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Original Article

# Urban Family Physician Program and Out-of-Pocket Health Expenditures in Iran: A Quasi-Experimental Interrupted Time Series and Difference-in-Difference Analysis, 2002-2020

**Seyede-Fereshte Hosseini[1], Ali Imani[1,2], Farhad Lotfi[3,4], Behzad Najafi[1*]**

[1]Health Economics Department, School of Management and Medical Informatics, Tabriz University of Medical Sciences, Tabriz, Iran
[2]Tabriz Health Services Management Research Center, Health Management and Safety Promotion Research Institute, Tabriz University of Medical Sciences, Tabriz, Iran
[3]Health Human Research center, School of Health Management and Information Sciences, Shiraz University of Medical Sciences, Shiraz, IR,Iran
[4]National Center For Health Insurance Research, Tehran, IR, Iran

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***Corresponding Author:**
Behzad Najafi,
Email: bnadjafi59@gmail.com

**Abstract**

**Introduction:** Out-of-pocket (OOP) payment is an key indicator of financial burden in health. We assessed changes in per-capita OOP expenditures associated with Iran's Urban Family Physician Program (UFPP), implemented in Fars and Mazandaran provinces in 2012, compared with aggregated non-intervention provinces.

**Methods:** We conducted a quasi-experimental policy evaluation with difference-in-differences (DID) and interrupted time series (ITS) analyses using Statistical Center of Iran data for 2002–2020. Fars and Mazandaran were the intervention provinces; while the remaining provinces constituted the aggregated non-intervention comparison group. The outcome was annual per-capita household OOP expenditure at constant 2020 prices. DID estimated changes relative to the comparison series, while ITS estimated immediate level and post-intervention trend changes. Inference was based on Newey–West HAC standard errors.

**Results:** In Fars, DID analysis indicate a significant decrease in per-capita OOP expenditures relative to the aggregated non-intervention comparison series ($\beta_3 = -5{,}981$; CI, −11,400 to −595; $P = 0.031$). ITS showed a significant immediate level reduction ($\beta_6 = -9{,}242$; CI, −16,800 to -1.712; $P = 0.016$), with no significantly change in trend ($\beta_7 = -1{,}278$; CI -2.623 to 68; $P = 0.063$). In Mazandaran, no significant change was observed in aggregate OOP expenditures; however, service-specific analyses revealed heterogeneous changes across expenditure categories.

**Conclusion:** UFPP implementation was associated with an immediate reduction in per-capita OOP expenditures, without a significant trend change in Fars and no significant aggregate change was observed in Mazandaran.

## Introduction

Health financing is a core function of health systems and an important determinant of progress toward universal health coverage (UHC).[1,2] In many low- and middle-income countries, out-of-pocket (OOP) payments remain a major source of health financing because of incomplete or fragmented health insurance coverage.[3] High OOP spending can undermine financial protection and contribute to delayed or forgone care, financial hardship, and health inequalities.[4-6]

In Iran, OOP payments accounted for approximately 39% of total health expenditure in both 2019 and 2021, [7,8] highlighting persistent challenges in financial protection.[9] In response, the Iranian health system introduced several reforms, including the Urban Family Physician Program (UFPP),[10,11] which aimed to strengthen primary care, improve continuity and coordination of care, establish a referral and gatekeeping system, and reduce unnecessary service use and expenditures.[12-14]

Fars and Mazandaran provinces volunteered to participate as pilot provinces for the UFPP, which was launched on 8 July 2012. Together, the two provinces had a population of more than 7 million at the time.[15] However, because their selection was based on willingness to participate rather than random assignment, differences in pre-intervention characteristics and expenditure trends should be considered when interpreting the findings. Previous studies have mainly examined access, utilization, and implementation challenges, while evidence on the long-term association between UFPP and OOP health expenditures remains limited.[14,16]

Understanding the drivers of regional differences can

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help inform strategies to improve health financing.[6] International evidence suggests that strengthening health insurance coverage, primary care, and family physician systems can contribute to lower OOP expenditures and promote equity.[17] For example, Thailand and Turkey have expanded UHC through investments in primary care and gatekeeping systems, with reported improvements in access and financial protection.[18]

However, the effects of such reforms may vary across demographic, socioeconomic, and health-system contexts, highlighting the importance of context-specific evaluations, particularly in low- and middle-income countries.[2,10]

Against this background, this study examines whether the introduction of the UFPP was associated with changes in annual per-capita OOP health expenditures over the period 2002–2020. Using a quasi-experimental comparative longitudinal design, trends in Fars and Mazandaran were compared separately with an aggregate comparator constructed from the rest of the country (i.e., all provinces other than the two intervention provinces). Thus, the comparator was not a panel of individual non-intervention provinces. Difference-in-differences and interrupted time series approaches were used to assess changes in the level and trend of OOP expenditures following UFPP implementation.

## Methods

### *Study Design and Setting*

This quasi-experimental study employed a comparative longitudinal design combining Difference-in-Differences (DID) and Interrupted Time Series (ITS) analyses to evaluate changes in annual per-capita OOP health expenditures following UFPP implementation. The study covered the period 2002–2020, with Fars and Mazandaran provinces were analyzed separately as intervention settings, and an aggregated comparison series was constructed from all remaining provinces in the country.

For both the DID and ITS analyses, the non-intervention comparison series was computed annually by excluding Fars and Mazandaran from the national aggregate. Thus, the comparator represented the aggregated trend across provinces unexposed to UFPP during the study period. This approach prevented the intervention provinces from contaminating the comparison series, thereby providing a counterfactual proxy for the expected OOP trend in the intervention provinces in the absence of UFPP, under the parallel trend assumption.

### *Data Sources and Variables*

Annual province-level OOP health expenditures data were extracted from the Household Expenditure and Income Survey (HEIS) conducted by the Statistical Center of Iran (SCI). For each province and year, household OOP expenditures were weighted using the sampling weights provided by the SCI. Monthly reported expenditures were annualized by multiplying by 12. These weighted household expenditures were then aggregated to estimate total annual OOP health expenditures for Fars, Mazandaran, and the national level.

