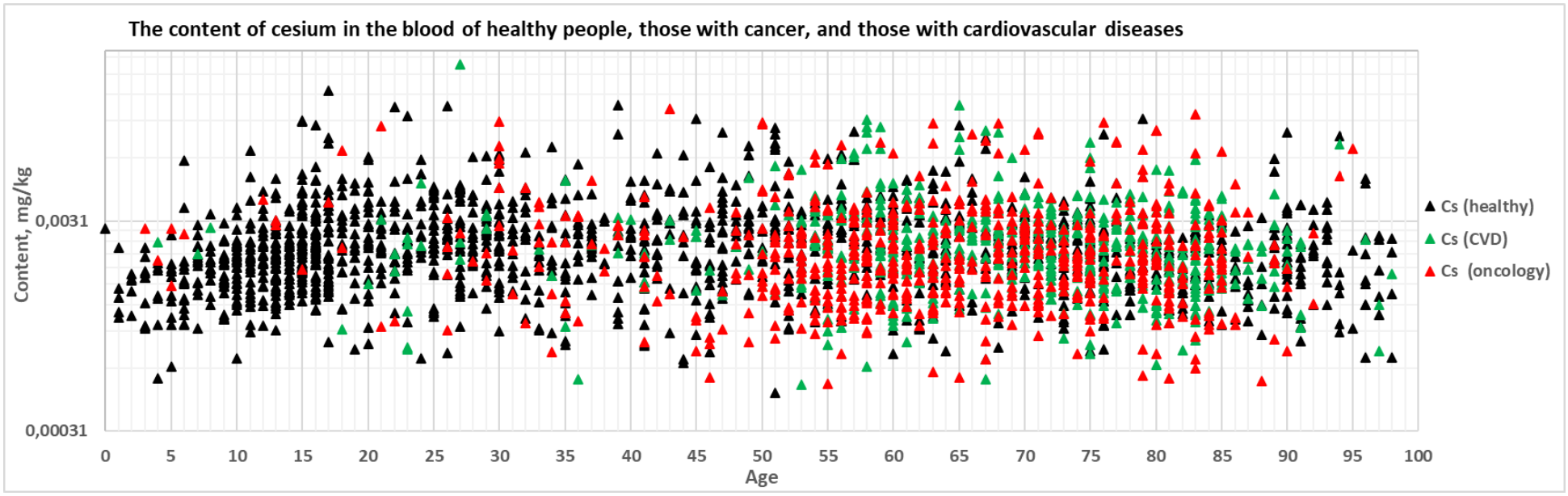

The content of cadmium in the blood of healthy people, those with cancer, and those with cardiovascular diseases
Content, mg/kg
0,005
0,0005
5E-05
0
5
10
15
20
25
30
35
40
45
50
55
60
65
70
75
80
85
90
95
100
Age
Cd (healthy)
Cd (CVD)
Cd (oncology)

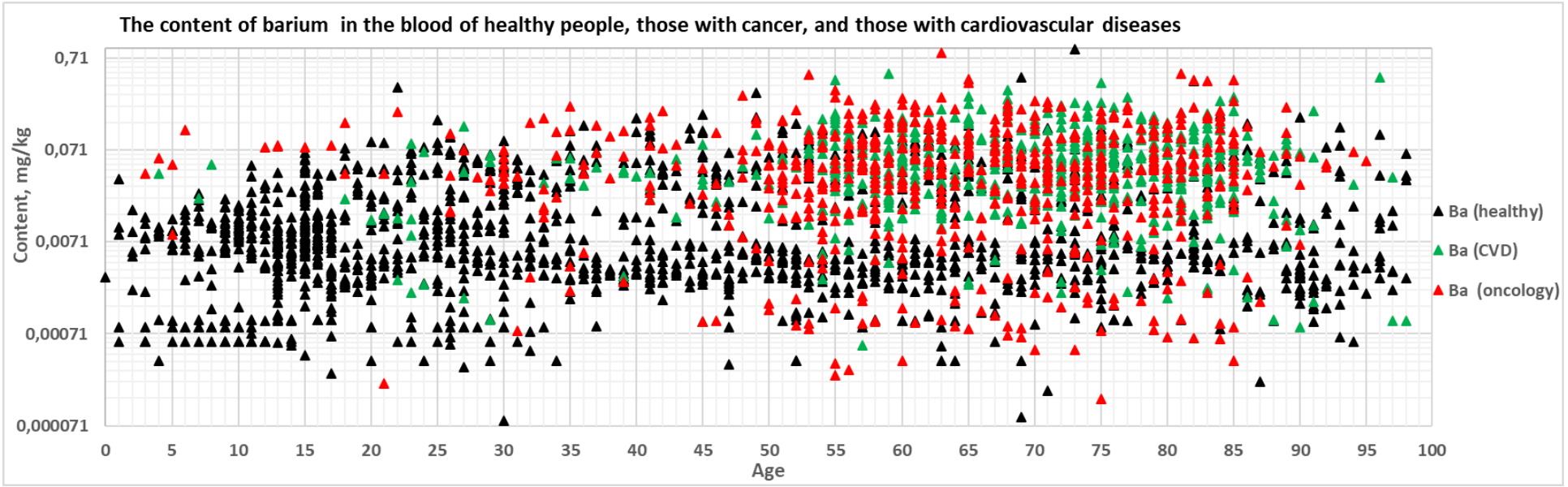

The content of stannum in the blood of healthy people, those with cancer, and those with cardiovascular diseases
Content, mg/kg
0,01
0,001
0,0001
0,00001
0
5
10
15
20
25
30
35
40
45
50
55
60
65
70
75
80
85
90
95
100
Age
Sn (healthy)
Sn (CVD)
Sn (oncology)

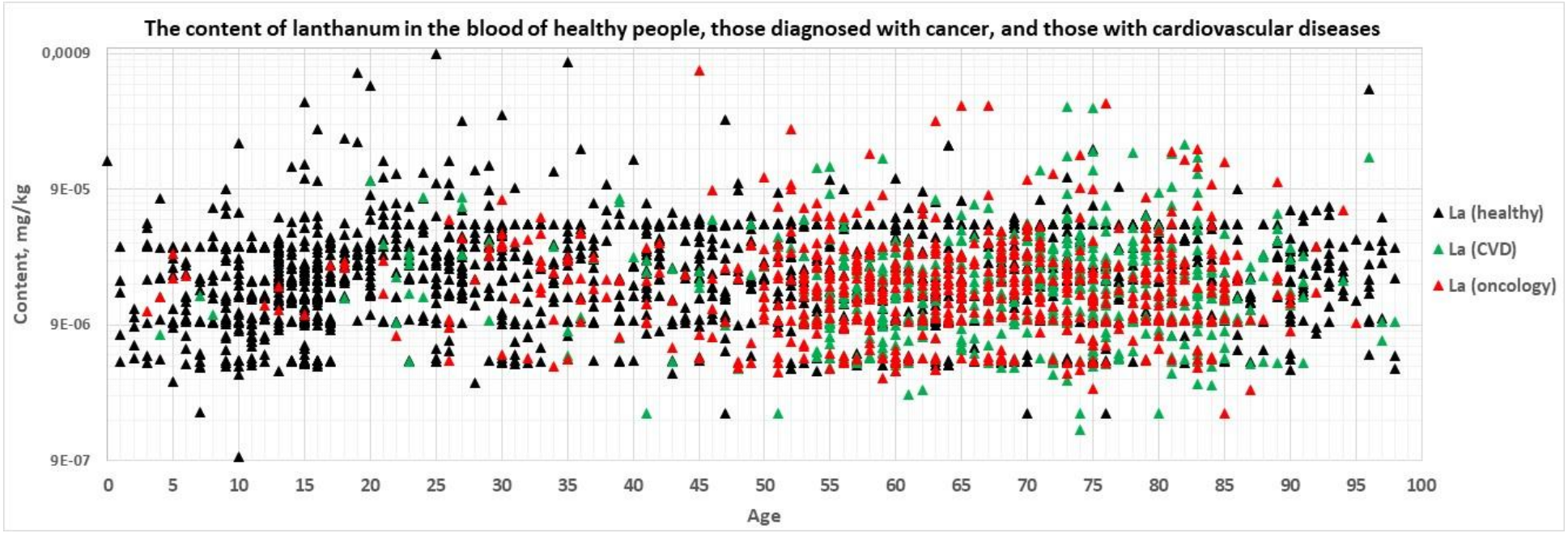

The content of stibium in the blood of healthy people, those with cancer, and those with cardiovascular diseases
Content, mg/kg
0,01
0,001
0,0001
0,00001
0
5
10
15
20
25
30
35
40
45
50
55
60
65
70
75
80
85
90
95
100
Age
Sb (healthy)
Sb (CVD)
Sb (oncology)

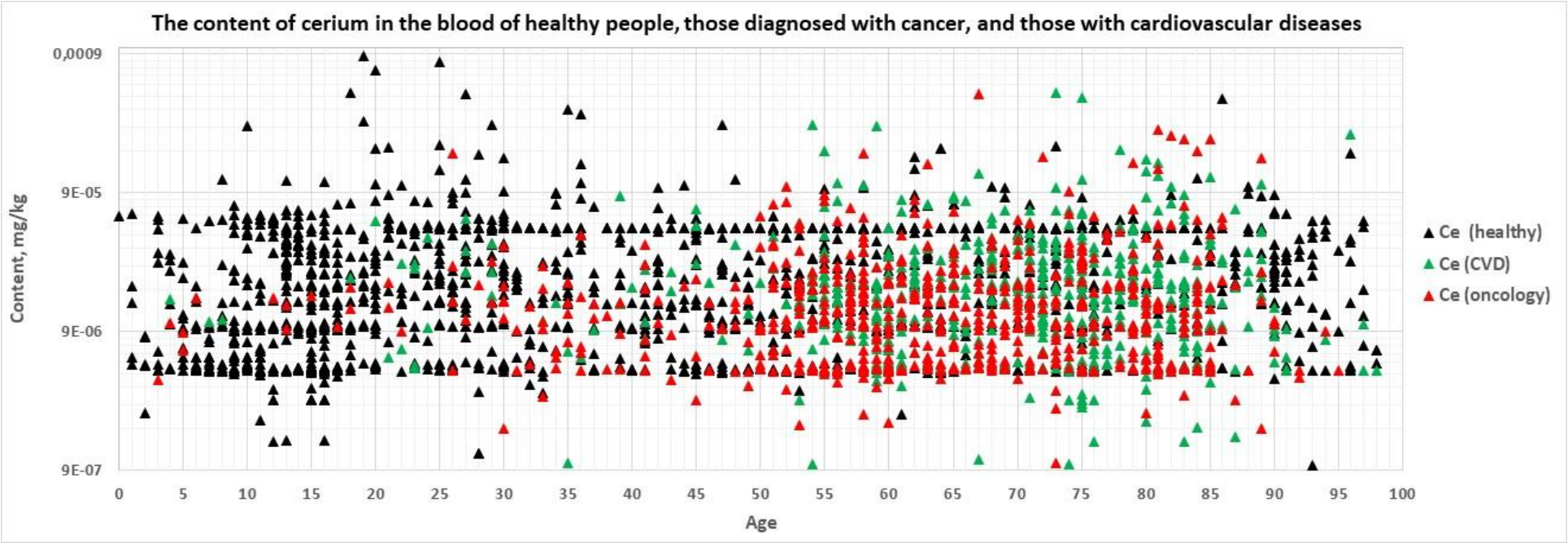

The content of tellurium in the blood of healthy people, those with cancer, and those with cardiovascular diseases
Content, mg/kg
0,01
0,001
0,0001
0,00001
0
5
10
15
20
25
30
35
40
45
50
55
60
65
70
75
80
85
90
95
100
Age
Te (healthy)
Te (CVD)
Te (oncology)

