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SOCIAL AND ECONOMIC EFFECT OF WASTE MANAGEMENT POLICY IN THE REPUBLIC OF MOLDOVA

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Background. Waste collection, transport, processing, and disposal are important for both environmental and public health reasons. Different elements have been proposed to reduce, reuse, recycle, recover energy and finally dispose of municipal solid waste, but the environmental impacts of these are controversial. Several studies of the possible health effects on populations living in proximity of landfills and incinerators have been published and both landfills and incinerators have been associated with some harmful effects over the quality of life. Consequently, there is controversy over the possible health implications of waste management policies and both policy makers and the public require more information on the likely health impacts (and importantly, the associated nature and extent of the uncertainties).

Objectives. The purpose of this paper is to underline the possible social and economic effects caused by Municipal Solid Waste Management Policies.

Data and Methods. The method of analysis, synthesis method, logic and dialectic method, normative method, the study of statistical sampling and time series, personal observations, and monographic studies were used for drafting this article.

Results. The expected result of MSW Management in several regions of the Republic of Moldova can significantly improve the quality of public health.

Keywords: *MSW, Waste Management Policy, Landfills, Greenhouse Gas Emissions, Health, Morbidity, Recycling.*

EFECTUL SOCIAL ȘI ECONOMIC AL POLITICII DE GESTIUNE A DEȘEURILOR ÎN REPUBLICA MOLDOVA

Premise și context. Colectarea, transportul, prelucrarea și eliminarea deșeurilor sunt importante atât din motive de mediu, cât și din motive de sănătate publică. Se propun diferite elemente pentru reducerea, reutilizarea, reciclarea, recuperarea energiei și, în cele din urmă, pentru eliminarea deșeurilor solide municipale, însă impactul acestor strategii asupra mediului este controversat. Au fost publicate mai multe studii privind posibilele efecte asupra sănătății populației care locuiește în imediata apropiere a depozitelor de deșeuri și a incineratoarelor, atât depozitele de deșeuri, cât și incineratoarele fiind asociate cu unele efecte nocive asupra calității vieții. În consecință, există păreri controversate cu privire la posibilele consecințe asupra sănătății ale politicilor de gestionare a deșeurilor, iar atât factorii de decizie politică, cât și publicul solicită mai multe informații despre impactul probabil asupra sănătății (și, implicit, natura și amploarea asociate incertitudinilor).

Obiective. Scopul acestei lucrări este de a scoate în evidență posibilele efecte sociale și economice cauzate de politica de gestionare a deșeurilor urbane solide.

Date și metode. Pentru elaborarea acestui articol au fost utilizate metoda de analiză, metoda de sinteză, metoda logică și dialectică, studiul eșantionării statistice și a seriilor de timp, observațiile personale și studiile monografice.

Rezultate. Rezultatul așteptat al managementului eficient al deșeurilor solide municipale în mai multe regiuni ale Republicii Moldova poate îmbunătăți semnificativ calitatea sănătății publice.

Cuvinte-cheie: *deșeuri solide municipale (DSM), politică de gestionare a deșeurilor, depozite de deșeuri, emisii de gaze cu efect de seră, sănătate, morbiditate, reciclare.*

Introduction

The topicality of the research consists in the need for a complex study of the waste management problem, with the aim of proposing measures for the waste management policy which provides for the solution of the subject of the research under three aspects: ecological, social and economic. In this context, waste management policy is geared towards setting environmental protection measures, improving the quality of life by preventing or reducing the adverse effects of improper waste production and management, by reducing the overall impacts of use of resources and by increasing the efficiency of their use.

Implementing an effective waste management policy leads to the prevention of waste generation and its adverse impacts, which lead to enhancing environmental safety and ultimately improving the quality of life.

At the same time, besides the ecological side, a viable waste management policy solves social problems by raising the quality of life and, to the same extent, has a positive economic effect through the energetic recovery of wastes.

From an environmental perspective, biogas production is a better way to use Municipal Solid Waste (MSW) organic fractions than incineration. When biogas is used to generate electricity, the impact on the Global Warming Potential (GWP) decreases by approximately 80-130 CO₂-eq / t compared to the incineration scenario and also has a lower impact on acidification and eutrophication. The result also showed that the use of gas as a vehicle fuel has the same impact on GWP as when gas is used to generate electricity, but has a much lower impact on acidification and eutrophication.

