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A regional analysis of the impact of remittances on health expenditures: evidence from Mexico

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Abstract

Using a quasi-experimental technique and data from the 2020 National Household Income and Expenditure Survey, we not only provide evidence that both internal and international remittances have a positive impact on various categories of health expenditures in Mexican households, but also highlight regionally heterogeneous effects. International remittances have a larger impact at the household level, whereas internal remittances impact a greater number of households. In western Mexico, with its long-standing international migratory tradition, remittances from abroad have more pronounced impacts. Internal remittances are more relevant in the poorer south-southeast, a region known for having inadequate access to healthcare services. These findings are associated with structural socioeconomic disparities that characterize Mexico, and are also linked to whether the additional income is perceived permanent or transitory.

Keywords Internal vs. International remittances · Healthcare-related expenditures · Impact analysis · Regions · Mexico

JEL classification R23 · F24 · O18 · C21

1 Introduction

In 2022, Mexico was the second largest recipient of international remittances in the world, receiving 58.4 billion dollars, surpassing China by more than 7 billion dollars (World Bank, 2023). These figures highlight the importance of the Mexico-United States international migration corridor. The magnitude of this monetary flow between

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the two countries has inspired multiple lines of research that examine the impact of international remittances on several development indicators such as poverty (Nuñez and Osorio-Caballero, 2021; Canales, 2006; Taylor et al., 2008), expenditure patterns (Mora-Rivera and Arellano González (2016); Airola, 2007; Taylor and Mora-Rivera (2006)), inequality (Koczan and Loyola, 2021), well-being (Corona, 2014; Taylor and Filipski, 2011), natural resources (López-Feldman and Chávez, 2017), food security (Mora-Rivera and van Gameren, 2021), education (Zhunio et al., 2012; McKenzie, 2006), and healthcare expenses (García-Amador et al., 2023; Amuedo-Dorantes and Pozo, 2011). This body of research collectively underscores the multifaceted impact and importance of remittances, shedding light on their significant contribution to Mexico's development.

Most of the existing literature focuses on international remittances, with fewer studies incorporating a comparison with internal remittances (Aguayo-Téllez et al., 2021; Mora-Rivera and Arellano González (2016)). Data from the 2020 National Household Income and Expenditure Survey (ENIGH) reveals that approximately 20% of Mexican households received internal remittances—nearly five times the number of recipients of international remittances (INEGI, 2021a). This highlights the importance of integrating internal remittances into the existing body of literature for a more comprehensive analysis. It is worth noting that although a greater number of households in Mexico receive internal remittances, the monetary value of international remittances is higher, potentially leading households to perceive and treat these remittances differently (Azizi, 2018).

Likewise, the relevance of studies that encompass both types of remittances surfaces when considering the uneven distribution of these monetary flows throughout the country. Approximately 50% of international remittances entering Mexico are sent to households in the western region, which is well-known for its longstanding migratory tradition (Durand, 2016). In contrast, receiving internal remittances is more strongly concentrated in the southern region of the country (INEGI, 2021a). This pattern implies that the outcomes of research at the national level might conceal the diverse impacts among regions. Dissimilar effects can be influenced by not only the origin of remittances but also the socioeconomic and demographic characteristics of each region, given the substantial disparities in development across the regions of Mexico (Delajara et al., 2022; Valdivia-López and Lozano-Ascencio, 2010).

According to human capital theory, education and health strengthen and enhance individuals' skills, increasing their productivity, which in turn allows them to improve their level of well-being (Adjei-Mantey and Horioka, 2023; Ogundari and Awokuse, 2018; Schultz, 1995). Therefore, for nations to experience economic and social development, high levels of health and education are crucial. In Mexico, in terms of health, instead of improving healthcare coverage, a regression has occurred, principally due to the abolishment of the *Seguro Popular* program that had ensured access to healthcare services for the most vulnerable part of the population (Knaul et al., 2023). At the national level, the proportion of the population lacking access to healthcare services increased by twelve percentage points between 2018 and 2020, rising from 16.2% to 28.2% (CONEVAL, 2021). In this context, the south-southeast region remains the most vulnerable, with approximately 32% of its population experiencing deprivation in access to health services.

The challenge faced by households without access to the public health system is the burden of bearing healthcare costs privately. As a result, they are compelled to allocate a significant portion of their income towards covering these expenses. According to OECD figures, in 2020, 47.1% of the total healthcare expenditure of Mexican households was made through out-of-pocket payments (OECD, 2021). One source of income through which households have been able to obtain resources to meet various healthcare expenses is remittances. According to data from the Mexican Migration Project, two of the main categories where remittances are spent are food (31.5%) and health (16.7%) (MMP, 2020).

Consequently, households utilize remittance income to mitigate the lack of access to healthcare services, particularly in regions with higher vulnerability and limited medical infrastructure, as is the case in southern Mexico (Huffman and van Gameren, 2019). Despite the evident connection between the receipt of (internal and international) remittances and the expenditures for recipient households across Mexico, to date, we have not encountered studies that determine the impact of these monetary flows at the regional level on expenditure categories, and specifically on healthcare spending.

