National strategic program for the development of Radiation Oncology in Armenia for 2012-2018 years

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1. Introduction

1.1. Brief history & geography

The Republic of Armenia (RA) covers an area of 29800 km². According to different sources (National Statistical Service and www.worldfacts.us/Armenia), Armenia has a population of 2.8 – 3.2. The latest population census was conducted in Autumn 2011. The final results will be published next year, but according to preliminary data released in February 2012 by the NSS of RA, 2.8 million people lived in Armenia, on 130,000 less than 10 years ago.

More precise definition of the RA population is not only the prerogative of national safety, but it's also important for many other reasons, like understanding the objective picture of standardized indicators of morbidity and mortality for all nosological units. Hereinafter all cited data is based on official information of Analytical Centre of the Ministry of Health (MH) and the NSS.

By population quantity and territorial area Armenia is a smallest country in the South Caucasus. More than 90% of its area lies at an altitude of over 1000 m. above sea-level with an average altitude of 1800 m. The climate is highland continental, which means that the country is subjected to hot summers and cold winters. The land rises to 4,090 meters above sea-level at
Mount Aragats, and no point is below 390 meters above sea-level. Armenia has no outlet to the sea, and all water surface of the country has only 1400 km².

Armenia became the first nation to declare Christianity as its state religion in 301 AD. It's a mononational country, ethnic armenians make up 98% of the population. This fact has many negative effects and influence on nation's health as well. Armenia is divided into ten provinces (marzer), the country's capital is Yerevan with 1.11 million population. Three years later after devastating earthquake, on 21 September 1991, Armenia was officially recognized as an independent country. As all of the former republics of the USSR, the first years of independent Armenia were gone through the same scenario of industrial and economic decline. However, the Republic of Armenia have been burdened with variety of factors, like impact of the stunning earthquake, the war, the problems of refugees and mass migration, which brought the country into economic and energy collapse. The specified circumstances affected on a Public Health System of Armenia and particularly on oncology.

The Republic of Armenia is a member of the United Nations, OSCE, IAEA, WHO, IMF, WB, WTO and many other international organizations.

1.2 The Importance of the National Strategic Program for the Development of Radiation Oncology

Development of the National Strategic Program for Radiation Oncology as an integral part of the National Cancer Control Program requires no discussion. This is confirmed by decreased rates of mortality and morbidity for malignant neoplasms in those countries that implemented the program. Moreover, that program is so important for Armenia, because of the very high morbidity and death rates from cancer. There are some reasons that have led to such situation in RA. They only prove the policy failure and the lack of proper attention to oncology issues and the struggle against cancer in Armenia. In order to create a realistic and effective program we should take an objective inventory of existing funds such as human resources, diagnostic and treatment technologies, etc. It is necessary to assess their efficiency, map the levels of palliative care, appraise all available preventive and screening programs and take control over realization of these programs. The important point of program realization is correct defining of program goals and objectives. After that we should define problems and program realization periods. It would be better to start finding solutions for those problems which require the minimal financial investments in its early stages. Many expected and additional difficulties we have to overcome during the process of program implementation. This is related to the fact that Armenia is considered a middle-income developing country, and increase of cancer morbidity is forecasted in the coming decade especially for developing countries like Armenia. Moreover, heath insurance system in Armenia is in its embryonic stage and the state financing for cancer treatment is extremely underfunded. Therefore at each stage of program realization it's necessary to put together medical and economic aspects of the problem, determine the priorities of one or the other cancer treatment course and offer additional mechanisms of overcoming the financial difficulties.
To clearly determine our aims we should identify and comprehend the reasons resulting backlog in cancer treatment, first of all Radiation Oncology in Armenia, which was not so long ago the leader in this area among the countries of Southern Caucasus.

1.3 The main reasons for the current situation in Armenia

As the similar situation prevailed in all CIS countries including Russian Federation, let's us quote an extract from the speech of V. Kostylev, the Chairman of the Russian Association of Medical Physicists, at 1st Congress of Oncologists of the CIS countries. The reasons of 30 years backlog of radiation oncology in Russia he has explained by the residual model of health care financing in the USSR and executive health care leaders' misunderstanding of the radiotherapy’s role and place in oncologic patients treatment. This state of affairs has been handed down to all CIS countries. There have been made no drastic changes to radiation oncology development since then and in 2010 Kostylev addressed his request to the president of Russian Federation.