In terms of impact size, medium and large sized installations have a lower environmental impact than small installations when the gas is used as motor fuel. When gas is used to generate electricity, going down the scenario of smaller plants, they have a higher GWP but lower acidification and eutrophication [1].

Main text

According to the European Environment Agency [2], for many years, landfills were the predominant choice in Europe for the definitive disposal of MSW. The solid waste disposal rate in 1995 was 68%, this figure dropped to 40% in 2008 and continues to decline. It is expected that less than 28% of MSW will be stored in landfills by 2020.

The most important stage for replacing landfills was the waste priority of the Landfill Directive 1999 [3]. The reasons were obvious: such as the capacity of landfills and the environmental impact of greenhouse gas emissions and contamination of groundwater and soil. The law has succeeded in reducing the disposal of MSW in landfills and promoting the use of less environmentally-friendly techniques.

According to the Landfill Directive [3], organic material should be diverted from landfills to biological treatments. The law also provides methane collection and emissions monitoring throughout the life cycle of all landfills. Since biodegradable material buried in a landfill is responsible for methane production through microbial and abiotic reactions, the trend is to reduce emissions gradually as more organic materials are diverted to these locations. The targets set out in the law were based on 1995 emissions and represented as percentages: 75% in 2006; 50% in 2009 and 35% in 2016 [4].

Each European country considers various factors that need to be taken into account to effectively divert organic material from landfills, factors such as socio-economic situations, population density and urbanization. Considering all these aspects, the process of managing organic materials differs in time and speed across each country, region, or city. Some of these areas have been very confronted with the modernization of solid waste systems: Italy, Estonia and Hungary, where there were no separate collectors for organic materials.

However, in countries such as Germany, Austria and Belgium (Flemish Region), the objectives set out in the law have been partially met as these areas have already implemented the necessary modifications for the treatment of bio-waste before the implementation of European regulations.

Some countries, such as Sweden, Germany, Austria, Denmark, Belgium, the Netherlands and Luxembourg, have already reached the 2016 target requirements of the Landfill Directive. Finland and France are close to reaching it, but some of the states still have much to do in this respect: Italy, Greece, Portugal, Ireland and others. These countries have called for the postponement of the European Union's objectives. The later derogation requires each country to meet each objective with a four-year delay: 2010 instead of 2006; 2013 instead of 2009 and 2020 instead of 2016 [5].

To comply with the legislation, EU Member States use biological treatments to distract organic material from landfills. These treatments include: recycling of biodegradable materials such as paper, cardboard, wood, composting food waste, manure, etc.; and energy recovery through digestion, fermentation and anaerobic incineration.

In order to adhere to the Landfill Directive, several countries have addressed various alternatives to storage taxation. The landfill tax should be increased to discourage waste disposal [5]. Other incentives to reduce waste disposal in landfills, which prove to be effective, are "pay as you go" and various fees for finished products are applied. However, all these schemes should be developed in a way that significantly alters the behaviour of residents, producers and waste collection and processing companies.

In addition to the Landfill Directive, other relevant EU regulations help to reduce the disposal of organic materials in landfills. The Packaging Directive [6] requires all municipalities to have separate collection for packaging materials. Some countries (for example, Estonia and Hungary) have initiated a specific collection of biodegradable packaging (wood, paper, cardboard), directing these materials for recycling.

Another effective regulation in this sense was the Renewable Energy Directive [7], which required all member countries to have renewable energy targets. Since the transformation of waste into energy is considered a source of renewable energy, this law also encouraged energy recovery and other treatments of organic material by diverting from landfills. Indeed, the diversion of landfill waste is based on the integration of public policies with the participation of all parties (consumers, government and producers). To succeed, countries need to combine several types of systems, such as recycling, waste composting into energy and others instead of focusing on a single system [5]. Currently, Directive 2009/28 / EC [8] promoting the use of energy from renewable sources, which amended and repealed earlier Directive 2001/77/EC [7] and Directive 2003/30/EC, creates a common set of rules for the use of renewable energy in the EU, so as to limit emissions of greenhouse gases and promote cleaner transport.

