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Dynamic effects of sports and physical activities and public health spending on sustainable environmental performance? New evidence from 50 U.S. states

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ABSTRACT

Environmental-friendly behaviours are increasingly imperative in the current era to diminish the speed of environmental degradation and its damaging impacts. Increased sports and physical activities entail positive health outcomes, as well as having the potential to reduce vehicle-related carbon emissions. Therefore, the present study investigates the impact of sports and physical activities and public health spending on environmental performance in 50 U.S. states for the period 2010–2019. The system of the generalised method of moment (G.M.M.) and feasible generalised least squares (F.G.L.S.) are employed in the present analysis. The results reveal that sports and physical activities are significantly increases environmental performance in U.S. Similarly, health expenditures are negatively and significantly associated with air pollution and encourage overall environmental performance. However, economic growth contributes to higher emissions and therefore impede environmental performance. The interaction term of health expenditures and sports activities indicate that the combination of higher health expenditures with sports activities puts a profound effect on environmental quality. These findings signal the need to retrace health care spending programs and sports activities to accomplish zero-carbon targets and better environmental performance.

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1. Introduction

Environmentally-friendly behaviours are increasingly imperative in the current era to diminish the speed of environmental degradation and its damaging impacts (Khan et al., 2021). The United Nations' (U.N.) agenda for 2030 has established 17

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'Sustainable Development Goals' (S.D.G.s) to address more pressing global challenges worldwide (UN, 2020). The main environmental cost is connected to air pollution (Zhang et al., 2021; Zhuang et al., 2021). Air pollution mainly encompasses greenhouse gases (G.H.G.s), for instance, carbon dioxide (CO_2), nitrogen oxides (NOx), sulphur dioxide (SO2), and emissions from industries and active transport, which produce atmospheric particulate matter (P.M.) (Ozturk & Acaravci, 2013; Razzaq, Wang et al., 2021; Sharif et al., 2020). Apergis et al. (2018) claim that the augmented development and emanation of unadorned types of G.H.G.s are triggering environmental corrosion which is a threat to public health on a continuous basis (Ling et al., 2021; Lingyan et al., 2021). One of the important goals is to 'take urgent action to combat climate change and its impacts'. Environmental deterioration has global relevance not only in connection with global economic facets but also in stimulating human lives and natural systems that are affected by adverse weather events adversely (IPCC, 2018; Razzaq, Ajaz et al., 2021; Sharif et al., 2021; UN, 2020). It also signifies the need for fighting the drivers behind environmental degradation.

Environmental issues are instigated by global warming, triggered largely by social activities, for instance travelling through active transport and industrial production (Xuefeng et al., 2021). In this regard, IPCC (2018) mentions that sustainable human behaviours like reasonable consumption and production activities and good health and well-being can take part in emission reduction (An et al., 2021; Sun et al., 2021). In recent years, there is a worldwide concern to eliminate climatic emissions, so there is also a global call for amplified physical activity. Physical activities and sports involvement donate a beneficial effect on human health and well-being (Orlowski & Wicker, 2018; Wicker & Frick, 2020). Practising these activities promote positive externalities in terms of a healthy lifestyle, well-being, enhance environmental impressions and has the potential to reduce CO_2 emissions by lowering transport-related carbon emissions (Woodcock et al., 2009). Transportation activities yield about 23% of worldwide climate gas releases, indicating the significance of an active transportation systems as a potential source to reduce carbon emission (Abagnale et al., 2015; Wang et al., 2021).

Moreover, the environmental degradation caused by transportation behaviours, the individual attitude in rich societies also entails major energy consumption. In western economies, the major part of the population's leisure consumption often embraces plenty of clothes and equipment, vehicle activities, buying of home electronic appliances, and holiday journeys by air, all significantly contributing to the carbon emanations (Aall, 2011). In this way, instead of spending time in leisure activities, sports and physical activities put a positive effect on environmental quality. In a similar manner, bicycling from home rather than driving a car to a gym or fitness centre to do a spinning class, would favour the environment by diminishing the transport-related carbon emissions. Sports activities for instance running and walking organised in the community makes motorised transportation redundant, favouring the environment by less consumption of fossil fuel and reduced emanations of climate gases (Bjørnarå et al., 2017, 2019).

