Cancer mortality in the Mexican Social Security Institute, 1989-2013

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Abstract

Objective. To analyze cancer mortality in affiliates of the Mexican Social Security Institute (*Instituto Mexicano del Seguro Social - IMSS*) and time trends in the risk of death due to cancer from 1989 to 2013. **Materials and methods**. A descriptive analysis of cancer mortality trends in beneficiaries of the IMSS was performed. Age- and sex-adjusted mortality rates were obtained using direct standardization with the WHO population. Changes in the risk of death due to cancer over time were evaluated using Poisson regression. **Results**. The absolute number of deaths due to cancer doubled from 1989 to 2013 due to increasing age of the affiliate population. The risk of death among affiliates decreased for the majority of cancers except for colon and rectal cancer. **Conclusion**. The risk of dying from cancer among IMSS affiliates showed a marked decrease, which may be due to an increase in detection and opportune treatment.

Keywords: cancer; mortality; trends

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Resumen

Objetivo. Analizar la frecuencia de las defunciones por cáncer en la población derechohabiente (DH) del Instituto Mexicano del Seguro Social, así como la tendencia temporal en el riesgo de muerte por esta causa de 1989 a 2013. **Material y métodos**. Se realizó análisis descriptivo del comportamiento de la mortalidad por cáncer en población derechohabiente del IMSS. Las tasas de mortalidad ajustadas por edad y sexo se obtuvieron con el método directo utilizando la población mundial estándar de la OMS. Los cambios en el riesgo de morir por cáncer a través del tiempo se evaluaron mediante regresión de Poisson. **Resultados**. El número absoluto de defunciones por cáncer se duplicó de1989 a 2013 debido a un aumento y al envejecimiento de la población derechohabiente. El riesgo de muerte en los DH disminuyó para la mayoría de los diferentes tipos de cáncer, excepto para el cáncer de colon y recto. **Conclusión**. El riesgo de morir por cáncer en DH del IMSS muestra una discreta disminución, posiblemente debido a la mejora en la detección y tratamiento oportuno.

Palabras clave: cáncer; mortalidad; tendencias

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Cancer is one of the leading causes of death worldwide, and it was responsible for 8.2 million deaths in 2012. The malignant cancers that cause the most deaths each year are lung (1.59 million deaths), liver (745 000 deaths), stomach (723 000 deaths), colon (694 000 deaths), and breast (521 000 deaths) cancers. It is predicted that cancer deaths will increase 45% by 2030, due in part to population growth and in part to population aging. The slight reductions in mortality that are predicted for some types of cancer, including breast, lung, and colon cancer in high-resource countries, is considered in these estimates.[1,2] More than 60% of all new annual cases worldwide occur in Africa, Asia, Central America, and South America.[2]

In the Americas, in 2012, cancer caused 1.3 million deaths, 47% of which occurred in Latin America and the Caribbean. It is thought that deaths due to cancer in the Americas will increase to 2.1 million by 2030.[2,3]

However, important differences in the frequency of malignant tumors according to level of development and economic resources of different countries have been observed. The most common cancers in the most developed countries are breast, colon and rectal, lung, and prostate cancers. However in poorer countries, the most common cancers are cervical, stomach, esophageal, pharyngeal, and liver cancers. These differences are closely related to access to and quality of health services, population education regarding early detection, and lifestyle.[3]

Aging is another fundamental factor in the development of cancer. The incidence of this disease increases considerably with age, which is due to the accumulation of risk factors for certain types of cancer.

The objective of this study was to evaluate whether the increase in the number of cancer deaths among Instituto Mexicano del Seguro Social (IMSS) affiliates is due to population growth, to population aging, or to a real increase in the risk of death as measured through time trends in cancer mortality rates in adults, children, and adolescents from 1989 to 2013.

Materials and methods

Mortality data were obtained from the National Institute of Statistics and Geography (Instituto Nacional de Estadística y Geografía, INEGI) mortality database published on the Secretary of Health's National Health Information System (Sistema Nacional de Información en Salud, SINAIS) page for 1989 to 2013.[4] IMSS affiliation was identified using the affiliate variable reported on the death certificate.

The selection of site-specific cancer diagnoses was based on the Ninth Revision of the International Classification of Diseases (ICD IX) for 1989 to 1997, and the Tenth Revision of the International Classification of Diseases (ICD X) was used for 1998 to 2013.

The general analysis included all cancers (CIE-9 140-208 y CIE-10 C00-C97). For adult men and women, the following malignant cancers were analyzed: tracheal, bronchial and lung (CIE C33-C34), colon and rectal (CIE C18-C21), stomach (CIE C16), liver (CIE C22), pancreatic (CIE C25), malignant kidney (CIE C64-C66, C68), nervous system and brain (CIE C70-C72), biliary tract (CIE C23-C24), skin (CIE C43-C44), bladder (CIE C67), myeloma (CIE C88-C90), mouth (CIE C00-C14), esophagus (CIE C15), larynx (CIE C32), and bone (CIE C40-C41) cancers as well as lymphoma (CIE C81-85, C96) and leukemia (CIE C91-C95). In men, prostate (CIE C61) and testicular (CIE C62) cancers were included, and in women, breast (CIE C50), cervical (CIE C53), uterine (CIE C54), and ovarian (CIE C56) cancers were included.

