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Diagnostic services in oncology. The problem of scarce resources

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Abstract: The high dynamics of growth in cancer incidence in Poland, coupled with the low survavility rate, is a strong indication of an ineffective approach to the problem at hand and poses a great challenge for public administration bodies. Problems arise not only in the context of systemic organisation of the oncologic treatment process as such, but also in the availability of diagnostic procedures and the capabilities of financing this type of services. The paper examines the cost of diagnostic radiology procedures (PET scans) against the funds assigned for this purpose from the public health care system (National Health Fund – NFZ), with the purpose of evaluating the public accessibility of diagnostic services in oncology. The conclusions are supplemented by analyses of the initial results brought about by the recent systemic reform of the so-called 'oncology package'. The paper presents an explanatory approach based on diagnostic and replicative methods of research. This line of enquiry served to confirm the present development trends in the area of diagnostic oncologic services, and provided suggestions for the most crucial amendmends and revisions of the existing system.

Keywords: financing health prophylactics, cost of diagnostic services, health security

JEL codes: I12, I15, I18

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1. Introduction

Health security is a term related to the elimination of restrictions in the access to life- and health-saving procedures and services in cases involving sudden or critical deterioration of health condition (Paplicki, 2018: 104). In such cases, the state should strive to upkeep their statutory obligation to finance the required procedures (the Constitution of the Republic of Poland, art. 68), and patients should be well aware of the fact that they cannot possibly demand state support for all of the available health services recommended in response to their specific condition. Among other things, public health security is largely determined by the public availability, accessibility

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and competence of the public health care system, especially the competence and effectiveness of public health care providers. In effect, any limitation in the availability of medical services or any rationing thereof may be viewed as a risk to public health security (Leowski, 2000).

The availability of health care services should be approached in a multi-aspectual fashion, in line with the natural perception of 'health' as a special commodity. Of all the important aspects of the notion at hand, the following perspectives seem the most prominent: personnel dimension (i.e. the availability of skilled staff), infrastructural, technical, and financial. While each of the above dimensions seems of equal importance, the financial aspect appears as decisive, as the availability of financing largely determines the results observed in the other dimensions (Węgrzyn, 2013: 46-48) and is commonly viewed as one of the main reasons for the introduction of service rationing solutions. In the context of health care services, rationing relates to formal limitations in the access to publicly financed medical procedures, services or effective treatment; this includes limitations introduced by the funding institution or those decided by a service provider (Rój, Sobiech, 2006: 26). Service rationing is also a good illustration of the various practical approaches to the economic decisions made by the participants of the public health care system, and their immediate effects, both individual and social.

The need for service rationing is called in response to the scarcity of resources and the limited amount of financing assigned for health care services. Health care services may be limited by character (such as the availability of organs for transplants) or by financial means (Szewczyk, 2009: 13]. Limits to financing can easily be managed and controlled through socially accepted rules of conduct. However, it seems blatantly inappropriate to invoke the argument of social acceptance for non-provision of medical care in response to diagnosed conditions, particularly when such services are financed from public resources.

Due to the limited role of market mechanisms in the public health care segment, service rationing is inevitable – and this observation holds true whether we define health care as a public commodity or not (Golinowska, 2004; Stiglitz, 2004: 15 ff.). The necessity of rationing stems from economic limitations and the ever-growing cost of medical services. The most essential postulate in this context is to ensure that the benefits from rationing clearly outweigh any potential health hazards or losses resulting from the limitation of access to services. The responsibility for proper distribution of financial resources among individual health service providers is held predominantly by politicians and managers (Węgrzyn, 2003: 64). The limited

volume of financial resources assigned to the health care system naturally forms barriers in the access to medical services – and this effect, sadly enough, is also observed in diagnostic procedures. More and more hospitals find it difficult to cover the running cost of their operation, and this leads to a steep increase in their liabilities.

Table 1. Liabilities due from independent providers of public health care services, spanning 2002 to the 1st quarter of 2017 (in PLN thousand)

Liabilities due from independent providers of public health services, in PLN thousand		
As for:	Liabilities due	
		including those related to commissioned goods and services
30.06.2017	1 801 468	1 634 868
31.12.2016	1 730 476	1 555 351
30.06 2016	1 847 401	1 655 884
31.12.2015	1 758 890	1 564 129
31.12.2014	1 813 469	1 616 074
31.12.2013	1 930 971	1 657 225
31.12.2012	2 360 475	1 961 131
31.12.2011	2 281 329	1 844 829
31.12.2010	2 258 826	1 657 537
31.12.2009	2 340 755	1 579 090
31.12.2008	2 379 577	1 510 519
31.12.2007	2 627 427	1 664 235
31.12.2006	3 603 739	1 912 989
31.12.2005	4 875 372	2 310 073
31.12.2004	5 684 426	2 839 630
31.12.2003	4732974	2 480 863
31.12.2002	3 248 783	2 084 406