Another important issue that has emerged in recent years, and by which millions of people are dying, is the novel COVID-19 and related issues, so there is a dire need

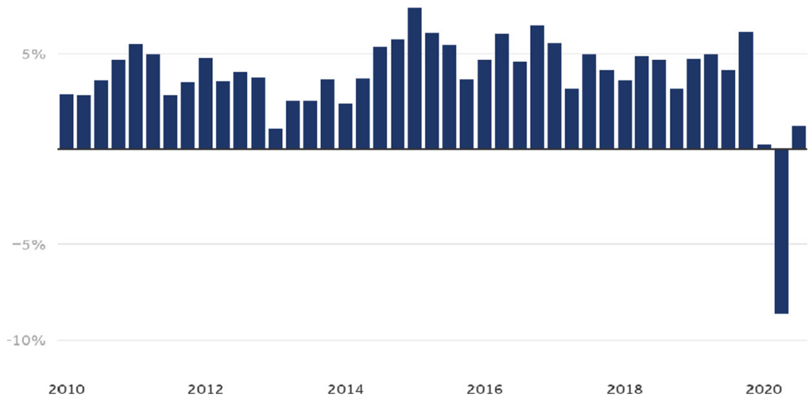

Figure 1. Year-over-year growth percentage in healthcare spending in the U.S. Q1 2010–Q3 2020. Source: KFF analysis of Quarterly Services Survey (QSS).

for time to research the association between health-related issues and their potential effect on the environment as well (World Health Organization [WHO], 2020; Worldometers, 2020; Yu et al., 2021). The blowout of diseases is mainly accredited to air pollution, high-temperature intensity, and other meteorological aspects (Irfan et al., 2021; Sarkodie & Owusu, 2020; Tosepu et al., 2020). The recent research echoes that air pollution has hazardous health outcomes and well-being costs that affect long-term eco-sustainability and human growth as well (Owusu & Sarkodie, 2020). Moreover, global differences in health spending have also caused changes in maternal and infant health and death rates (Owusu et al., 2021). Still, there is a scarcity of investigation on the impression of health expenditure on air quality and environmental pollution.

A very few numbers of studies have explored health expenditure as a determinant of environmental quality (An et al., 2021; Ganda, 2021). In environmental perception, health expenditure enables the public health care units to underneath the risks of illness by providing a healthy natural environment, and through improving the economy's green productivity (He et al., 2021). In this way, it may be the indispensable factor that stimulates environmental quality. So, it is imperious to evaluate the health costs of CO_2 emanations for both environment and health care policy development. From a green accounting perspective, the main goal of the present investigation and policy concern is to inspect how health expenditure in the different states of the U.S. impact environmental quality. Over the five years to 2022, total health expenditures are anticipated to surge at an annual rate of 3.2% to grasp $3.7 trillion. In 2020, health expenditure falls to 8% (See Figure 1). While the services and expenses to fighting the COVID-19 remain high, it has also affected other areas of health care. In this regard, a dire need to explore the possible channel of health expenditures towards air quality is crucial.

According to the Bureau of Labor Statistics (2019)[1], approximately 19.3% of the U.S. population is engaged in sports and physical activities daily. This involvement includes participation in sports, physical activities (exercise and other leisure activities). In 2019, only in Wales about 32% of the population allegedly involved in

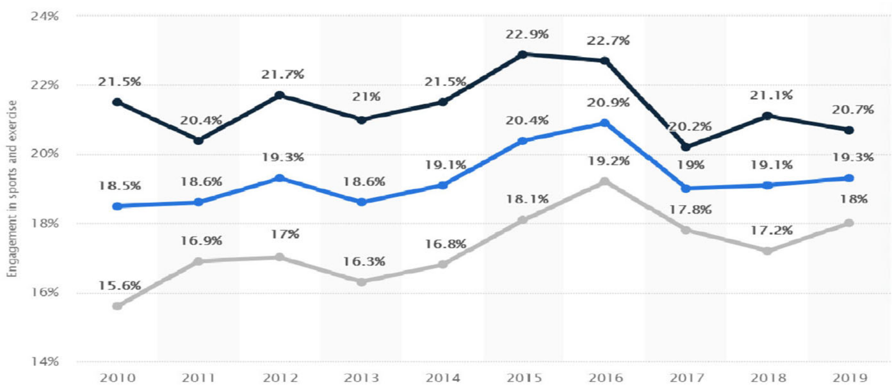

Figure 2. Average percentage of U.S. population participating in sport and physical activities daily (2010–2019).
Source: Bureau of Labor Statistics Statista (2020).

sporting activities three time a week and on average spent half an hour per day doing sport, including exercise and recreation (See Figure 2).

