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The impact of pharmaceutical innovation on health outcomes and utilization in Turkey: A re-examination

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Abstract
Previous research investigating the impact of pharmaceutical innovation in Turkey has shown that the use of newer drugs increased mean age at death by approximately 3 years during the period 1999–2008 and reduced the number of hospital days by approximately 1% per year during the period 2007–2010.

The present study assesses the contribution of pharmaceutical innovation to longevity and hospital use in Turkey during a more recent period (2009–2013), using different longevity measures, and with a different data set. The IMS Health Turkey Medical Prescription Index, which provides detailed diagnosis and treatment profiles of patients treated in outpatient clinics, is used. This enables us to use annual data during the period 2009–2013 on the drugs prescribed by doctors for the treatment of 19 medical conditions to measure pharmaceutical innovation.

Our findings indicate that new technology continued to have a favorable impact on potential years of life lost before age 70, the age-standardized mortality rate, and hospitalization during the period 2009–2013. Pharmaceutical innovation (i.e., the use of newer molecules) decreased premature deaths by 2.2%, the age-adjusted mortality rate by 3.6%, and hospitalization by 7.3%.

Turkish healthcare policy-makers should consider the broader outcomes of restrictions on access to new medicines.

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Introduction

Health care reforms have been on the agenda of Turkish policy-makers for more than a decade. The debate around the reforms has moved from making new changes in the financing and provision of services to measuring the outcomes and investigating the results of cost-containment measures. Concerns about sustaining the reforms and using scarce resources more efficiently and effectively have resulted in using health technology assessment (HTA) as a policy tool for controlling the diffusion of new technology within the health care system. Although attempts have been made to extend the coverage of HTA to medical devices, HTA has been used mainly for pharmaceuticals as a fourth hurdle to overcome during the market access process.

The debate about the contribution of healthcare services and technology to improvements in life expectancy has not been adjourned yet. Historically, there is a powerful group advocating socioeconomic developments, life style and environmental factors as the main drivers of increases in life expectancy. However, there is also a growing literature on the impact of health care services and new technology on life expectancy [3,7,9,10,16]. Pharmaceutical innovation is an important component of the health system contributing to improvements in health status, but there are other factors as well.

Biomedical innovation can contribute to healthcare outcomes in several ways, and this contribution is classified as substitution effect of treatment and treatment expansion effect [3]. Substitution effect connotes the replacement of old therapies by new ones. Treatment expansion effect, on the other hand, refers to innovative treatments making diseases that cannot be treated previously treatable. A potential outcome for both of them is increased healthcare expenditures leading to discussions and policies to curb them. However, the increase in healthcare expenditures caused by new technologies may be offset by decreases in other components of health expenditure as the new technology may reduce hospitalization and nursing home utilization, need for surgical interventions, etc.

Pharmaceuticals are the most important components of health technology and contribute to the health and wellbeing of the population in diagnosis, prevention and treatment of a wide range of health conditions. Development of a new molecule is a high-cost endeavor containing high risks and also requiring a long time from the invention of the molecule to its use. The cost of the innovation is shared by healthcare systems using the product until its patent expiration and this is one potential underlying factor in rising healthcare expenditures. However, new drugs can also offset their impact on health budgets by (i) shortening treatment duration, (ii) increasing effectiveness and (iii) decreasing hospital costs by decreasing the number of admissions and/or average length of stay in hospitals. These outcomes may both affect the health status of patients positively and offset the increase in pharmaceutical expenditures [6]. A number of studies have aimed at showing the relationship with technological development and healthcare expenditures and concluded that new technology can both improve outcomes and also offset the increase in costs through savings in other parts of the healthcare system [1,2,4,5,7,8,11,15]. This effect was analyzed for impact of cardiovascular drugs on hospitalization and it was concluded that if the drug vintage had not increased during 1995–2004, hospitalization and mortality from cardiovascular diseases would have been higher in 2004 [11]. Also, Lichtenberg [12] estimated that 87% of the increase in pharmaceutical expenditure in France attributable to pharmaceutical innovation was offset by a reduction in hospital expenditure. In the United States, more than 100% of the increase in pharmaceutical expenditure attributable to pharmaceutical innovation was offset by a reduction in hospital expenditure [13].