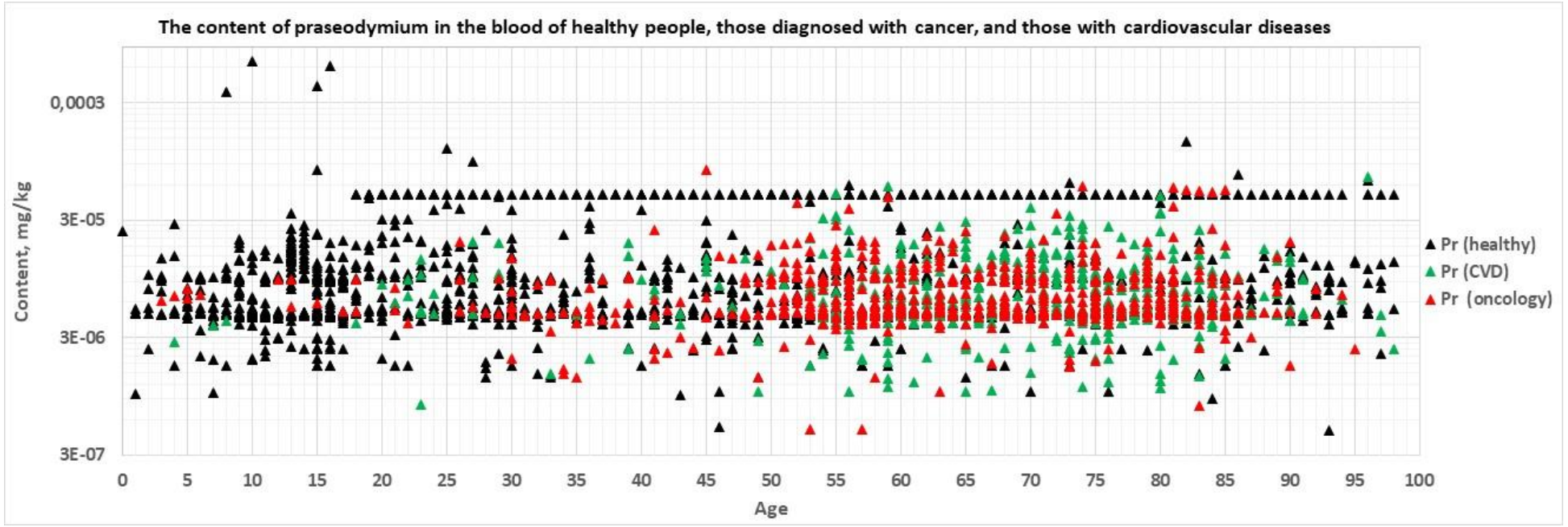

The content of iodine in the blood of healthy people, those with cancer, and those with cardiovascular diseases
Content, mg/kg
10
1
0,1
0,01
0,001
0,0001
0
5
10
15
20
25
30
35
40
45
50
55
60
65
70
75
80
85
90
95
100
Age
I (healthy)
I (CVD)
I (oncology)

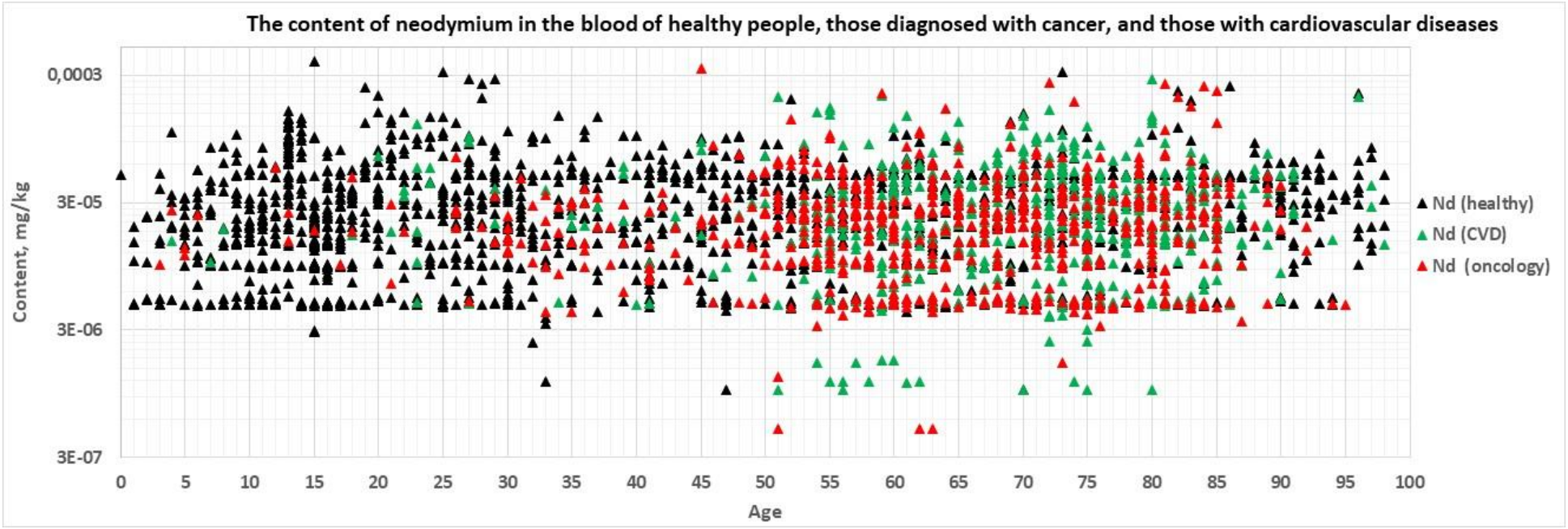

The content of cesium in the blood of healthy people, those with cancer, and those with cardiovascular diseases
Content, mg/kg
0,0031
0,00031
0
5
10
15
20
25
30
35
40
45
50
55
60
65
70
75
80
85
90
95
100
Age
Cs (healthy)
Cs (CVD)
Cs (oncology)

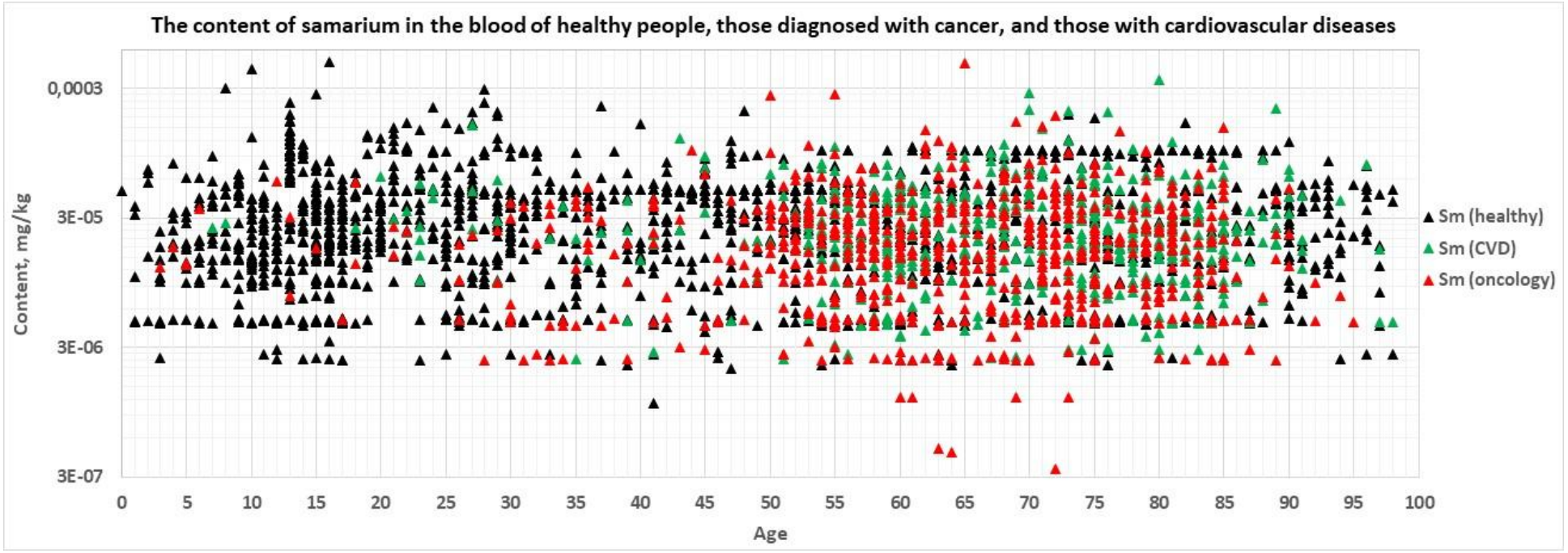

The content of barium in the blood of healthy people, those with cancer, and those with cardiovascular diseases
Content, mg/kg
0,71
0,071
0,0071
0,00071
0,000071
0
5
10
15
20
25
30
35
40
45
50
55
60
65
70
75
80
85
90
95
100
Age
Ba (healthy)
Ba (CVD)
Ba (oncology)

