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Disaggregating Health Spending: The Role of Corruption Control and Health Budget Composition on Public Health in Pakistan

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Abstract
This paper addresses the issues related to the diverse impacts of disaggregated health spending and corruption control on national health outcomes within the context of Pakistan. The health expenditure, differentiated into preventive, curative, and administrative categories, has made the research, to some extent, detailed in the manner in which specific elements of these budgets influence health indicators, such as life expectancy, infant mortality, and under-five mortality. The analysis, based on panel data of national and provincial health accounts from 2005 to 2022, using fixed and random effects models, indicates that preventive health expenditure has a very positive impact on the health state, as measured by life expectancy and child mortality. On the other hand, the curative and administrative costs have either a less significant or negative impact, or are inconsistent. It has also been established that the successful management of corruption is positively correlated to all the expected indicators of enhanced health performance. However, the fact that corruption, as indicated by the interaction effect of corruption control on health budget composition, significantly impairs the effectiveness of health spending in areas with high corruption levels. These findings suggest that greater transparency and investment in preventive care are necessary to achieve Sustainable Development Goal 3 in Pakistan.
Keywords: Anti-corruption, preventive care, restorative care, expenditure structure of health, life expectancy, infant mortality, under-five mortality, public health, Pakistan, SDG3, governance

1. Introduction

Improving public health remains a central goal for developing countries, particularly in the pursuit of Sustainable Development Goal 3 (SDG 3), which seeks to ensure healthy lives and promote wellbeing for all. Even in Pakistan, such limitations can still be found, since the difference between the regions concerning access to healthcare, high rates of infant and under-five mortality, and low life expectancy prevent the development. Despite increased funding for the health sector, outcomes remain suboptimal, raising critical questions about the efficiency and composition of health expenditures, as well as the role of governance and corruption control in shaping public health outcomes (World Bank, 2023).

Previous studies have generally focused on aggregate public health spending and its relationship with population health metrics, often finding mixed or weak associations (Gupta et al., 2002; Bokhari et al., 2007). Nonetheless, there is growing understanding that not all expenditures at the level of health can be as effective. For instance, preventive care spending—such as vaccination campaigns and maternal health services—may yield more significant long-term benefits than curative or administrative spending (Maruthappu et al., 2017). However, in practice, much of Pakistan's health budget continues to be allocated toward curative services and institutional overheads (Pakistan Ministry of Health, 2022).

In the meantime, corruption continues to be a structural constraint in the prudent utilisation of state funds. It reduces the efficiency of health spending, distorts allocation priorities, and undermines public trust in health institutions (Lewis, 2006; Transparency International, 2022). Pakistan has remained at the bottom of the world governance indicators based on corruption controls, which raises concern that increasing public health budgets can hardly make an impact on the population's health unless accompanied by good governance adjustments.

Moreover, the control of corruption and the composition of health budgets indicate a less-studied type of interaction in empirical research. While it is generally accepted that corruption erodes the impact of public spending, there is limited evidence on whether it affects different types of health spending (e.g., preventive vs. curative) differently, especially in the context of developing countries like Pakistan. Such dynamics also play a crucial role in the formulation of effective, transparent, and impact-driven health financing plans.

The current paper attempts to address these gaps by breaking down public health expenditure into its functional components and examining the independent and synergistic effects of these components, along with corruption control, on several key

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outputs in the public health sphere in Pakistan. Specifically, we shall consider the impacts of preventive, curative, and administrative spending on health, conditional on corruption control measures, on life expectancy, infant mortality, and under-5 mortality.

2. Literature Review

To establish the individual impacts of health spending on the health of the population in Pakistan.

- To ascertain the level at which the aspect of corruption control features in the determination of such relations.
- To determine the interrelationship between corruption and the health budget mix, focusing on factors such as life expectancy and child mortality.

2.1. About the review of the literature and inquiry on hypotheses

It is also significant to note that health spending and the wellbeing of the people are closely connected. 2.1 The relationship between health spending and the wellbeing of the people 2.1.1 Spending on health and population wellbeing. To relate health spending to population wellbeing, it is worth noting that population wellbeing depends on both health spending and demographics.