We’ve performed the same path but the situation remained almost the same. The fact is that all CIS countries had the state of affairs recently, but many of them have achieved significant progress. The reasons for the lag in radiation oncology sector, given by A. Kostylev, are typical for Armenia, but there are several other problems:

- The absence of an approved National Cancer Program (including problems of cancer prevention system, screening processes, the need of early diagnosis and treatment, palliative care, including pain control, rehabilitation and training programs) and, Radiation Oncology development program as a part of it.
- Totally inappropriate financing of oncology by the State. There were no funds available for radiation machines upgrade and repair during the last 20 years.
- Absence of legislative & regulatory documents, regulating and defining the scope of work done by Radiation Oncology department; list of necessary equipment to provide guaranteed quality of radiation therapy and obtaining permission to use it, etc. (the last order of that kind after N1004 was published in 1977, when no PET/CT scanners, CT simulators, planning systems and other required equipment were available in the USSR)
- The absence of legislative documents, regulating the duties of radiation oncologist, technician and medicine physicist.
- The absence of radiation oncologist, technician and medicine physicist specialties in a list of postgraduate courses.
- The absence of teaching and learning guides in Armenian for the Yerevan State Medical University (YSU) students, postgraduates, general medicine doctors and family doctors (specialized in Radiotherapy).
- The closure of 2 out of 4 operating in Armenia departments of Radiation Therapy.
- The available equipment doesn't meet the IAEA standards to guarantee the quality of radiotherapy and to provide conformal radiotherapy.
- The absence of the nuclear medicine department equipped with SPECT/CT and PET/CT scanners which limits the correct identification of disease stage with all the ensuing consequences (There were 12 laboratories of radionuclide diagnostics in the Armenian SSR and for now there are only 3 due to IAEA). Moreover, we cannot provide highly
effective "system" radiotherapy in the case of thyroid cancer, metastatic bone lesions and other system diseases.

- The absence of approved protocols on Radiation Oncology.
- The absence of a modern cancer registry, diagnostic and records systems, possibility to keep the records of all medical documentation in electronic format and data backup.
- The absence of information and entertainment programs for generalist physicians and everyone.

2. The diagnostics, registration, prevalence and mortality from malignant neoplasms in the RA.

In the RA as well as worldwide (except for economically developed countries) has been observed the growth of morbidity and mortality from MN. Identification and mortality records are being collected by Republic Cancer Registry under the National Oncology Center and then all data arrives in the Information and Analysis Unit of the MH. Collected information is being published in special data collections and being uploaded to the official website (www.HealthInfo.am). All statistics and epidemiological data we've used are taken from official sources, though we consider some of them incorrect. Moreover, some of the required data is not published on the website at all.

One of the main reasons for the growth rates of morbidity is increased average life expectancy almost in all countries. The RA is not the exception, where the average life expectancy is 74 years - higher than in all the CIS countries. That's pleasant but inexplicable fact as the average life expectancy – the integrated conception and besides the health impacts, depends on social, economic, psycho-emotional and other aspects. On the mentioned aspects there is no significant progress in the RA. Besides, the average life expectancy in the Republic of Armenia has grown on the back of all chronic noncommunicable diseases (CHNCD) increase, including cancer. According to the official sources (D. Dumanyan, M. Avakyan "The analysis of the epidemiological situation in respect of major noncommunicable diseases in the Republic of Armenia" Practical medicine 2009, N4, pp. 3-7 and the website of MH), on NCDs' share accounts for 86% of overall mortality, including ~ 20% from the malignant neoplasms.
Above the columns are given the absolute value of the rates and in brackets - intensive indicators per 100 000 people.