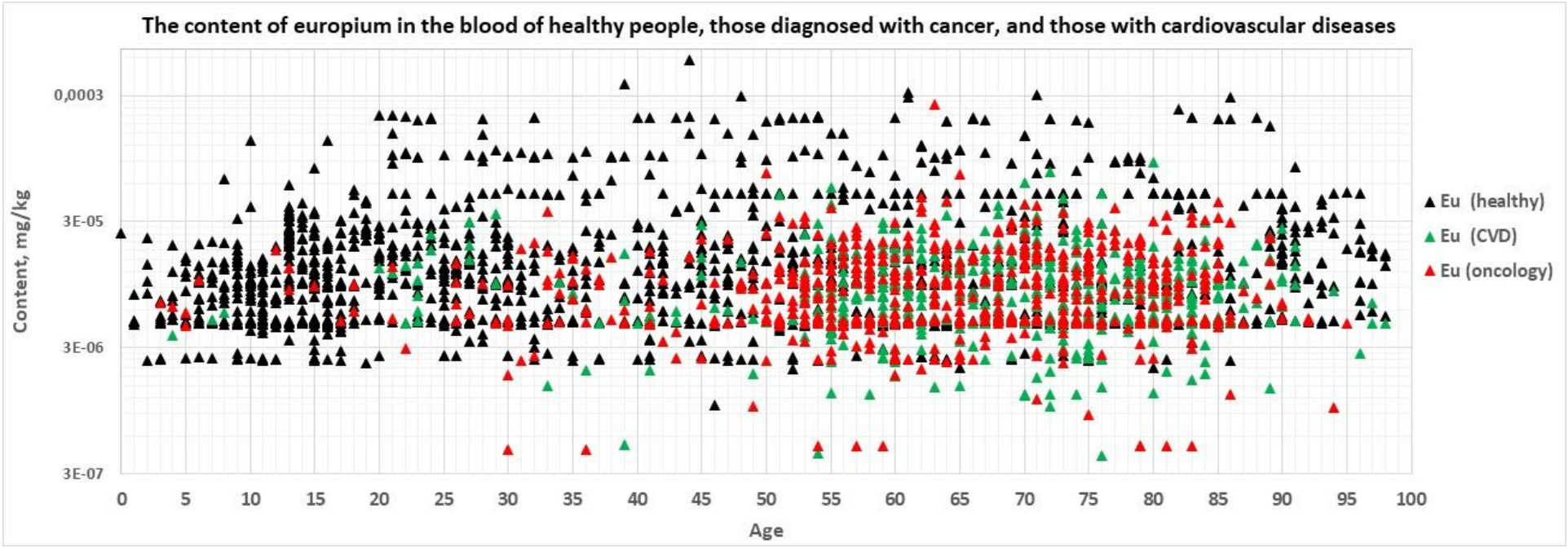

The content of lanthanum in the blood of healthy people, those diagnosed with cancer, and those with cardiovascular diseases
0,0009
9E-05
9E-06
9E-07
Content, mg/kg
0
5
10
15
20
25
30
35
40
45
50
55
60
65
70
75
80
85
90
95
100
Age
La (healthy)
La (CVD)
La (oncology)

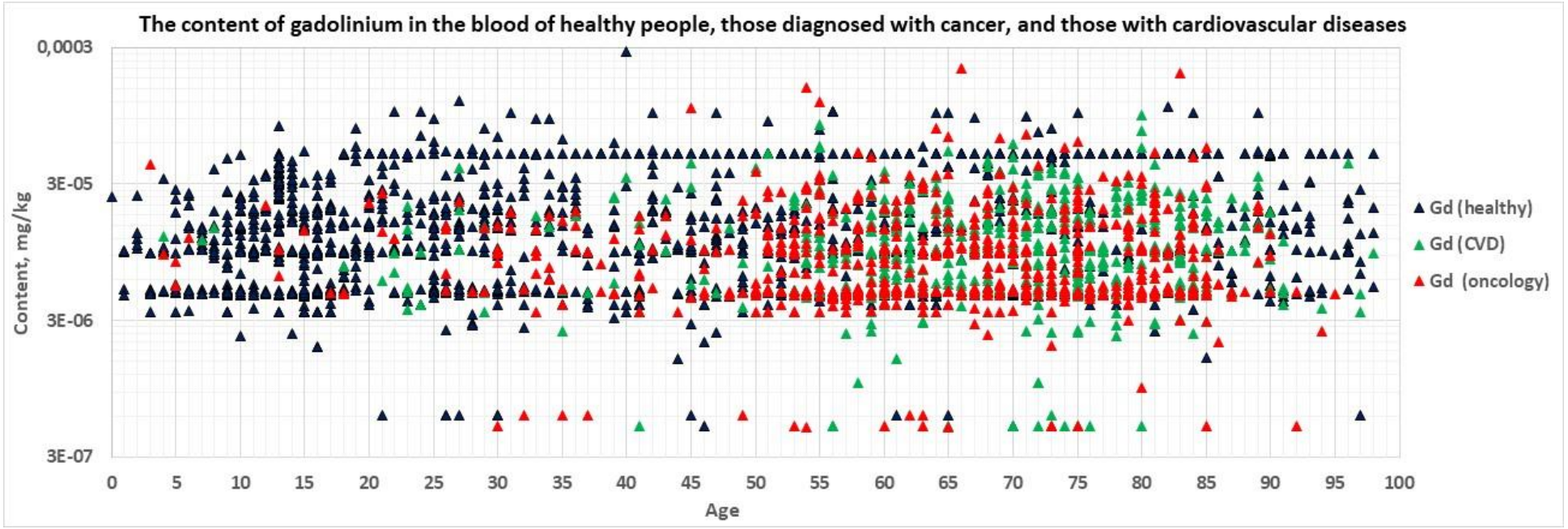

The content of cerium in the blood of healthy people, those diagnosed with cancer, and those with cardiovascular diseases
0,0009
9E-05
9E-06
9E-07
Content, mg/kg
0
5
10
15
20
25
30
35
40
45
50
55
60
65
70
75
80
85
90
95
100
Age
Ce (healthy)
Ce (CVD)
Ce (oncology)

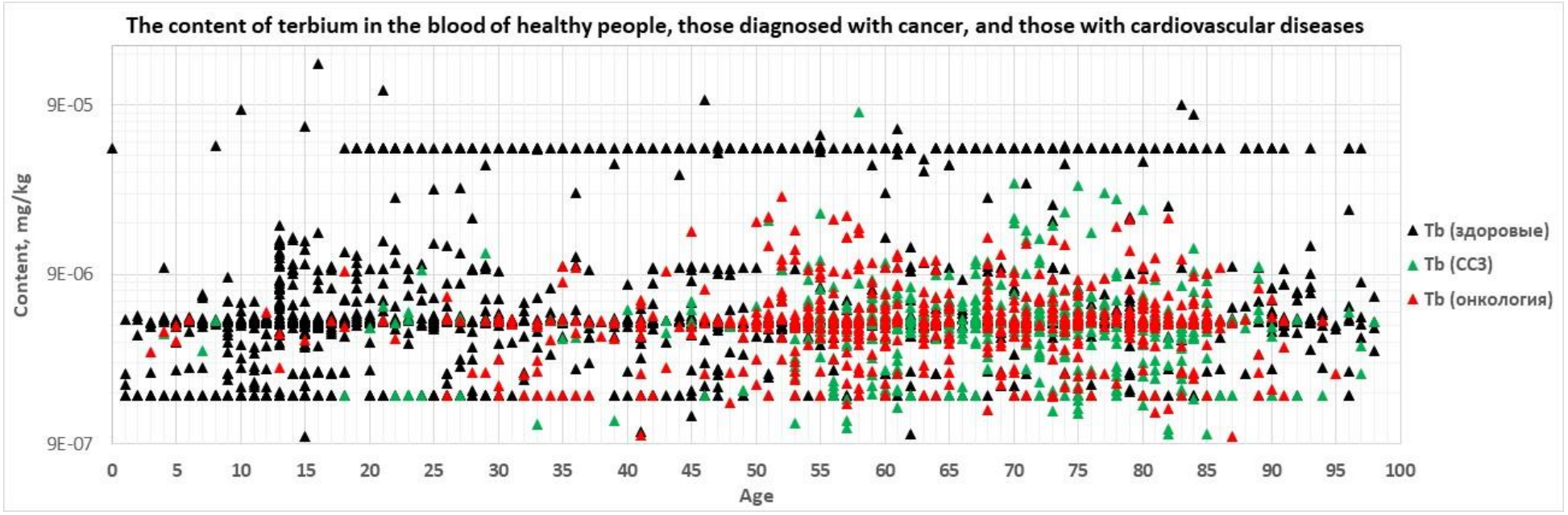

The content of praseodymium in the blood of healthy people, those diagnosed with cancer, and those with cardiovascular diseases
Content, mg/kg
0,0003
3E-05
3E-06
3E-07
0
5
10
15
20
25
30
35
40
45
50
55
60
65
70
75
80
85
90
95
100
Age
Pr (healthy)
Pr (CVD)
Pr (oncology)

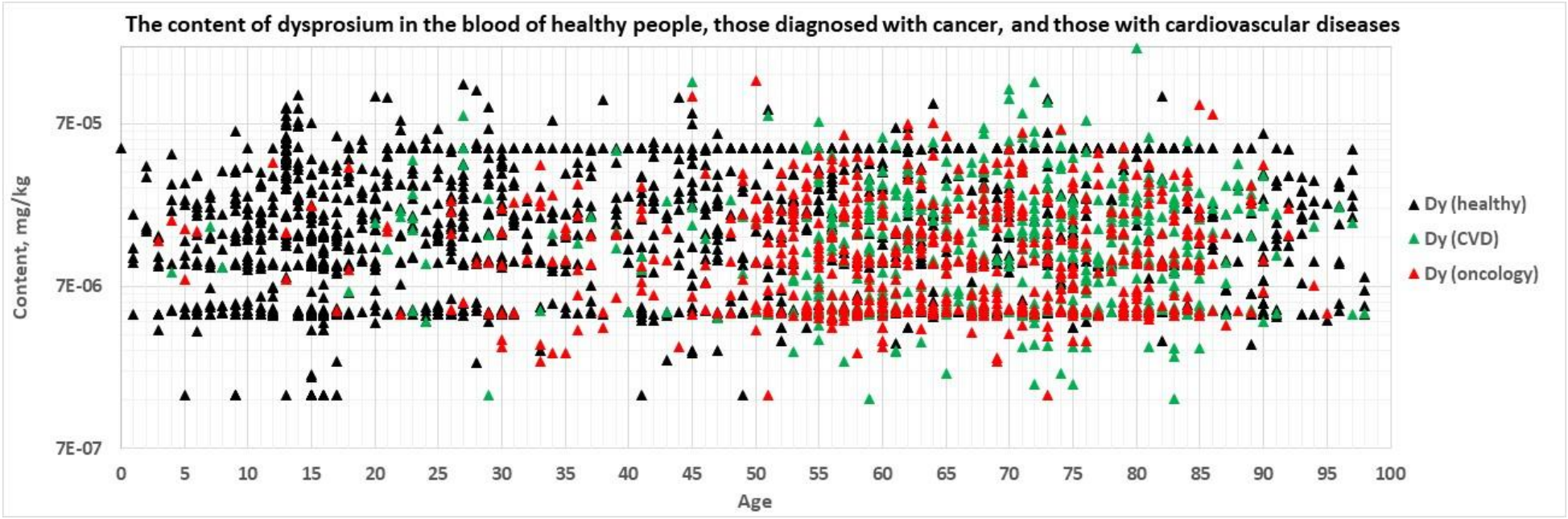

The content of neodymium in the blood of healthy people, those diagnosed with cancer, and those with cardiovascular diseases
Content, mg/kg
0,0003
3E-05
3E-06
3E-07
0
5
10
15
20
25
30
35
40
45
50
55
60
65
70
75
80
85
90
95
100
Age
Nd (healthy)
Nd (CVD)
Nd (oncology)