For individuals younger than 15 years of age, the following malignant cancers were included: nervous system and brain (CIE C70-C72), bone (CIE C40-C41), and kidney (CIE C64-C66, C68) cancers as well as leukemia (CIE C91-C95) and lymphoma (CIE C81-85, C96). For the 15- to 19-year age group, the following were included: bone (CIE C40-C41), nervous system and brain (CIE C70-C72), testicular (CIE C62 in males) and ovarian (CIE C56 in females) cancers as well as leukemia (CIE C91-C95) and lymphoma (CIE C81-85, C96).

The description of the frequency of cancer in the IMSS is presented in two sections. In the first part, the variation in the total number of deaths by malignant cancer is presented stratified by affiliation and sex from 1989 to 2013. These are the years when the databases allowed for differentiating social security affiliation according to what was recorded on the death certificate. A detailed analysis of the main cancers for men and women is presented for 2013, with separate records for children, adolescents, and adults.

In the second part, to evaluate the changes in the risk of dying from cancer over time and by geographic area, taking into account affiliate population growth and population aging over time, cancer mortality rates in the IMSS affiliate population were estimated from 1998 to 2013. The principle malignant neoplasms in those less than 15 years, adolescents from 15 to 19 years of age, and adults 20 years of age and older, as well as specific cancers in men and women, were calculated. Poisson regression was used to evaluate whether the changes in trends were significant. The age- and sex-adjusted rates were estimated by direct standardization using the world standard population (WHO 2001).[5]

To calculate rates, all health service recipients (HSR) were used as the denominator for each year of the study

and in each state in the country as published by the IMSS Office of Incorporation and Collection.[6] The HSR designation includes affiliates of the IMSS and those who have been assigned to a family medicine department. This population is greater than the population belonging to family medicine because not all affiliates come to the department to be assigned a family physician. The selection of this population is consistent with mortality data, which focuses on all affiliates who have died, independent of whether the death occurred within IMSS departments.

Results

Absolute frequencies

Table I shows the number of cancer deaths from 1989 to 2013 in IMSS affiliate and non-affiliate populations. During these 25 years, the number of deaths due to malignant cancer almost doubled. The increase was 72% in the IMSS non-affiliate population and 98% in the affiliate population, which represents an increase from 15 450 deaths in 1989 to 30 658 deaths in 2013, with similar behavior for both sexes.

Table I
Malignant cancer deaths according to affiliate status. Mexico, 1989-2013

Year	*IMSS Affiliates*	*IMSS Non-affiliates*	*Total*
1989	15 450	25 105	40 555
1990	16 333	24 792	41 125
1991	17 395	24 558	41 953
1992	18 640	25 044	43 684
1993	19 313	25 626	44 939
1994	20 442	25 980	46 422
1995	21 428	26 790	48 218
1996	22 445	27 471	49 916
1997	23 105	28 146	51 251
1998	23 547	29 116	52 663
1999	24 111	29 549	53 660
2000	24 722	30 271	54 993
2001	25 472	30 705	56 177
2002	26 548	32 034	58 582
2003	26 333	33 697	60 030
2004	26 371	34 785	61 156
2005	26 683	36 440	63 123
2006	26 743	37 142	63 885
2007	26 942	38 167	65 109
2008	27 931	39 115	67 046
2009	28 419	40 029	68 448
2010	29 040	41 195	70 235
2011	29 640	41 709	71 349
2012	30 492	42 747	73 239
2013	30 658	42 763	73 421

Source: reference 4
IMSS: Mexican Institute of Social Security

Table II shows that of all deaths occurring in the IMSS during 2013 among adults 20 years of age and older (N=192 855), 15.5% (n=29 902) were due to malignant cancer. Tracheal, bronchial, and lung cancer contributed the greatest numbers of deaths, followed by breast, prostate, colon and rectum, liver, stomach, and pancreatic cancers.

In men, among all deaths occurring in 2013 (n=103 018), 12.5% were due to malignant cancer (n=15 031). The largest contributor was prostate cancer, the second largest was tracheal, bronchial and lung cancer, and the third largest was colon and rectum cancer. In women, among 89 837 deaths recorded in 2013, 16.6% were due to malignant cancer. The three most common were breast, cervical and liver cancers.