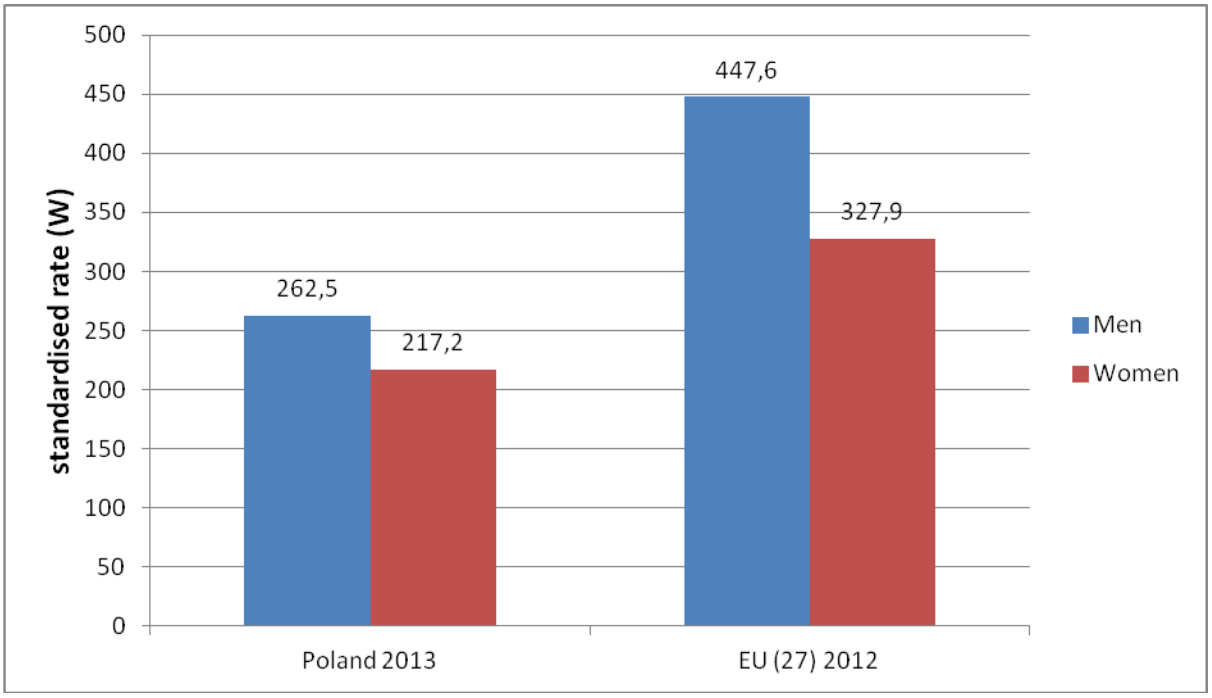
Source: https://www.gov.pl/web/zdrowie/zadluzenie-spzoz (2018-09-08)

In effect, service rationing can be seen as the system's natural response to the scarcity of financial resources which impedes the effective provision of medical services for patients in need of medical assistance.

2. Cancer incidence

The recent years have brought a sizeable increase of cancer incidence in Poland. Malignant neoplasm is one of the major causes of mortality, not only in Poland, but also in Europe and globally. More than a half of cancer incident reports, globally, come from developed countries. Malignant neoplasm is the second leading cause of death in Poland's population, with a toll of ca. 100 thousand deaths, annually. According to recent forecasts, the number of new cancer cases by 2029 will be in excess of 213 thousand. Coupled with the forecasted 180.3 thousand new cases registered in 2016 and with 159.2 thousand of formally registered cases in 2014, the trend may be viewed as a sort of an oncological epidemic. In the light of the Health Needs Map (www.mpz.mz.gov.pl, 2017-12-15), the year 2025 will bring a 16% increase in new cancer cases, up to the level of 204 thousand of diagnosed malignant neoplasm cases. However, despite the significant increase in the number of new cancer cases registered annually, Poland remains on the low end in the EU rating of countries by cancer incidence. Higher increases are still observed and are not limited to developed countries such as Denmark (696 cases per 100 thousand population), the Netherlands, Sweden and Germany, but also in the developing economies of Hungary (980 cases) or the Czech Republic (872 cases). In Poland, the per 100 thousand ratio of patients with diagnosed malignant neoplasm for the years 2012-2015 was slightly in excess of 400 cases, annually. At that time, lower rates were only registered in Montenegro (395), Russia (375), Israel (372), Cyprus (361), Ukraine (361), and Romania (295) (www.pexps.pl, 2017-10-08). Cancer incidence in Poland places well below the EU average, and this statement is true for the both sexes: by ca. 20% for male patients and by ca. 10% for female patients.

Chart 1. Malignant neoplasm incidence in Poland and in the EU

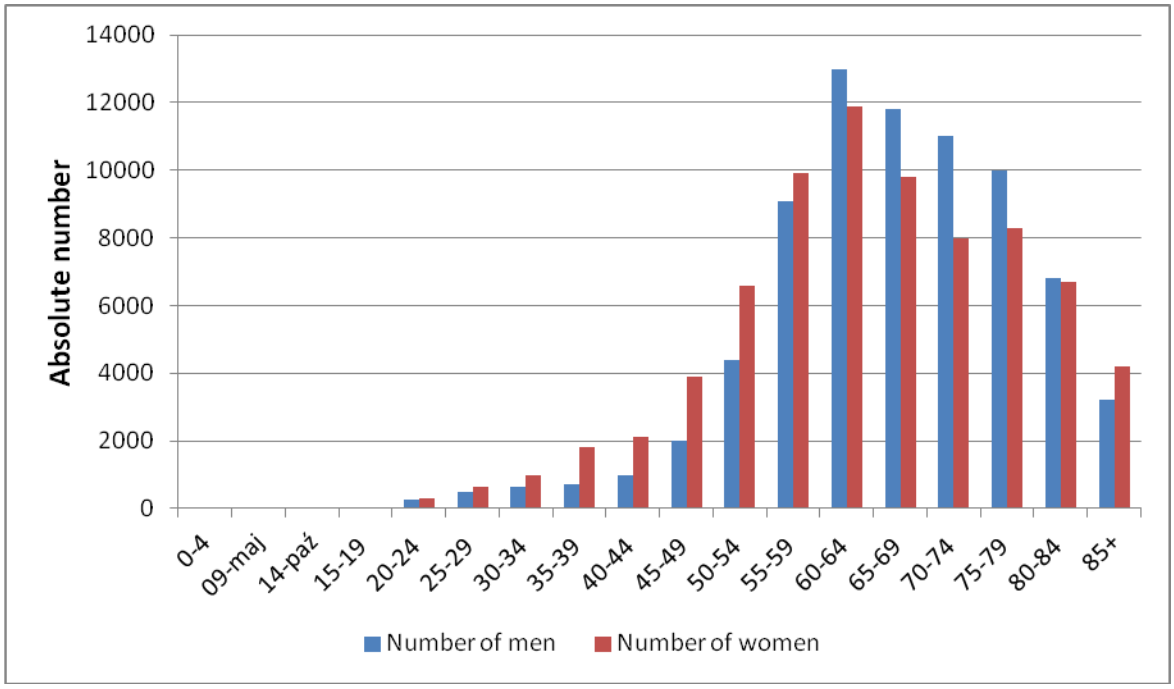


Source: Krajowy Rejestr Nowotworów; http://onkologia.org.pl/wp-content/uploads/Nowotwory2014.pdf. Accessed on 8 September 2017.