Since greenhouse gas (GHG) emissions are at the heart of solid waste management plans, the deviation of organic waste from landfills has become a priority. Biodegradable waste continues to produce methane for decades after being buried. For this reason, countries that allocate a significant amount of solid waste to landfills could take advantage of misappropriating organic material to biological treatments. This primary action will drastically reduce gas emissions from waste and will also contribute to combating global warming. In the same way, countries with low waste rates can increase recycling and recovery energy, avoiding greenhouse gases emitted by producing new products and saving natural resources and energy. It is noticeable that countries with high recycling rates also have high levels of incineration with recovered energy, and when the recovery rate is satisfactorily high, the solid waste sector contributes to meeting the Kyoto targets [5].

Greenhouse gas emissions were calculated by the European Environment Agency, which identified the proportion of GHG represented by each type of installation in solid waste management. Incineration without energy recovery accounts for 3% of the emissions in this sector, the landfill is the strongest accounting for 95% of the emissions, the rest being other types of waste treatment operations. The waste sector contributed 11% to reducing greenhouse gas emissions in 2011, which represents 1.8% of total emissions. Emissions from "energy waste" facilities are not included in this calculation because they are taken into account in the energy sector [9].

The emissions calculated in the landfills are the fugitive emissions, which are modelled not measured with consideration for the temperature and humidity of a specific locale. In order to develop the model, it is necessary to consider the three phases of a typical landfill. In the first phase, the landfill is active and is not sealed, thus the material buried suffers the action of aerobic and anaerobic microorganisms, and methane (CH_4) and carbon dioxide (CO_2) are emitted. The second phase, termed methanogenic, the landfill is sealed and a considerable quantity of methane is produced. In the last stage, several materials with different rates of degradation continue producing methane for an indefinite period [10]. The challenge is to capture the methane, mainly during the second phase, to produce energy through burning. According to IPCC Guidelines for National Greenhouse Gas Inventories (2006) the most accurate equation for calculation of greenhouse emissions is called FOD (first-order decay), by which the emissions produced depend on the quantity of organic material buried in a given period [4].

Although methane and carbon dioxide compose the principal emissions from landfill, about 1% of the landfill gas is comprised of 120 to 150 different substances, of which 90 were present in all landfills studied. Some of them, which are listed below, represent a considerable toxicological impact [11]. Therefore, these fugitive emissions into a landfill represent a potential risk to human health. The toxic substances present in the landfills classified after the highest toxicological impact are as follows: Benzene, Cloretan, 2-Butoxyethanol Chloroethene, Arsenic, Mercury, 1,3-Butadiene Methanal, 1,1-Dichloroethane 1,1- Trichloroethane, Trichloroethane, Hydrogen Sulphate, Furan-1,2-Dichloroethane, Carbon Disulfide, Chloromethane, Tetrachlorobenzodioxine.

A study by the UK Small Area Health Statistics Unit is early the only study that shows a consistent statistical relationship between living near MSW landfill sites and adverse health effects. This study investigated the occurrence of birth defects in children born to families living within two kilometres of landfill sites in the UK. It included data on over eight million births in the UK between 1983 and 1999. The birth data were grouped into two categories:

- where the mother lived within two kilometers of a landfill site;
- where the mother lived more than two kilometers from a landfill site.

The two categories were then compared to see if there was any statistical difference between the occurrence of birth defects in the two groups. The comparison showed slightly higher rates of birth defects in the group living closer to landfill sites. However, there are serious problems with interpreting the results of studies of this type including:

- the geographical location data was based on postcodes, which are broad indicators, this is the reason for using a 2 km distance cut-off point;
- the type of landfill site studied is unclear, it may be that it includes sites which have received hazardous waste in addition to MSW;
- even after attempting to allow for known ‘confounding factors’ it may be that the two groups differ due to residual confounding factors such as misclassification of socio-economic status, rather than a real difference in health (‘poor people’ have worse health than ‘rich people’);
- for some landfill sites which opened during the study, for some of the health effects studied, the group who lived nearer the landfill site suffered fewer birth defects than the group living further away (in other words living near the landfill site appeared beneficial to health). This indicates that factors other than residence near a landfill site may be the cause of the statistical differences;
- the very small scale of the incremental health risks identified in this study mean it is less likely that the reported effects are caused by any emissions from the landfill site.