As you can see, for 25 years in the RA has been sharply increased the cancer morbidity, especially in the past 15 years. Intensive mortality rates grew faster and over 25 years has increased more than 2 times. At the same time, about 50% of patients (depending on the tumor localization the rates range from 40% to 80%) are detected at advanced stages, which lead to treatment failure and death rates increase.

Analyzing the available data, it should be noted that, on average, about 25% of cancer patients who died were considered posthumously and received no professional medical care. To confirm this, we provide data by the National Cancer Registry for 2008 – 2011 years, which is not available on the Ministry’s website.

Table 1

<table>
<thead>
<tr>
<th>Year</th>
<th>2008</th>
<th>2009</th>
<th>2010</th>
<th>2011</th>
</tr>
</thead>
<tbody>
<tr>
<td>Morbidity rates</td>
<td>7336</td>
<td>7657</td>
<td>7593</td>
<td>7856</td>
</tr>
<tr>
<td>Death rates</td>
<td>5415</td>
<td>5445</td>
<td>5707</td>
<td>5597</td>
</tr>
<tr>
<td>Considered posthumously</td>
<td>1354 (25%)</td>
<td>1374 (25.23%)</td>
<td>1338 (23.44%)</td>
<td>1287 (22.9%)</td>
</tr>
</tbody>
</table>

The above-mentioned facts testify the low availability of cancer treatment services in specialized medical institutions, the absence of preventive and screening programs, missed opportunities for
early diagnosis and imperfection of patients accounting methods. Bearing in mind that, there were more than 32,540 cancer patients in Armenia by the end of 2011, it becomes clear that the state can't take the burden of oncology patients and doesn't cope with existing problems.

3. Organization of oncology care and the resources available in the RA

The main place in the organization of cancer care for patients is occupied by the National Center of Oncology (NCO), which was founded in 1946. NCO is a closed joint-stock company and all the shares are held by the Ministry of Health. On the basis of the Center operates the Department of Oncology of YSMU.

The clinic has: 11 specialized surgery units, including Laparoscopic, Department of Anesthesiology and Intensive Care, Pediatric Cancer unit, two Chemotherapy Departments, Department of Radiation Oncology and Nuclear Medicine, Department of Brachytherapy, Department of Morphology, Department of Integrated Diagnostics with the full range of laboratory services. It is supposed to open the Pain and Palliative Care unit.

The Republican Cancer Registry operates on the basis of the NCO. In 2011, there were 10,164 hospitalized patients and in 28,563 cases was provided an ambulatory care services. 154 doctors work in the Center (104 surgeons, chemotherapists and radiation oncologists), 184 nurses and 243 engineering and technical staff. The disparity between the number of doctors and nurses is obvious and has many negative consequences.

On the basis of clinical hospital in Yerevan operates the Unit of Chemotherapy, which is the base for students of Oncology Department of the Yerevan State Medical University, staffed by five doctors and eight nurses.

The patients with hemoblastosis (including children) receive the chemotherapy in the Institute of Hematology and Blood Transfusion, staffed by 10 doctors and 14 nurses. There is impossible to provide an integrated cancer treatment in these two clinics, that's why all the surgical treatment and radiotherapy is provided in the National Oncology Center.

In Gyumri (the second largest city of Armenia, almost destroyed during the earthquake), there is a Municipal Oncology Dispensary, with operating departments of the surgery, chemo- and radiation therapy. The clinic staffed by 13 doctors, 42 nurses and 10 attendants.

In Vanadzor also operates Oncology Dispensary on the basis of the city clinical hospital with the Chemotherapy Department, staffed by 2 doctors and 3 nurses.

Besides, cancer care in the RA is provided by 29 oncologists in Yerevan and 16 in the regions. All oncology care service in Armenia is provided by 179 doctors.

All these specialized oncology clinics are subordinated to the Ministry of Health and local authorities. The cost of cancer treatment is paid from the state budget.

Unfortunately, since Armenia became independent 2 oncology dispensary have been closed - one was in Yerevan and another one in Kapan city. Both of them had departments of radiotherapy.