At the same time, Poland registers particularly high mortality rates among professionally active patients, both young and middle-age, which places Poland at a very disadvantageous position in the EU ratings. Compared to Poland, countries such as Denmark, Great Britain, the Czech Republic or the Netherlands (Causes of death, https://ec.europa.eu/eurostat/statistics-explained/index.php/Causes_of_death_statistics_-_people_over_65#Standardised_death_rates_for_the_elderly_.E2.80.94_main_causes_of_death_in_the_EU_and_the_Member_States, Accessed on 2 November 2017).

report higher mortality rates among patients aged 65+, but the rates for younger persons are considerably lower than those observed in Poland. In the years 1999-2014, the number of new cases in the latter age segment had increased from 4 thousand to 5 thousand, marking an increase of as much as 22%.

Chart 2. Malignant neoplasm incidence in Poland, by age group, in 2011-2013



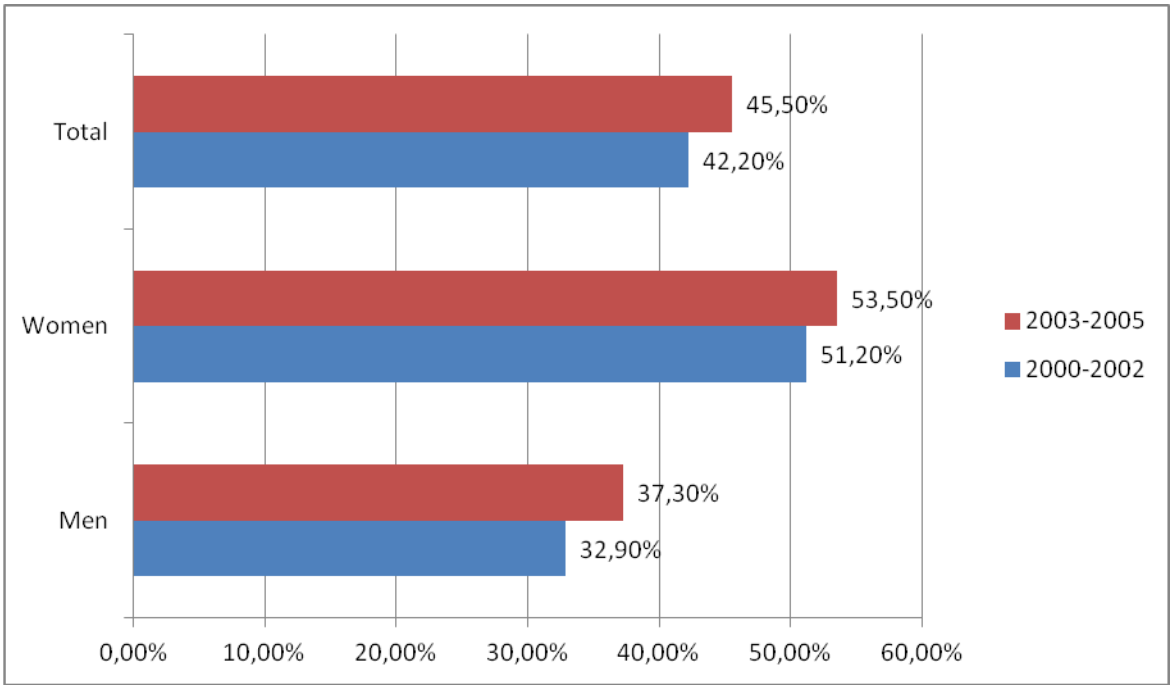
Source: Krajowy Rejestr Nowotworów, http://onkologia.org.pl/wp-content/uploads/Nowotwory2014.pdf. Accessed on 8 September 2017.

The unfavorable position of Poland against other countries ranked for cancer mortality in both age groups, i.e. younger and older patients, may be seen as an indicator of systemic inadequacy to meet the challenge of increased cancer incidence. Another confirmation of the above thesis can be derived from observations of changes in mortality rates by the country (Raport, https://www.pexps.pl/publikacje.html/Downloads/Raport2017_Fundacja_Alivia.pdf, Accessed on 5 October 2017). Major improvements, both in caner diagnostics and treatment, were introduced in Poland over the last decades (1990–2013). Equally important changes were also observed with respect to social awareness of neoplastic diseases. Through concerted effort, Poland has managed to reduce mortality rates associated with neoplastic growth by ca. 8%. However, reports for other countries show reductions of a much higher order. For instance, Luxembourg, Switzerland, Belgium, and even the Czech Republic recorded mortality rate reductions in excess of 25%, with the OECD average calculated at 17%.

Another important measure in the context under study is the 5-year relative survival rate for patients with diagnosed malignant growth. A Polish patient, on average, has a much lower chance to live with cancer for at least 5 years after being diagnosed with it, compared to patients

from other EU countries. Reports from Sweden, Finland and Iceland indicate that more than 60% of cancer patients diagnosed in the period of 2000-2007 had managed to live for at least 5 years after being diagnosed with malignant neoplasm. Over the same period, the Czech Republic and Portugal reported survival rates in excess of 50%. For Poland, the 5-year relative survival rate was found at 41%, meaning that – out of each 100 people with diagnosed cancer – only 41 (on average) were still alive 5 years after the diagnosis or treatment.