Turkey's health care system has been subject to a radical reform process since 2003, and major changes have been achieved both in the provision and financing sides. These changes had an impact on pricing and reimbursement policies of pharmaceuticals, which in the end affected the entry of innovative products into the Turkish health care system. The impact of these policies on longevity, hospital utilization and health expenditures have been elaborated upon in previous research [14]. The study aimed at estimating the effects of pharmaceutical innovation on mortality in Turkey during the period 1999–2008, and hospitalization and health expenditures during the period 2007–2010. The study briefly investigated whether the diseases that experienced more pharmaceutical innovation had larger increases in longevity and smaller increases in hospitalization by using longitudinal disease-level data to estimate difference-in-differences models. The results showed that during the study period, mean age at death increased by approximately 3 years, from 63.6 to 66.6. The estimates implied that in the absence of any increase in drug vintage, mean age at death would have increased by only 0.6 years.

According to the study, the number of hospital days increased 22% during the period 2007–2010. The estimates indicated that in the absence of pharmaceutical innovation, the number of hospital days would have increased by 25% during this period. Hence, 3 years of pharmaceutical innovation reduced the number of hospital days in 2010 by approximately 3%. Pharmaceutical innovation reduced the number of hospital days by approximately 1% per year.

These results, showing that pharmaceutical innovation has increased longevity and reduced hospitalization in Turkey, were in line with findings from a number of other countries. The study also separately analyzed the entry of new molecules to the Turkish market in comparison with the USA and European markets. FDA and EMA data showing the entry of new molecules to the market were compared with the Turkish entries between 2012–2013 and 2005–2013 (Tables 1 and 2).

As the tables show, the entry of new molecules to the Turkish market compared to the USA and Europe has slowed down over the years. The restrictions and new regulations in market approval, pricing and reimbursement are among the main drivers of this trend. Although the FDA approved 36 molecules and the EMA approved 22 molecules during the period between 2012–2013 Q2, only two molecules were approved in Turkey (4% of FDA and EMA approvals). In the period between 2005 and 2013 Q2, 36% of the molecules approved both by the FDA and EMA were approved in Turkey. The previous study drew the attention of the policy makers to the contribution of pharmaceuticals to longevity, hospital

Table 1 Comparison of New Chemical Entities (NCE) Marketed in the USA-FDA, EU-EMA and Turkey between 2012 and 2013 Q2.

Countries	NCEs marketed in 2012–2013 Q2	NCEs both in Turkey and comparison country	NCEs in Turkey but not in comparison country	NCEs in comparison country but not in Turkey	Drug accessibility index[a]
USA-FDA +EU-EMA	45	2	0	43	1
TR-TİTCK	2				0.04
USA-FDA	36	2	0	34	0.8
EU-EMA	22	1	0	37	0.48

[a]The drug accessibility index is calculated by dividing the number of NCEs marketed in the country by the number of NCEs marketed in the FDA and EMA.

Table 2 Comparison of New Chemical Entities (NCE) marketed in the USA-FDA, EU-EMA and Turkey between 2005 and 2013 Q2.

Ülkeler	NCEsmarketed in 2005–2013 Q2	NCEs both in Turkey andcomparison country	NCEsinTurkeybut notincomparison country	NCEsincomparison country but not in Turkey	Drug accessibility index[a]
USA-FDA +EU-EMA	210	75	0	135	1
TR-TİTCK	75				0.36
USA-FDA	178	67	8	111	0.85
EU-EMA	158	75	0	83	0.75

[a]The drug accessibility index is calculated by dividing the number of NCEs marketed in the country by the number of NCEs marketed in the FDA and EMA.

utilization and health expenditures, and to the slowdown in the pace of entry of these technologies to the Turkish market. It was clear from the study results that although pharmaceutical pricing and reimbursement policies may control pharmaceutical expenditures, they may do so at the expense of public health and rational use of resources.