Nominal provincial OOP expenditures were deflated to constant 2020 Iranian Rials (IRR) using the annual Consumer Price Index (CPI) for all goods and services reported by the SCI. All monetary values in this study are were expressed in thousand IRR at constant 2020 prices.

Annual per-capita OOP health expenditure was calculated by dividing the deflated total provincial OOP expenditure by the corresponding annual provincial population reported by SCI, using the following formula:

$$OOPper\text{-}capita\ non\text{-}intervention, year = \frac{OOPnational, year - OOPFars, year - OOPMazandaran, year}{Papulationnational, year - PapulationFars, year - PapulationMazandaran, year}$$

### *Analytical Approach*

We conducted separate analysis for Fars and Mazandaran provinces, as the UFPP was implemented only in these regions during the study period. An aggregated non-intervention comparison series, constructed from all provinces except Fars and Mazandaran, was used as the control group for both DID and ITS analyses. Both approaches were primarily applied using per-capita OOP expenditure on its original scale. Log-transformed models were estimated as sensitivity analyses to assess the robustness of the findings to alternative functional forms at the province-year aggregate level. Furthermore, we performed disaggregated analyses to categories, including medication, outpatient visits, inpatient care, dental services, and paraclinical services.

#### *Difference-in-Differences Analysis*

We estimated separate DID models were for Fars and Mazandaran provinces, to compare pre- and post-UFPP changes in per-capita OOP expenditures against those observed in the aggregated non-intervention comparator series.

The DID specification included an indicator for the intervention group, a post-intervention indicator representing the period following UFPP implementation (2012–2020), and their interaction term. The interaction coefficient represents the differential change in per-capita OOP expenditures in each intervention province relative to aggregated non-intervention comparison series after UFPP implementation. We utilized robust standard errors to account for potential heteroskedasticity in the error terms.

The model specification was:

$$Y_{it} = \beta_0 + \beta_1 Treat_i + \beta_2 Post_t + \beta_3 \left(Treat_i \times Post_t\right) + v_{it}$$

Where $Y_{it}$ represents the per-capita health expenditure outcome for province $i$ in year $t$. $Treat_i$ is a binary indicator equal to 1 for the intervention province and 0 for the aggregated non-intervention comparison series. $Post_t$ indicates the post-intervention period and equals 1 after UFPP implementation and 0 otherwise. The interaction term $Treat_i \times Post_t$ captures the difference-in-differences effect, and its coefficient $\beta_3$, represents the change in expenditure in intervention provinces after

UFPP implementation relative to the change observed in the comparison series. $\beta_1$ represents baseline difference between the intervention and comparison groups, $\beta_2$ captures the overall change between the pre- and post-intervention periods, and $Y_{it}$ represents the error term. No province- or year-specific fixed effects were included in this DID specification because the comparison group was constructed as an aggregated non-intervention series rather than as a panel of individual provinces.

The parallel trends assumption was assessed by graphically inspecting pre-intervention trends and conducting a formal regression-based test for differential pre-intervention trends. Specifically, the interaction between intervention status and calendar year was examined using pre-intervention data only. Given the limited number of intervention provinces, the results of this assessment were interpreted with caution.

### *Interrupted Time Series Analysis*

Comparative ITS models were estimated separately for Fars and Mazandaran provinces to assess changes in the level and trend of per-capita OOP expenditures following UFPP implementation. The models included terms for the baseline trend, differential changes in level following the intervention, and differential changes in the post-intervention trend, allowing these changes differ between the intervention and comparison series.

The ITS analysis included 11 annual observations before UFPP implementation (2002–2012) and 8 annual observations after implementation (2013–2020). Given the limited number of time points, particularly for detecting gradual changes in differential post-intervention trends, the findings were interpreted with caution.

The ITS model specification was:

$$Y_t = \beta_0 + \beta_1 Time_t + \beta_2 Post_t + \beta_3 \text{PostTime}_t + \beta_4 Group_t + \beta_5 GroupTime_t + \beta_6 GroupPost_t + \beta_7 ExposedPostTime_t + v_t$$

In the ITS model, $\beta_1$ represents the baseline time trend in the comparison group before the intervention; $\beta_2$ represents the immediate level change in the comparison series after UFPP implementation, and $\beta_3$ represent the trend changes in the comparison series after UFPP implementation; $\beta_4$ captures the baseline level difference in the comparison groups with intervention group; $\beta_5$ represents the difference in baseline trends between the intervention and comparison groups, $\beta_6$ indicates the differential level change attributable to the intervention in the intervention group relative to the comparison group, and $\beta_7$ represents the differential post-intervention trend in the intervention group compared with the comparison group.

The coefficients $\beta_6$ and $\beta_7$ were interpreted as complementary measures of changes associated with UFPP implementation, representing differential changes in level and differential changes in post-intervention trends, respectively.

Standard errors were estimated using the Newey–West variance estimator with zero lags, which adjusts for potential heteroskedasticity in the error term. The stationarity of the outcome series was assessed using the Augmented Dickey–Fuller (ADF) unit-root test with zero lags. The non-stationarity of the aggregated non-intervention comparison series was considered when interpreting the ITS findings and was acknowledged as a limitation of the analysis.

### *Consideration of Concurrent Policy Interventions*

The potential influence of concurrent national health policies on the ITS estimates was considered. In particular, the Health Transformation Program (HTP), introduced in 2014, was implemented nationwide after the initiation of UFPP implementation had begun. Because HTP was a nationwide policy affecting both UFPP and non-intervention provinces, any changes in OOP expenditures attributable to this policy would be expected to affect both series. Therefore, the comparative ITS design helps account for nationwide policy effects by estimating differential changes in OOP expenditures in UFPP provinces relative to the aggregated non-intervention comparison series. Accordingly, the estimated UFPP-associated changes should be interpreted as relative changes within the broader national health policy context rather than as the isolated effect of UFPP.