The U.S. economy is the world's biggest economy in terms of world G.D.P., and second-largest economy contributing to global emissions significantly. To rig out the matter there is a need to elucidate the role of health expenditures and sport and physical activity in air quality performance. Very few studies to date check environmental performance consequences of sports and health expenditures for the U.S. economy. The present study is motivated by several facts, which are interrelated: (1) the ongoing situation of COVID-19 which limits the physical and sports activities and linked health expenditures affect the environment of the U.S. badly. So, the main contribution of the current study is to examine how improved health expenditures and sports and physical activities influence the U.S. economy, for this, we use the 50 U.S. states. The present study also examines how improved health expenditures with sports and physical activities encourage environmental performance.

The rest of the study is structured as; section 2 discusses the literature review, section 3 captures data, methodology, model specification. Whereas section 4 provides the findings of the study, and section 5 present the conclusion and policy recommendation.

2. Literature review

The research of human and environmental connections generally considers that how extremes of the environment affect humans or how individuals affect the ecology. It is well established that physical activity enhances both the physical and psychological well-being of individuals (Orlowski & Wicker, 2018; Wicker & Frick, 2020). It is also documented that improved quality of environment puts a profound effect on individual health (Downward & Dawson, 2016).

Since ancient times, humans entertain themselves with physical and sports activities. Physical activities are emblematic of health, but ironically, even as physical activities and sports endorse health, they also damage the environment upon which healthy life depends. Though the area has important insights very few studies establish the relation between sports and physical activities and environment. The present study examines three main associations: (1) association between sports and physical activities and air quality performance; (2) association between health expenditures and air quality performance; and (3) association between economic growth and air quality performance in the present analysis.

Since 1970, the association between economic growth and the environmental problem has been a long-lasting worldwide concern (Grossman & Krueger, 1991). Economic growth is fuelled by industry, infrastructure, transport, and technology which also cause higher resource consumption and energy that negatively affects air pollution. Economic development requires the production of goods and services, that unavoidably needs more resource use and energy (Auci & Vignani, 2013; Jaunky, 2012). So, the countries who for economic development also faced the serious issue of environmental degradation.

From 2008 onwards, there is a mounting public concern in environmental issues, entertained by proportionately increasing research in the area of sports and the environment (Dingle & Mallen, 2017). Whereas the literature initially tried to explore why and how environmental policies are applied in sports activities (Trendafilova et al., 2013). Although, one can easily learn about the impressions of sports activities on the environment by looking at sport mega-activities, yet there is a range of more sport-specific environmental effects (positive and negative) which attract the attention of researchers over time (Braksiek et al., 2021). One strand of researchers argues that sports and physical activities have a negative effect on environmental quality. They argue that environmental degradation is produced by worldwide emissions, triggered considerably by individual activities such as sports, travelling and industries that produce these emissions.

McCullough, Orr, and Watanabe (2020) inspected the environmental impacts of sports and physical activities and established that it has a negative association with the environment, as these activities deploy natural resources which in turn produce emissions in the air. A few researchers examined the environmental degradation related to active sports members (Chard & Mallen, 2012; Dolf & Teehan, 2015) and snow-related sport (Wicker, 2019). Similarly, Dolf and Teehan (2015) analyse the carbon emissions of 10 university sports teams over two varsity seasons 2011–2012 and find a positive association. Chard and Mallen (2012) studied the connection between ice hockey and carbon emissions in a Canadian community and reported an average carbon footprint raised with ice hockey. Wicker (2019) calculated the annual carbon footprints from snow-sport linked travel of skiers and boarders in 2015 amounted to 431.6 kg CO_2-e per person and estimated that with boarders fabricating a higher annual carbon emission than skiers.

On the other hand, there is also a researcher discourse on the positive association between outdoor recreation and the environment. That is, one becomes environmentally friendly by being in nature (Fredman & Sandell, 2013). Latterly, a group of researchers has convened the various environmental methods in the underpinning literature under the discipline of sports ecology (McCullough, Orr, & Kellison, 2020). Former literature in the discipline of sports was two-folded. The first approach inspected different perspectives is the influence of sports on the environment (Dolf &

Teehan, 2015; McCullough, Orr, & Kellison, 2020; Wicker, 2019), whereas the second one engrossed the effect of environmental variations in sports activities (Orr & Inoue, 2019). Within sport and physical activities, existing research has established a positive connection between environmental beliefs and pro-environmental behavioural intentions among sports fans. Physical activities promote healthy physical minds that in turn flourish the environmental consciousness and pro-environmental behaviours which puts a positive effect on air quality.