As new data became available, a new study was designed to look at the results from another angle. The methodology and results of this study are presented below.

Methodology

The most important newly available data source is the IMS Health Turkey Medical Prescription Index, which provides detailed diagnosis and treatment profiles of patients treated in outpatient clinics. The index provides patient- and prescription-level information about patients and diagnoses (the incidence of the disease, the age and sex distribution, the type of medical establishment where diagnosis is made, the specialty distribution of the diagnosis, and whether the disease is acute or chronic) and about prescriptions (the number of prescriptions for each product, the specialty distribution of the prescriptions, new/repeat/change Rx, reimbursement information, co-prescribed products, and dosage information). The study period covered 2009–2013. The physician survey upon which the Medical Prescription Index is based contains nationally representative information on about half a million prescriptions per year, so we had detailed information about approximately three million prescriptions.

The new project's most important contribution was about the measure of pharmaceutical innovation. In the previous one, the launch year of the molecules was used as the measure of pharmaceutical innovation without referring to actual use of these products. In the second research, the IMS Medical Prescription Index enabled us to use the mean vintage of drugs actually prescribed in both the hospitalization and longevity analyses, and to use a less aggregated disease classification in the longevity analysis. This measure strengthened the results of the research and helped to overcome some limitations of the previous study.

The specific measures used for each component of the research are as follows:

- Pharmaceutical innovation measure: the fraction of prescriptions that were for drugs (molecules) with world launch years $>$ 1970.
- Mortality measures:
  - (Sex-specific) premature (before age 70) mortality rate (potential years of life lost before age 70 per 100,000 population below age 70).
  - (Sex-specific) age-standardized mortality rate.

- Hospitalization measure: inpatient hospital days per 100,000 population.

The databases used in the research were:

- Pharmaceutical data
  - IMS Turkey Medical Prescription Index (data on number of prescriptions, by molecule, disease and year).
  - IMS MIDAS database (data on world launch years of molecules).
- Mortality and hospitalization data: OECD Health database (http://stats.oecd.org/index.aspx?DataSetCode=HEALTH_STAT#).

Table 3 Disease classification used in IMS Turkey medical prescription index.

A0 INFECT and PARASITIC DIS
C0 NEOPLASMS
D5 DIS-BLD/BLD FRM ORG/IMM
E0 ENDOCR NUTR/METAB DIS
F0 MENTAL/BEHAVIOUR DIS
G0 DISEASES OF NERV SYS
H0 DIS OF THE EYE/ADNEXA
H6 DIS-EAR/MASTD PROC
I0 DIS OF THE CIRCULAT SYS
J0 DIS OF THE RESP SYSTEM
K0 DIS OF THE DIG SYSTEM
L0 DIS OF THE SKN/SC TISS
M0 DIS-M/SKEL SYS/CONN TISS
N0 DIS OF THE GU SYSTEM
O0 PREG CHILDBIRTH/ PUERP
P0 COND ORIG PERINATAL PER
Q0 CONG MALF DEF CHROM ABS
R0 SYM/SIG ABN CLIN/LAB FIN
S0 INJUR/POIS/OTH EXT CAUSE

The study is based on the disease classification used in the IMS Turkey Prescription Index (Table 3).

As stated earlier, the information from IMS Health about six million prescriptions contributed to the accuracy of the estimations as reflections from real life experience. The index was also valuable as diseases are categorized under 19 classifications, whereas the previous data was based on 10 disease classifications. (Tables 4 and 5).

Findings

The findings of the study are as follows.

As can be seen from the table, according to the MIDAS data, the mean launch year of the new molecules was 1943.6, and 14.3% of the drugs prescribed in 1999 had been launched post 1970. In 2010, the mean launch year increased to 1959.4 and the percentage of the products launched post 1970 had more than doubled (30.6%). The positive impact of the increase in the mean vintage of drugs on longevity, hospitalization and healthcare expenditures

Table 4 Pharmaceutical trends in Turkey.