Table II
Malignant cancer deaths among individuals age 20 years and older according to sex
IMSS, Mexico 2013

Cause	*Male*		*Female*		*Total*	
All causes	*103 018*		*89 837*		*192 855*	
Malignant cancers	*15 031*		*14 871*		*29 902*	
	n	%	*n*	%	*n*	%
Tracheal, bronchial and lung	1 881	12.5	1 025	6.9	2 906	9.7
Breast	–	–	2 374	16	2 374	7.9
Prostate	2 341	15.6	0	0	2 341	7.8
Colon and rectum	1 277	8.5	1 020	6.9	2 297	7.7
Liver	1 092	7.3	1 111	7.5	2 203	7.4
Stomach	1 160	7.7	910	6.1	2 070	6.9
Pancreas	727	4.8	830	5.6	1 557	5.2
Leukemia	671	4.5	588	4	1 259	4.2
Cervical	–	–	1 340	9	1 340	4.5
Lymphoma	686	4.6	549	3.7	1 235	4.1
Kidney	608	4	372	2.5	980	3.3
Ovarian	–	–	952	6.4	952	3.2
Nervous system and brain	460	3.1	333	2.2	793	2.7
Biliary tract	249	1.7	460	3.1	709	2.4
Skin	300	2	236	1.6	536	1.8
Bladder	326	2.2	128	0.9	454	1.5
Myeloma	290	1.9	266	1.8	556	1.9
Mouth	271	1.8	137	0.9	408	1.4
Esophageal	310	2.1	84	0.6	394	1.3
Laryngeal	364	2.4	39	0.3	403	1.3
Bone	151	1	108	0.7	259	0.9
Uterine	–	–	241	1.6	241	0.8
Testicular	186	1.2	–	–	165	0.6

Among individuals age 0 to 14 years, deaths due to malignant cancer represented 5.7% (n=513) of all deaths in 2013 (table III). The most common malignant cancers were leukemia, which accounted for 48.7% of cancers, and this was followed by nervous system and brain cancers and lymphomas. Males were more affected by overall and type-specific malignant cancer.

Table III also presents deaths per malignant cancer among those 15 to 19 years of age stratified by sex for 2013. In this age group, malignant cancers represent 14.1% (n=232) of all causes of mortality. The most common malignant cancers include leukemia, which accounted for 48.3% (n=112) of cases, followed by bone cancer. A marked difference was observed between males and females, with males having a higher incidence of each type of malignant cancer.

Mortality rates

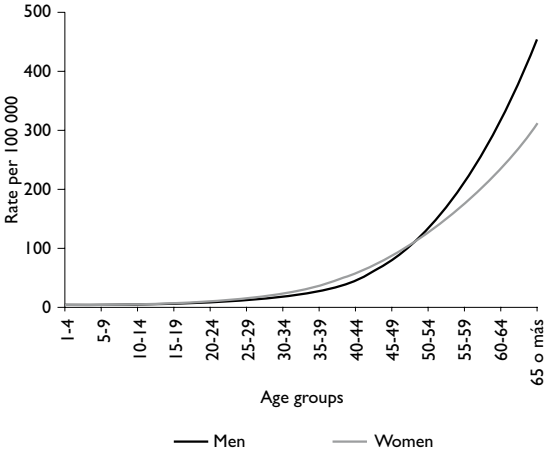
The risk of dying from malignant cancers increases exponentially with age, and this is most marked after 40 years of age, as shown in figure 1. The mortality rate is similar for both sexes. However, it is greater for men after 50 years of age.

Table III
Malignant cancer deaths in children and adolescents according to sex. IMSS, Mexico 2013

	Male		*Female*		*Total*	
All causes	*4 810*		*4 139*		*8 949*	
Malignant cancer	*278*		*235*		*513*	
	n	%	*N*	%	*n*	%
Children, 0 to 14 years of age						
Leukemia	137	49.3	113	48.1	250	48.7
Nervous system and brain	49	17.6	37	15.7	86	16.8
Lymphoma	25	9	11	4.7	36	7.0
Bone	12	4.3	23	9.8	35	6.8
Kidney	7	2.5	8	3.4	15	2.9
Tracheal, bronchial and lung	5	1.8	3	1.3	8	1.6
All causes	*1 109*		*532*		*1 641*	
Malignant cancers	*139*		*93*		*232*	
	n	%	*N*	%	*n*	%
Adolescents, 15-19 years of age						
Leukemia	67	48.2	45	48.4	112	48.3
Nervous system and brain	13	9.4	9	9.7	22	9.5
Bone	11	7.9	10	10.8	21	9.1
Lymphoma	10	7.2	7	7.5	17	7.3
Testicular	13	9.4	–	–	13	5.6
Colon and rectal	4	2.9	4	4.3	8	3.4

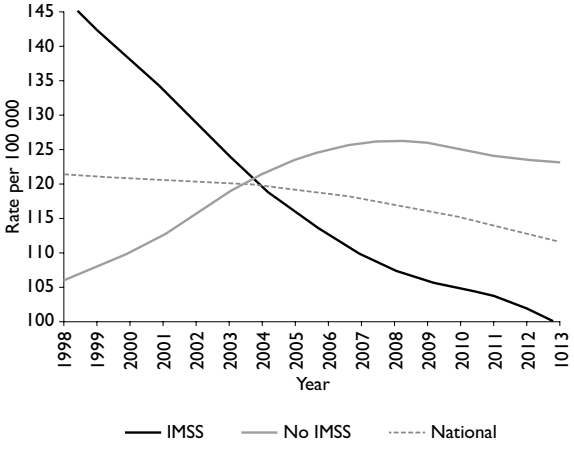
IMSS: Mexican Institute of Social Security