Chart 3. The 5-year relative survival rates for patients with diagnosed malignant neoplasm in Poland



Source: Krajowy Rejestr Nowotworów, http://onkologia.org.pl/wp-content/uploads/Nowotwory2014.pdf. Accessed on 8 September 2017)

Sadly enough, Poland ranks exceptionally low with respect to the 5-year relative survival rate for cancer patients. The 41% rate score for Poland, as quoted above for the period of 2000-2007, is based on the Eurocare-5 report (www.eurocare.it, https://www.sciencedirect.com/science/article/pii/S0959804915008096, Accessed on 15 October 2017). Although the National Health Fund (NFZ) reports indicate significant increases in the 5-year relative survival rate over the first decade of the 21st century: from 32.9% to 37.3% for male patients, and from 51.2% to 53.5% for female patients, Poland still ranks last but one in the EU

ranking in this respect (www.pexps.pl, 2017-08-15), followed only by Bulgaria with the survival rate for cancer patients reported at 39%. Poland is closely preceded by Latvia (42% relative 5-year survival rate), Slovakia (45%), and by Croatia, Lithuania and Estonia (each at 46%). Cancer treatment effects were found to be the most positive in Sweden (65% rate for the period of 2000-2007), Finland (61%), and Belgium and Austria (also 61%). Over the same period, the EU average 5-year relative survival rate for cancer patients was in excess of 54%. At the same time, the 5-year relative cancer survival rates for Polish patients were found at 38.8% for male patients and 48.3% for female patients. These represent the low end of the ranking scale for OECD countries, and should be seen as indicators of Poland's problems in the systemic approach to effective treatment of cancer patients.

Cancer-related indices and rates gathered in other countries of Central and Eastern Europe seem to follow similar trends, showing evidence of lower cancer incidence, a similar level of mortality, and significantly lower 5-year relative survival rates compared with countries of Western Europe. No evidence is available to form viable hypotheses as to whether these results should be read as indicators of poor quality of the systemic support and treatment or rather as indicators of the poor quality of information recorded in relation to cancer cases.

The analytical evaluation of the extensive records of oncologic cases in Poland, presented in the Health Needs Map (http://www.mpz.mz.gov.pl/wp-content/uploads/sites/4/2019/02/12_hematologia_nowotwory.pdf, Accessed on 9 September 2017). shows a large number of premature deaths from preventable forms of malignant growth, such as cervical cancer, breast cancer, colorectal cancer, and prostate cancer. However, only 1% of malignant growth cases recorded in Poland are diagnosed at stage 1, as evidenced by the records of the National Cancer Registry (KRN) (Więckowska, 2015). This contrasts with the 17% rate reported by the National Health Fund (NFZ), which may be seen as indicative of poor reporting of early stage cancer diagnoses to the registry authorities. For example, based on analyses of KRN and NFZ records commissioned by the Ministry of Health, detection of stage 1 breast cancer in Poland is ca. four times lower than that reported in the Czech Republic or the United Kingdom (Dagiel, Koń, 2015).

The above conclusion seems puzzling, particularly in the context of the recent improvements of cross-population cancer prevention programs targeting three of the most prevalent forms of cancer – cervical, breast, and colorectal. Moreover, it raises considerable

doubts as to the effectiveness of records produced by cancer prevention programs and their practical use as an instrument of support in the organization of cancer prophylaxis.

2. 1. Cancer and the national economy

Cancer should be viewed from the economic perspective, too. At present, cancer-related expenditure represents ca. 10% of the total budget of the NFZ, annually. Apart from the immediate cost of oncological care and prophylaxis, cancer should also be accountable for indirect (alternative) cost, such as the loss in production related to cancer incidence. In 2013, the alternative cost attributed to cancer cases in Poland was estimated at ca. PLN 16.8 bn. In effect, the Polish GDP suffered a 1% loss directly attributable to cancer incidence (i.e. fully avoidable if the number of cancer patients were at zero). Based on the forecasts of cancer incidence and mortality published by the Polish Oncological Association (http://ingos.pl/public/userfiles/pdf/Ocena_strat_ekonomicznych_i_kosztow_%20leczenia_nowotworow_piersi_szyjki_macicy_i_jajnika_w_Polsce.pdf, Accessed on 2 October 2017) the estimated alternative cost attributable to cancer incidence in the year 2025 will increase by ca. 29% compared to 2013 and amount to ca. 1.3% of the GDP.

On the other hand, it should be noted that the total economic loss incurred by premature departure of patients with cancer illnesses is much more pronounced when viewed from the perspective of lost years of gainful employment. It must be remembered that a premature death results in the loss of a major segment of the patient's professionally active life. For instance, total value of the GDP loss incurred by premature deaths of professionally active patients in 2014 alone (and compared to their expected lifetime yield) was estimated between 8 and 10 billion PLN.

Thus, the identification of major determinants of the cancer prevention and treatment systems' effectiveness and establishing potential for elimination of their deficiencies proves particularly challenging. Practical observation provides three major groups of such determinants, representing the following realms: resources, processes, and management.

1) Resources, defined here as the sum of financing, personnel, and medical equipment/apparatuses available for the realization of diagnostic and treatment processes, including:
    a. total health care expenditure, together with the per capita GDP,

   b. diagnostic equipment,
   c. the availability of innovative drugs,
   d. personnel, including professional medical care and nursing care.
2) Processes, defined here as the realization of diagnostic and cancer treatment procedures, together with the evaluation of their effectiveness, including:
   a. cross-population screening programs,
   b. wait times for diagnostic assessment,
   c. wait times for treatment,
   d. the use of optimal therapies.
3) Management, defined here as the organization of the entire system for cancer prevention and treatment within the bounds of the national health system, including:
   a. operating activities within the framework of the nationwide cancer prevention strategy,
   b. organization of the treatment effectiveness monitoring and evaluation system,
   c. coordination and organization of the treatment process.

According to the EY report (https://www.ey.com/Publication/vwLUAssets/Raport_EY/$FILE/Raport_system_opieki_onkologicznej_2014.pdf, Accessed on 15 June 2017), the quality of resources may be accountable for 45-55% of the variance in the 5-year relative survival rate, with the role of resources being more pronounced in less-developed countries. Similarly, the quality of processes may be accountable for 25-35% of the variance in 5-year relative survival rate, and management: 20-30% of the variance.