The authors of this report are quite clear that there is no direct evidence of any cause and effect relationship between the identified health effects and living near a landfill site. In fact, it is quite possible that if residence near municipal swimming pools were substituted for landfill sites then similar statistical differences might be found between the two populations due to residual confounding effects from socio-economic factors, such as the mother’s diet, smoking and alcohol intake. Factors that include the mother’s health and the child’s genetic make-up are known to be causes of birth defects, but even so, the majority of birth defects are of unknown origin.

The independent expert Committee on the Toxicity of Chemicals in Food, Consumer Products and the Environment (COC) concluded “it is inappropriate to draw firm conclusions on the possible health effects of landfill sites from the results of this study”.

There have been other studies on landfill sites, many of them on hazardous waste sites rather than sites for MSW. No study has shown unequivocal evidence that residence near a landfill site causes negative health impacts.

As can be seen from Table 1 there are available quantitative data on most substances for most techniques, but there are some areas where data are not available.

Table 1

Available data on emissions used in quantitative study

Element	Composting	Mechanical and biological treatment	Anaerobic Digestion	Pyrolysis Gasification	Incineration	Landfill
NOx	----	Yes	Yes	Yes	Yes	Yes
S	----	Yes	Yes	Yes	Yes	Yes
PM10	Not	Yes	Yes	Yes	Yes	Yes
HAP	Not	Not	Not	Not	Yes	Not
Dioxins	Not	Not	Insignificant	Insignificant	Insignificant	Insignificant
Benzene	Not	Not	----	----	----	Yes
Vinyl chloride	Not	Not	----	----	----	Yes
Arsenic	Not	Not	Yes	Yes	Yes	Yes
Chromium VI	Not	Not	Not	Not	Yes	Not
Nickel	Not	Not	Yes	Yes	Yes	Yes
Bioaerosols	Not	Not	----	----	----	Not

Source: A Review of the Potential Health and Environmental Impacts from Municipal Waste Management Technologies, which might be used in Milton Keynes, The Environmental Protection Team, Environmental Health Division Milton Keynes Council, July, 2003.

The most relevant categories of impact identified in the Life Cycle Impact Assessment (LCIA) [12] and other Life Cycle Assessments are the following:

Global Warming Potential (GWP100)

Final disposal of MSW in landfills is the most impactful scenario, with recycling less impactful, followed by incineration. In other studies, the results were the same, which means diverting waste from landfill to recycling and recovery energy is the most adequate solution. Indeed, comparing landfilling and recycling, the quantity of CO₂ equivalent (kg/t) is much higher in the first option. In addition, comparing the emissions from landfills, Waste-to-Energy (WTE) and coal-fired power stations, the best solution continues to be the WTE and the worst is the coal-fired power stations, which represents a higher level of GWP.

Eutrophication Potential

The eutrophication potential in the waste sector is essentially due to emissions of ammonia and NO_x. The landfilling process represents the largest contributor because of the NO_x emissions from landfill gas burning and other emissions composed of nitrogen and phosphorus. Biological treatments producing organic fertilizer also produce emissions through leaching to the soil and water. In this category of impact, recycling and incineration presented the same results.

Photochemical Ozone Creation Potential (POCP)

In this category the most important contributor is the landfill that produces NMVOC (Non- Methane Volatile Organic Compounds) emissions, followed by thermal processes which produce NO_x and CO. The VOCs (Volatile Organic Compounds) are converted into ethylene equivalents in order to compare all substances.

The primary emissions from solid waste management correspond to methane in landfills and pollutants from collection and other phases of the chain. It is possible to avoid significant amount of GHG through recycling of used material rather than using virgin material and through the energy recovery gotten by incineration and collection and treatment of gases in landfills. The LCIA analysis contributes in calculating the avoided emissions with established practices (e.g. recycling), as compared to the use of raw material and incineration (producing heating and electricity), as compared to the use of fossil fuels. Taking into account that between 50 and 60% of the total MSW produced contains material of biogenic origin (food waste, clothes, paper, wood and others) the emissions from an incinerator is much lower in comparison with other industries which utilize fossil fuel as energy [2].

A considerable number of LCA studies comparing the different kinds of solid waste treatments and final disposal of solid waste in landfills and waste-to-energy demonstrated that energy recovery is less impactful than landfills. However, other studies also documented that recycling and composting programs, diverting recyclables and food waste from landfills and waste-to-energy facilities, minimize the environmental impact and avoid the extraction of more natural resources. Consequently, the promoted hierarchy of solid waste (avoid, reuse, recycle, recovery energy and landfill) adopted in numerous countries has been proven as the most functional method for treatment of MSW. The municipalities have to consider, for their solid waste plan, that all systems should work in an integrated manner, in order to reduce greenhouse emissions and promote sustainable development.