### *Statistical Analysis*

All analyses were performed using Stata/MP version 17 (StataCorp LLC, College Station, TX, USA). Difference-in-Differences and comparative Interrupted Time Series models were estimated as described in the corresponding sections. Statistical significance was assessed at the 0.05 level.

### *Ethical Considerations*

This study was conducted as part of a doctoral dissertation at Tabriz University of Medical Sciences and received ethical approval from the Research Ethics Committee of Tabriz University of Medical Sciences (IR.TBZMED.REC.1403.271), and the Research Ethics Committee of the National Institute for Medical Research Development (NIMAD) (IR.NIMAD.REC.1405.071). The study used aggregated and de-identified data obtained from the Statistical Center of Iran; therefore, individual informed consent was not required.

## Results

### *Descriptive Findings*

Between 2002 and 2020, per-capita OOP expenditures differed between the intervention provinces and the aggregated non-intervention comparison series. In the aggregated non-intervention comparison series, per-capita OOP expenditures increased by 45.9%, from 9,827 thousand IRR in 2002 to 14,338 thousand IRR in 2020. Over the same period, per-capita OOP expenditures decreased by 21.6% in Fars Province, from 10,092 thousand IRR in 2002 to 7,908 thousand IRR in 2020, whereas they increased by 96.4% in Mazandaran Province, from 10,911 thousand IRR in 2002 to 21,437 thousand IRR in 2020.

These percentage changes reflect end-point comparisons between the initial and terminal years and do not represent annualized trends across intervening years.

Compared with the pre-intervention period, mean per-capita OOP expenditures increased in the aggregated non-intervention comparison series (from 14,000 to 17,300 thousand IRR) and in Mazandaran Province (from 17,800 to 19000 thousand IRR), whereas Fars Province showed a decrease (from 17000 to 13000 thousand IRR). These descriptive changes represent unadjusted differences between periods and do not account for underlying secular trends or macroeconomic fluctuations, which were further assessed using DID and comparative ITS models.

### *Difference-in-Differences Analysis- Fars and Mazandaran Provinces*

In Fars Province, UFPP implementation was associated with a statistically significant differential reduction in per-capita OOP expenditures compared with the aggregated non-intervention comparison series (DID estimate: $\beta_3 = -5{,}981$ thousand IRR; 95% CI: −11,400 to −595; $P = 0.031$). In contrast, the DID estimate for Mazandaran indicated a negative but statistically non-significant change in per-capita OOP expenditures after UFPP implementation ($\beta_3 = -2{,}453$ thousand IRR; 95% CI: −7,289 to 2,382; $P = 0.310$).

Pre-intervention trends were assessed separately for Fars and Mazandaran provinces using formal regression-based tests of differences in pre-intervention linear trends. For Fars, no statistically significant difference in the pre-intervention linear trend of OOP expenditures compared with the aggregated non-intervention comparison series was observed ($\beta = 881$; 95% CI: −174 to 1,937; $P = 0.096$). Similarly, no statistically significant difference was observed for Mazandaran ($\beta = 40$; 95% CI: −1,312 to 1,393; $P = 0.950$). Visual inspection of pre-intervention trajectories (Figure 1) also suggested broadly similar patterns. These findings indicate no statistical evidence of differential pre-intervention linear trends; however, they do not definitively verify the parallel trends assumption or rule out non-linear year-specific fluctuations.

### *Interrupted Time Series (ITS) Analysis: Fars Province*

The stationarity of the outcome series was evaluated using the Augmented Dickey–Fuller (ADF) test. The per-capita OOP expenditure series in Fars was stationary at level (ADF statistic = −2.961, $P = 0.039$), whereas the aggregated non-intervention comparison series was non-stationarity at level (ADF statistic = −1.550, $P = 0.509$). These results were considered when assessing the underlying time-series properties and interpreting the ITS estimates.

Segmented linear regression models with Newey–West heteroskedasticity- and autocorrelation-consistent (HAC) standard errors were used to estimate changes in per-capita OOP expenditures associated with UFPP implementation in Fars Province. In the log-transformed model, UFPP implementation was associated with a statistically significant differential reduction in the level of per-capita OOP expenditures ($\beta 6 = -0.501$ (95% CI: −0.94 to −0.06), $P = 0.026$), corresponding to an estimated 39.4% decrease after exponentiation. The differential post-intervention trend also showed a decline ($\beta_7 = -0.091$ (95% CI: −0.18 to 0.00), $P = 0.054$), corresponding to an estimated 8.7% annual relative decrease, although this association did not reach conventional statistical significance. Results from the raw-scale model are detailed in Table 1 and Supplementary table 1.

Overall, the results indicate that UFPP implementation in Fars was associated with a statistically significant differential level reduction in total per-capita OOP expenditures following the intervention. However, no statistically significant change was observed in the differential post-intervention trend compared with the pre-intervention trend.

### *Service-Specific ITS Results: Fars Province*

At the aggregate level, total OOP expenditures showed a differential reduction in level following UFPP implementation, while the differential post-intervention trend showed a downward change that did not reach conventional statistical significance. Overall, these findings indicate a differential change in OOP expenditures following UFPP implementation, primarily reflected in the post-intervention level.

service-specific disaggregation revealed substantial heterogeneity across healthcare expenditure categories.