Thus, besides Yerevan there are only two marzes (regions) where the cancer patients can recieve the minimal amount of oncology care services (with surgical methods and/or chemotherapy, low-level diagnostics and treatment). And the patients living in marzes (regions) to the South and
East of the Yerevan are excluded from it and that directly impacts on cancer mortality rates. The low access to specialized medical care is most observed in application to the radiation therapy for cancer patients.

3.1 Technical equipment

The technical equipment in diagnostic and therapeutic aspects remains unsatisfactory. Only in NCO cancer patients may receive the integrated diagnostic tests: ultrasound examination, endoscopy, X-ray, computer tomography, radionuclide diagnostics with SPECT camera, tumor marker tests, immunohistochemical analyses, other morphological tests, etc.). Some tests are paid by the patients. For example, the cost of CT and MRI test, depending on the number of examined anatomical areas, with or without contrast, is estimated higher than the average salary of Armenia residents. There are no CT scans and radionuclide diagnostics equipment in the other oncology clinics, so for receiving them the patients are sent to other institutions. The same considerations applied to the equipment of radiation therapy departments.

Summarizing the above-described, we can state that in Armenia there is no problem with the number of oncologists, but there are issues related to their qualifications and workload. We had a great problem with ensuring the number of nurses and their qualification.

The training of radiation oncologists and especially, medical physicists (there is no department in Armenia to teach them) and radiographers is a serious cause for concern. The state of technical equipment (diagnostic and therapeutic) nowadays can be compared with equipment in some European countries in the early 80's of last century.

Proceeding from the existing problems, in this National Program we have tried to give our vision of available solutions that will allow Armenia to become fully member of the international community of oncologists and radiation oncologists.

4. The key objectives and indicators of the program.

The program is structured as a multi-faceted, multi-stage pyramid and does not include the issues highlighted in the National Cancer Control Program: preventive care and screening problems, an early diagnostics, ensuring the guaranteed quality of treatment at all stages, palliative care organization, including pain control, psycho-emotional and physical rehabilitation of cancer patients. In the case of reaching the top of the pyramid, at a certain time we could have some success at reducing cancer morbidity rates, increasing life expectancy and improving quality of life. The concept of this program has been presented to the Ministry of Health of Armenia.

Assuming that radiation oncology is a separate medical discipline, but it's an integral part of Oncology and development program for it should be prepared separately and be integrated into the National Cancer Control Program. We will primarily focus on the development of RO within the framework of existing reality. We are convinced that the consideration of both programs
(Cancer Control and RO Development programs) should be integrated with the chronic noncommunicable diseases (CHNCD) control programs, which will lead to tangible positive results, particularly for prevention system.

The success factors of program implementation would be: reduced cancer mortality rates; decreased number of patients detected at an advanced stages of disease (particularly, with easily diagnosable localizations); 100% intravital recording of patients and providing them with medical care; increased number of those patients (up to 4500 - 5000), who need to receive radiation therapy during a year; extended and improved the life quality of cancer patients.

4.1 The substantiation of radiation oncology development program in Armenia

117 years have passed since the first use of ionizing radiation (IR) in diagnostics and treatment of oncological/non-oncological diseases. In the Republic of Armenia IR is used for diagnostic purposes since 1912, and for treatment - since 1927. During this historical period of time radiation therapy has proven to be an effective and universal method at all stages and phases of cancer treatment.

Of the total budget allocated for combined/integrated treatment of the cancer patients, some 5% of resources relate to the standard methods radiation therapy (excluding the cost of stereotaxic irradiation, hadron therapy, etc.).

This is especially important to take into account the above-mentioned facts in the low- and middle-income countries, where in the health development planning the clarifying of "cost-effectiveness" issue becomes a priority. In some localization of tumors and disease stages the radiotherapy becomes no alternative treatment. This is confirmed by 50 - 70% of prescribed RT treatment to patients with malignant neoplasms in developed countries.

In RA this figure is less than 20%, and there are only two Radiation Oncology Departments. Forced limitation of prescribing RT treatment is one of the reasons of low efficacy of treatment and high mortality rates, which were described above. It should be noted, that over the past 20 years no funds have been allocated from the state budget to purchase and repair the radiation oncology equipment.