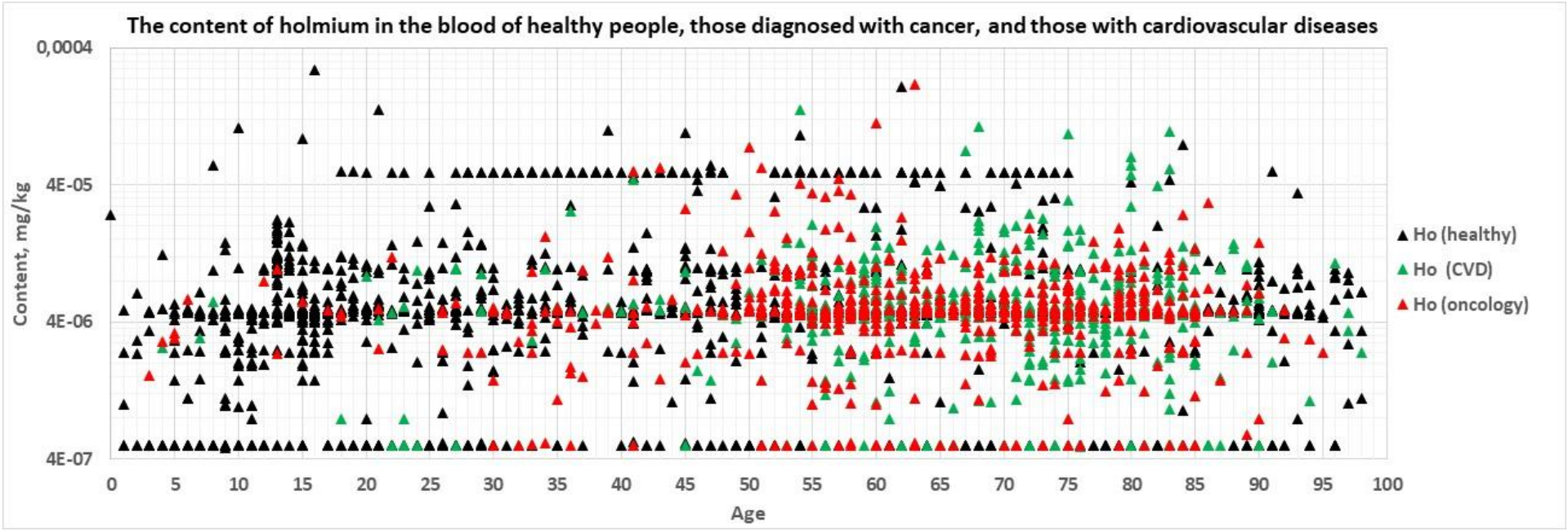

The content of samarium in the blood of healthy people, those diagnosed with cancer, and those with cardiovascular diseases
Content, mg/kg
0,0003
3E-05
3E-06
3E-07
0
5
10
15
20
25
30
35
40
45
50
55
60
65
70
75
80
85
90
95
100
Age
Sm (healthy)
Sm (CVD)
Sm (oncology)

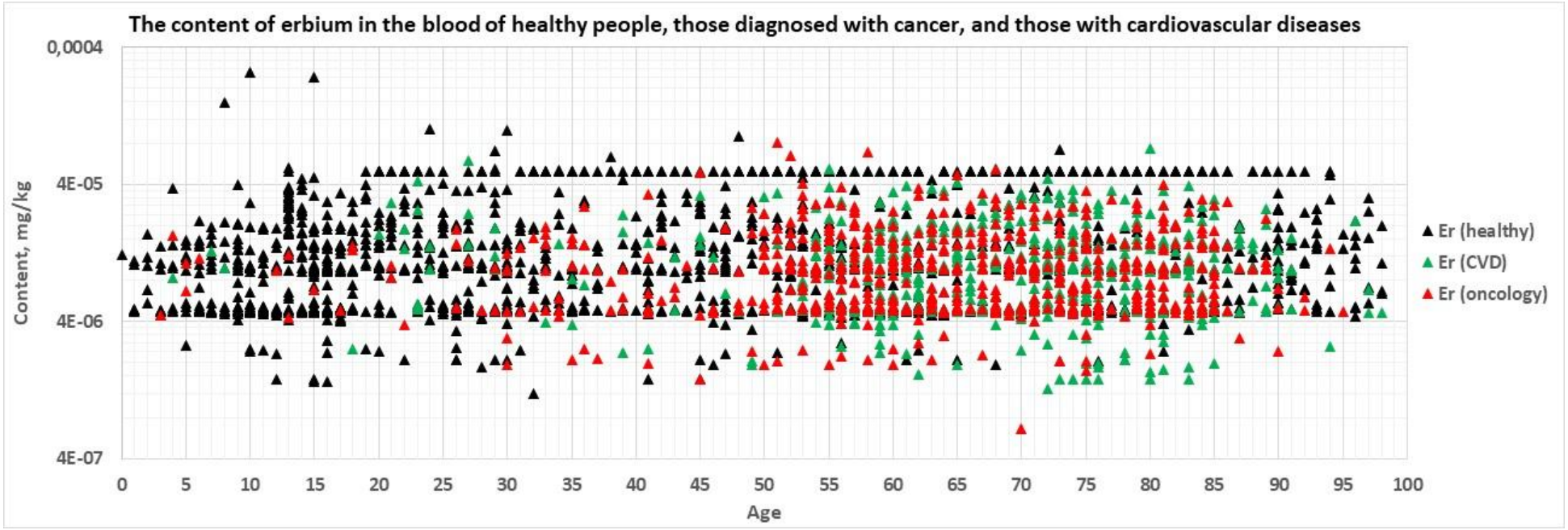

The content of europium in the blood of healthy people, those diagnosed with cancer, and those with cardiovascular diseases
Content, mg/kg
0,0003
3E-05
3E-06
3E-07
0
5
10
15
20
25
30
35
40
45
50
55
60
65
70
75
80
85
90
95
100
Age
Eu (healthy)
Eu (CVD)
Eu (oncology)

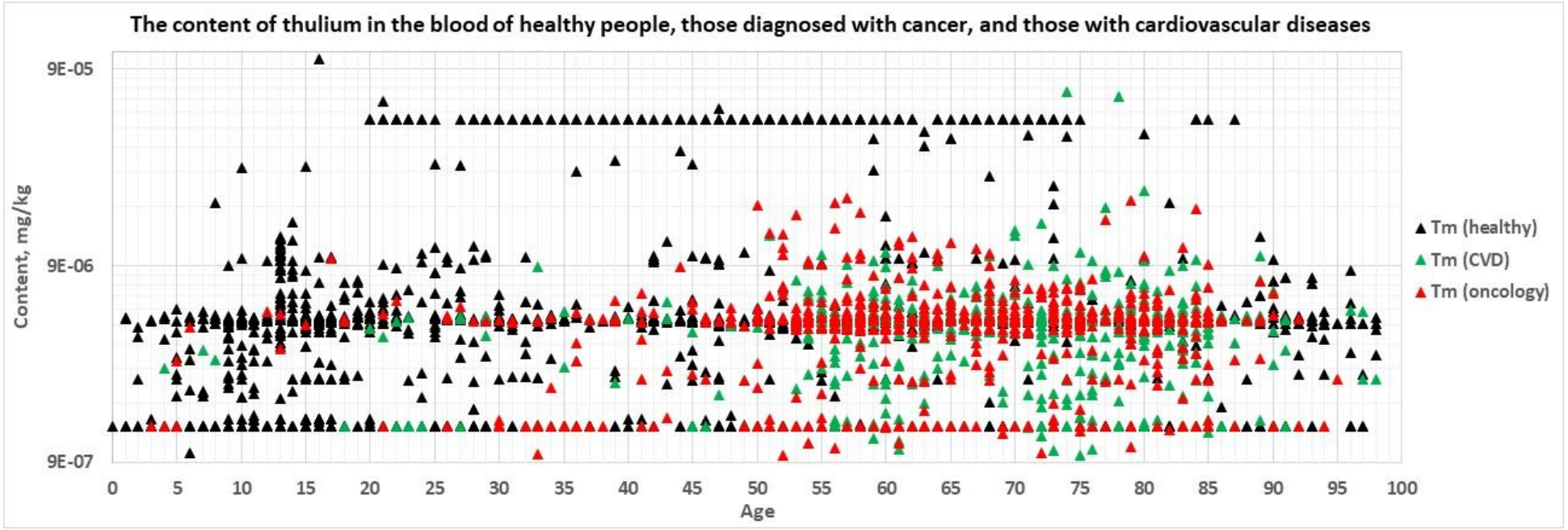

The content of gadolinium in the blood of healthy people, those diagnosed with cancer, and those with cardiovascular diseases
0,0003
3E-05
3E-06
3E-07
Content, mg/kg
0
5
10
15
20
25
30
35
40
45
50
55
60
65
70
75
80
85
90
95
100
Age
Gd (healthy)
Gd (CVD)
Gd (oncology)