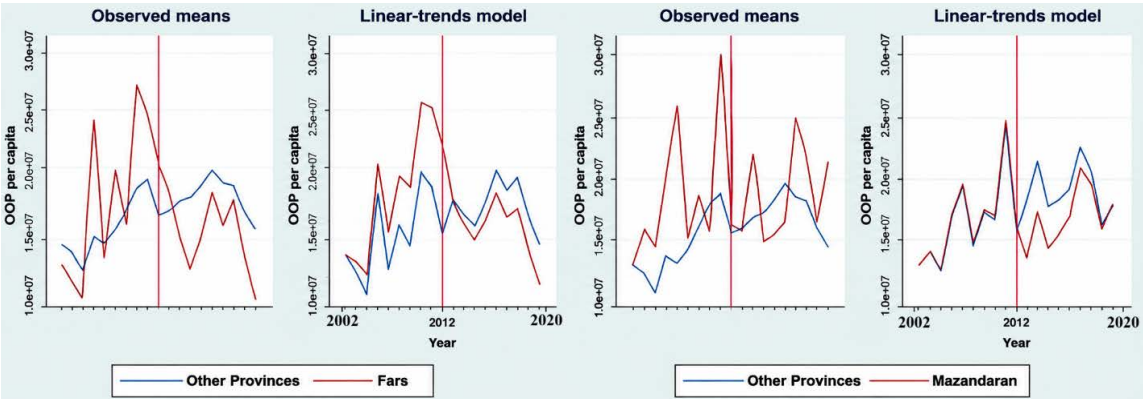



**Figure 1.** Trends in real per-capita OOP expenditures (thousand IRR, constant 2020 prices) in Fars and Mazandaran provinces compared with aggregated non-intervention comparison series, 2002–2020 (raw scale)

As detailed in Table 2, significant differential level reductions ($\beta_6$) following UFPP implementation were observed for outpatient services, medicine, dental care, and paraclinical services, consistent with the trajectory observed for total OOP expenditures. In contrast, no statistically significant differential changes were detected in the post-intervention trends ($\beta_7$) across any of these specific expenditure categories For outpatient services, ITS estimates indicated decrease in per-capita expenditure differential level on both raw and log- transformed scales. For inpatient care, no statistically significant changes in level or the differential post-intervention trend were detected, indicating no statistical evidence of a measurable change in hospitalization-related expenditures.

Figure 2 illustrates annual OOP expenditure patterns in Fars province and the aggregated non-intervention comparison series from 2002 to 2020. Both series showed an overall upward trend before UFPP implementation, with no clear visual evidence of differences in pre-intervention trends. Following UFPP implementation in Fars province in 2012, OOP expenditures showed a visible reduction relative to the comparison series, followed by fluctuations in subsequent years. The ITS analysis confirmed a statistically significant differential level reduction in OOP expenditures, whereas the differential post-intervention trend change was not statistically significant.

### *Interrupted Time Series (ITS) Analysis: Mazandaran Province*

The point estimates indicated a differential reduction in the post-intervention level and an upward differential change in the post-intervention trend of total per-capita

**Table 1.** Interrupted time-series analysis of per-capita out-of-pocket expenditures in Fars province compared with the aggregated non-intervention comparison series, by service category: raw-scale model (thousands IRR, constant 2020 prices)

| Service | B6 Differential level change | B 7 Differential trend change |
|---|---|---|
| Medicine | −909 (95% CI: −1,745 to −73), *P*=0.033 | −14 (95% CI: −170 to 140), *P*=0.850 |
| Dental | −2,252 (95% CI: −4,343 to −161), *P*=0.035 | −233 (95% CI: −599 to 132), *P*=0.210 |
| Inpatient | −3,573 (95% CI: −8,639 to 1,491), *P*=0.160 | −216 (95% CI: −979 to 546), *P*=0.570 |
| Outpatient | −1,471 (95% CI: −2,311 to −630), *P*=0.001 | −16 (95% CI: −179 to 146), *P*=0.840 |
| Paraclinical | −1,485 (95% CI: −2,533 to −438), *P*=0.005 | −167 (95% CI: −391 to 55), *P*=0.140 |
| Total OOP | −9,241 (95% CI: −16,800 to −1,711), *P*=0.016 | −1,277 (95% CI: −2,622 to 67), *P*=0.063 |

**Table 2.** Interrupted time-series analysis of per-capita out-of-pocket expenditures in Mazandaran Province compared with the aggregated non-intervention comparison series, by service category: raw scale (thousand IRR, constant 2020 prices)

| Service | B6 Differential level change | B 7 Differential trend change |
|---|---|---|
| Medicine | −1,622 (95% CI: −4,425 to 1,180), *P*=0.250 | 246 (95% CI: −131 to 623), *P*=0.200 |
| Dental | 180 (95% CI: −2,565 to 2,925), *P*=0.890 | 3 (95% CI: −554 to 561), *P*=0.990 |
| Inpatient | −2,536 (95% CI: −7,435 to 2,362), *P*=0.310 | 344 (95% CI: −380 to 1,069), *P*=0.350 |
| Outpatient | −1,152 (95% CI: −2,277 to −26), *P*=0.045 | 115 (95% CI: −73 to 303), *P*=0.230 |
| paraclinical | −337 (95% CI: −1,802 to 1,127), *P*=0.650 | −237 (95% CI: −453 to −20), *P*=0.030 |
| Total OOP | 5,104 (95% CI: −15,700 to 5,492), *P*=0.340 | 595 (95% CI: −989 to 2,180), *P*=0.460 |

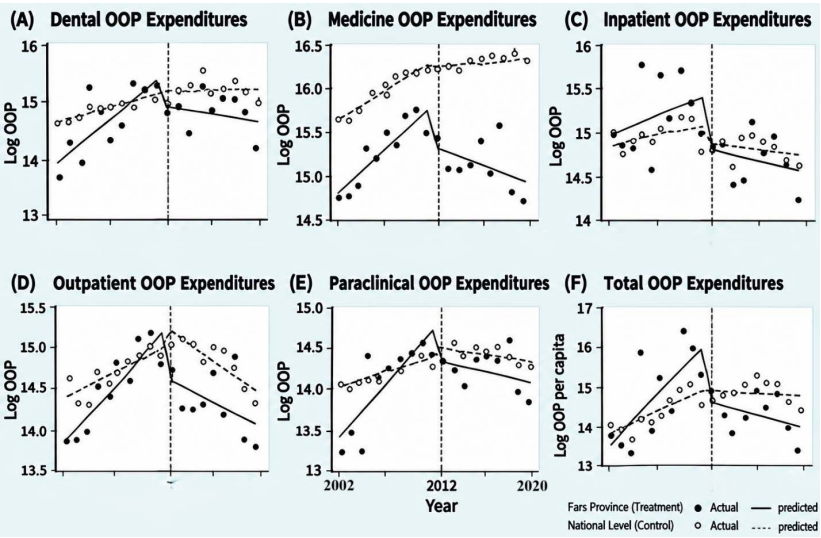



**Figure 2.** Average annual per-capita OOP expenditures trends in Fars Province and the aggregated non-intervention provinces from 2002 to 2020-- ITS respectively for OOP in dental, medicine, inpatient, outpatient, paraclinical services and total OOP- Log Scale
(Solid lines represent fitted values estimated from the interrupted time-series model
The vertical line indicates the year the intervention began, 2012)