In the similar way, Woodcock et al. (2009) also explore the association between physical activities and the environment and find a positive association, using the bicycle to work and other activities which reduce the vehicle-based emission, which has a beneficial effect on the environment. Opting for a walk and bicycling over other transportation modes reduce the number of injurious emissions produced and released into the air. Walking is the best opportunity for plummeting the traffic congestion which can itself diminish emanations and fossil fuel energy consumption (Hatamzadeh et al., 2020). Globally, the transport system is alone responsible for approximately a quarter of total energy associated with G.H.G. emissions, due to reduced walk and increased use of vehicle transport emissions which are increasing at a faster rate as compared to other energy sectors. Another benefit of these physical activities includes reduced noise pollution in the environment (Schlömer et al., 2014).

Recently another important driving factor of the environment is health care expenditures. The existing studies examine that environmental degradation has a harmful effect on health and has welfare costs that affect long-run economic sustainability and also impact human development badly as well (Owusu & Sarkodie, 2020). There are a few studies on the influence of health spending on the quality of the environment (Çakar et al., 2021; Erdoğan et al., 2020) and have mixed findings. For instance, Yazdi et al. (2017) and Yazdi and Khanalizadeh (2017) find a positive association between health expenditure and the environment, whereas Lu et al. (2021), Halkos and Paizanos (2013) and Zaidi and Saidi (2018) establish a negative association. A primary study by Apergis et al. (2018) demonstrates bi-directional causality between emanations and health expenditure whereas Chaabouni et al. (2016) observed unidirectional causality. Although a huge literature demonstrates the association of environmental and health expenditures and explain the causality that runs from the environment to health expenditures, very limited studies explain the possible relationship of the health expenditures on the environment in the case of the U.S. economy.

This study is unique in the way that it analyses the possible relationship of health expenditures on the environment as former literature does not focus on this side. The study also gives a new direction to the literature to explore the possible channels of health expenditures on air quality and the environment. The present study uses the air quality index to explain the potential channels of sports and physical activities and health expenditures on the environment.

3. Data and methodology

The relationship between Environmental Performance and Sports and physical activity has two-way causality. Physical activities are necessary to maintain health throughout life to avoid chronic diseases. Therefore, sports and exercise keep one healthy and active. With many other factors, the environment plays a well-established role in one's physiological response to physical activities. Attributes of the physical environment change the behaviour of people in adopting physical activities. With continuously changing climatic and weather patterns and their harmful effects on breathing and respiratory system, people choose to use transport against walking, cycling or exercising (Van Holle et al., 2012). While envisioned behaviour of people towards this changing environmental pattern such as the use of cycles instead of fuelled transport, keeping sports grounds clean and other cleaning attitudes to keep the environment clean and green also matters. So clean environment enhances sports and exercising behavior and similarly sports with the use of careful means for cleaning and keeping the environment safe act as a determining factor in ecological changes (Gao et al., 2020).

To tackle the issue of endogeneity, we are using System G.M.M. because O.L.S. estimators show an upward biasedness and inconsistency while parameters depict the picture of downward biasedness resulting from within-group estimators (Bertrand et al., 2004). Then chances of the presence of omission of unobserved time-invariant country effect increase. Blundell et al. (2001) argue that the first difference approach, introduced by Anderson and Hsiao (1982) to overcome the issues of O.L.S., may not be well suited due to the presence of correlation between endogenous variables and error term of the differenced model. They justify lagged endogenous variables as weak instruments used in differenced G.M.M. proposed by Arellano and Bond (1991). Difference G.M.M. estimator has the issue of small sample biases when the time period is small and regressor is persistent (Alonso-Borrego & Arellano, 1999). So, we use System G.M.M. estimate by following Blundell et al. (1996) which mitigates finite sample biases under mild assumptions.