4.2 The available staff and technical equipment in radiation oncology departments

In the 80th of the last century in Armenia were registered 4500-4800 initial detected cancer patients annually, and on average, 1,600 patients were received the radiotherapy treatment in one of the four existing RO departments. During the past three years over 7,600 new patients have been registered, and the same number (1600) of them was referred for RT.

In 2011 it were identified 7856 new cancer cases, of which at least 3900 patients had to be referred to radiotherapy. At the end of 2011 more than 32000 cancer patients lived in Armenia, being diagnosed in previous years, and 10-15% of them also need to receive the RT. Thus, more
than 7000 patients in Armenia who need to receive the radiation therapy treatment, and there are only 2 operating departments of RO in the republic.

One of them operates in Gyumri Oncological Dispensary (Gyumri is an administrative center of Shirak region). There are working two radiation oncologists, including the head of the department, a medical physicist and three technicians. The installed equipment: one cobalt machine released in 1990 (produced by USSR), X-Ray installation, released in the USSR in 1991 and brachytherapy installation "Bebig" with the planning system and the C-ARM produced in Germany in 2008.

The planning system for teletherapy (calculations are done manually), a complex dosimetric equipment, the simulator, etc. are not available. In some cases, the CT image is forwarding to the NCO to conduct planning of the treatment. A dosimetry of the beam is carried out on the equipment and by medical physicists of the NCO.

It was supposed, that the Gyunmy Department of RT would serve the patients in the neighboring Lori region (marz), where annually identifying more than 1600 new cancer patients, and during 2011 the RT were received only by 213 patients out of the expected 1000. 34 patients out of 213 received the combined course of radiation and brachytherapy, 59 patients received adjuvant therapy and 62 patients were provided with palliative course of teletherapy. Another 58 patients recieved a short distance x-ray therapy. Thus, the available technical equipment of Gyunmy RO Department casts doubt on efficacy and reasonableness of provided radiation therapy.

In the NCO there are 3 remote gamma-therapeutic apparatus - 2 of them were produced in the USSR (1983) and "Teragam", which was made in the Czech Republic (2006). The last recharge of the source Co$^{60}$ on a soviet equipment was held in 1999, but we still forced to use them due to the large numbers of patients. There is also an accelerator made in Russia (2003), which is permanently repaired. We use also 2 brachytherapy machines (Selectron and Microselectron with Ir192 and Ce 137) with planning system, the C-arm, a simulator, CT, complex dosimetry equipment and two planning systems. Equipment names marked in bold has been arrived within the framework of technical co-operation with the IAEA.

The Department of Radiation Oncology is located in a radiological block of the NCO. Structurally it is divided into tele- and brachytherapy blocks. Besides the head of the Department, there are 7 teletherapy radiation oncologists, 6 technicians, 3 engineers and 4 medical physicists who served the Department of Brachytherapy. During 2011 for teletherapy were referred 1426 patients, but only 1376 received it. After providing some tests and examinations 50 patients were denied to get RT because of medical conditions (major blood vessel invasion, dissemination process, panhemocytopenia, acute cardiovascular disease, etc.). Some patients from regions refused themselves because of family circumstances. Totally, 1376 patients were carried out 29 818 radiotherapy sessions by 70 179 fields. (RT treatment was conducted to 432 patients, 137 of them received combined RT and another 116 combined chemo-radiation therapy. Adjuvant course of radiotherapy were received by 723 patients, including, 129 who received combined course of RT. Another 221 patients received palliative/symptomatic course of RT.)
Besides the head of the brachytherapy department there are 4 radiation oncologists, 1 radiographer and 2 technicians. In addition to the 266 cases of combined RT, a large number of unjustified mono brachytherapy was provided to 235 patients. All procedures were performed to the patients who have had gynecologic pathology.

Based on the existing regulatory standards (1 teletherapy machine should serve about 500 initially identified patients), we require 15 teletherapy machines, instead of existing 5, at least 3 of which need to be immediately written off due to technical condition and sharp decline in radiation intensity. The situation concerning brachytherapy equipment is more safely. Two out of three existing brachytherapy machines are modern.