OOP expenditures in Mazandaran Province; however, neither estimate was statistically significant (Table 2 and Supplementary Tables 2 and 3).

### *Service-Specific ITS Analysis: Mazandaran Province*

At the service-specific level, analyses indicated heterogeneous changes across expenditure categories. Outpatient OOP expenditures showed a statistically significant differential reduction in level in both the raw-scale and log-transformed models (raw-scale: $\beta_6 = -1{,}152$ thousand IRR (95% CI: −2,278 to −26), $P = 0.045$; log-transformed: $\beta_6 = -0.458$, $P = 0.032$), corresponding to an estimated 36.7% reduction (95% CI: 3.8% to 58.1%). In the log-transformed model, the differential post-intervention trend showed a statistically significant upward change, corresponding to an estimated 8.3% annual increase ($\beta 7 = 0.080$ (95% CI: 0.2% to 17.2%), $P = 0.045$), whereas no statistically significant change in the differential post-intervention trend was observed in the raw-scale model (Table 2, Supplementary Tables 2 and 3).

For paraclinical services, the raw-scale model indicated a statistically significant reduction in the differential post-intervention trend ($\beta_7 = -237$ (95% CI: −453 to −20), $P = 0.030$), whereas the corresponding log-transformed model showed no statistically significant trend change in the differential post-intervention trend. For medicine expenditures, the log-transformed model showed a statistically significant upward change in the differential post-intervention trend, corresponding to an estimated 6.8% annual increase ($\beta_7 = 0.066$ (95% CI: 0.3% to 12.7%), $P = 0.039$), while no statistically significant change was observed in the raw-scale model. No other service-specific ITS coefficients reached statistical significance.

The ITS models did not indicate a statistically significant differential level change or post-intervention trend change in total OOP expenditures in Mazandaran Province (Table 2 and Supplementary Tables 2 and 3). Figure 3 provides a visual representation of the model-estimated trends. At the service-specific level, the analyses indicated heterogeneous changes across expenditure categories. Outpatient OOP expenditures showed a statistically significant differential level reduction followed by an upward change in the post-intervention trend in the log-transformed model. Medicine expenditures showed a statistically significant upward change in the differential post-intervention trend in the log-transformed model, whereas paraclinical expenditures showed a statistically significant downward change in the differential post-intervention trend in the raw-scale post-intervention trend (Table 2, and Supplementary Tables 2 and 3).

## Discussion

This study provides evidence that UFPP implementation was associated with heterogeneous changes in per-capita OOP health expenditures between the two intervention provinces. In Fars province, the UFPP implementation was associated with a statistically significant differential reduction in the level of total per-capita OOP expenditures, consistent with findings reported by Abdulla et al.[19] Conversely, no statistically significant change in total per-capita OOP expenditures was observed in Mazandaran province. The findings from Mazandaran are consistent with projections suggesting an increasing reliance on OOP payments in Iran by 2030.[20] Furthermore, a previous study reported an increase in the share of household budgets allocated to health expenditures and an increase in the incidence of the catastrophic health expenditures (CHE) at the capacity to pay (CTP) level, from 2.1 to 10.1% between 1991–2017.[21] The contrasting findings between the two provinces suggest that the financial-protection effects of primary care reforms may depend not only on policy adoption but also on factors such as PHC investment, implementation design, enforcement, and continuity of implementation.[10,22,23]

In Fars province, the DID analysis indicated a statistically significant reduction in total per-capita OOP expenditures relative to the aggregated non-intervention comparison series following UFPP implementation. Pre-intervention trend analyses provided no statistical evidence against the parallel trends' assumption; however, the relatively limited

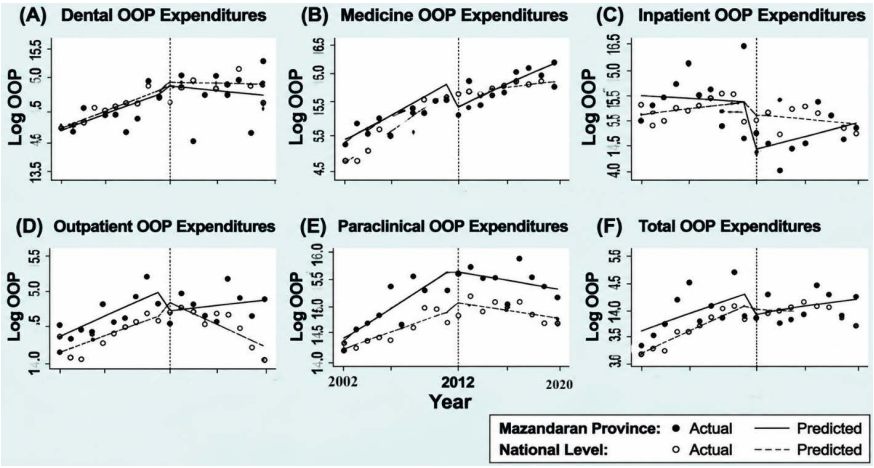



**Figure 3.** Trends in per-capita OOP expenditures in Mazandaran Province and the aggregated non-intervention comparison series, 2002–2020: comparative interrupted time-series models for dental, medicine, inpatient, outpatient, paraclinical, and total OOP expenditures (log scale)
Solid lines represent values fitted from the interrupted time-series models. The vertical line indicates the year of UFPP implementation (2012)

number of pre-intervention observations and fluctuations in the series warrant cautious interpretation. Although causal interpretation should remain cautious due to the non-random allocation of the intervention and the potential for unmeasured province-level confounding, the findings suggest an association between UFPP implementation and lower total per-capita OOP expenditures in Fars Province. Similar associations between strengthened primary care, gatekeeping mechanisms, and reduced household financial burden have been reported in both Iranian and international settings.[19,24]