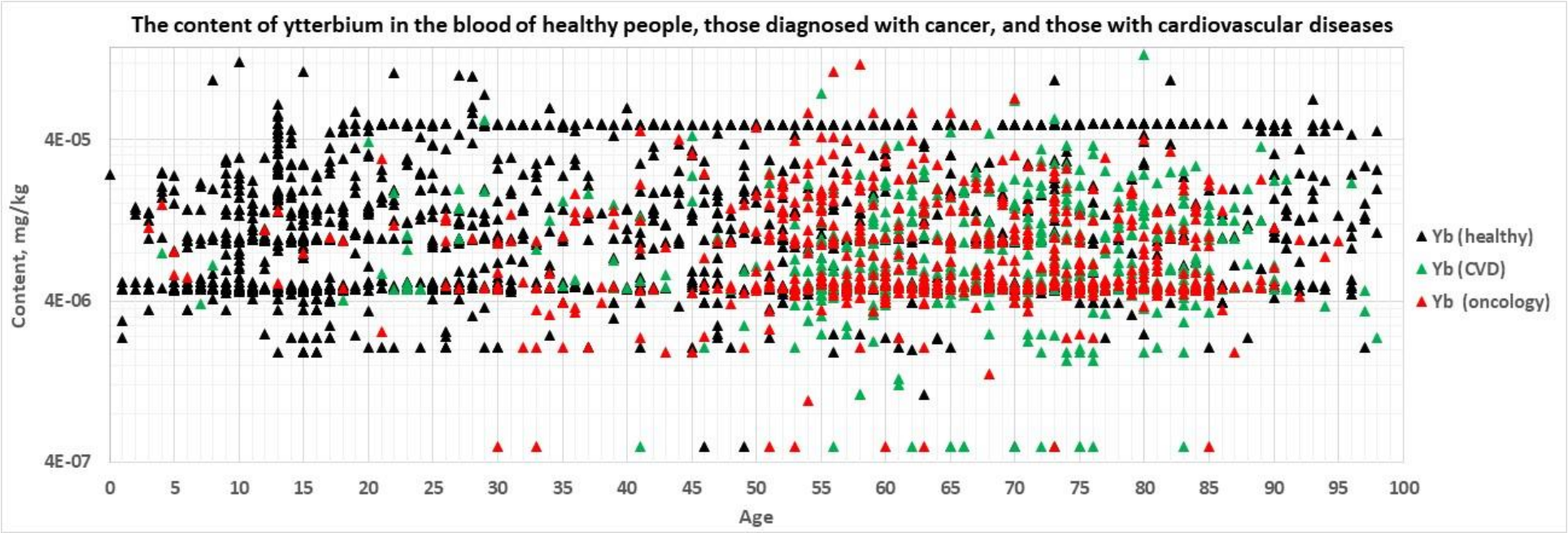

The content of terbium in the blood of healthy people, those diagnosed with cancer, and those with cardiovascular diseases
Content, mg/kg
9E-05
9E-06
9E-07
0
5
10
15
20
25
30
35
40
45
50
55
60
65
70
75
80
85
90
95
100
Age
Tb (здоровые)
Tb (ССЗ)
Tb (онкология)

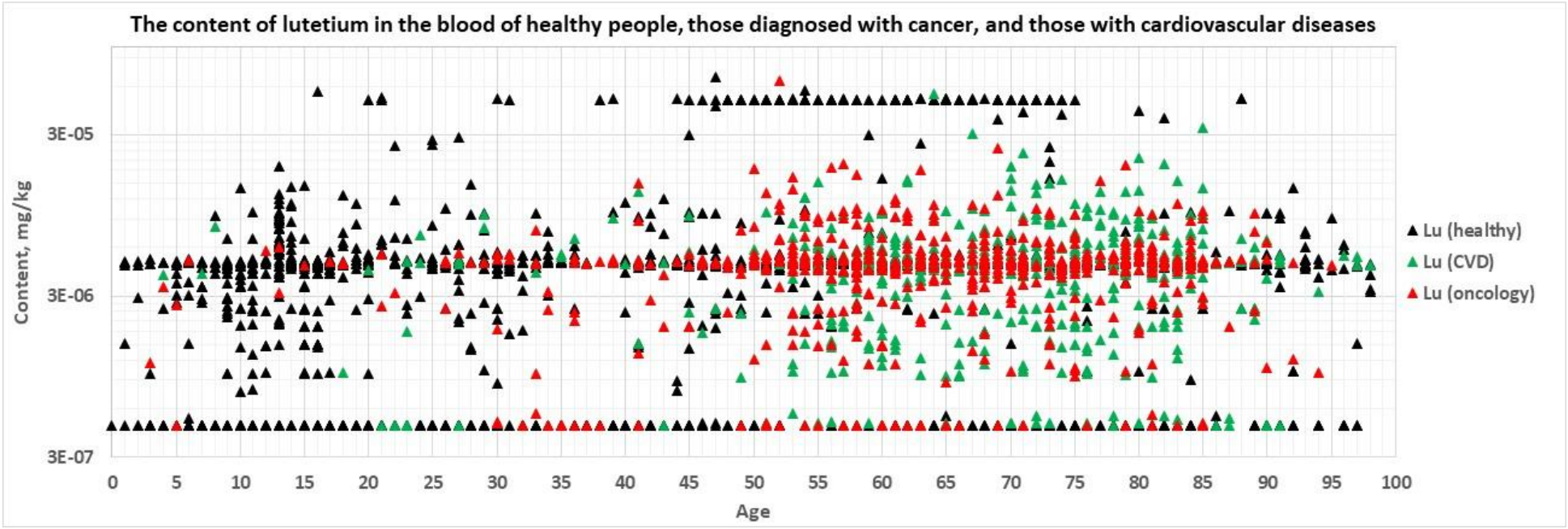

The content of dysprosium in the blood of healthy people, those diagnosed with cancer, and those with cardiovascular diseases
Content, mg/kg
7E-05
7E-06
7E-07
0
5
10
15
20
25
30
35
40
45
50
55
60
65
70
75
80
85
90
95
100
Age
Dy (healthy)
Dy (CVD)
Dy (oncology)

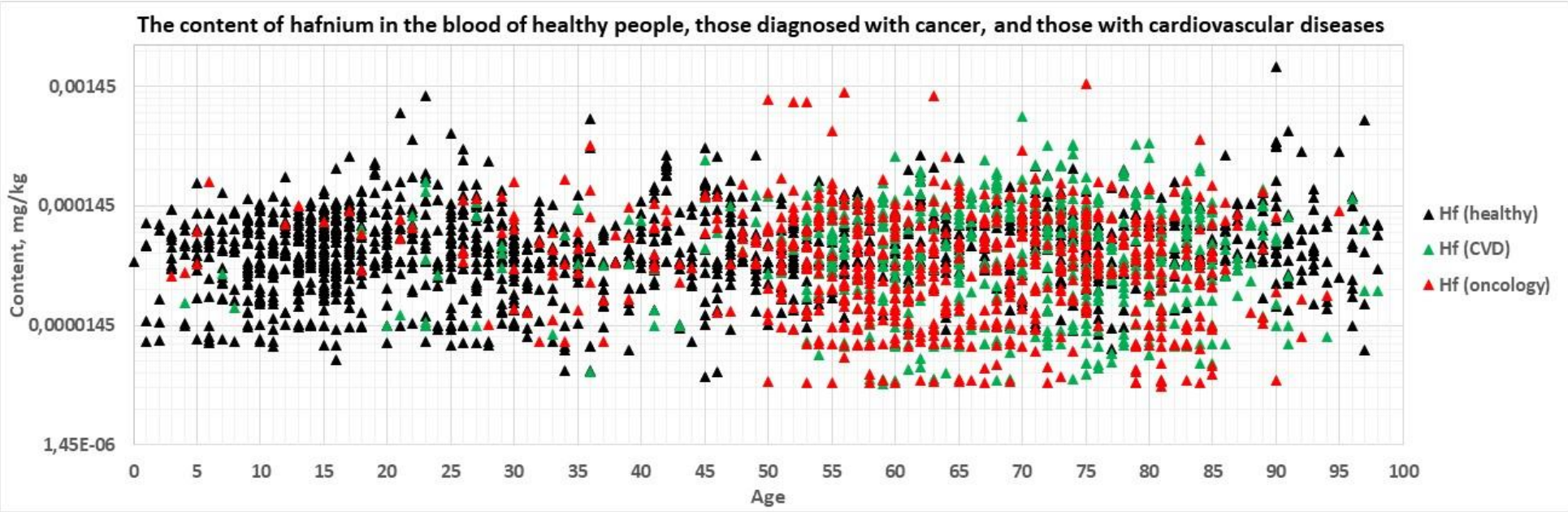

The content of holmium in the blood of healthy people, those diagnosed with cancer, and those with cardiovascular diseases
0,0004
4E-05
4E-06
4E-07
Content, mg/kg
0
5
10
15
20
25
30
35
40
45
50
55
60
65
70
75
80
85
90
95
100
Age
Ho (healthy)
Ho (CVD)
Ho (oncology)

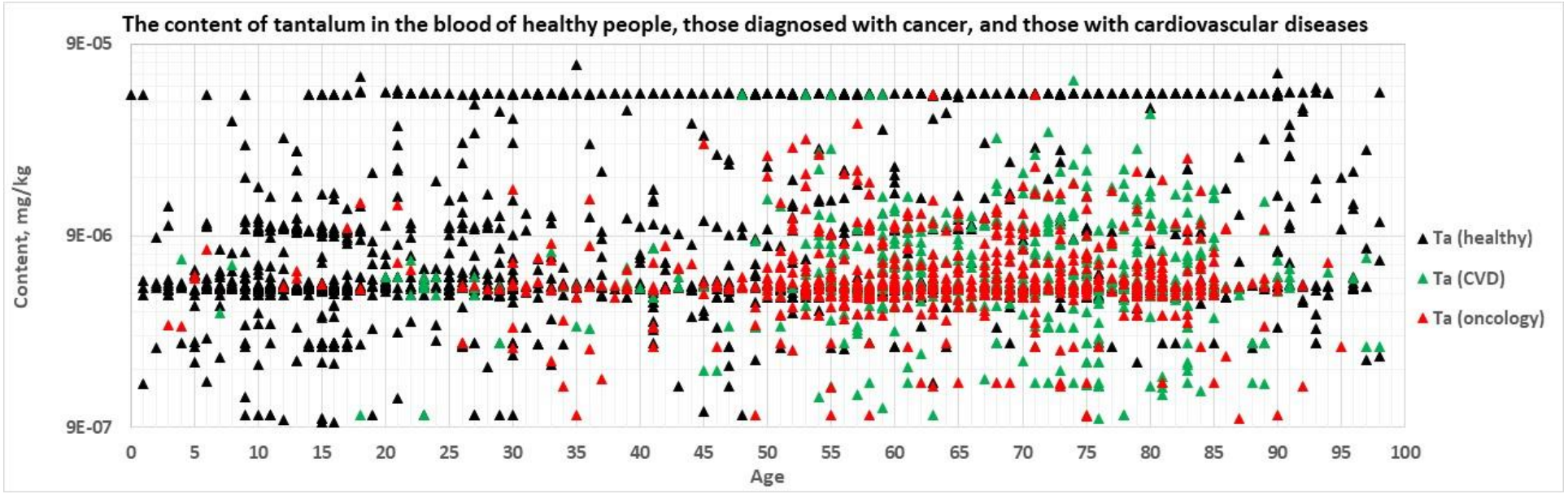

The content of erbium in the blood of healthy people, those diagnosed with cancer, and those with cardiovascular diseases
0,0004
4E-05
4E-06
4E-07
Content, mg/kg
0
5
10
15
20
25
30
35
40
45
50
55
60
65
70
75
80
85
90
95
100
Age
Er (healthy)
Er (CVD)
Er (oncology)