The fifteen radiation oncologists working in the Department have been trained on the spot as well as in radiation clinics abroad. Besides that, some of them require the further qualification improvement, and the other radiation oncologists also need regular training courses.

One more important issue is the lack of qualified technicians. The 15 radiation oncologists are supported by 10 technicians. The training course for technicians lasts only one month and their qualification improvement abroad is excluded, because of the lack of foreign languages. The low qualification of technicians is the main reason why some of their duties are performed by doctors and that overloads them with unusual work.

Also we have to work out the issue of medical physicists training. The above-described reveals many problems and only step by step solutions will allow reaching the goals. The first part of the program is calculated for 6 years with the further prolongation to achieve new goals.

5. Stages and timing of the program implementation

Stage I – Preparation stage

- Building programs for radiation oncology development, its examination and correction with further approval of the necessary structures
- Develop and approve a package of legislative and normative documents regulating the activities of RO, defining the status of the department and its staff and the scope of their activities. Determine the minimum list of equipment necessary to meet the requirements for the QA of RT and obtain permission for RO operation. Bring each unit of RO department into conformity with international standards.
- Development and improvement of treatment protocols by means of RO.
- Develop and approve a program of training for radiation oncologists and technicians in accordance with the recommendations of ESTRO. Such program is already developed by us and adapted to the RA realities.
- Develop a mechanism of two-stage training for medical physicists (the first 3 courses at the Faculty of Nuclear Physics, Yerevan State University with further education at foreign universities with help of intergovernmental agreements.)
- Develop a plan of sanitary and educational activities to inform the public and doctors about the capabilities of RT and to overcome mass phenomena of onco- and radiophobia.
- Begin preparation of educational manual in Armenian for students and interns, oncologists, radiation oncologists.
- Increase spendings on cancer treatment by the state, with a multiple increase of amount spent on RO. If necessary, introduce the principle of co-financing by the patient.
- Provide position of deputy for the chief oncologist of the Ministry of Health for radiation oncology problems. The deputy should prepare a quarterly report on the implementation of the program for the appointed working group. Supposed composition of the group is representative of the Office of the Prime Minister, the representative of the Ministry of Health, Ministry of Health chief oncologist, a member of ANRA, the representative of the NGO Armenian Association of Radiation Oncologists and Radiologists (AAROR), radiation oncologist, and medical physicist.
- Initiate the preparation of construction documents for building two additional modular bunkers for the teletherapy in NCO and one bunker in Gyumri.
- Reintroduce the licensing of individuals.

These are all core issues of the preparatory stage. In case of professional treatment these problems can be solved within 6-8 months after approval of National Strategic Program for the Development of Radiation Oncology (NSPDRO). Except for the issues related to the project documentation (the only issue that needs funding) during the implementation of the remaining issues AAROR offers its assistance, especially because preliminary work has begun on some of the issues. With AAROR direct participation information brochure on the RO was written and published for patients and their families, after consulting with which the patient gives well-informed consent to RT. In addition, members of AAROR designed inter-department documents to provide QA of RT, received patents for the prevention, treatment of radiation dermatitis and mucositis, are written RO treatment protocols by some localizations, work is being done to digitize medical records, forecasting scales are being developed, etc.
2-nd stage

- Final preparation, review and publication of educational manuals in the Armenian for students, interns, family physicians, oncologists, radiobiology, radiation oncologists. Work will be completed within 8 - 10 months after the start of NSPDRO.
- Collecting all necessary equipment for providing QA of RT in operating offices of RO, based on the standards of the IAEA. To this end, following work is due in NCO: complete construction of two bunkers for teleradiotherapy; through technical cooperation with IAEA, get monoenergetic 6 MeV LINAC with multileaf collimator (MLC), immediately after the start of its operation dismantle two soviet cobalt machines, afterwards using the free bins for HDR brachytherapy devices, get CT simulator, recharge "Teragam"; train for working on LINAC two doctors, three engineers and two medical physicists.
- For RO department in Gyumri it’s necessary to: purchase of 2,5 D planning system, complex of dosimetric equipment, CT simulator, a new cobalt machine, equipment for mould-room; train staff for working on new equipment, complete the construction of new bunker.
- Extend the functionality of the nuclear medicine department in NCO. Expand the options of SPECT camera by installing the CT and PET attachments. Implement radionuclide "systematic" therapy.
- Begin designing construction documents for building offices of RO in Goris with 2 bunkers and facilities necessary for irradiation preparations. We are planning to build the department at the Central Hospital of the Goris. Prepare two radiation oncologist, 3 engineers, and a medical physicist. These works should be completed within 18-24 months after the start of the program.