Conversely, the DID analysis did not identify a statistically significant reduction in total per-capita OOP expenditures in Mazandaran province. The pre-intervention levels and trends of total per-capita OOP expenditures in Mazandaran were broadly comparable with those observed in the aggregated non-intervention provinces, and neither differential level changes nor differential post-intervention trend shifts reached statistical significance in the ITS analysis. These findings suggest that the implementation of UFPP in Mazandaran was not associated with measurable improvements in financial protection during the study period. This observation is consistent with previous evidence indicating that Iran has maintained a relatively high share of OOP health expenditure compared with many other countries despite the expansion of family physician programs.[25] For inpatient services in Mazandaran, a non-statistically significant increase was observed following UFPP implementation, which is consistent with findings reported by Salavati et al. in Tehran province. Both studies observed an increase in inpatient expenditures during the early stages of UFPP implementation; however, this increase did not appear to persist over the longer term.[13]

One possible explanation for the divergent findings between Fars and Mazandaran may relate to differences in organizational and service-delivery arrangements for UFPP implementation.[26] In Fars province, UFPP services were predominantly delivered through public health centers, where physicians were employed and remunerated within the public sector. In contrast, in Mazandaran, the UFPP was more predominantly delivered through contracted private physician practices.[27] These differences may have contributed to variation in healthcare utilization and expenditure patterns between the two provinces. However, because this study did not quantitatively assess implementation fidelity, service-delivery characteristics, or program intensity, these differences should be interpreted as potential contextual factors explaining the observed heterogeneity rather than as empirically established mechanisms.

Service-specific ITS findings in Fars further support this interpretation. More pronounced reductions in per-capita OOP expenditures were observed for outpatient, medicine, dental, and paraclinical services. These service categories may be particularly responsive to effective referral mechanisms and prescribing oversight within publicly organized primary care systems. This pattern is consistent with international evidence suggesting that well-organized primary care systems with effective gatekeeping are associated with reduced use of specialist services and potentially unnecessary medication. Conversely, the absence of statistically significant changes in inpatient expenditures may reflect structural characteristics of inpatient care, including limitations in insurance coverage and weaker integration with primary care referral systems.[26]

Inpatient services showed less pronounced changes. This pattern suggests that strengthening primary care alone may be insufficient to achieve substantial reductions in hospital-related OOP expenditures, and that additional policy measures may be needed to address the factors contributing to these expenditures.

Although the ITS analysis did not demonstrate a statistically significant change in per-capita OOP expenditures in Mazandaran, service-specific analyses revealed heterogeneous patterns across healthcare service categories. In log-transformed models, pharmaceutical and outpatient expenditures showed statistically significant increases in differential post-intervention trends. Conversely, outpatient expenditures demonstrated a statistically significant differential level reduction after the intervention. Paraclinical expenditures showed a statistically significant decline in the differential post-intervention trend on the raw expenditure scale. These findings suggest that the absence of a statistically significant change in aggregate OOP expenditures may reflect offsetting changes across service categories rather than a uniform pattern of change across all healthcare services.

The heterogeneous effects observed in Mazandaran are consistent with previous evidence indicating that health system reforms may affect different components of healthcare expenditure in distinct ways. Evaluation of Iran's Health Transformation Program (HTP), for instance found that while inpatient OOP payments decreased, whereas payments for outpatient, ancillary, and dental services increased, suggesting that the financial effects of health reforms may vary across service categories rather than resulting in a uniform reduction in OOP expenditures.[28] Similar assessment of the Health Transformation Program in Gilan Province reported increases in total and outpatient OOP expenditures, while no significant changes were observed in inpatient and drug-related OOP payments, further supporting the presence of heterogeneous effects across service categories.[29]

Differences across service categories in Mazandaran may be related to changes in healthcare utilization patterns following UFPP implementation. Increased access to primary care and greater contact with primary care providers may have contributed to changes in outpatient and pharmaceutical expenditures, whereas strengthened gatekeeping and referral mechanisms may have contributed to reductions in diagnostic service use, potentially explaining the decline in paraclinical OOP expenditures. Similar heterogeneous responses have been reported following health reforms in Iran. The Health Transformation Program was associated with

reductions in inpatient OOP payments but increases in outpatient, ancillary, and dental expenditures.[28] Likewise, an interrupted time-series analysis of the Iranian Family Physician Program in Fars Province showed that the effects of primary care reform varied across services and over time, with different short- and long-term patterns of expenditure changes across healthcare categories.[30] Consequently, aggregate OOP expenditure alone may not fully capture heterogeneous changes across healthcare service categories following UFPP implementation.

International empirical studies indicate that reliance on OOP health payments increases the risk of catastrophic and impoverishing health expenditures. In contrast, prepayment mechanisms and health financing policies, including those emphasizing primary care, can play an important role in protecting households from financial hardship. For example, Xu et al. found that prepayment mechanisms can reduce the risk of catastrophic health spending.[4] Wagstaff and van Doorslaer developed methods for assessing the financial burden and distributional effects of OOP health payments, highlighting the importance of policies that protect households from financial hardship.[3]

Ultimately, our findings suggest that the effects of UFPP may have been heterogeneous across expenditure categories rather than reflecting a uniform change in aggregate OOP expenditures. The differences observed between Fars and Mazandaran may provide useful insights for future implementation of the program in other settings, particularly with regard to referral systems, provider accountability, and integration of services. However, as these factors were not directly assessed in this study and should therefore be considered potential contextual factors rather than established mechanisms underlying the observed differences.