Year	MIDAS data			Medical index data					
	No. of standard units (000s)	Mean launch year	Post 1970	No.of prescriptions	Mean launch year	Post1960	Post1970	Post1980	Post1990
1999	33,562,867	1943.6	14.3%						
2000	34,574,132	1945.3	15.9%						
2001	32,207,553	1948.3	18.8%						
2002	32,924,578	1949.1	19.4%						
2003	36,877,004	1949.3	19.6%						
2004	39,872,508	1950.3	20.7%						
2005	54,358,548	1953.3	24.0%						
2006	57,399,899	1954.3	25.5%						
2007	60,577,129	1955.5	26.6%						
Year	MIDAS data			Medical index data					
	No. of standard units (000s)	Mean launch year	Post1970 (%)	No. of prescriptions	Mean launch year	Post1960 (%)	Post1970 (%)	Post1980 (%)	Post1990 (%)
2008	64,516,861	1956.8	28.1						
2009	65,847,514	1958.2	29.2	1,204,705,201	1961.7	46.1	38.1	26.0	12.7
2010	68,430,053	1959.4	30.6	1,257,336,174	1962.5	47.3	39.0	26.9	13.7
2011				1,289,039,896	1962.5	47.4	38.9	27.3	13.9
2012				1,305,393,304	1963.2	48.1	39.9	28.2	14.9
2013				1,221,871,311	1963.6	48.8	40.6	28.9	15.5
2014				1,264,101,082	1963.7	49.1	40.8	28.9	15.7

Medical index data are subject to sampling error; MIDAS data are not.

Table 5 Years lost, /100,000 population, aged 0–69 years old.

	2009	2010	2011	2012	2013
All causes of death	3891.4	3726.6	3668.8	3627.2	4024.2
Certain infectious and parasitic diseases	99.8	91.2	85.2	82.2	90.7
Neoplasms	880.6	882.8	873.5	860	908.6
Diseases of the blood and blood-forming organs	31.5	33.2	33.6	33.7	34.5
Endocrine, nutritional and metabolic diseases	165.7	155.3	153.3	143.4	147.6
Mental and behavioral disorders	7.3	7.9	7.1	6.7	3.9
Diseases of the nervous system	122	128.3	127.2	139.2	146.1
Diseases of the circulatory system	834.5	781.9	755.4	724.9	755.5
Diseases of the respiratory system	224	164.2	190.3	170.9	204
Diseases of the digestive system	89.4	85.2	82.7	81.2	86.4
Diseases of the skin and subcutaneous tissue	1.5	1.5	1.7	1.6	1.8
Diseases of the musculoskeletal system and connective tissue	17.3	14.2	15.2	14.6	13.7
Diseases of the genitourinary system	68.1	66	68.9	67.2	69.2
Certain conditions originating in the perinatal period	529.1	395.5	377.2	412.8	497.2
Congenital malformations and chromosomal abnormalities	277.6	280.1	305.2	269.8	340.3
Symptoms, signs, ill-defined causes	221.6	236.3	218.5	232.1	112.2
External causes of mortality	319.9	400.6	371.1	384.6	599.3

was shown in the previous research. The mean launch year of drugs prescribed in 2009 calculated from the Medical Index data was 3.5 years greater than the mean launch year of products sold in 2009 calculated from the MIDAS data (1958.2 vs 1961.7).

The potential life years lost per 100,000 population aged 0–69 years old was 4024.2 for all causes of death in 2013, increasing from 3627.2 in 2012. There was a decrease in the life years lost from 2009 to 2012 (from 3891.4 to 3627.2). Neoplasms were the leading cause of life years lost (908.6 per 100,000 in 2013) followed by diseases of the circulatory system (755.5), external causes of mortality (599.3) and certain conditions originating in the perinatal period (497.2). Life years lost due to the diseases of the circulatory system has declined from 834.5 in 2009 to 755.5 in 2013. These findings are in line with the place of Turkey in terms of epidemiological transition.