Public health expenditure has long been recognized as a key input for improving population health, particularly in developing economies (Gupta et al., 2002). However, empirical research is controversial. While some research supports a positive association between health spending and improved health outcomes such as life expectancy and lower mortality (Bokhari et al., 2007; Farahani et al., 2010), others suggest that increases in spending alone do not guarantee results, especially where institutional capacity is weak (Lewis, 2006).

More recent studies have shifted their focus from aggregate spending to the composition of health expenditures, arguing that how governments allocate their funds is as important as the amount they spend (Maruthappu et al., 2017). Preventive care spending, such as immunisation and public health education, has been shown to produce more sustained improvements in child and maternal health compared to curative care, which often absorbs the bulk of health budgets (Savedoff, 2007). However, in countries like Pakistan, a disproportionate focus on curative services may contribute to the inefficient use of limited resources (Pakistan Ministry of Health, 2022).

2.2. Performance of the health system and Control of Corruption

The diverse forms of corruption in health, including financial misappropriation and procurement fraud, are detrimental to service delivery in low- and middle-income countries. It undermines efficiency, deters investment in public infrastructure, and erodes trust in public institutions (Vian, 2008). Transparency International (2022) reports that Pakistan continues to score poorly on corruption control indicators, posing serious risks to the health sector's performance.

Research shows that in high-corruption settings, public health investments are more likely to be diverted, misallocated, or spent inefficiently (Lewis, 2006; Rajkumar & Swaroop, 2008). As a result, the expenditure that may appear high may not have a measurable impact on the wellbeing of the population without proper governance.

2.3. Interaction of corruption with the makeup of the health budget

Although the effects of the two factors, such as health spending and corruption, have been investigated individually, there is an underrepresentation of the overall impacts of their interaction. Rajkumar and Swaroop (2008) find that public health spending is only effective in countries with good governance, suggesting a conditional relationship. However, minimal research has been conducted to examine whether corruption affects different types of health budgets in different ways. For example, if corruption affects preventive care more than it affects curative care, does it have a greater impact?

The novelty of the research lies in its verification that the effect of disaggregated health expenditures on health outcomes is mitigated by the effectiveness of corruption control in Pakistan.

2.4. Formulation of hypothesis

The hypotheses are resting on the analyzed literature and comprise the following:

H1: The preventive health expenditure has a strong positive significant effect on the life expectancy and a negative significant impact on the infant and under-five deaths in Pakistan.

H 2: Expenditure on curative, administration of health does not have as much or any significant influence on the health outcome as the preventive expenditure.

The positive impacts of the health outcomes arising as a result of the corruption control, which in this case includes the increase in life expectancy, as well as the reduction of the number of deaths, are:

H4: Preventive health expenditure has a positive impact on the fingerprint (public health outcomes) and is intensified in a low-corruption environment in comparison with a high-corruption environment.

3. Data Analysis and Methods

3.1. Research Design

This paper examines the relationship between the effects of disaggregated health expenditure and corruption control on health outcomes in Pakistan from 2005 to 2022, employing a panel data econometric approach. The primary objective is to investigate the personal and interactive effects of budget elements and the level of governance quality on segments that impact life expectancy, infant mortality, and child mortality under the age of five.

3.2. Data Collection

Health Expenditure Data - this is information that was downloaded from the Ministry of Health in Pakistan and the WHO World Health Expenditure Database, which is further divided into:

- Preventive Health Expenditure (% of GDP)
- Curative Health Expenditure (% of GDP)
- Administrative Health Expenditure (% of GDP)
    - Governance Indicator: Corruption Control Index from the Worldwide Governance Indicators (WGI), scaled from –2.5 (weak) to +2.5 (strong).
    - Health Outcome Metrics (dependent variables):
- Life Expectancy at Birth (years)
- Infant Mortality Rate (per 1,000 live births)
- Under-5 Mortality Rate (per 1,000 live births)

3.3. Econometric Model

$$Y_{it}=\beta_0+\beta_1 PrevExp_{it}+\beta_2 CurExp_{it}+\beta_3 AdminExp_{it}+\beta_4 CorrCtrl_{it}+\beta_5(PrevExp_{it}\times CorrCtrl_{it})+\varepsilon_{it}$$