These findings have several policy implications. The heterogeneous effects of UFPP suggest that expansion to other provinces should be informed by careful assessment of local implementation capacity, financing arrangements, and governance structures to support context-sensitive adaptation. Future research should investigate the contextual and financing determinants of program effectiveness to better inform scale-up strategies in non-intervention provinces and identify approaches that may strengthen financial protection. This study has several limitations. First, because UFPP implementation was not randomly assigned, residual confounding cannot be completely excluded. Unmeasured province-level characteristics or time-varying factors may have influenced OOP expenditures. The inclusion of only two intervention provinces and the relatively short annual time series also limit the precision and generalizability of the findings.

Second, the analysis used annual province-level expenditure measures derived from the Statistical Center of Iran's Household Income–Expenditure Survey. Although the underlying data were collected at the household level, the analytical unit was the province-year. Therefore, the findings represent population-level associations rather than individual-level effects, and aggregation of household data to the provincial level limits the extent to which individual-level relationships can be inferred. In addition, household survey data may be subject to recall and reporting errors in the measurement of health expenditures.

Third, concurrent health-sector reforms may have influenced OOP expenditure trends. Although the comparative ITS design and the use of aggregated non-intervention provinces help account for common nationwide changes, the effects of the Health Transformation Program (HTP), introduced in 2014, cannot be completely distinguished from those of UFPP because the two policies overlapped in time. Therefore, the findings should be interpreted within the broader health policy context of Iran rather than attributed exclusively to UFPP.

Finally, the study did not include quantitative measures of implementation fidelity, service-delivery arrangements, or UFPP intensity. Consequently, differences in implementation across provinces could not be formally assessed as potential explanations for the heterogeneous findings. This limitation also restricts the extent to which the observed findings can be generalized to other settings with different organizational, financing, or implementation contexts.

## Conclusion

This study provides additional evidence on the association between the Urban Family Physician Program (UFPP) and household out-of-pocket (OOP) health expenditures in Iran using a quasi-experimental approach. Using Difference-in-Differences and Interrupted Time Series analyses, the study examined changes in OOP expenditures from complementary analytical perspectives. UFPP implementation was associated with a statistically significant reduction in per-capita OOP expenditures in Fars province, whereas no statistically significant change was observed in Mazandaran. These findings indicate that the financial protection outcomes associated with UFPP were heterogeneous across pilot provinces and suggest that the effects of primary care reforms may vary across implementation settings.

Overall, this study extends the evidence on UFPP by providing a longitudinal assessment of OOP expenditures beyond short-term utilization outcomes. The findings highlight the value of comparative longitudinal designs in evaluating health reforms and may inform future refinement and scale-up of family physician programs aimed at strengthening financial protection and advancing universal health coverage.

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### Authors' Contribution

Conceptualization: All Authors
Data Curation: Seyede-Fereshte Hosseini, Behzad Najafi
Formal Analysis: Seyede-Fereshte Hosseini, Behzad Najafi
Funding Acquisition: Behzad Najafi
Methodology: Behzad Najafi
Project Administration: Seyede-Fereshte Hosseini
Software: Seyede-Fereshte Hosseini
Supervision: Behzad Najafi, Ali Imani
Validation: All Authors
Visualization: Seyede-Fereshte Hosseini
Writing–Original Draft: Seyede-Fereshte Hosseini
Writing–Review & Editing: All Authors

## Competing Interests

The authors declare that they have no competing interests.

## Ethical Approval

This study was conducted as part of a doctoral dissertation at Tabriz University of Medical Sciences and received ethical approval from the Research Ethics Committee of Tabriz University of Medical Sciences (IR.TBZMED.REC.1403.271) and the Research Ethics Committee of the National Institute for Medical Research Development (NIMAD) (IR.NIMAD.REC.1405.071). The study used aggregated and de-identified data obtained from the Statistical Center of Iran; therefore, individual informed consent was not required.