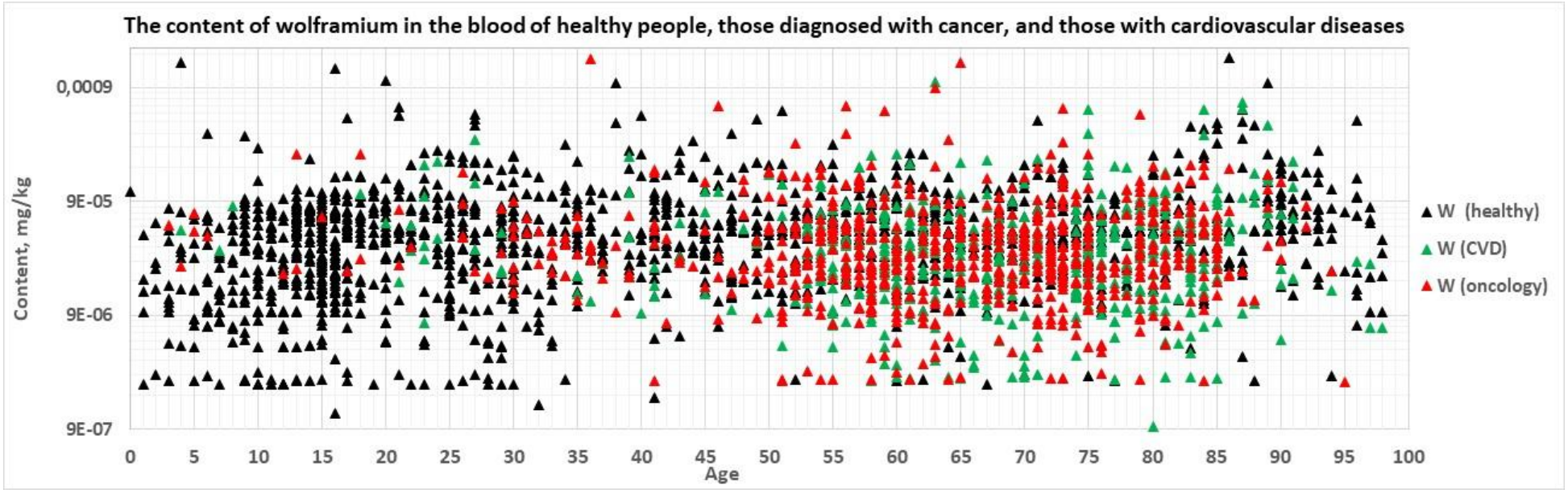

The content of thulium in the blood of healthy people, those diagnosed with cancer, and those with cardiovascular diseases
Content, mg/kg
9E-05
9E-06
9E-07
0
5
10
15
20
25
30
35
40
45
50
55
60
65
70
75
80
85
90
95
100
Age
Tm (healthy)
Tm (CVD)
Tm (oncology)

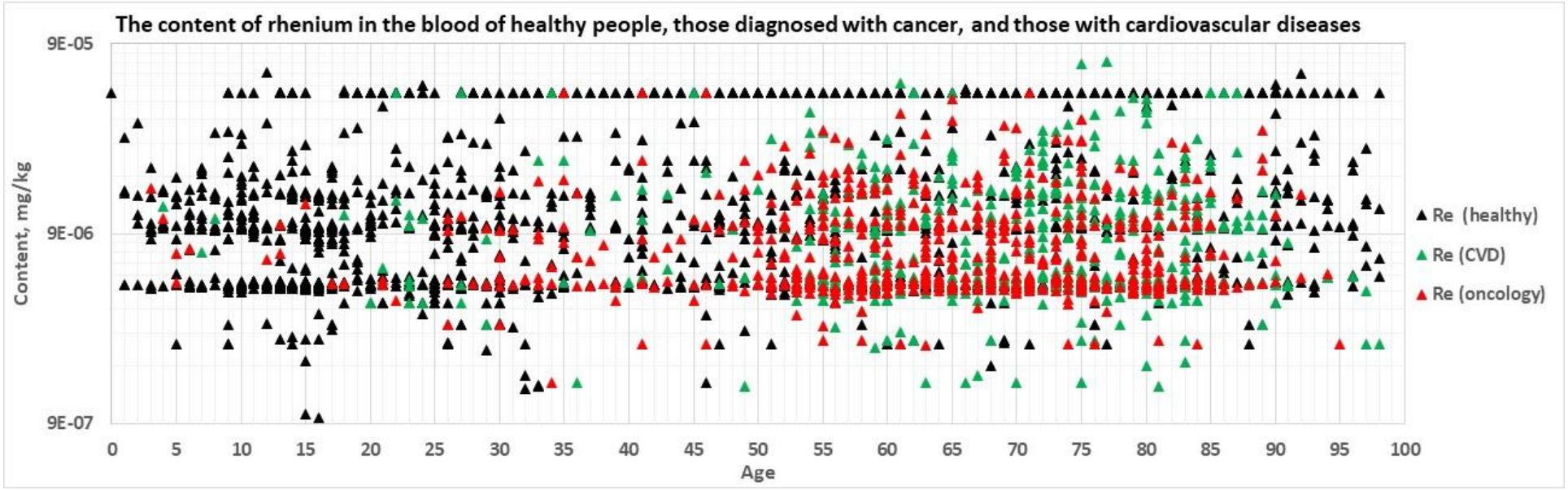

The content of ytterbium in the blood of healthy people, those diagnosed with cancer, and those with cardiovascular diseases
Content, mg/kg
4E-05
4E-06
4E-07
0
5
10
15
20
25
30
35
40
45
50
55
60
65
70
75
80
85
90
95
100
Age
Yb (healthy)
Yb (CVD)
Yb (oncology)

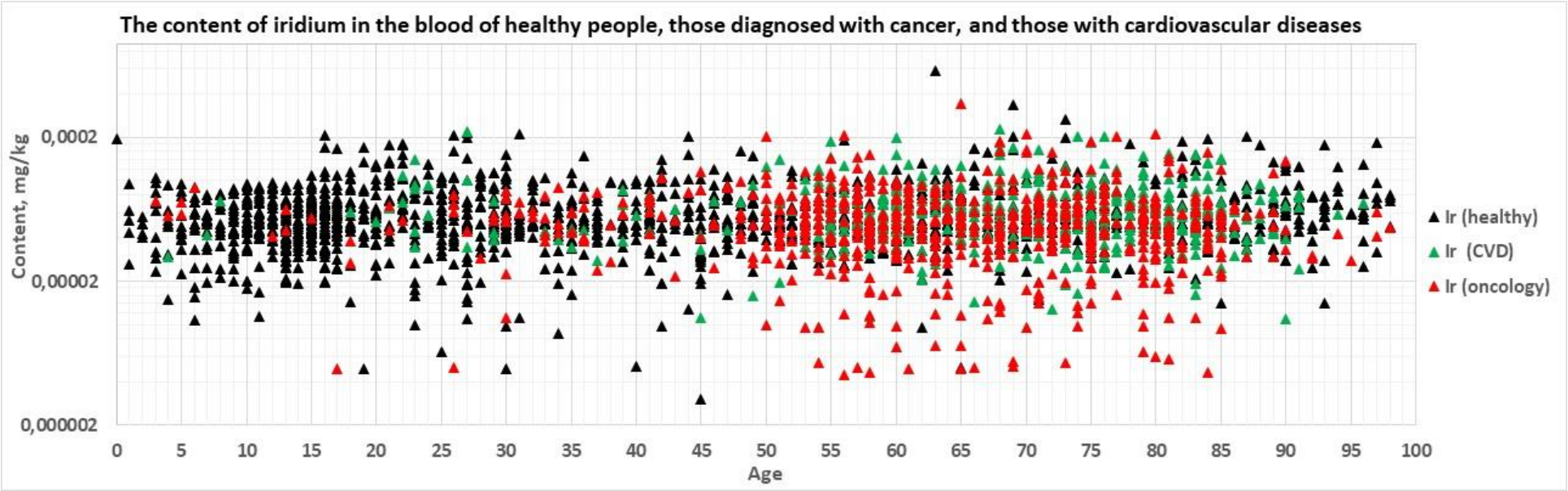

The content of lutetium in the blood of healthy people, those diagnosed with cancer, and those with cardiovascular diseases
Content, mg/kg
3E-05
3E-06
3E-07
0
5
10
15
20
25
30
35
40
45
50
55
60
65
70
75
80
85
90
95
100
Age
Lu (healthy)
Lu (CVD)
Lu (oncology)

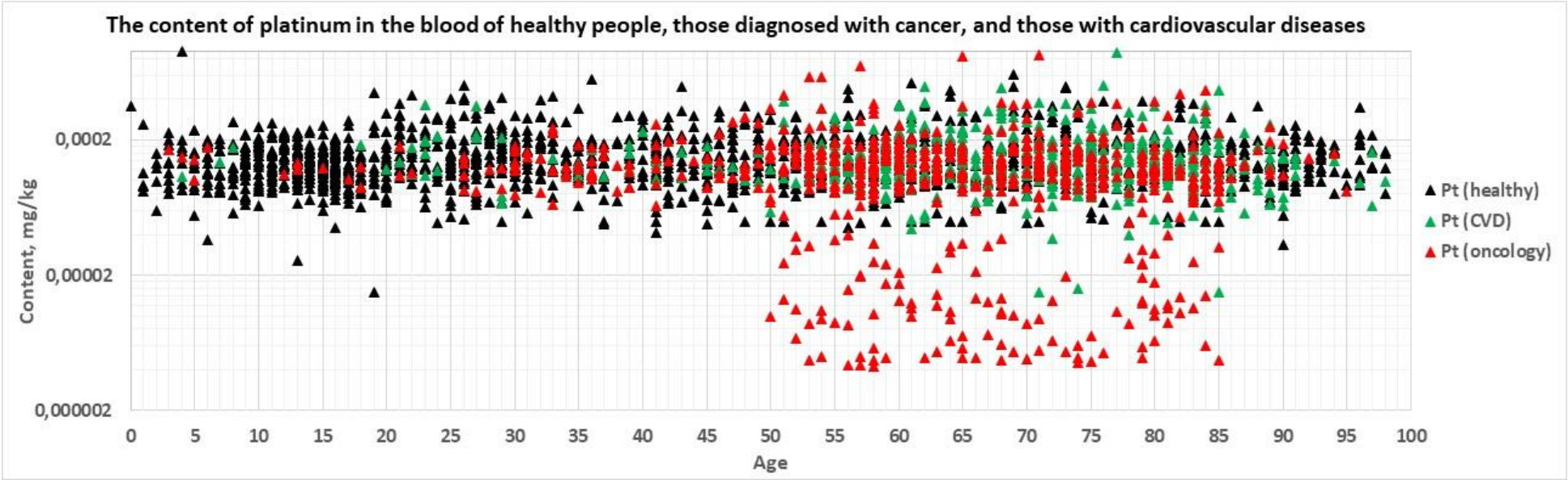

The content of hafnium in the blood of healthy people, those diagnosed with cancer, and those with cardiovascular diseases
Content, mg/kg
0,00145
0,000145
0,0000145
1,45E-06
0
5
10
15
20
25
30
35
40
45
50
55
60
65
70
75
80
85
90
95
100
Age
Hf (healthy)
Hf (CVD)
Hf (oncology)