As can be seen from Table 6, as far as the standardized death rates per 100,000 population is concerned, diseases of the circulatory system had the highest figure with 395.9 deaths per 100,000 followed by neoplasms (1699 per 100,000). In line with the lost life years trend, there was a decline in deaths from 2009 to 2012 and an increase in 2013 (from 835.7 to 898.4)

Table 7 shows that there was a decline in hospital discharges per 100,000 between 2009–2013 for neoplasms (from 852.1 to 620), for diseases of the nervous system (from 306.3 to 288.8) and for disease of the circulatory system (from 1441.7 to 1271.7). On par with this, hospital days per 100,000 population has also declined for the same disease groups. (Tables 8 and 9).

Mortality models

Premature mortality rate model

The following model was used in estimating the impact of pharmaceutical innovation on potential years of life lost in the study period.

$$\ln(\mathbf{PYLL_{ist}}) = \beta\ \mathbf{POST1970\%_{ist}} + \alpha_i + \pi_s + \delta_t + \varepsilon_{ist}$$

$PYLL_{ist}$ = potential years of life lost before age 70 in year t (t = 2009,…,2013) from disease i by people of sex s per 100,000 population below age 70.

$POST1970\%_{ist}$ = the fraction of prescriptions in year t for disease i and people of sex s that were for drugs (molecules) with world launch year > 1970.

Inclusion of year and disease fixed effects controls for the overall decline in premature mortality and for stable between-disease differences in premature mortality. Negative and significant estimates of β would signify that diseases for which there was more pharmaceutical innovation had larger declines in premature mortality.

The model was estimated by weighted least squares; weight = (1/5) Σ_t $PYLL_{ist}$. Standard errors were clustered by disease*sex.

Estimate of β:

Estimate	Standard error	95% confidence limits		Z	Pr > |Z|
−0.884	0.2244	−1.3238	−0.4442	−3.94	<0.0001

Age-standardized mortality rate model

The following model was used in estimating the impact of pharmaceutical innovation on the age standardized mortality rate.

$$\ln(\mathbf{MORT\_ASR_{ist}}) = \boldsymbol{\beta}\ \mathbf{POST1970\%_{ist}} + \alpha_i + \pi_s + \delta_t + \varepsilon_{ist}$$

$MORT\_ASR_{ist}$ = the age-standardized mortality rate in year t (t = 2009,…,2013) from disease i by people of sex s.

The model was estimated by weighted least squares; weight = (1/5) $\Sigma_t MORT\_ASR_{ist}$. Standard errors were clustered by disease*sex.

Estimate of β:

Table 6 Deaths per 100,000 population (standardized rates).

	2009	2010	2011	2012	2013
All causes of death	835.7	832.9	848.6	837.2	898.4
Certain infectious and parasitic diseases	11.3	12.1	12.3	13.7	15
Neoplasms	150.7	156.1	159.3	158.9	169.9
Diseases of the blood and blood-forming organs	3.1	3.1	3.1	3	3.2
Endocrine, nutritional and metabolic diseases	54	54.7	54.2	51.1	51.7
Mental and behavioral disorders	1.5	1.4	1.4	1.8	1.6
Diseases of the nervous system	26.1	33.2	34.9	39.6	41
Diseases of the circulatory system	373.7	368.9	364.4	348.6	395.9
Diseases of the respiratory system	79.3	75.7	92.9	88.5	96
Diseases of the digestive system	20.3	20.8	21.3	21.6	23.9
Diseases of the skin and subcutaneous tissue	0.7	0.6	0.7	0.7	0.8
Diseases of the musculoskeletal system and connective tissue	4.3	4.3	3.6	3.7	2.9
Diseases of the genitourinary system	24.2	26.4	29.5	29.6	28.9
Certain conditions originating in the perinatal period	7.6	5.7	5.4	5.9	7.2
Congenital malformations and chromosomal abnormalities	4.3	4.2	4.6	4.4	5.1
Symptoms, signs, ill-defined causes	47.8	39.2	35.7	41.2	20.7
External causes of mortality	26.7	26.2	25.1	24.8	34.4

Table 7 Hospital discharges per 100,000 population.