2.2. Diagnostic imaging in cancer detection and treatment

As evidenced by the above, proper diagnostic equipment and modern diagnostic imaging techniques constitute a major factor in the battle against cancer, as it provides means for effective diagnosis of various types of neoplastic growth, for evaluating the progress of malignant changes (cancer stage), for selecting the most suitable therapeutic strategy, for monitoring the effectiveness of adopted measures and for early detection of potential relapse. The most important determinant in the studied context is the prompt use of diagnostic procedures. For instance, the majority of patients with lung cancer receive their initial diagnoses in fairly advanced stages of the illness (for more than 70% of patients, diagnoses are passed at stage 3 or 4

(i.e. in inoperable condition), resulting in their premature and otherwise fairly preventable demise. Only one out of every five patients may benefit from early detection, i.e. one passed within 4 to 6 weeks after initial suspicion of malignant growth. Radical forms of surgical interventions, i.e. ones that offer the best therapeutic outcome, may only be used with some 10-13% of patients with this type of growth. Taking aside the natural reluctance of most patients in reporting worrisome conditions, such late detection and poor therapeutic effects of medical interventions in lung cancer can also be attributed to insufficient 'oncological vigilance' – both on the part of first-contact practitioners and the patients themselves – such as negligence to keep up with the regime of regular screening procedures, needless deferrals between initial suspicion and formal diagnosis, and limited access to specialist diagnostic equipment (Batura-Gabryel *et al*., 2015).

Modern diagnostic procedures in oncology involve the use of two principal groups of imaging techniques. The first group includes imaging methods designed to detect the morphology of neoplastic growth and includes standard radiology techniques (X-ray examination, mammography), ultrasonography (US), computed tomography scan (CT) and magnetic resonance imaging (MRI).

The second major group of diagnostic methods are those designed for examination of characteristic biological and metabolic properties of growth formations (such as their activity level) and include standard radio-isotopic and scintigraphy techniques, single-photon emission computed tomography (SPECT) and positron-emission tomography (PET) (Gołębiowski *et al*., 2011). In recent years, the most popular approach in diagnostic imaging has been the use of hybrid solutions that integrate two techniques in parallel. This typically applies to combinations of PET-CT or PET-MRI, i.e. the use of positron-emission tomography with simultaneous TK or MRI scan, to allow for cross-examination of morphological and metabolic changes as part of a single diagnostic procedure (Wytyczne, 2015).

Imaging resolutions offered by the above non-invasive methods are sufficient enough to allow for accurate localization and identification of a malignant growth, together with precise evaluation of its progression and activity level, as basis for effective planning of therapeutic responses. At the same time, these methods are the only solution available at present to offer early detection of cancerous growth and fast evaluation of treatment effectiveness, since they can be adopted right after the initial chemotherapy session, as opposed to other types of imaging. In

effect, results obtained from hybrid scans can be used as basis for the running modifications and updates to the therapeutic processes. This, in turn, offers a range of benefits, such as the reduction in treatment times, reduction of the associated cost and, most of all, an increase in the patient's chance for survival and recovery.

As suggested by the available foreign reports, the introduction of PET scan methods may result in reduction in the number of oncological surgical interventions by ca. 20-30%, since many of the changes previously diagnosed as potentially malignant may now, thanks to PET scans, be properly diagnosed as benign. In addition, for some patients, PET scan imaging may bring evidence that malignant changes are more advanced than suggested by the results of other diagnostic imaging techniques (https://www.pexps.pl/publikacje.html/Downloads/Raport2017_Fundacja_Alivia.pdf, Accessed on 5 October 2017). In the both scenarios, the use of PET scan functionality allows for prompt adjustments in the therapeutic strategies and (in the latter case) helps spare the patient from ineffective and painful interventions (and the associated cost). In this way, the personnel can focus on alternative approaches to treatment or resort to palliative care for prevention and relief of suffering and discomfort. Similar effects can be observed in chemotherapy (Żarczyńska, 2017) – instead of making wasteful use of non-effective and expensive medication, the personnel may now apply prompt adjustments to treatment procedures, saving the patient from excessive toxic effects of drugs and reducing treatment times. The imaging strength offered by this method is fairly adequate: for instance, the use of 18-FDG-PET in malignant granuloma or lymphocytic leukaemia detection offers 100% accuracy; with lung cancer, the accuracy is close to 97%. This allows accurate identification of growth advancement and prompt modification of therapeutic plans.

Another benefit offered by the above solution is its application in radiotherapy planning, as it helps establish exact location and extent of growth, particularly in challenging situations, where CT scans alone may prove insufficient due to the growth being obscured by other tissues, such as in a collapsed lung (atelectasis), or in cases requiring precise definition of growth limits, as in esophageal cancer. The PET method allows making very detailed specifications of areas to be targeted by radiation, to help reduce needless contamination of healthy tissue surrounding the growth. PET scans are also indispensable in the early detection of growth relapse, as the new growth is often located deep within post-operative or post-radiation cicatricial tissue which – under other imaging techniques – tends to produce a strong obscuring effect.

However, the availability of this method in Poland is fairly limited, mostly due to the steep cost of the associated technology, the lack of apparatuses and the shortage of personnel skilled in the use of this technique. Despite the ongoing increase of cancer incidence and the recent introduction of the so-called "fast oncological response" solution (www.pakietonkologiczmy.gov.pl, 2017-11-05) in the form of a dedicated medical chart of Oncological Diagnostics and Treatment (DiLO) which offers priority rights to cancer patients with the view of culling the response times and wait times in this segment of medical care, the recent years have brought no significant increase in the number of diagnostic laboratories or dedicated equipment.