Figure 2 shows that in the 1998-2013 period, the risk of dying from malignant cancer declined significantly in men and women in the IMSS affiliate population as measured with age- and sex-adjusted rates. For comparison purposes, the population trends in the IMSS affiliate population and in the overall Mexican population are shown. The average rate in both populations is also shown. The slight trend of decreasing rates in the



IMSS: Mexican Institute of Social Security

Figure 1. Malignant tumor mortality rates by age group. IMSS, Mexico 2013



*Adjusted by age and sex using the world standard population

Source: Deaths: reference 4
Population: For affiliates receiving services. IMSS Office of Incorporation and Collection. For non-affiliates: Consejo Nacional de Población (Conapo)

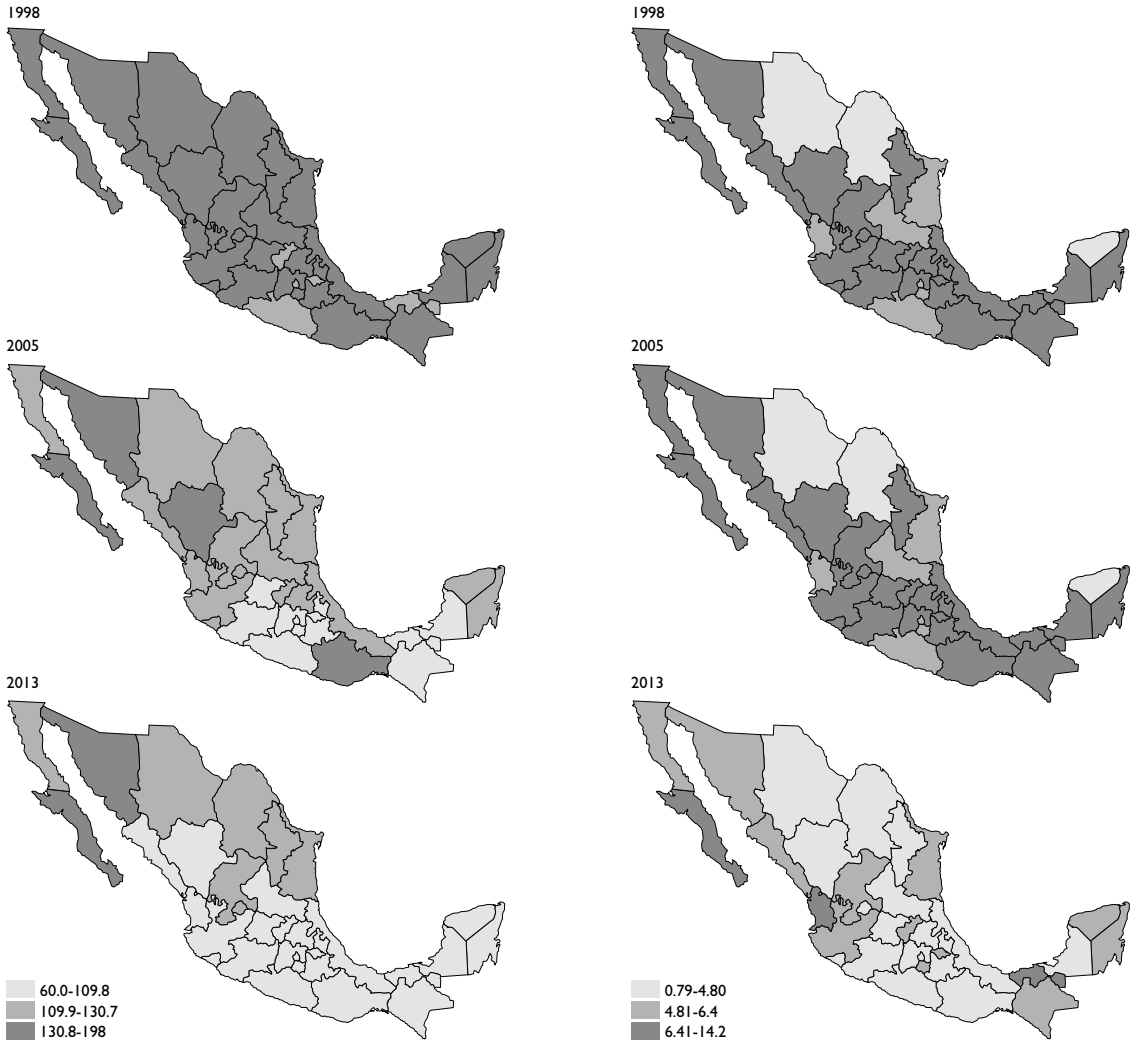
Figure 2. Malignant cancer mortality rates in individuals 20 years of age and older, for IMSS affiliates and IMSS non-affiliates, 1998-2013, Mexico

country is due to a greater contribution from the affiliate population during this period.

Figure 3 shows the age- and sex-adjusted cancer mortality rate by state in the following three periods: 1998, 2005, and 2013. It was observed that the risk of death for adults age 20 years of age and older decreased in all states. However, in spite of the decrease, the northern zone of the country has consistently high rates of death. A reduction in mortality rates in the majority of the states was also observed among those less than 20 years of age when comparing the years 1998 and 2013. Southern Baja California and Tabasco have had consistent rates, while the rates are increasing in Nayarit.