	2009	2010	2011	2012	2013
All causes	13398.8	14239.2	15242.1	15762.3	16073.9
Infectious and parasitic diseases	365.5	379.7	487.4	492.7	501.1
Neoplasms	852.1	852.2	625.8	645.8	620
Diseases of the blood and blood forming organs	179.1	210.8	230.9	249.4	278.8
Endocrine, nutritional and metabolic diseases	396.4	421.9	439.6	441.9	436.8
Mental and behavioral disorders	176.7	190.5	225.2	270.4	222.5
Diseases of the nervous system	306.3	331.9	280.4	281.1	288.8
Diseases of the eye and adnexa	631.2	698.5	531.6	612.6	685.5
Diseases of the ear and mastoid process	97.4	103.7	111.8	100.5	91.8
Diseases of the circulatory system	1441.7	1504.4	1140.6	1207.8	1271.7
Diseases of the respiratory system	1684.6	1788.9	2050.7	2037.3	2062
Diseases of the digestive system	1102.1	1176.7	1434.2	1602.3	1767.2
Diseases of the skin and subcutaneous tissue	274	302.6	438	458.8	479.8
Diseases of musculoskeletal system and connective tissue	670.3	713.5	713.8	714.8	703.3
Diseases of the genitourinary system	1179.6	1256.3	1219	1221	1297.5
Certain conditions originating in the perinatal period	313.2	335.5	337.6	376.1	362.6
Congenital malformations, deformations and chromosomal abnormalities	144.8	143.9	115.2	117.1	117.8
Symptoms, signs and abnormal clinical and laboratory findings, n.e.c.	710	862.5	698.1	656.1	554
Injury, poisoning and other consequences of external causes	588	591.7	956.6	937.1	868.7

Estimate	Standard error	95% confidence limits		Z	Pr>|Z|
−1.4731	0.4523	−2.3596	−0.5866	−3.26	0.0011

Hospitalization rate model

The following model was used to estimate the impact of pharmaceutical innovation on hospitalization rate.

$$\ln(\mathbf{HOSP\_DAYS_{it}}) = \beta\ \mathbf{POST1970\%_{it}} + \alpha_i + \delta_t + \varepsilon_{it}$$

$HOSP\_DAYS_{it}$ = inpatient hospital days for disease i per 100,000 population in year t (t=2009,...,2013)

$POST1970\%_{it}$ = the fraction of prescriptions in year t for disease i that were for drugs (molecules) with world launch year > 1970.

The model was estimated by weighted least squares; weight = (1/5) Σ_t $HOSP\_DAYS_{it}$. Standard errors were clustered by disease.

Estimate of β:

Estimate	Standard error	95% confidence limits		Z	Pr>|Z|
−2.0725	0.976	−3.9855	−0.1595	−2.12	0.0337

Table 8 Hospital days per 100,000 population.

	2009	2010	2011	2012	2013
All causes	57,615	58,381	59,444	63,049	62,688
Infectious and parasitic diseases	1572	1481	1852	1823	1754
Neoplasms	4942	4602	3004	3100	3038
Diseases of the blood and blood forming organs	770	822	739	873	864
Endocrine, nutritional and metabolic diseases	2220	2236	2330	2298	2315
Mental and behavioral disorders	2933	2991	4144	4137	4094
Diseases of the nervous system	1991	2124	1570	1602	1560
Diseases of the eye and adnexa	1326	1397	957	919	891
Diseases of the ear and mastoid process	351	342	302	332	285
Diseases of the circulatory system	6632	6619	6045	6401	6486
Diseases of the respiratory system	7918	8229	10,869	11,001	11,341
Diseases of the digestive system	4188	4118	4589	4807	4771
Diseases of the skin and subcutaneous tissue	1014	999	1139	1055	1056
Diseases of musculoskeletal system and connective tissue	4625	4638	4711	4718	4642
Diseases of the genitourinary system	4247	4146	3413	3541	3503
Certain conditions originating in the perinatal period	1503	1577	1654	1805	1813
Congenital malformations, deformations and chromosomal abnormalities	767	720	518	515	530
Symptoms, signs and abnormal clinical and laboratory findings, n.e.c.	2840	3278	1815	1706	1607
Injury, poisoning and other consequences of external causes	2705	2663	3539	3842	3996

Table 9 Summary results of estimations.