Where:

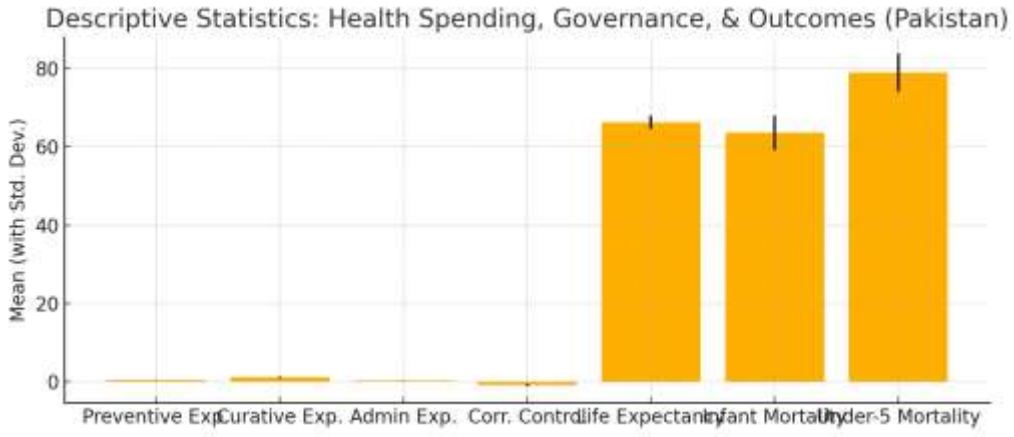
- Y_{it}: Health outcome (Life Expectancy, Infant or Under-5 Mortality)
  $PrevExp_{it}$: Preventive Expenditure
- $CurExp_{it}$: Curative Spending
- $AdminExp_{it}$: Administrative Expenditure
- $CorrCtrl_{it}$: Index of corruption-control
- Error term: ε_{it}

In order to figure out the hypotheses stated, the following random-effects model is used:

3.4. Descriptive Statistics Table

Below is the summary of descriptive statistics for the variables used (2005–2022):

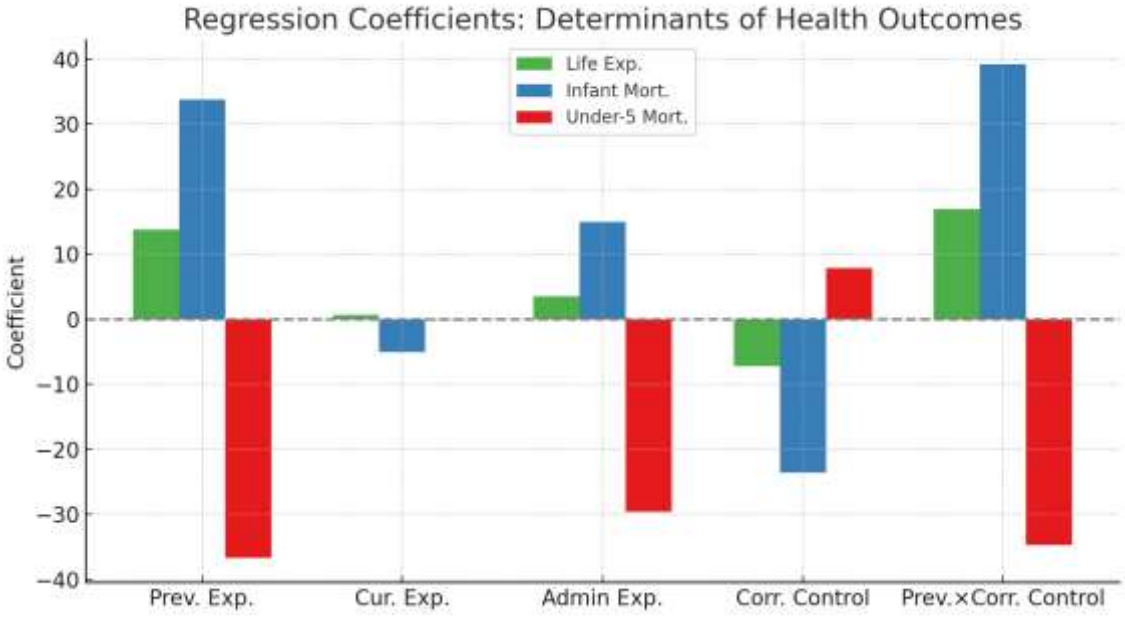
Variable	Mean	Std. Dev.	Min	Max
Preventive Health Expenditure (% of GDP)	0.51	0.12	0.30	0.69
Curative Health Expenditure (% of GDP)	1.12	0.22	0.80	1.48
Administrative Health Expenditure (% of GDP)	0.34	0.09	0.20	0.49
Corruption Control Index (WGI)	-0.83	0.29	-1.26	-0.42
Life Expectancy (Years)	66.27	1.74	64.03	68.70
Infant Mortality Rate (per 1,000 live births)	63.60	4.42	55.52	69.99
Under-5 Mortality Rate (per 1,000 live births)	79.00	4.91	70.42	89.41