To tackle the issue of reverse causality, Sys-G.M.M. uses internal instruments to deal with endogenous regressors. These instruments are lags of independent variables. The instrumental variable technique assumes that good instruments need to be valid and correlated with independent variables but impertinent to error terms (Baum et al., 2007). Blundell and Bond (1998) validate that the Sys-G.M.M. estimator engenders efficiency gains by adopting Monte Carlo simulations in a relatively short time series and large cross-sections. Roodman (2009) proposes that time dummies are imperious to use when there is no correlation in cross-sectional error terms. Hence, the use of too many instruments causes the problem of over-identifying restrictions therefore, to check the validity of instruments Hansen J-test is appropriate to use. Instruments must be less than cross-sectional units in G.M.M. Therefore, to restrict the number of instruments we are taking one or two lags. Furthermore, time-dummies are created to inflate the probability of zero autocorrelation around group individuals in the 'idiosyncratic disturbance' presumption to hold.

Based on the literature, Ahmad et al. (2017) proposes a theoretical framework to scrutinise environmental quality through economic growth. The model is further extended by many researchers (Alhassan et al., 2020; Aslam et al., 2021; Shahbaz et al., 2012; Shaheen et al., 2019). Following previous studies, we investigate the impact of sports and physical activities, health care expenditures and G.D.P. on environmental quality. Sports and physical activities entertain millions of people worldwide along with beneficial impacts on health and environment using efficient technology that helps reduction in CO_2 emissions and improves air quality (Triantafyllidis, 2018). Similarly, G.D.P. affects CO_2 in three ways: technology, composite, and scale effect. GDP enhances trade that boosts modern technology which is favourable for the environment (Zafar et al., 2019). Health expenditures also play determining role in environmental performance. Chaabouni et al. (2016) argue that health expenditures include redistributive transfer which equalises income that leads to increasing demands of environmental quality. Furthermore, if the environment is treated as a luxury public good then its demand will rise after the satisfaction of other public goods. Based on these arguments we estimate environmental quality from sports and physical activities by writing the model in G.M.M. form as:

$$\begin{aligned} API_{it} &= \alpha_{it} + \beta_1 lnAPI_{it-1} + \beta_2 lnSPA_{it} + \beta_3 lnHE_{it} + \beta_4 GDP_{it} \\ &\quad + \beta_5 lnSPA_{it} \times lnHE_{it} + \varepsilon_{it} \end{aligned} \tag{1}$$

where in Equation (1), 'i' represents all cross sections (states), 't' indicates time series, ε_{it} is the error term. Here ln is a natural log of variables to make the model linear. Log transformation controls the issues of multicollinearity and heteroscedasticity simultaneously, it also gives efficient and stable results (Naseem & Ji, 2020; Zafar et al., 2019). 'E.P.' is environmental performance, 'S.P.A.' is sports and physical activities, 'H.E.' is health expenditure and 'G.D.P.' is economic growth and S.P.A. × H.E. is the interactive term to apprehend the effect of S.P.A. conditional upon H.E. After sys-G.M.M., to check the reliability of results, we apply F.G.L.S. by following Parks (1967). F.G.L.S. offers covariance structures for errors in panel data and allows heteroskedasticity across panels and correlation within panels leading to efficient estimators. Hence, F.G.L.S. is a robust check of Sys-G.M.M. (Liu et al., 2017).

3.1. Data

To analyse the impact of sports and physical activities and public health spending on environmental performance, this study incorporates the air quality index to measure environmental performance. Our main variable of interest is air quality index (A.Q.I.), which measures the concentration of five key air pollutants regulated under the Clean Air Act. Higher A.Q.I. values are worse and lower ones are better – and 'good' air quality is defined as having an air quality index level between 0 and 50. The national A.Q.I. is the average A.Q.I. across all counties. For each state, the A.Q.I. shown is the average air quality across the counties in the state. The data is taken from U.S. Environmental Protection Agency. While Sports and Physical Activity (S.P.A.) is measured as a percentage of adults in the state who usually biked or walked to work in the last week, whereas health expenditure (H.E.) measures annual health expenditure per capita (both S.P.A. and H.E. are derived From National Centre for Health Statistics, Centre for Disease Control and Prevention (C.D.C.). Economic growth is an important determinant of the environment, the data on the

Table 1. Definition of variables and data sources.

Variable name	Acronym	Description	Measurement	Data source
Environmental performance	EP	Air Quality Index	Index	US Environmental Protection Agency
Sports and Physical Activity	SPA	Adults in the states who usually biked or walked to work in last week.	Head count	US National Center for health Statistics
Health expenditure	HE	Public expenditure in health sector	Per capita	US National Center for health Statistics
Economic growth	GDP	Real Gross Product per Capita	US Dollar	US Bureau of Statistics

Note: Data 2000–2019. All variables are transformed into a quarterly data set to make consistent analysis.
Source: Author's estimations.