The trends in mortality rates for the ten most common malignant cancers in men 20 years of age and older are shown in figure 4. The risk of death decreased for different types of cancer, with the exception of colon and rectal cancer, which increased after 2004. For men, the greatest reduction in the risk of dying was due to decreasing cases of lung cancer, which has been the second largest cause of death since 2009, at which point it was superseded by prostate cancer.

Figure 5 shows the mortality trends associated with select malignant cancers in women 20 years of age and older in the IMSS from 1998-2013. The decrease in the risk of death due to cervical cancer is noteworthy. There is a



Adults 20 years of age and older according to state. IMSS, Mexico 1998, 2005 and 2013

Individuals younger than 20 years according to state. IMSS, Mexico 1998, 2005 and 2013

Figure 3. Trends in adjusted mortality rates for malignant cancers

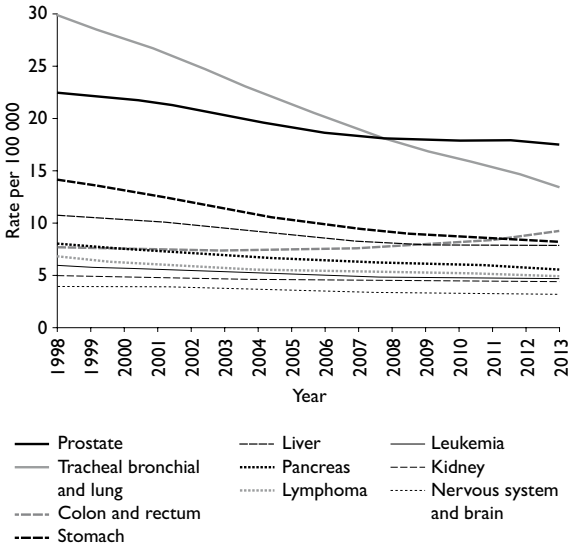


Figure 4. Trends in select malignant cancers in men 20 years of age and older. IMSS, Mexico 1998-2013

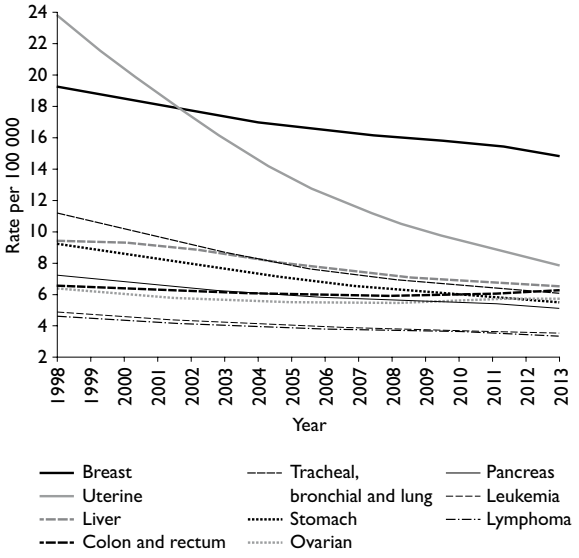


Figure 5. Trends in select malignant cancers in women 20 years and older. IMSS, Mexico 1998-2013

slight decreasing trend for other types of cancers, with the exception of colon and rectal cancer, which has been increasing in the past five years. In 2002, breast cancer superseded cervical cancer as the leading cause of cancer mortality and has remained the leading cause until 2013.

Figure 6 shows the annual changes in mortality rates of the principle cancers by age group, which were obtained using a Poisson regression. Among individuals age 20 years of age and older, the cancers showing the greatest decrease were prostate, cervical, biliary tract, lung, skin, and stomach cancers. In individuals age 20 to 39 years, there was no significant trend in cancers such as pancreatic and kidney cancers. Among individuals less than 64 years of age, colon and rectal and cervical cancers showed an increasing trend.

Figure 7 shows the trends in malignant cancer mortality among individuals age 15 years and younger according to sex. In both men and women, leukemia decreased and had the highest rate of mortality in the analysis period. Nervous system and brain cancer and lymphomas also decreased. Kidney cancer decreased among men, while bone cancer increased in the last five years. In women, bone and kidney cancer increased throughout the study period.

Figure 8 shows mortality rates by principle malignant neoplasm in affiliates aged 15 to 19 years from 1998 to 2013. In both men and women, leukemia had the highest mortality rate, although the incidence is clearly decreasing. Lymphomas and nervous system and brain cancer also showed declines. However, kidney cancer shows an increasing trend. Bone cancer shows a different trend; it is clearly increasing in men, while it has been slightly decreasing in recent years among women.

Discussion

The results show that the number of deaths due to malignant cancer has doubled in the last 23 years and that the risk of dying from cancer in the IMSS affiliate population has decreased. These results may seem to be contradictory. However, they express distinct phenomena, and both rates are useful for planning and evaluating services.