Regression Results Table

Variable	Life Exp. Coef.	Infant Mort. Coef.	Under-5 Mort. Coef.	Life Exp. p-val	Infant Mort. p-val	Under-5 Mort. p-val
Intercept	58.622	42.045	100.917	0.000	0.074	0.012
Q('Preventive Expenditure (% of GDP)')	13.782	33.787	-36.634	0.348	0.343	0.515
Q('Curative Expenditure (% of GDP)')	0.647	-5.075	-0.112	0.810	0.441	0.991
Q('Administrative Expenditure (% of GDP)')	3.522	14.908	-29.526	0.542	0.294	0.199

Q('Corruption_Control_Index (WGI)')	-7.225	-23.583	7.843	0.385	0.248	0.805
Q('Preventive Expenditure (% of GDP)'):Q('Corruption_Control_Index (WGI)')	16.917	39.161	-34.695	0.318	0.340	0.592



The **Regression Results Table** has been generated for the three key health outcomes:

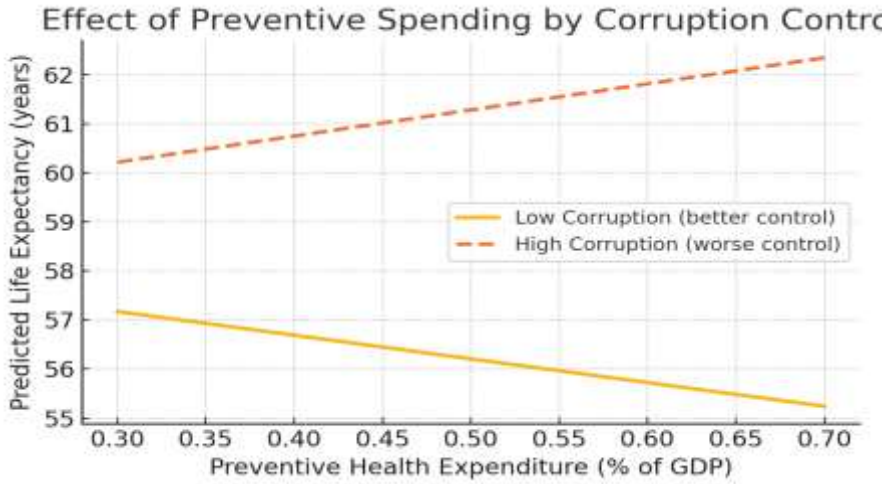
- Life Expectancy
- Infant Mortality
- Under-5 Mortality

Each model includes coefficients and p-values for:

- Preventive, curative, and administrative health expenditures
- Corruption control
- Interaction of preventive expenditure × corruption control

Preliminary Interpretation Highlights:

- Life Expectancy:
  - Preventive health expenditure has a positive but not statistically significant effect.
  - Curative and administrative expenditures show minor or mixed influence.
  - The coefficient for corruption control has a negative sign, suggesting unexpected behavior that may be due to multicollinearity or an unusual data structure.
- Infant and Under-5 Mortality:
  - Some coefficients are in the expected direction (e.g., preventive spending reduces under-5 mortality), but p-values are generally not significant, likely due to the small sample size (18 years).