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## Supplementary Files

Supplementary File contains Tables S1-S3

## References

1. Gabani J, Mazumdar S, Suhrcke M. The effect of health financing systems on health system outcomes: A cross-country panel analysis. Health Econ 2023;32(3):574–619. doi:10.1002/hec.4635
2. World Health Organization. Health financing. 2024. Available from: https://www.who.int/health-topics/health-financing. Accessed September 29, 2026.
3. Wagstaff A, van Doorslaer E. Catastrophe and impoverishment in paying for health care: with applications to Vietnam 1993-1998. Health Econ 2003;12(11):921–34. doi:10.1002/hec.776
4. Xu K, Evans DB, Carrin G, Aguilar-Rivera AM, Musgrove P, Evans T. Protecting households from catastrophic health spending. Health Aff (Millwood) 2007;26(4):972–83. doi:10.1377/hlthaff.26.4.972
5. Organisation for Economic Co-operation and Development. *Health at a Glance 2023: OECD Indicators*. Paris: OECD Publishing; 2023.
6. World Health Organization. Designing health financing systems to reduce catastrophic health expenditure. Geneva: World Health Organization; 2005. Available from: https://apps.who.int/iris/handle/10665/70005. Accessed September 29, 2026.
7. IndexMundi. Iran - Out-of-pocket expenditure as a share of current health expenditure. IndexMundi; 2023. Available from: https://www.indexmundi.com/facts/iran/indicator/SH.XPD.OOPC.ZS. Accessed September 29, 2026.
8. P4H Network. Iran: Health financing profile. 2022. Available from: https://p4h.world/en/countries/iran-islamic-republic-of/. Accessed September 29, 2026.
9. Mirabedini SA, Fazl Hashemi SME, Sarabi Asiabar A, Rezapour A, Azami-Aghdash S, Hosseini Amnab H. Out-of-pocket and informal payments in Iran's health care system: A systematic review and meta-analysis. Med J Islam Repub Iran 2017;31:70. doi:10.14196/mjiri.31.70
10. Doshmangir L, Bazyar M, Rashidian A, Gordeev VS. Iran health insurance system in transition: equity concerns and steps to achieve universal health coverage. Int J Equity Health 2021;20(1):37. doi:10.1186/s12939-020-01372-4
11. Ahmadnezhad E, Murphy A, Alvandi R, Abdi Z. The impact of health reform in Iran on catastrophic health expenditures: Equity and policy implications. Int J Health Plann Manage 2019;34(4):e1833–e45. doi:10.1002/hpm.2900
12. Mehrolhassani MH, Jahromi VK, Dehnavieh R, Iranmanesh M. Underlying factors and challenges of implementing the urban family physician program in Iran. BMC Health Serv Res 2021;21(1):1336. doi:10.1186/s12913-021-07367-3
13. Salavati S, Rashidian A, Hajimahmoodi H, Ememgholipour S, Varahrami V, Khodayarimoez E. Avoidable hospitalization after family physician and rural health insurance: interrupted time series and regression analyses, Tehran province, Iran. Prim Health Care Res Dev 2022;23:e7. doi:10.1017/s1463423618000300
14. Bayati M, Keshavarz K, Lotfi F, KebriaeeZadeh A, Barati O, Zareian S, et al. Effect of two major health reforms on health care cost and utilization in Fars Province of Iran: family physician program and health transformation plan. BMC Health Serv Res 2020;20(1):382. doi:10.1186/s12913-020-05257-8
15. Honarvar B, Lankarani KB, Rostami S, Honarvar F, Akbarzadeh A, Odoomi N, et al. Knowledge and Practice of People toward their Rights in Urban Family Physician Program: A Population-Based Study in Shiraz, Southern Iran. Int J Prev Med 2015;6:46. doi:10.4103/2008-7802.158172
16. Mehrolhassani M, Najafi B, Yazdi Feyzabadi V, Haghdoost A, Abolhallaje M, Ansari M, et al. Total Health Expenditures and Proportion of Out-Of-Pocket Payments in Iranian Provinces; 2008-2014. Iran J Epidemiol 2017;12:1-12. [Persian]
17. Kutzin J. Health financing for universal coverage and health system performance: concepts and implications for policy. Bull World Health Organ 2013;91(8):602–11. doi:10.2471/blt.12.113985
18. Tatar M, Mollahaliloğlu S, Şahin B, Aydin S, Maresso A, Hernández-Quevedo C. Turkey: health system review. European Observatory on Health Systems and Policies; 2011. Available from: https://iris.who.int/bitstream/handle/10665/330325/HiT-13-6-2011-eng.pdf. Accessed September 29, 2026.
19. Tirgil A, Altun A, Yanikkaya H. Does family medicine reduce household health expenditures: evidence from Türkiye. J Public Health Policy 2023;44(1):75–89. doi:10.1057/s41271-022-00391-5
20. Jahanmehr N, Noferesti M, Damiri S, Abdi Z, Goudarzi R. The Projection of Iran's Healthcare Expenditures By 2030: Evidence of a Time-Series Analysis. Int J Health Policy Manag 2022;11(11):2563–73. doi:10.34172/ijhpm.2022.5405
21. Rezaei S, Woldemichael A, Ebrahimi M, Ahmadi S. Trend and status of out-of-pocket payments for healthcare in Iran: equity and catastrophic effect. J Egypt Public Health Assoc 2020;95(1):29. doi:10.1186/s42506-020-00055-w
22. WHO Barcelona Office. Tracking primary health-care spending in selected countries. System of Health Accounts 2011 methodology. 2022. Available from: https://www.who.int/europe/publications/i/item/9789289058544. Accessed September 29, 2026.
23. Mohammadibakhsh R, Aryankhesal A, Jafari M, Damari B. Family physician model in the health system of selected countries: A comparative study summary. J Educ Health Promot 2020;9:160. doi:10.4103/jehp.jehp_709_19
24. Abedi G, Marvi A, Soltani Kentaie A, Abedini E, Asadi Aliabadi M, Safizadehe Chamokhtari K, et al. SWOT analysis of implementation of urban family physician plan from the perspective of beneficiaries: A qualitative study. Mazandaran Univ Med Sci 2017;27(155):79-93. [Persian]
25. Fardid M, Jafari-Sirizi M, Vosoogh-Moghaddam A, Ravaghi

H. Family Physician Financing: Developing versus Developed countries. Revista Publicando 2018;5(16(2)):577-89.
26. Ruano AL, Wong BLH, Winkelmann J. *The impact of PHC on equity, access and financial protection: Implementing the primary health care approach: A primer*. 2024.
27. AArabi M, Asadi-Lari M, Janbabaei G. Public-private partnerships: The Mazandaran experience on contracting with private family physicians, Islamic Republic of Iran. In: Salah H, M Kidd, editors. *Family Practice in the Eastern Mediterranean Region: Primary Health Care for Universal Health Coverage*: CRC Press; 2019. p. 153-62.
28. Abdi Z, Hsu J, Ahmadnezhad E, Majdzadeh R, Harirchi I. An analysis of financial protection before and after the Iranian Health Transformation Plan. East Mediterr Health J 2020;26(9):1025–33. doi:10.26719/emhj.19.026
29. Homaie Rad E, Yazdi-Feyzabad V, Yousefzadeh-Chabok S, Afkar A, Naghibzadeh A. Pros and cons of the health transformation program in Iran: evidence from financial outcomes at the household level. Epidemiol Health 2017;39:e2017029. doi:10.4178/epih.e2017029
30. Safarpoor Z, Lotfi F, Bayati M, Moordzade H, Goudarzi Z, Keshavarz K. The effect of family physician program and health transformation plan on utilization and cost of health services. Cost Eff Resour Alloc 2025;23(1):30. doi:10.1186/s12962-025-00637-5