The increase in the number of deaths is not due to an increase in the risk of dying from these causes but rather to the increased number of affiliates and to population aging. The registered affiliate population increased from 26 million in 1989 to 50.6 million in 2013. The internationally recognized method for evaluating changes in risk of death is to calculate age-standardized rates, which allows the effect of the differences in age between populations or population aging over time to be eliminated.[5]

The increase in the absolute number of cases is seen by physicians in health services as a worsening of the disease in the population, as evidenced when the infrastructure to care for patients does not increase at the same rate as population growth. The volume of resources to care for patients should consider this increase

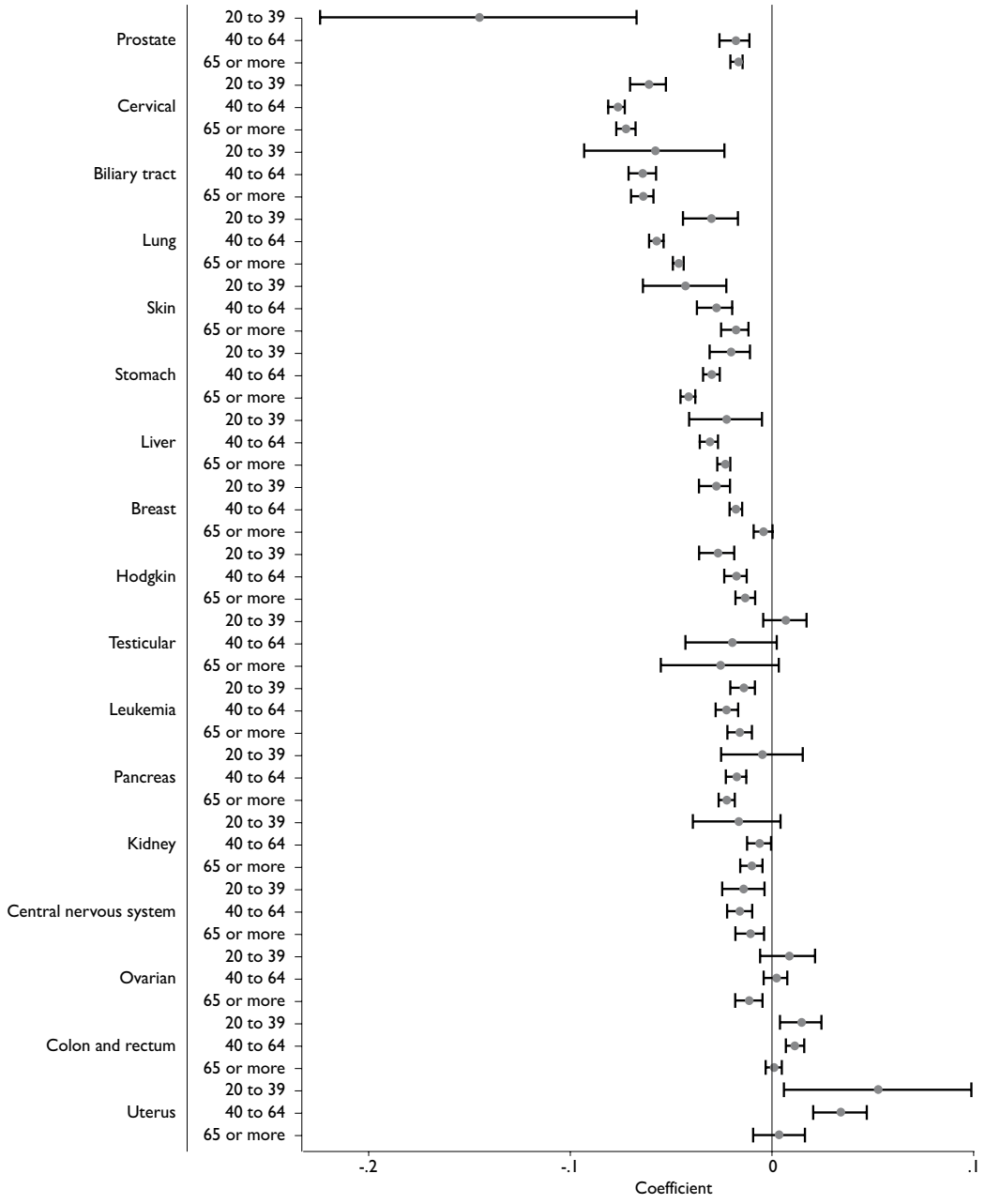
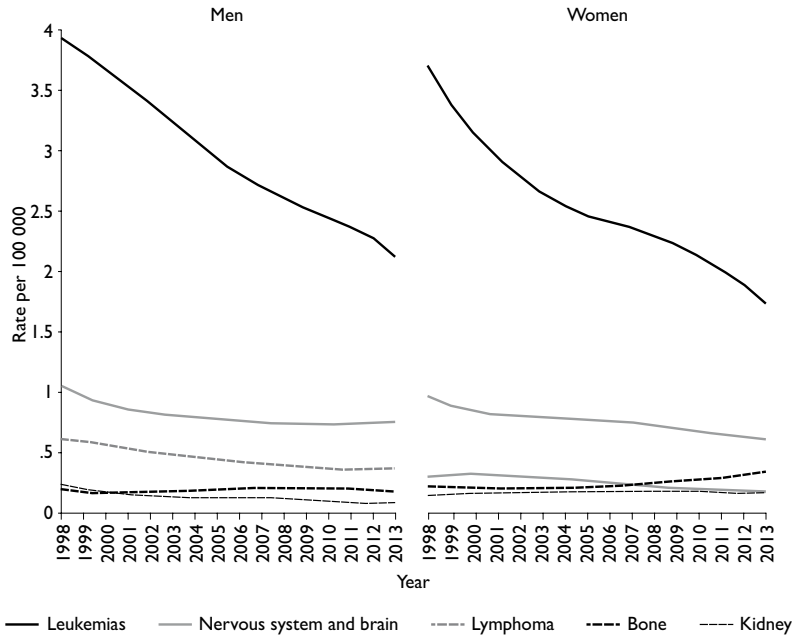