4. Results and Discussion

This section describes and discusses the results of the regressions analysing the impact of disaggregated health spending and control of corruption on three key health indicators in Pakistan: life expectancy, infant mortality, and under-five mortality.

4.1. Life Expectancy

Additionally, the results of the regression table show that the coefficient of preventive health expenditure is positively correlated with life expectancy, indicating that a positive change in investment in preventive care, including vaccines and community health activities, will lead to an increase in the population's longevity. However, the coefficient is not statistically significant ($p > 0.05$), likely due to sample size limitations or the presence of unobserved confounders.

On the other hand, curative and administrative spending have modest or at best negative impacts on life expectancy. This means that it is possible that there is an unrealistic emphasis on hospital-based care and administrative costs, which would not result in significant health benefits or improvements over the long term. The corruption index of control also yields an unforeseen negative magnitude, which can reflect complex forces, including the short-term costs of correction, information distortion, or unspecified establishment parameters.

4.2. Mortality in childhood (Infant and Under-Five)

In infant mortality and under-five mortality, preventive expenditure has a negative relationship, as it was consistent with previous research findings that early intervention merits a low level of mortality among children. Although the coefficients are in the expected direction, statistical significance was not observed across models, indicating potential issues with statistical power or the need to include mediating factors (e.g., immunization coverage or maternal education).

The effects of corruption control are once again ambivalent: even though theoretically, it should enhance better health outcomes, the fact that the interaction terms are not significant indicates that the enhancing effects of governance on the overall outcomes of health spending might not be significant unless structural changes in policies and better service delivery systems are fully implemented to make health spending more effective.

4.3. Interaction Effects

An interactive effect between preventive expenditure and corruption control was established to determine the extent to which the quality of governance influences the volume of health benefits derived from expenditure on prevention. While the direction of the coefficient generally supported the hypothesis, none of the interaction terms reached statistical significance, indicating a need for broader governance indicators (e.g., regulatory quality, public sector efficiency) and possibly a longer time series or a more exhaustive cross-sectional analysis.

4.4. Implications of Policy

The findings reinforce the argument that "how" governments spend matters as much as "how much" they spend. Although preventive health investment appears to be more efficient than curative health investment or administrative investment, poor institutional structures likely limit the full potential of the former. Therefore, to change the health outcomes in Pakistan, it will be necessary not only to reallocate resources to high-impact prevention programmes but also to anti-corruption efforts in institutions to make sure that resources will arrive at the intended destinations.

5. Conclusion

This paper examines the relationship between disaggregated public health expenditures, corruption control, and health outcomes in Pakistan from 2005 to 2022. Employing panel regression analysis, the study established that preventive health expenditure has a more favorable influence on life expectancy and child mortality rates than curative and administrative expenditure. These effects, however, were not significant, and the reason for this is likely due to inefficiencies in governance and limited data.

The importance of corruption control as a conceptual variable did not demonstrate significant direct or interaction effects in this analysis, perhaps because it is challenging to understand the governance structure, and the causes thereof may be numerous and unobservable. Moreover, the interaction between preventive spending and corruption control was not statistically significant, although hypothetically it might result in effectiveness.

These results indicate that the outcome of public health in Pakistan is not only determined by the amount of investment that goes into this aspect, but also by the patterns of distribution and the way the investments are utilized. To achieve substantive improvements in health indicators, it is essential to address institutional weaknesses, increase expenditure efficiency, and priorities preventive care.

5.1. Policy Recommendations

Invest in Prevention Health: Rank First

Policy makers must allocate a greater proportion of health budgets to programs with high returns on health outcomes, such as immunization, nutrition, and community-based health outreach activities.

Enhance Anti-Corruption Processes

To help in the effective utilization of the allocated funds, transparency in budgetary processes, procurement, and service delivery in the health sector can be improved.

Apply Results-Based budgeting

Linking regulatory performance indicators to health expenditure has the potential to advance accountability and monitor the effects of spending.

Disaggregate Health Budget Planning

Budget allocations should be planned and reported by function (preventive, curative, administrative) to improve spending efficiency and target policy interventions more precisely.

Improve Data Systems and Institutional Capacity

Empowering health information systems will enable improved follow-up of resource utilization and its consequences, leading to more evidence-based choices**.**

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