Table 2. The availability of diagnostic equipment in Poland, by year

YEARS	Number of RTG diagnostic apparatuses	Number of CT scanners	Number of magnetic resonance apparatuses	Number of gamma chambers/PET
2015	1388	642	284	145/26 (PET-CT)
2014	1404	584	246	136/29 (PET-CT)
2013	1453	640	239	133/16 (PET-CT)
2012	1453	574	202	119/19 (PET-CT)
2011	1398	506	176	127
2010	1316	430	148	108
2009	1272	374	115	104

2008	1248	335	86	
2007	968	263	54	
2006	965	244	49	
2005	972	221	52	

Source: prepared on the basis of report bulletins the Statistical Bulletin of the Ministry of Health for the years 2009-2015 (https://www.gov.pl/web/zdrowie/ochrona-zdrowia-w-liczbach, Accessed on 1 October 2017).

At present, there are 26 PET-CT laboratories in Poland, with some regions (voivodships) having no access to such facilities at all; moreover, many of the existing ones remain in the hands of commercial providers (such as Affidea or Voxel), i.e. outside the existing public hospital structure. The present deficiency of PET-CT facilities in Poland is not merely a result of the steep cost of entry associated with this method, but can also be attributed to the insufficient supply of skilled medical personnel.

In the light of the pending requirements, a PET-CT scan must be examined by two medical practitioners, including one specializing in nuclear medicine. Prior to that, formal evaluations of PET-CT scan results also required an expert opinion from a practitioner specializing in radiology and medical imaging in diagnostics. The present requirement of two expert opinions is still an arduous and time-consuming obligation, but it offers the benefit of largely limiting the risk of error in image interpretation, produces more accurate diagnoses and helps establish a treatment plan tailored to the needs and constraints of the patient. However, the above must be read in the context of the critically inadequate supply of medical personnel, particularly of MDs with suitable specialization.[1]

The need for increased development of imaging diagnostics has been postulated as one of the main objectives of the National Program for the Reduction of Neoplastic Disease for the years

[1] Poland places exceptionally low with regard to the number of MDs per thousand population compared to other European countries. The OECD reports for Poland place our country at 2.2 MDs per 1000. For Greece, the ratio is at 6.3, in Austria – at 5.1, in Germany- at 4, with the EU average of 3.5 MDs per thousand population.

2016-2024.[2] The program is financed both from the state budget and from non-public resources, with limits of expenditure established at PLN 250 thousand, annually (MP, 2015). Its main objectives include improvement of diagnostic quality in oncology, cardiology, and neurology, with the view of reducing the number of oncological interventions by 20-30%. The program's operational objective is to establish a network of PET centers in Poland. Due to the steep cost of entry and the number of patients with medical recommendations for this method of diagnostic evaluation, it is assumed that the early stage of the program should ensure public access to the service at the ratio of one PET center per 10 million population.

Presently, there are more than 100 scanners in operation in Europe (PET, PET-CT). According to a report by the German Nuclear Medicine Society, 0.34 PET scan examinations are performed per thousand population in Germany. Estimates derived from the above (Optymalizacja opieki, 2011) suggest that the present demand for such services in Poland is in the range of 15 000 examinations, annually. The number of examinations per apparatus (PET chamber) varies between countries (and is strongly determined by the total number of such chambers in use) and averages between 1 000 - 2 000 examinations, annually. By adopting modern solutions, session times may be reduced to 20-30 minutes, making it possible to obtain a daily yield of ca. 10 examinations per day. Based on proper organization of work, a PET scan laboratory may thus produce a yield of ca. 2 500 examinations, suggesting that the initial stage of the program should ensure the effective provision of 4 such centers (www.mz.gov.pl, 2017-09-08). New centers should possibly be established around large academic centers or medical institutes, to ensure their use for both clinical and scientific purposes.

2.3. Cost of PET-CT examinations

The majority of PET-CT examinations are refunded from the National Health Fund. No NFZ refunds are offered for PET-MR hybrid scans, despite their evident superiority in many diagnostic situations. Service prices are individually negotiated with providers. Based on a report by *Agencja Oceny Technologii Medycznych i Taryfikacji* (Agency for the Evaluation of Medical

[2] The National Program for the Reduction of Neoplastic Disease includes the following main objectives:

- improving the survival rate of patients with neoplastic disease,
- improving the access to medical equipment and apparatuses in cancer screening, diagnostics and treatment; eliminate differences across the entire structure of health service providers,
- improving knowledge and skills of medical practitioners and other personnel in those areas which are directly related to oncological diagnostics,
- improving the operation and functionality of cancer data collection systems in Poland.

Technologies and Charge Rates) (http://bipold.aotm.gov.pl/index.php?option=com_content&view=article&layout=edit&id=5323) and data publications of the National Health Fund, and by 2014 (inclusive), the prices for PET scan examinations were at an average of PLN 4 100. The year 2015 has brought a reduction in price, with the price expectation set at a level of PLN 3 300. In 2016, the AOTMiT postulated a further reduction: a PET scan employing group I radiopharmaceuticals (18F-FDG,18F-NaF) would be valued at PLN 2 700, and one based on the use of group II tracers (such as choline) – at PLN 4 000. Price reductions are expected to produce NFZ savings in the neighborhood of 14.6%, i.e. some PLN 20 million, corresponding to more than 7 thousand additional PET scans, annually – as suggested in the Agency's report (http://www.politykazdrowotna.com/37836,aotmit-ws-wyceny-dla-swiadczen-z-zakresu-chorob-reumatologicznych, Accessed on 24 October 2017).

For comparison, Table 3 below presents free market prices for a similar range of PET scan services offered by commercial providers, as published by the AOTMiT on the basis of available online price lists (Tab. 3).

Table 3. Commercial prices for PET scan procedures in 2016

	Price for a PET scan with F-FDG tracer	Price for a PET scan with choline tracer
Average	4320	5800
Median	4200	5900
Minimum	3700	5500

Source: Agencja Oceny Technologii Medycznych i Taryfikacji, 2016 (http://wwwold.aotm.gov.pl/assets/files/taryfikacja/raporty/SOK_03_04_PET/AOTMiT_WT_553_19_2015_PET_raport.pdf, Accessed on 15 June 2017).