Dependent variable	Estimate	Std. error	95% confidence limits		Z	Pr>|Z|
Premature mortality rate	−0.884	0.2244	−1.3238	−0.4442	−3.94	<0.0001
Age-adjusted mortality rate	−1.4731	0.4523	−2.3596	−0.5866	−3.26	0.0011
Inpatient hospital day rate	−2.0725	0.976	−3.9855	−0.1595	−2.12	0.0337

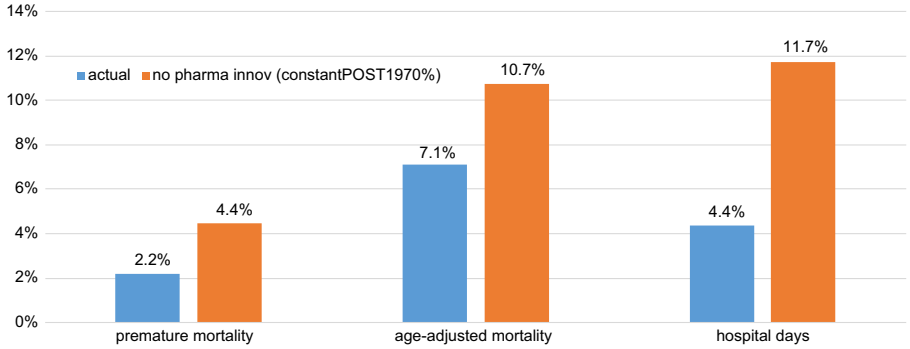

Fig. 1 Change in mortality and hospitalization rates, 2009–2013: actual vs. estimated, in absence of pharmaceutical innovation.

The results from the models are summarized below.

The results of the study indicated that diseases experiencing more rapid pharmaceutical innovation (i.e., greater increases in the fraction of prescriptions that were for drugs with world launch years > 1970) had larger declines in the premature mortality rate, the age-adjusted mortality rate, and the inpatient hospital day rate as summarized in Fig. 1.

As can be seen from Fig. 1, pharmaceutical innovation has contributed significantly to reducing premature mortality, age-adjusted mortality and hospital days.

Conclusion

The findings of the study are parallel to our previous research and literature, emphasizing once again the contribution of pharmaceutical innovation to longevity growth and reducing hospitalization. This also indicates the importance of accessibility to new drugs as well. There is a growing tendency in a majority of countries to control pharmaceutical expenditures, especially since the global economic crisis in 2008. As the OECD figures show, pharmaceutical expenditure has been the leading declining healthcare expenditure item between 2008 and 2011.

However, pharmaceutical policies developed in austerity times to curb pharmaceutical expenditures and to control healthcare expenditures can be at the expense of improving longevity and hospital efficiency. This means that curbing pharmaceutical expenditures and hence slowing the entry of new molecules to the market may lead to more hospital days, which in the end could result in higher healthcare expenditures. In addition to this, when the potential life years lost is concerned, premature deaths will have an impact on the overall economy through lost workforce and productive working hours. Indirect costs caused by diseases that do not benefit from new technologies should not be overlooked, as they may be more than direct costs in certain disease areas.

Due to data limitations, the effects of non-pharmaceutical medical innovation (e.g. surgical and diagnostic imaging innovation) could not be analyzed in this study. But pharmaceutical R&D accounts for a large fraction of total biomedical R&D, and previous research based on U.S. data indicates that non-pharmaceutical medical innovation is not positively correlated across diseases with pharmaceutical innovation. As stated earlier, pharmaceutical innovation is one of a number of elements contributing to improvements in health outcomes.

To conclude, our study has once again revealed that new technology has a favorable impact on years of life lost, premature deaths and hospitalization. Use of new molecules during the period 2009–2013 decreased premature deaths by 2.2%, age-adjusted mortality by 3.6%, and hospitalization by 7.3%. The results indicate that Turkish healthcare policymakers should consider the broader outcomes of restrictions on access to new medicines.

Author Statements

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Competing interests

None declared.

Ethical approval

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