Through LCIA significant benefits in the MSW management policy have been identified, such as: waste to energy replaces the use of other energy sources; recycling prevents the extraction of more raw material; the compost produced by composting replaces artificial fertilizer; the biogas produced by biological treatment substitutes for fossil fuels; slag from incineration can be used as gravel for paving; among other benefits.

Certainly, landfills need to be monitored for decades until they cease production of GHG production and soil erosion. After that, the locale could become a public park, leisure area or just a green area. To plant trees and bushes into soil with non-degradable materials can be a complex task and needs to involved targeted techniques to promote tree growth.

Biogas produced from landfilling of solid waste contains mainly methane and carbon dioxide, but it is considered that only CH₄ emission is relevant to the global warming.

Global warming potential has high values because of the higher content of organic waste that were landfilled. The organic wastes are degraded through a series of consecutive reactions, which take place in the body of landfill, as follows:

- the large molecules (biopolymers like carbohydrates, proteins, fats) are broken down into simpler molecules;

- the simpler molecules (monomers like sugars, amino acids etc.) are biodegraded in intermediates such as fatty acids, alcohols;
- the intermediate compounds are degraded under anaerobic conditions in acetates and hydrogen;
- the acetates and hydrogen will then form biogas (CH₄ and CO₂).

Impact of Landfills on Quality of Life in the Republic of Moldova

An unidentified dark brown liquid flows continuously from landfills (millions of m³), forming a lake of harmful substances with unsupportable odour. The situation is getting worse every day, and the inhabitants suffocate in their homes because of the viscous and toxic smell. At the same time, the average age of the population has declined considerably in places near the landfills, the inhabitants of these areas are predominantly around the age of 60, the main causes of death being cancer, various respiratory pathologies and lung diseases.

The Ministry of the Environment established that during the years 2010-2015, in the adjacent areas of solid landfills, and in the first nine months of 2016, the maximum concentration of pollutants monitored in the area exceeded sanitary standards. The National Public Health Centre verified the quality of the water in the mines located near the solid waste landfills and found the increase of level of non-compliance of the water quality with the sanitary-chemical parameters, including the nitrate content and the residues.

There is an alarming situation in the commune of Bubuieci, Chisinau, where the number of cancer patients has increased drastically in recent years. Thus, according to the data from the Municipal Public Health Centre, it has risen from 53 cases in 2015 to 87 cases in 2016. The source of the disease, experts say, is the nearby heap that has changed in recent years into a real green bomb. Every day the garbage collected in Chisinau is brought to the garbage disposal site. Only residential houses are located just 800 meters from the landfills. People are worried and say they are forced to endanger their lives daily. In rural areas, Colonita – 26.1%, Bubuieci – 24.1% prevail in mortality caused by malignant tumours.

There is an increasing tendency in the number of new cases of detected and recorded oncological diseases. In 2011 in Chisinau municipality were registered 1829 new cases (the indicator at 100 thousand – 232.1), while in 2015 this number has increased to 2 319 persons diagnosed with primary cancer (the indicator at 100 thousand – 285,6). It is important to note that this terrible image is specific not only to the area used in the example but also to any area adjacent to solid waste landfills.

Table 2

Statistics morbidity of Balti

Health Centre	Coverage area	General morbidity ‰		Gastric infections and parasites ‰		Tumours ‰		Respiratory diseases ‰		Morbidity ‰	
		2016	2017	2016	2017	2016	2017	2016	2017	2016	2017
N1	Dacia district, Baiducova market district	6152	6238	127	199	39	32	1795	2014	6.3	6.0
N2	Centre District	6450	7237	122	140	77	80	1866	2138	6.2	6.0
N3	Centre, Veterans' House	10045	10059	286	260	197	293	2577	2740	6.0	5.8
N4	District 10	6328	6353	286	260	32	36	2273	1984	5,8	5.4
N5	The districts no. 5, 6, 7, 8	7853	8754	172	160	177	198	2706	3080	6.4	6.5
N6	Northern Station	9521	10004	200	231	104	233	2671	2995	6.3	6.3

Source: Information provided by the Ministry of Labour, Social Protection and Family of the Republic of Moldova.