In 2014, the National Health Fund refunded a total of 35 959 PET scan procedures to a joint total sum of PLN 141 099 095, placing the average per session at PLN 3 924. The joint sum refunded in 2015 was at PLN 134 032 236 (40 795 examinations), placing the average at PLN 3 286. Table 4 presents the number of procedures per year, the associated joint refund values, and the average per-examination price for PET scan procedures.

Table 4. The number of PET examinations, their joint refund value and the average price per session, by year

Year	Number of PET scans performed	Volume of refunds	Price average
2012	27 012	109 992 162	4 072
2013	31 770	128 835 500	4 055
2014	35 959	141 099 095	3 924
2015	40 795	134 032 236	3 286

Source: based on NFZ data, 2016, (http://wwwold.aotm.gov.pl/assets/files/taryfikacja/raporty/SOK_03_04_PET/AOTMiT_WT_553_19_2015_PET_raport.pdf, Accessed on 15 June 2017).

In Poland, the main limitation to accessing PET scan procedures is the formal limit of procedures contracted with the NFZ. For 2015, it fluctuated between 626 and 4252 examinations per provider, annually, with the EU annual average per provider held at 1 622 PET examinations (Tab. 5).

Table 5. Providers of positron emission tomography service and the number of procedures performed, in the years 2012 – 2015

Year	Number of providers	Number of PET scans performed	Annual average of PET scans per provider
2012	18	27 012	1 501
2013	18	31 770	1 765
2014	21	35 959	1 712
2015	22	40 795	1 854

Source: based on NFZ data, (http://wwwold.aotm.gov.pl/assets/files/taryfikacja/raporty/SOK_03_04_PET/AOTMiT_WT_553_19_2015_PET_raport.pdf, Accessed on 15 June 2017).

In 2015, the National Health Fund signed PET scan service agreements with 22 service providers. In 2014, the service under study was performed by 21 units, and by a total of 18 units in the years 2012 and 2013. In the view of an independent expert group (Żarczyńska, 2017), the

present demand in Poland for PET scan services amounts to 70 330, annually, corresponding with the requirement of some 28 additional diagnostic centres. The above estimates are based predominantly on the epidemiologic records available for oncological diseases.

In December 2015, the Ministry of Health published the document titled "Poland's Map of Health Needs in Oncology" (http://www.mpz.mz.gov.pl/wp-content/uploads/sites/4/2019/02/12_hematologia_nowotwory.pdf, Accessed on 15 June 2017). with a forecast of PET/CT centers required for the realization of the program's objectives. Thus, in 2018, the requirement for PET/CT centers was assessed at 21, including 3 PET chambers for each of the following voivodships: Mazovian, Małopolskie, Silesian, and Wielkopolskie. In addition, each voivodship should provide access to a minimum of one PET chamber. Two of Poland's regions at present (Opolskie and Lubuskie voivodships) perform no PET scan services whatsoever (as attested by their null contracts with the NFZ).

The improvement of diagnostic services is also emphasized in the context of the recent reform of the so-called 'fast oncologic response' chart, introduced formally on January 1, 2015. The number of DILO charts issued by October 15, 2017 amounted to 590 643, with the number of preliminary diagnoses in excess of 117 000, and in-depth diagnoses at ca. 201 000. Despite the large number of both 'fast path charts' issued and diagnoses performed in association with the program, the rates of charts issued at the level of first-contact institutions is alarmingly low (30% for first contact units, 20% for ambulatory units). This may be read as evidence for poor effectiveness of preventive and screening programs for early detection of cancer. The above conclusion can also be attested by the incessantly low rate of cancer growths diagnosed at early stages (in comparison to other EU countries) (Prognozowanie zapadalności, http://www2.mz.gov.pl/wwwfiles/ma_struktura/docs/narodowy_plan_zdrowia_30042004.pdf).

One of the main rationales behind the introduction of the 'fast oncologic response' chart was to reduce the wait times associated with initial expert assessment and diagnostic procedures. At present (http://www.nfz.gov.pl/dla-pacjenta/pakiet-onkologiczny/), the average wait time for an oncological service amounts to 2.2 weeks for a DiLO holder and 6.6 weeks for patients without a DiLO chart. However, the average wait time for oncological procedures has been found to increase in 4 out of 5 disciplines under monitoring: oncology, oncologic surgery, haematology, haemato-oncology, and oncologic radiotherapy. A wait time decrease was only observed with regard to oncologic gynaecology. It should also be noted that the program came with no extra

financial support for public health institutions to help them deal with the resulting surge in demand for oncologic services.

2.4. Practical results of the Polish oncologic chart reform in the period between 01.01.2015 – 30.04.2017

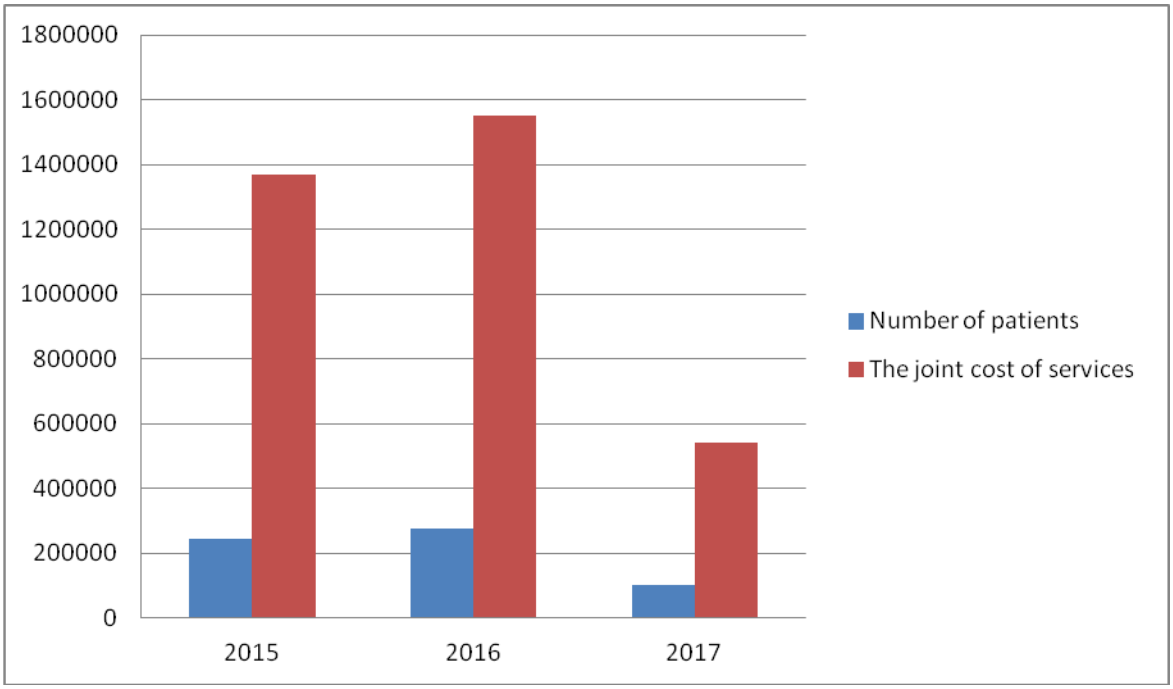
From Jan.1, 2015 to Apr. 30, 2017, Polish health care system rendered services to 622 227 patients, to a joint cost of PLN 3 457 010 745.72 in total. The above values seem to follow a rising trend (by 25% for number of patients, by 18% for total cost), as presented in Table 6.