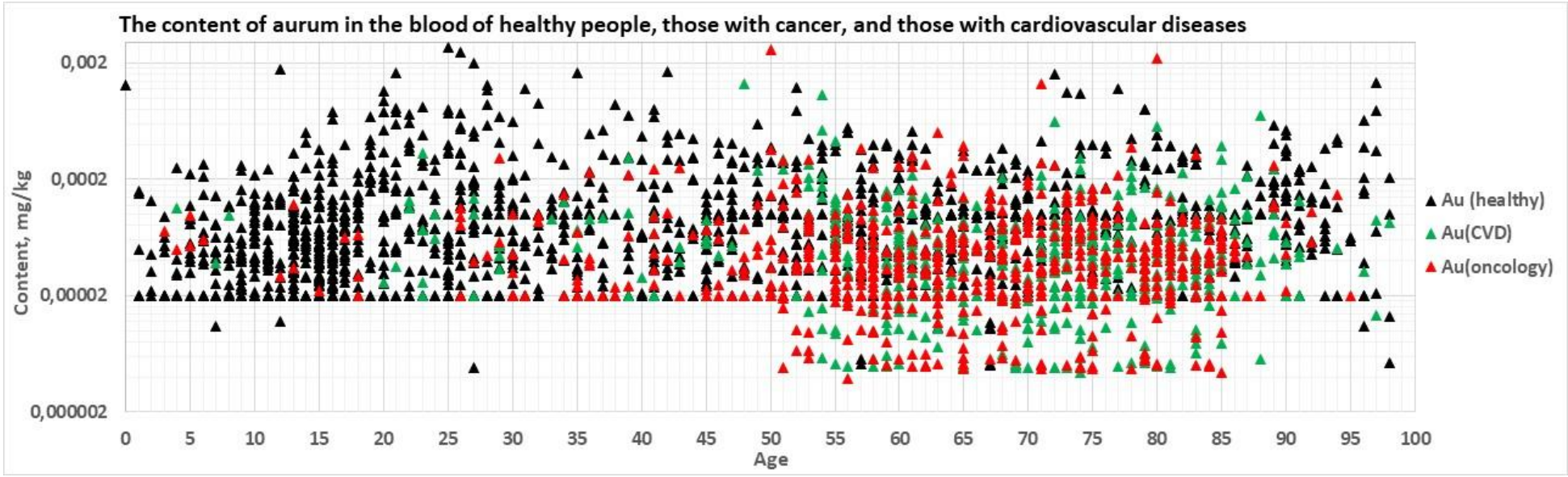

The content of tantalum in the blood of healthy people, those diagnosed with cancer, and those with cardiovascular diseases
9E-05
9E-06
9E-07
Content, mg/kg
0
5
10
15
20
25
30
35
40
45
50
55
60
65
70
75
80
85
90
95
100
Age
Ta (healthy)
Ta (CVD)
Ta (oncology)

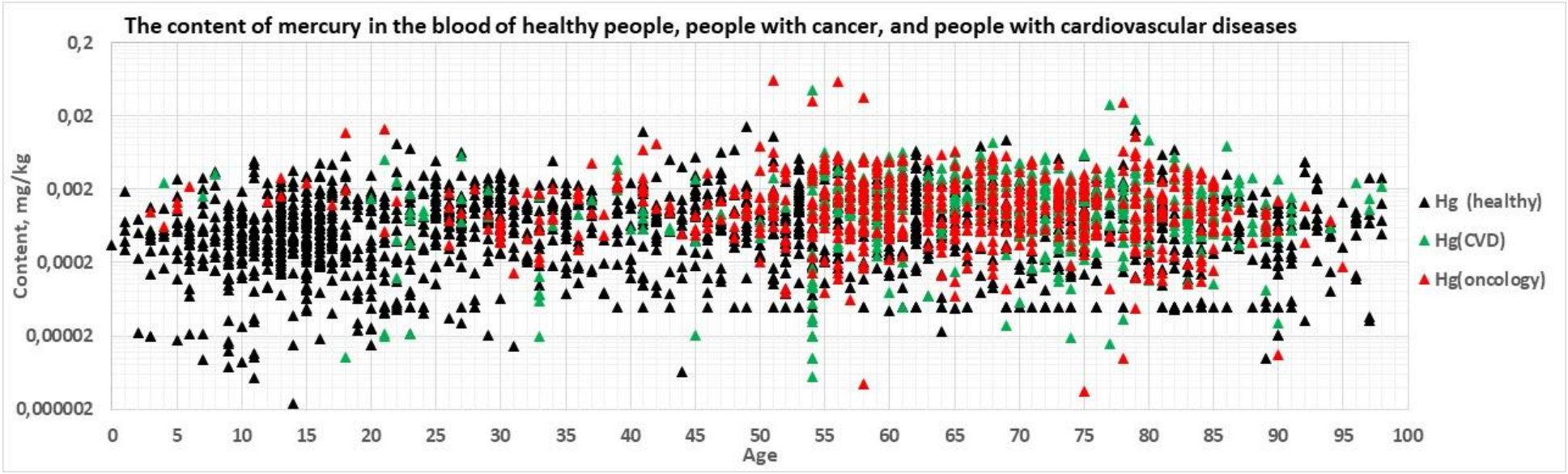

The content of wolframium in the blood of healthy people, those diagnosed with cancer, and those with cardiovascular diseases
Content, mg/kg
0,0009
9E-05
9E-06
9E-07
0
5
10
15
20
25
30
35
40
45
50
55
60
65
70
75
80
85
90
95
100
Age
W (healthy)
W (CVD)
W (oncology)

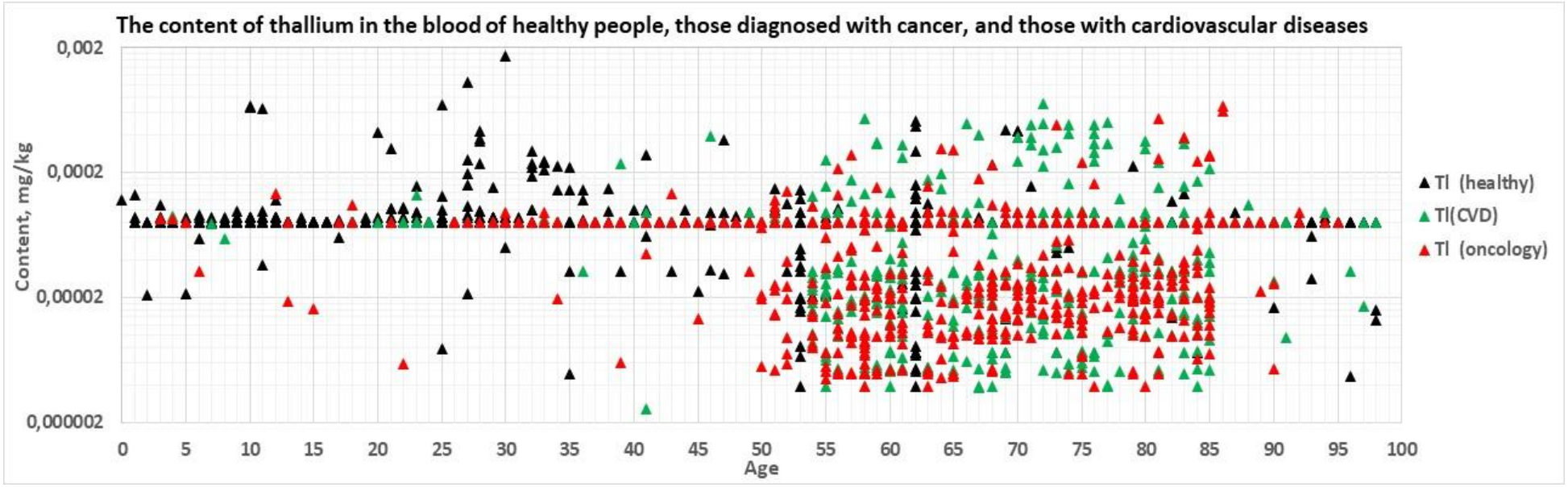

The content of rhenium in the blood of healthy people, those diagnosed with cancer, and those with cardiovascular diseases
9E-05
9E-06
9E-07
Content, mg/kg
0
5
10
15
20
25
30
35
40
45
50
55
60
65
70
75
80
85
90
95
100
Age
Re (healthy)
Re (CVD)
Re (oncology)

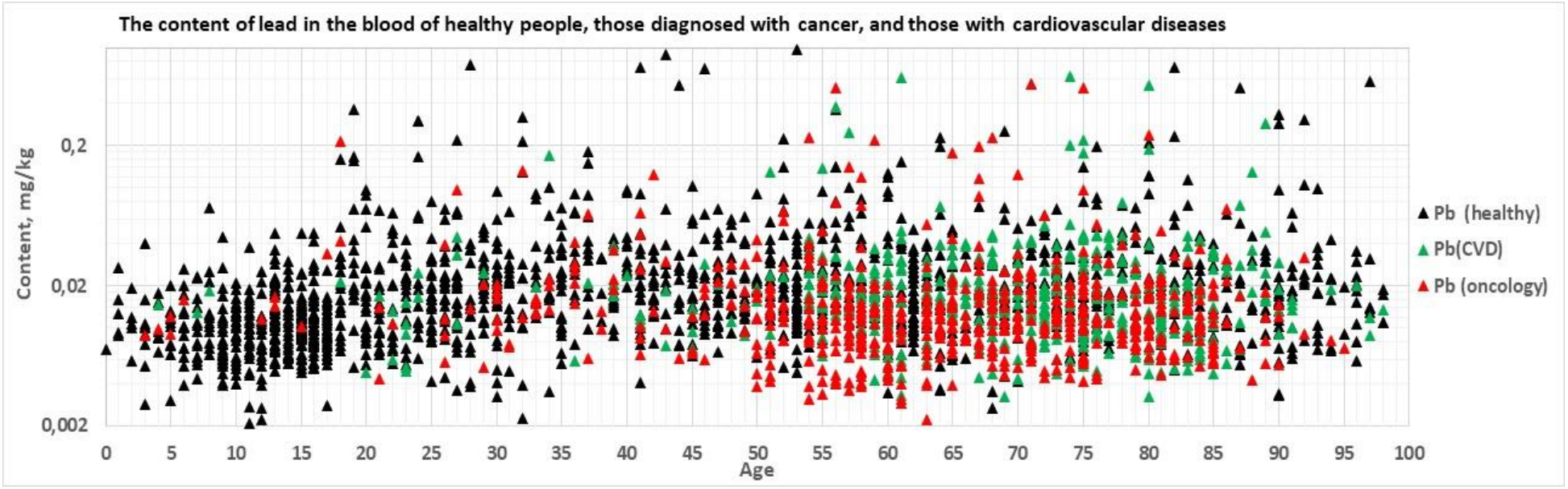

The content of iridium in the blood of healthy people, those diagnosed with cancer, and those with cardiovascular diseases
Content, mg/kg
0,0002
0,00002
0,000002
0
5
10
15
20
25
30
35
40
45
50
55
60
65
70
75
80
85
90
95
100
Age
Ir (healthy)
Ir (CVD)
Ir (oncology)