For example, the statistical data of a municipality in the Republic of Moldova shows that the general prevalence of the population is from 9177 to 7000 per 10000 (2016 – 8306 ‰), through infectious and parasitic diseases 211 ‰ (2016-190 ‰), by 104 ‰ tumours 2016 – 94 ‰), by respiratory diseases 2066 ‰ (2016 – 1889 ‰). Overall mortality on the municipality is 6.4 ‰ (2016 – 6.4 ‰). In the Table 2 are presented more detailed data on the morbidity in the municipal area adjacent to the landfills.

Estimation of the MSW social effect

The potential impact on the health of MSW processing is estimated by comparing the increased morbidity in the areas near the landfills and the morbidity in areas far away from the landfill site. The estimated social impact of implementing a MSW management system in the area is the expected improvement in morbidity in the areas closest to the landfill within 5 km of the landfill.

The total population of the examined area is estimated to be at least 5474 people affected by gastric infections caused by intoxication. The morbidity of gastric infections in the areas near the landfills in the Republic of Moldova varies approximately to the limit of 1,100 per 100,000 of population, while the areas outside the region have morbidity at approximately 790 per 100,000 of population. The difference between morbidity in the areas described is illustrated in Figure 2.

A social side of the economic effect is expressed by the opportunity cost, for example when citizens are on sick leave, naturally they pay no contributions and taxes to the state budget. According to the estimates based on the data presented in this research, the budget does not receive about 16,925,739 MDL (based on the tax and the aggregate medical and social contributions and salary for the economy for the year 2016, the population resident within 5 km of landfills) due to resident taxpayer diseases in areas within 5 km of landfills.

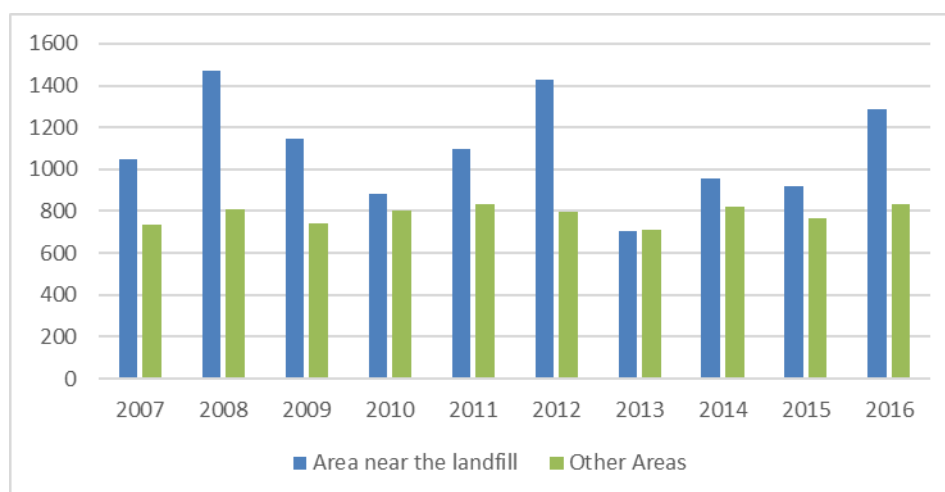


Fig.1. Morbidity by acute gastric infections to 100,000 population.

Source: Authorized by the Ministry of Health, Labour and Social Protection.

There is a general prevalence of numbers demonstrating that the hazardous environment created by landfills creates a dangerous situation around public health. The overall asymmetry is that eliminating the risks posed by landfills by managing the MSW reliably and efficiently can generally improve the situation by 30% for gastric diseases. In the case of localities in the examined municipality within the 5 km radius of the landfill, the expected effect is estimated to decrease by 30% the incidence of infections.

By eliminating the sources of the waste-related diseases with all harmful emissions they eliminate in the environment, based on own calculations, it is estimated that about 100,000 Moldovan lei per year will be saved per region situated within 5 km of the landfills solid waste. Estimates have been made within the limits of available data on average expenditure per person per treatment allocated from FOAM and the mean number of patients per region, with diseases caused by residing in areas adjacent to landfills.