3-rd stage

Complete the construction of RO section in Goris. Obtain and install the following equipment: 2,5 D planning system, a set of dosimetric equipment, CT simulator, a new cobalt machine, equipment for mould-room; training of staff for working on new equipment.
• Buy for NCO a LINAC with MLC with photon energy of 6 and 14 MeV, the electrons at 5, 8, 11, 14, 17 MeV, a new 3D planning system and a new set of dosimetric equipment. Train two physicians and a medical physicist.

• Obtain a new brachytherapy unit BEBIG and C-ARM with a set endostates and applicators for patients with gynecological cancer, for cancer of esophagus, trachea and bronchus, colon, interstitial irradiation. Training of two physicians, a medical physicist and an engineer.

Due date of the third stages is 25-55 months after the start of the program.

4-th stage

• Purchasing LINAC for NCO with possibility of stereotactic irradiation of cranial and extracranial structures (like NOVALIS TX), as an inexpensive alternative to proton and ion therapy. Acquisition of MRI, CT, 4D planning system. Training of two radiation oncologists, three technicians, two medical physicists.

• Complete the set of equipment in Gyumri and Goris sections of RO with monoenergetic LINAC for 6 MeV or with cobalt machines. Train three radiation oncologists, four technicians, two medical physicists. The fourth, that is the final stage of the first part of NSPDRO is planned to be completed in 56-72 months after the start of program implementation. In case it’s completed successfully, the discussion, correction and approval of the second part of NSPDRO will start.

6. Brief comments on the NSPDRO implementation stages

The program cannot be initiated and implemented without preparatory stage. While discussing NSPDRO extra points for the first phase may be offered, which should not increase its implementation period provided the experts are selected properly (responsible professionals, who have a high sense of duty towards his people).

The first sight might give the impression of quite intensive stages and program implementation periods, but they should be further reduced as far as possible. With appropriate funding, it will be desirable to complete the first part of the program in 2-3 years rather than six years. This is due to the fact that every year there appears a new high-tech, more expensive equipment for the RO, which makes even more noticeable the gap of available equipment between developed and
developing countries. In addition, the small number of assignments related to RT is due to well-
knowledge of doctors and public about the deterioration of the RT equipment in Armenia, which
leads to the corresponding attitude towards it. It is therefore necessary during 1.5-2 years of the
second stage, complete the set of equipment in existing RO units, which will allow to increase
the number of patients with MN and receiving RT in the next 3 years from 2.5 to 3 thousands a
year.
Taking into account the real situation, and not from lack of knowledge of existing high-tech
irradiation methods we initially propose to equip the sections of RO in Gyumri and Goris with
cobalt machines. The ground for such decision may serve the following facts: physical and
technical characteristics of the cobalt machines, in case of compliance with QA of RT
requirements, allow for efficient RT for 50-70% of patients with PN; their purchasing price,
maintenance cost is lower compared to the LINAC, they are easier to use and reliable, medical
treatment using them will be cheaper for the state, etc. It’s also necessary to purchase 6 MeV
LINAC for these sections, which will allow to reach a new level of RT, will increase the number
of patients receiving RT curative course, in case one set needs repair, the smooth operation of the
sections should be ensured, etc. In future sections of RO in Gyumri and Goris will be able not
only provide treatment for patients from own and neighboring marzes, but also for patients from
border countries. Further development of these sections depends on the successful
implementation of the first part of NSPDRO.