Figure 6. Poisson regression coefficients to evaluate trends in select tumors for three age groups. IMSS, Mexico 1998-2013

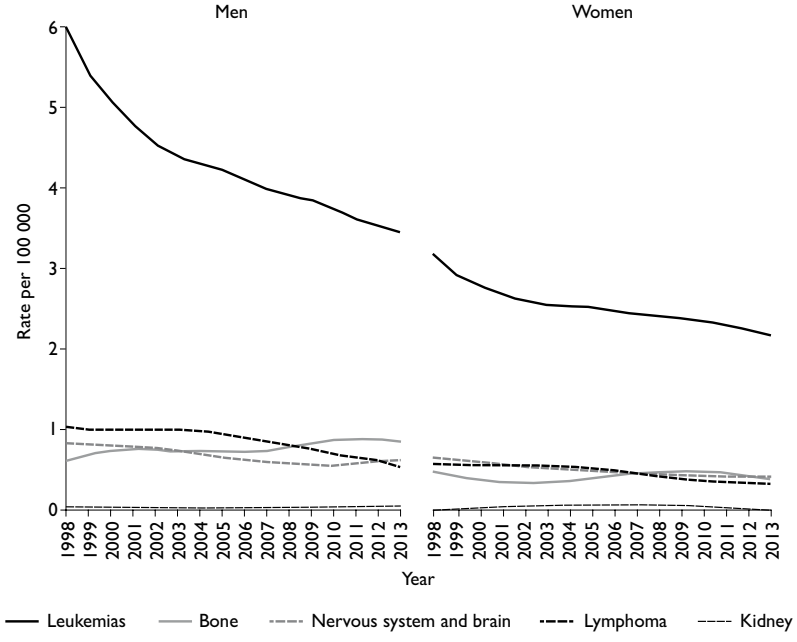
in the number of patients who are expected to need care independent of the improvements in the risk of getting sick or dying.

Reductions in lung cancer among men and cervical cancer among women have contributed to the reduction in the risk of dying from cancer. This reduction coincides with a recent report by Torres-Sanchez and colleagues.[7] As there is no evidence that the fatality of lung cancer has changed, the reduction in the risk of death due to lung cancer can be attributed to changes in incidence that are possibly due to environmental improvements and improvements in tobacco control. In the last 20 years, Mexico has promoted tobacco smoke-free space policies, especially in schools, work places and some public spa-



* Service recipients aged 15 years of age or younger
Source: Deaths: reference 4. Population: IMSS Office of Incorporation and Collection. For non-affiliates: Consejo Nacional de Población (Conapo)

Figure 7. Mortality trends in select cancers among individuals less than 15 years of age according to sex. IMSS, Mexico 1998-2013



* Service recipients aged 15 to 19 years of age
Source: Deaths: reference 4. Population: IMSS Office of Incorporation and Collection. For non-affiliates: Consejo Nacional de Población (Conapo)

Figure 8. Mortality trends in select cancers among individuals 15 to 19 years of age according to sex. IMSS, Mexico 1998-2013

ces. The majority of tobacco promotion and publicity has been prohibited, along with tobacco sponsorship. The impact and etiquette of tobacco consumption has also changed, and taxes have increased.[8] Although evidence for the reduction of tobacco use in Mexico exists,[9] there are no available data that allow us to evaluate whether these policies have affected IMSS affiliates and non-affiliates differently. The prevalence of tobacco use has not significantly changed. However, it is possible that environmental tobacco policies have benefitted IMSS affiliates more than informal workers, as formal workers spend more time in these regulated environments.