Table 2. Descriptive statistics.

Variables	Mean	Min.	Max.	Std. Dev.
EP	0.230	0.112	0.470	0.287
Log SPA	0.283	0.104	0.298	0.210
Log HE	0.401	0.175	0.476	0.310
Log GDP	0.724	0.490	0.942	0.561

Source: Author's estimations.

Gross domestic product in constant prices 2010 is taken from the U.S. Bureau of Statistics. Table 1 defines the variables used in the present analysis.

Table 2 demonstrate descriptive statistics of the variables. S.P.A. shows that on average minimum 10% of adults are involved in sports or any kind of physical activities while maximum number is 29% (S.D. = 0.21). Average public health expenditures of 50 states are 0.40 (S.D. = 0.31) out of 17.7% of total U.S. health expenditures in 2019 amounting to $3.8 trillion and per person estimate is $11,582. While average per capita income in these states is 0.72 (S.D.= 0.56) out of total $65,253.52 per capita G.D.P. which is the highest G.D.P. in the world.

4. Empirical analysis

Pre-estimation tests are mandatory to check the stationarity level of the variables. Therefore, we use Im, Pesaran and Shin unit root test to check the order of integration (Im et al., 2003; Pesaran, 2007). Table 3 displays that all variables in the model are stationary [I(1)] at first difference. The results of Sys-G.M.M. Model 1 in Table 4 show that S.P.A. has a significant negative impact on A.P.I. Implying that a 1% increase in S.P.A. improves environmental performance by 4%. Individuals' connectedness to nature in terms of physical and sports activities increase the involvement with the physical environment which build strong implications in terms of consciousness towards the environment. As humans improve their consciousness towards environmental quality through social interactions via sports and physical activities (Gladwell et al., 2013). Sports are indispensable in the modern era; similarly, physical activities promote healthy behaviours and healthy minds (Panter et al., 2017).

Model 2 extends the relationship by adding H.E. and show a negative and significant impact on air quality. From an environmental point of view, health expenditure guarantees less risk of diseases due to a healthy and safe natural environment that enhances green productivity also influences environmental quality (Ganda, 2021).

Table 3. Panel unit root test.

	Im et al. (2003)				
	I(0)		I(I)		
Variables	C	C&T	C	C&T	Order of integration
EP	−1.280	−1.863	−3.540***	−3.955***	I (1)
Log SPA	−1.091	−2.100	−3.623***	−3.278***	I (1)
Log HE	−2.318	−2.867	−4.841***	−4.452***	I (1)
Log GDP	−2.230	−2.314	−4.219***	−4.617***	I (1)

***Show significant levels at 1%.
Source: Author's estimations.

Table 4. Results of System G.M.M. and F.G.L.S.

Variable	Model-1 S-GMM	Model-2 S-GMM	Model-3 S-GMM	Model-4 S-GMM	Model-5 F-GLS
Lag EP	0.257***	0.268***	0.250***	0.256***	0.311***
	(0.011)	(0.012)	(0.014)	(0.012)	(0.024)
Log SPA	−0.044**	−0.050**	−0.125**	−0.128**	−0.140**
	(0.018)	(0.015)	(0.049)	(0.036)	(0.065)
Log HE	–	−0.133***	−0.119**	−0.121***	−0.166**
		(0.012)	(0.040)	(0.047)	(0.079)
Log GDP	–	–	1.190***	1.494***	1.793***
			(0.316)	(0.313)	(0.332)
Log (SPA* HE)	–	–	–	−0.124**	−0.139**
				(0.050)	(0.065)
Year Fixed Effect	YES	YES	YES	YES	YES
No. of States	50	50	50	50	50
AR-1 (*p* value)	0.000	0.000	0.000	0.000	–
AR-2 (*p* value)	0.641	0.650	0.675	0.678	–
Hansen Test (*p* value)	0.296	0.234	0.340	0.390	–

Source: Author's estimations.

Health care spending prolongs lives and reduces the risks of mortality. On the other hand, health care expenditures also create awareness about public health in society. Rising health care expenditures are related to CO_2 emissions efficiency in a way that the infrastructure involved in health care units including buildings (hospitals), equipment and transportation system improves (Bilgili et al., 2021). The redistributive effect of health expenditures is the demand for a clean environment that is the direct effect (Halkos & Paizanos, 2013; Khan et al., 2020). While indirect effect involves the steps taken by the government to reduce CO_2 emissions to improve air quality (Chaabouni et al., 2016).