7. Budget and funding sources of the program

The budget of the above NSPDRO program is approximately 15 million euros, i.e. annually on
the implementation of the program will need 2.5 million euros (in case the first stage is
completed in 6 years), which is a relatively small sum even for Armenia. In our view, we may
refuse credit financing of NSPDRO and offer well-known sources of funding with different
receipt mechanisms.

The main source of funding should be the Government of RA. In order not to burden the
expenses of the country’s budget, we place for consideration a mechanism of transformation of
risk factors for CHNCD, including MN, to source of funding for NPDRO.
In the unanimous opinion of numerous studies’ authors smoking is a major risk factor for
cardiovascular diseases, respiratory diseases, MN, etc. In the WHO report, published in 2009
(Elke Jakabowski and Albena Arnaudowa "10 questions about health care in the Caucasus and
Central Asia") reported a 27% permanent smoking population of RA, 57% of male smokers (one
of the highest rates in Europe) and 3% of women. If we rely on the WHO data and perform simple arithmetic we will get the following results. RA has 774,900 regular smokers who supposedly smoke a pack of cigarettes a day. If we impose additional targeted excise tax of 10 euro cents for each pack of cigarettes and send the revenue to specific fund supporting NSPRRO and the entire oncology service, it turns out that only in a day we will get an additional $ 77,490 euros, while on the annual term - 28283850 Euros. The calculation is based on data of WHO for 2006, which we believe is understated. The ground for this is the fact that during the past 2 years a world-famous company producing cigarettes and importing them to RA for more than 2 decades occurs in the top ten taxpayers of RA.

In the cited report, WHO provides data on the consumption of 1.1 liters of alcohol per person per year. We understand that the authors of reports relied on data submitted to them at the sites, but we want to mention the incompleteness of data as it is difficult to take into account the number of imported, produced and sold alcohol, especially vodka that is home-produced in rural areas. Even if annually in RA is consumed 1.1 liters of alcohol per person that means 3,157,000 liters of alcohol is used in Armenia, which can also be targeted for excise tax (with a differentiated value depending on the type of drink), using the proceeds to improve cancer services.

Of course, above proposals are unlikely to contribute to reduction of alcohol and tobacco consumption, but may become one of the factors hindering an increase in their use. Their use as an additional funding source will help a lot of people in matters of early detection, diagnosis and treatment of CHNCD, including MN, i.e. increase in life-time for large number of our citizens.

In addition to the above, we have a number of other proposals for the formation of off-budget sources of targeted funding for cancer of approximately 40 million euros annually.

We hope for further collaboration with IAEA within the framework of technical cooperation, which will allow receiving part of necessary equipment and carrying out training of specialists through the IAEA.

It is also necessary to attract private capital on clearly stated conditions with drawing up the agreement at the governmental level, without intermediaries.

For the purpose of rapid enrichment of RO sections with equipment we can use the willingness of some companies to provide the necessary equipment and pay for them in several years without increasing the original price. This would be quite feasible, provided the following two points.
A compulsory condition for the development of oncology in general and the RO, in particular, is an increase in funding of diagnosis and treatment of patients with MN, and RT in particular, by the state. In case of difficulties, due to a sharp increase in funding, co-financing by the patient can be introduced. Due to financing issues, the future certainly belongs to the medical insurance for the development of which first steps have already been made.

Currently NCO and Oncology Dispensary in Gyumri are closed joint-stock companies. Shareholders are, respectively, of the RA Ministry of Health and local authorities of the Shirak marz. For nearly two decades nothing substantial has been done by them to improve oncological services in general and, in particular, RO, as evidenced by a permanent increase in the disease incidence and mortality from MN. Therefore, we propose to change the shareholders and transfer the shares to teams of government agencies who can make optimal use of the proceeds, including the long term perspectives.

We understand that the proposed NSPDRO will have many opponents, who have a different vision of the development of RO, as one of necessary components of oncology. Therefore, we are ready to discuss with all interested organizations to develop an optimal, realistic version of NSPDRO. For this purpose, we posted the proposed version of NSPDRO on the website of AAROR (www.aaror.org.)

We have also developed a number of other proposals, aimed at improving various aspects of oncological services, which we are ready to submit for discussion in case of interest by certain government agencies.

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