Cancer

Figure 2 shows the major difference between morbidity on the prevalence of malignant tumours in areas near to landfills. Morbidity in these areas exceeds 100 times the average morbidity in malignant tumours. It is assumed that these statistic data show the direct impact of landfills on cancer formation in the population living near the landfill. Appropriate MSW management would eliminate the risks near the landfill and dramatically diminish the incidence of morbidity caused by malignant tumours (about 98%).

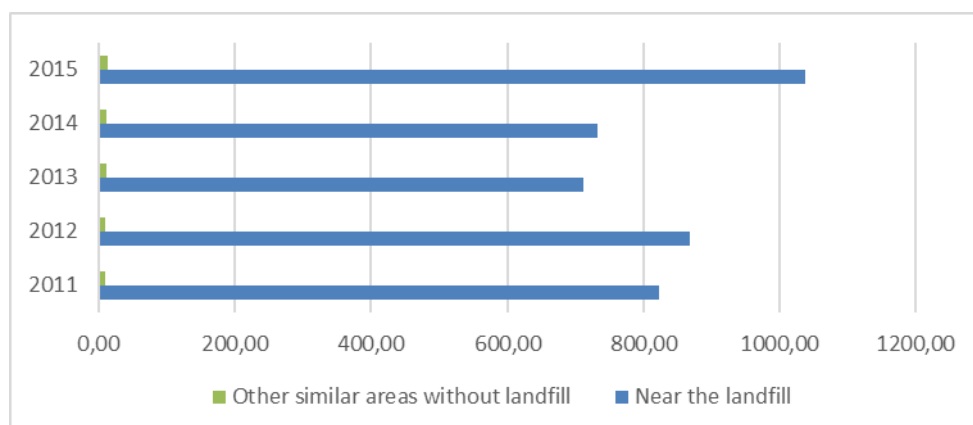


Fig.2. Morbidity according to the prevalence of cancer tumours to 100,000.

Source: Authorized by the Ministry of Health, Labour and Social Protection.

The economic effect of these changes can be reflected by reducing government spending on cancer treatment. Taking into account the fact that the general cost per patient in the Republic of Moldova amounts to 6770 MDL, the reduction of new incidence of cancer tumors in the region, influenced by the landfill, where a MSW processing station will be installed, will lead to a yearly decrease in government spending of around 86 thousand lei per year.

Conclusions on the health impact of the MSW management policy

According to the results of several LCIA studies mentioned in this paper, it is noted that the landfill scenario is the most immediate option adopted by different countries around the world. On the other hand, it is also the most environmentally friendly. Therefore, waste energy generation reduces environmental impacts and is a more competitive option from an economic point of view. Regardless of the final disposal of MSW in landfills or GWP, it is important to consider adopting an integrated solid waste management plan that would include all available treatments and follow the solid waste hierarchy.

Research has highlighted some important aspects of waste processing. Namely, to highlight the economic / financial effect and to measure it by estimating total budget savings at 187 931 lei.

At the same time, according to the authors, with the economic / financial effect, there is a social effect. Determining the social effect differs significantly from identifying and calculating the economic / financial effect. Using the indirect methods applied in this study, the social effect was identified in the decrease in the incidence associated with the disease caused by the presence of the landfill. The expected outcome of MSW management not only in municipalities but also in other localities can significantly improve the public health environment and implicitly increase the quality of life that is reflected by reducing morbidity rates for acute gastric infections and malignant tumors by 30% respectively, 98%.

Research indicates that both economic / financial and social effects can only be measured by indirect methods, being determined and conditional on the specificity of the subject matter. The results obtained make it possible to formulate proposals indicating that there is a fraction of the waste that is mixed and which is consequently incinerated or transferred to the landfill. Reducing this fraction can be achieved through raising awareness campaigns and other incentives promoted by the government together with producers who, through joint efforts, can increase recycling and composting levels. The crucial point is the proper separation of waste from the source. Consequently, in order to get the best results, it is necessary to engage the whole population. Moreover, it is necessary to avoid generating waste at source, with more actions needed in all sectors (producers, society and government) before treating waste produced. At the same time, the generation of more landfills should be avoided, followed by the promotion of materials repairs and re-use and, finally, the promotion of the necessary treatments: recycling, biological treatments and other treatments for hazardous and special waste (bulk, electronic, pharmaceutical, tyres etc.). Only materials that are not recyclable may be subject to another special treatment or composting, which has to be the final destination of landfills and GWPs.

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