The reduction in cervical cancer mortality can be attributed to the reduction in incidence attributable to a large variety of lifestyle factors, such as hygiene improvements, family planning, and sexual practices such as condom use. The use of the male condom increased from 38% in first-time sexual relations in 2000 to 71% in 2012.[10]

Additionally, the reduction in cervical cancer mortality could be related to the systematic implementation of cervical cancer screening and control, as has been observed in other health systems where the early detection of pre-invasive lesions and early stages of cervical carcinoma contributed to a reduction in mortality rates. Despite the lack of clinical trials, population screening for cervical cancer with cervical cytology has led to a significant reduction in associated mortality.[11]

Mortality is one of the most robust health indicators and reflects a combination of incidence and fatality of disease. For this reason, it is difficult to directly attribute the observed changes in mortality to preventive practices, especially in early detection. In the last 20 years, the IMSS has implemented measures to improve the quality of medical care, such as family physician training, the introduction of practical clinical guidelines, the introduction of the electronic clinical record, and the establishment of a preventive strategy called PREVENIMSS. It is feasible that these measures had an impact on the mortality rate during this period.[12] The mortality reduction for some cancers such as cervical cancer could be a result of the combination of a reduction in incidence due to primary prevention and an increase in opportune treatment. The mortality reduction for other cancers can be attributed to early diagnosis and to opportune treatment.

The comparison of cervical and breast cancer mortality trends between the IMSS affiliate and non-affiliate populations has been addressed in previous studies. These results show significant differences in mortality rates between the two groups, which can be explained by changes in the incidence rates and fatality rates associated with early detection and opportune treatment, as previously mentioned.[13]

In recent years, the quality of information regarding mortality has substantially improved, and these observed changes are not believed to be a consequence of classification errors, as indicated by Torres-Sánchez and colleagues.[7]

Finally, in the IMSS, like in other health systems, cancer represents a heavy burden with regard to both preventive and care measures needed as well as the need for improvements in the availability and quality of information.

Declaration of conflict of interests. The authors declare that they have no conflict of interests.

References

1. Ferlay J, Soerjomataram I, Ervik M, Dikshit R, Eser S, Mathers C, *et al.* GLOBOCAN 2012 v1.0, Cancer incidence and mortality worldwide: IARC CancerBase No. 11 [sitio de internet]. Lyon, France: International Agency for Research on Cancer; 2013 [accesed november 8, 2014]. Available in: http://globocan.iarc.fr

2. Organización Mundial de la Salud. Cáncer. Nota Descriptiva No. 297 [sitio de internet]. OMS; 2015. [accesed november 8, 2014]. Available in: http://www.who.int/mediacentre/factsheets/fs297/es/

3. Organización Mundial de la Salud. ¿Aumenta o disminuye el número de casos de cáncer en el mundo? Pregunta al experto. 1 de abril de 2008 [sitio de internet]. OMS; 2008. [accesed november 8, 2014]. Available in: http://www.who.int/features/qa/15/es/

4. Instituto Nacional de Estadística y Geografía, Secretaría de Salud. Bases de datos de mortalidad en México [sitio de internet]. México, DF: INEGI-SSA; 1998 a 2013 [accesed november 12, 2014]. Available in: http://www.sinais.salud.gob.mx/basesdedatos/std_defunciones.html

5. Ahmad O, Boschi-Pinto C, Lopez AD, Murray CJL, Lozano R, Inoue M. Age standardization of rates: a new WHO standard. Geneva: World Health Organization; 2001. Disponible en: www.who.int/healthinfo/paper31.pdf

6. Instituto Mexicano del Seguro Social. Estadísticas e informes [sitio de internet]. México: IMSS; 2014 [accesed november 12, 2014]. Available in: http://www.imss.gob.mx/conoce-al-imss/cubos

7. Torres-Sánchez LE, Rojas-Martínez R, Escamilla-Núñez C, de la Vara-Salazar E, Lazcano-Ponce E. Tendencias en la mortalidad por cáncer en México de 1980 a 2011. Salud Publica Mex 2014;56:473-491.

8. Reynales-Shigematsu LM, Lazcano-Ponce E. Nuevos retos para el control del tabaquismo en México y las Américas: estrategias contra la interferencia de la industria tabacalera. Salud Publica Mex 2012;54:201-203.

9. Ng M, Freeman MK, Fleming TD, Robinson M, Dwyer-Lindgren L, Thompson B, *et al.* Smoking prevalence and cigarette consumption in 87 countries, 1980-2012. JAMA 2014;(31182):183-192.

10. Gutiérrez JP, Rivera-Dommarco J, Shamah-Levy T, Villalpando-Hernández S, Franco A, Cuevas-Nasu L, *et al.* Encuesta Nacional de Salud y Nutrición 2012. Resultados Nacionales. Cuernavaca, México: Instituto Nacional de Salud Pública (MX), 2012.

11. International Agency for Research on Cancer: Cervix Cancer Screening. Lyon, France: IARC Press, 2005.

12. Gutiérrez G, Pérez-Cuevas R, Levy S, Reyes H, Acosta B, Cantón SF, *et al.* Strengthening preventive care programs: A permanent challenge for healthcare systems; lessons from PREVENIMSS Mexico. BMC Public Health 2010;10: 417.

13. Borja-Aburto VH, González-Anaya JA, Dávila-Torres J, Rascón-Pacheco RA, González-León M. Evaluation of the impact on non-communicable chronic diseases of a major integrated primary health care program in Mexico. Family Preactice 2015;1-7. Doi:10.1093/fampra/cmv049.