Lower portion of above table shows Hansen test of S-G.M.M. model's overidentifying restrictions and tests for first-order (AR-1) and second-order (AR-2) serial correlations. Hansen test confirms the validity of endogenous regressors used as instruments based on the probability values, where P values (>0.05) unable to reject Null hypothesis. The test of A.R. (1) is rejected but A.R. (2) cannot be rejected, pointing towards the fulfilment of S-G.M.M. assumptions, where first-order serial correlation is permitted, while no second-order serial correlation allowed which is confirmed through the acceptance of A.R.-2 hypothesis of 'No second-order serial correlation'. Robust standard errors are reported in parentheses. ***, ** and * indicate significance at the 1%, 5% and 10% levels, respectively.

Model 3 incorporates G.D.P. as a proxy of economic growth and demonstrates that a 1% rise in economic growth significantly contributes to air quality by 1.14%.

This positive impact is supported by many studies such as in the case of Azerbaijan (Mikayilov et al., 2018) and B.R.I.C.S. economies (Ganda, 2021). Increased CO_2 emissions due to increased G.D.P. is scale effect as pointed out by Khan et al. (2019). Rising G.D.P. leads to increased production so is the by-products and environmental pollution also. Therefore, economic success can be achieved at the cost of air quality (Alhassan et al., 2020).

In Model 4, the interaction term of S.P.A. and H.E. indicate that when healthy physical activities are used along with increased public expenditures on health impose a good impact on the environment hence reducing the use of harmful materials to the environment such as fuel used in cars to reach the destination of sports. People use the bicycle or walk on foot. Similarly, Suzuki et al. (2020) posit the need for investment in eco-friendly innovations in health care systems such as teleservices to reduce emissions.

Results of Sys-G.M.M. are based upon the validity of instruments checked by Hansen J-Test reported at the end of Table 4. Hansen test of each model shows the validity of instruments that is confirmed by p-values of instruments. Autoregressive 1 is rejected while Sys-G.M.M. A..R.-2 needs to be accepted because residuals must be serially correlated in the first order while uncorrelated in the second order. F.G.L.S. confirm the validity of Sys-G.M.M. results in Model 5.

5. Conclusion and recommendations

Sports and physical activities and health care systems contribute a significant role in alleviating the impacts of air pollution. The findings of this article suggest important insights. The empirical findings of sports and physical activities have a negative association with environmental degradation. Hence it can be realised that individual behaviour is very much responsible for their social well-being and environment also. So, regulations regarding lifestyle changes can flourish the sustainable environment. Evidence also supports that regular sport and physical activities produce a substantial positive environmental benefit. In this way, participation in physical and sports activities, like exercise, and recreation should be encouraged. Well-planned and structured sports activities with the help of technology and according to the green environment can also contribute profound effect on the environment. Further, far-reaching access to facilities like gyms, tennis courts pools, and open space is a barrier for an individual to participate in these activities so it should be in each community and accessible to everyone. From a social and economic perspective, it is also observed that individual well-being is not only good for themselves but also for the whole economy as well. A person's peace of mind and good health does not valuable for him but also necessary for sustainable environments.

The current study also analyses that the health expenditures are also improving air quality by lowering environmental degradation in the different states of the U.S. So, it is mandatory to inspect the different forms of health care spending and to certify that all are commensurate with the green economy policy of the U.S. Our findings of economic development are also consistent with previous literature and have a negative association with environmental quality. Moreover, environmental sustainability campaigns must encourage the health care system. This could be facilitated through the engagement of health care workers in training and posted to communities to educate and create awareness in friendly environmental practices in health and environment.

Green health care spending is significant for human well-being, improved spending is indispensable towards humanising standards of living and the quality of life as well as improving labour productivity, particularly in government health care systems and health institutions. Additionally, the investment is geared towards accomplishing a zero-carbon environment in the long run. Our results also suggest that enhanced health care spending with advanced sports and physical activities also put dual benefits on environmental quality. Emissions linked with active transport can be reduced if walking and cycling are promoted by creating awareness through the health care system.

Note

1. https://www.statista.com/topics/1749/physical-activity/#:~:text=According%20to%20the%20Bureau%20of,and%20other%20active%20leisure%20activities.

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