Table 6. Number of patients and the joint cost of services rendered within the framework of the 'fast oncologic response' chart programme over the period of 01.01.2015 – 30.04.2017.

	2015		**2016**		**2017**	
Type / year	No. of patients	Total value of services in PLN	No. of patients	Total value of services in PLN	No. of patients	Total value of services in PLN
Ambulatory specialist services	75 063	44 996 764.81	85 557	58 971 602.64	33 914	18 919 314.54
Hospital treatment	169 151	1 322 667 947.42	190 778	1 491 045 817.86	67 764	520 409 298.46
Total	**244 214**	**1 367 664 712.23**	**276 335**	**1 550 017 420.50**	**101 678**	**539 328 613.00**

Source: own elaboration based on data from the National Health Fund.

Chart 4. Number of patients and the joint cost of services (in PLN thousand) rendered within the framework of the 'fast oncologic response' chart program over the period of 01.01.2015 – 30.04.2017



Source: own elaboration based on data from the National Health Fund.

A good quality of cancer data on record is essential for the improvement of services and effects of treatment. While reports of the number of patients and total cost of services may be of some practical use, the systemic improvements require ample information on the effectiveness of therapeutic decisions, recorded by such indices as the 5-year relative survival ratio described in Sec. 2 above. However, with regard to the recently introduced 'fast response' program, this type of data is as yet unavailable.

3. Conclusions

The high dynamics of growth in cancer incidence in Poland, coupled with low relative survival ratios, is indicative of problems in effective treatment of cancer and presents an urgent challenge to institutions and managers of public health care. Polish oncology has already embarked on the path of systemic and organizational reforms to meet this pressing challenge. In the present approach, it seems of particular importance to provide access to modern diagnostic imaging techniques, as their specificity allows obtaining fast and accurate diagnoses and, consequently, more effective treatment. However, the present supply of fast and accurate imaging techniques in

Poland is by far inadequate to demand. The above limitations (technical and, most of all, financial) have to be addressed in the subsequent editions of program documents on development strategies and directions. Only in this way may the system stand a chance of improving (or at least, limiting the deterioration of) the public health across population and reducing the recovery time for patients undergoing cancer treatment (and helping them return to their gainful activities). The wealth of data (both financial and empirical) presented herein seems to confirm the formation of a trend for rationing the access to oncological diagnostic services. The system has already responded to the problem by introducing the 'fast path' systemic reform and the DiLO chart. The reform has already produced beneficial effects in terms of patient structure and access to rapid diagnostics. However, the systemic transformation has not yet been supported by suitable measures of financial support for units facing the increase in demand for oncological services (cf. Tab. 1). Lastly, priority of service for patients with oncological conditions has been established, but it seems that this came at the cost of limiting public access to health services for patients with other medical conditions. Results of research presented herein provide clear evidence of the urgent need to extend the public access to diagnostic services in oncologic treatment through a radical augmentation of diagnostic facilities (i.e. their number and quality). The present financial barriers and restrictions that impede the use of diagnostic (prophylactic) services will produce rapid increases in the cost of treatment at later stages, with negative consequences borne not only by the public health system, but, most importantly, by patients themselves. If the present restrictions and inadequacies in public access to diagnostic oncologic services are not addressed promptly, the system will soon face a landslide increase in the cost of oncologic treatment, a truly alarming scenario from the payer's perspective.

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Diagnostyczne świadczenia onkologiczne. Problem dostępności

Streszczenie

Wysoka dynamika wzrostu zachorowań na nowotwory w Polsce oraz niskie wskaźniki przeżyć świadczące o istnieniu problemu skutecznego leczenia stawiają przed administracją publiczną szczególnie istotne wyzwania. Mieszczą się one zarówno w zakresie organizacji procesu leczenia onkologicznego jak i w procesie diagnostyki onkologicznej i możliwościach jej sfinansowania. W artykule dokonano konfrontacji kosztów badań radiologicznych (PET) i możliwości ich sfinansowania przez NFZ w celu oceny dostępności do diagnostycznych świadczeń onkologicznych. Pokazanie pierwszych wyników realizacji tzw. „pakietu onkologicznego" jest uzupełnieniem analizowanej problematyki. Artykuł na charakter pracy eksplanacyjnej z zastosowaniem diagnostycznej i replikacyjnej metody badawczej. Dzięki wykorzystaniu tych metod uzyskano potwierdzenie zmian zachodzących w obszarze diagnostycznych świadczeń onkologicznych oraz wskazano konieczne kierunki zmian.

Słowa kluczowe: diagnostyka onkologiczna, profilaktyka zdrowotna, koszty świadczeń diagnostycznych, dostępność do świadczeń