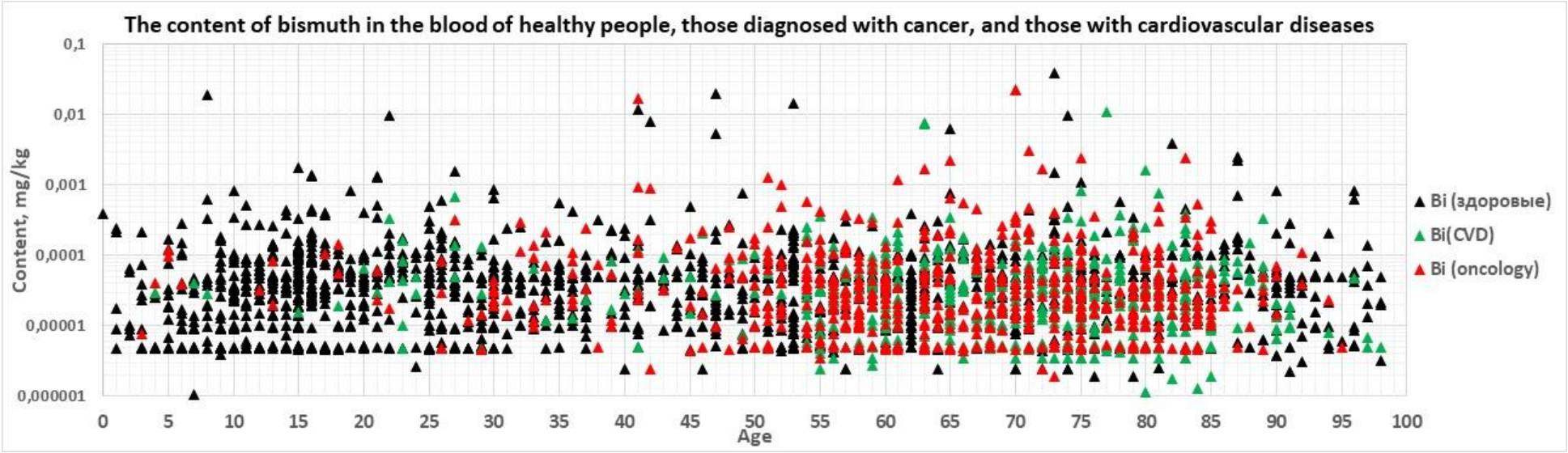

The content of platinum in the blood of healthy people, those diagnosed with cancer, and those with cardiovascular diseases
Content, mg/kg
0,0002
0,00002
0,000002
0
5
10
15
20
25
30
35
40
45
50
55
60
65
70
75
80
85
90
95
100
Age
Pt (healthy)
Pt (CVD)
Pt (oncology)

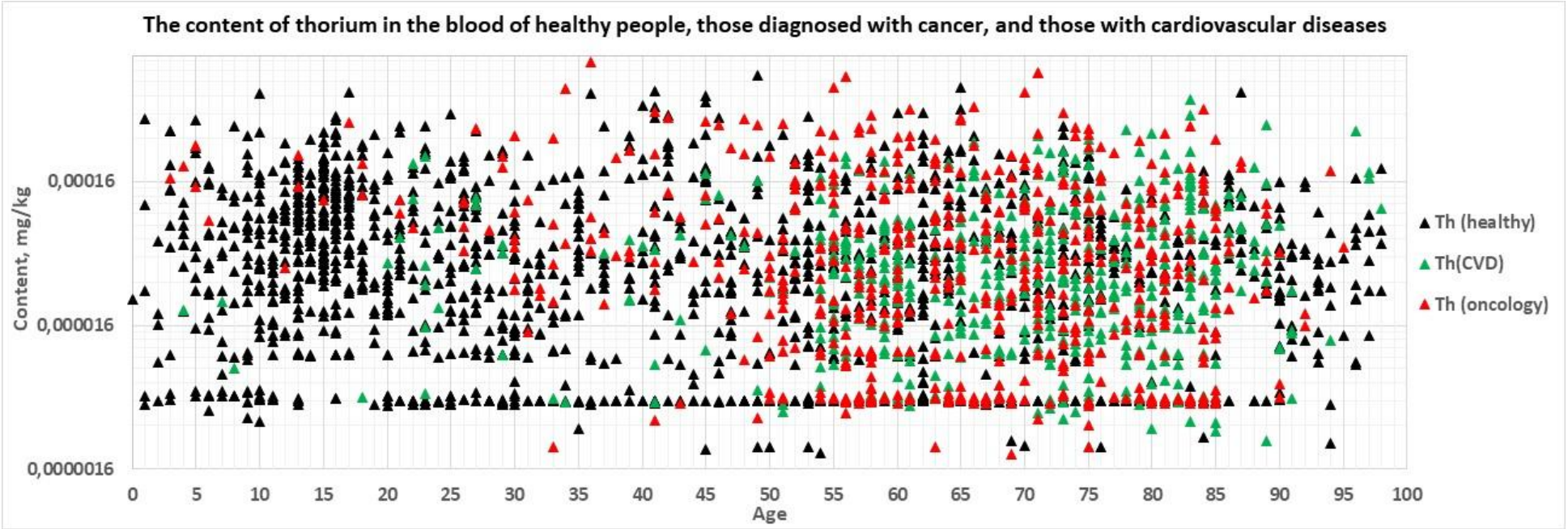

The content of aurum in the blood of healthy people, those with cancer, and those with cardiovascular diseases
Content, mg/kg
0,002
0,0002
0,00002
0,000002
0
5
10
15
20
25
30
35
40
45
50
55
60
65
70
75
80
85
90
95
100
Age
Au (healthy)
Au(CVD)
Au(oncology)

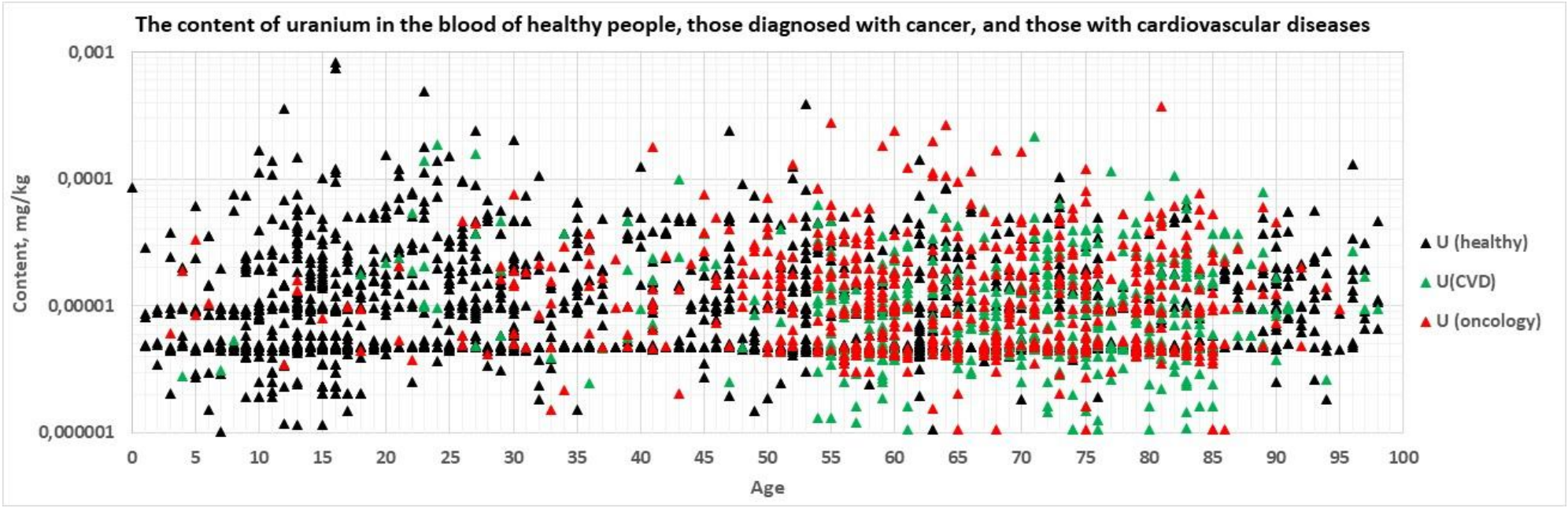

The content of mercury in the blood of healthy people, people with cancer, and people with cardiovascular diseases
Content, mg/kg
0,2
0,02
0,002
0,0002
0,00002
0,000002
0 5 10 15 20 25 30 35 40 45 50 55 60 65 70 75 80 85 90 95 100
Age
Hg (healthy)
Hg(CVD)
Hg(oncology)


The content of thallium in the blood of healthy people, those diagnosed with cancer, and those with cardiovascular diseases
Content, mg/kg
0,002
0,0002
0,00002
0,000002
0
5
10
15
20
25
30
35
40
45
50
55
60
65
70
75
80
85
90
95
100
Age
Tl (healthy)
Tl(CVD)
Tl (oncology)


The content of lead in the blood of healthy people, those diagnosed with cancer, and those with cardiovascular diseases
Content, mg/kg
0,2
0,02
0,002
0
5
10
15
20
25
30
35
40
45
50
55
60
65
70
75
80
85
90
95
100
Age
Pb (healthy)
Pb(CVD)
Pb (oncology)


The content of bismuth in the blood of healthy people, those diagnosed with cancer, and those with cardiovascular diseases
Content, mg/kg
0,1
0,01
0,001
0,0001
0,00001
0,000001
0
5
10
15
20
25
30
35
40
45
50
55
60
65
70
75
80
85
90
95
100
Age
Bi (здоровые)
Bi(CVD)
Bi (oncology)


The content of thorium in the blood of healthy people, those diagnosed with cancer, and those with cardiovascular diseases
Content, mg/kg
0,00016
0,000016
0,0000016
0
5
10
15
20
25
30
35
40
45
50
55
60
65
70
75
80
85
90
95
100
Age
Th (healthy)
Th(CVD)
Th (oncology)


The content of uranium in the blood of healthy people, those diagnosed with cancer, and those with cardiovascular diseases
Content, mg/kg
0,001
0,0001
0,00001
0,000001
0
5
10
15
20
25
30
35
40
45
50
55
60
65
70
75
80
85
90
95
100
Age
U (healthy)
U(CVD)
U (oncology)

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Монография

Чебоксары, 2026 г.

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