Aimed at addressing this gap in the literature, our objective is to estimate the impact of internal and international remittances on a variety of health expenditure categories and to differentiate among the effects observed in distinct regions across the country. To meet our objective, we employ an Inverse Probability of Treatment Weighting (IPTW) strategy with data taken from the 2020 National Household Income and Expenditure Survey (ENIGH). The critical challenges faced by developing economies in 2020 as a result of the unexpected COVID-19 pandemic, coincided with an increase in remittances—which in Mexico were 11% more than in 2019 (CONAPO et al., 2023). Although the first year of the pandemic may initially seem atypical, we consider it relevant for the analysis because, while remittances from the US constituted important resources in Mexican households long before the COVID-19 pandemic, the increase in remittances may have helped to overcome general economic hardships caused by the pandemic, including the financing of healthcare services. Moreover, we note that remittances have not dwindled since the pandemic but instead have remained at the 2020 level or increased even further (Ambrosius et al., 2023). Households' own resources were severely hampered not only by the pandemic but also by the lack of adequate (financial and material) support from government agencies, while at the same time their healthcare demands increased. This, moreover, happened in a context of changes in the organization of Mexico's healthcare system—in particular the closure of *Seguro Popular* without establishing a well-functioning alternative—which reduced access to services far beyond the impacts of COVID on the healthcare sector (Knaul et al., 2023). Therefore, we build on earlier findings that suggest that remittances have a countercyclical behavior that reacts to the needs of the migrants-sending communities in the home country (Yang, 2011; Adams, 2011); a potential mechanism that helped Mexican households to manage the financing of various categories of healthcare services—during and after the pandemic—was the use of domestic and international remittances.

The contribution of this paper to the literature is twofold. First, we estimate the impact of international and internal migrant remittances on health expenditure

considering different categories of expenditures. Several studies have tested the impact of international migrant cash transfers on health expenditure (González-Block et al., 2013; Amuedo-Dorantes and Pozo, 2011). However, very few disaggregate the results into different categories of health spending (García-Amador et al., 2023). In addition, only some have differentiated the impacts by origin of the remittances (Aguayo-Téllez et al., 2021; Mora-Rivera and Arellano González (2016)). To the best of our knowledge, this paper stands as a singular addition to the literature because it conducts a comprehensive analysis of the effects of both internal and international remittances on the distinct categories of health expenditures, thereby enabling the incorporation of evidence into the discussion regarding the permanent or transitory nature of remittances. This approach promises to shed light on the intricate relationship between migrant remittances and healthcare spending by identifying the categories of health expenditure on which remittances exert the greatest effect, thereby providing valuable insights for policymakers.

Second, we estimate the effects of remittances in four regions across the country. This regionalization, based on geographic characteristics and migratory intensity (CONAPO, 2012), allows for a more detailed and specific analysis of the effects of remittances by considering the particularities in the socioeconomic and migratory dynamics of different regions, rather than treating the country as homogeneous. In Mexico, major regional disparities are observed in crucial aspects such as the unequal distribution of infrastructure, resources, opportunities, and development (Delajara et al., 2022). For example, the western region has historically contributed more than half of the migrants and also accounts for nearly 50% of the total income from international remittances (Durand, 2016; CONAPO et al., 2023), while households in the south-southeast record the lowest average income and the highest levels of educational backwardness and of the lack of access to healthcare services in the country (CONEVAL, 2021).

Regional disparities are observed not only in remittances but also in the economic and sociodemographic characteristics. For instance, in 2020, the average GDP of the south-southeastern region was 386,460 million pesos compared to 551,763 million pesos in the north (INEGI, 2021b). Additionally, the unemployment rate in the northern and central regions was 5.6%, while the south-southeast registered 4.5% (INEGI, 2021c). Disparities in poverty levels are striking; while the northern and western regions report the lowest poverty rates, 26.9% and 38.1%, respectively, in the southern region, 61.2% of the population lives in poverty. Regional inequality remains evident when examining social deprivations, with nearly 30% of the population in the south facing food insecurity, compared to 16% in the northern region (CONEVAL, 2021). In terms of crime, in 2020, the western region had a total of 13,198 homicides, while the south-southeast region recorded 5,458 (INEGI, 2021d).

All these socioeconomic disparities are reflected in regional variations in health conditions, such as the prevalence of diabetes, obesity and high blood pressure. For instance, the central and northern regions together comprise nearly 60% of the population with these health conditions, whereas the south-southeast region represents only 19% of total cases (Gobierno de México, 2023). This regional disparity is also reflected in access to public healthcare services: in the central

region, 32% of the population has access to these services, compared to only 17% in the south-southeast who are affiliated to a public institution offering medical care (Gobierno de México, 2024). Furthermore, only 14% of the specialized hospitals are situated in the southern region, compared to nearly 45% in the central region (Secretaría de Salud, 2024). These differences in health issues further underscore the importance of analyzing the impacts of remittances on health expenditures disaggregated at the regional level.

Although the literature has considered the regional impact of remittances on economic variables and spending patterns in a general way (Manic, 2017; Valdivia-López and Lozano-Ascencio, 2010), we have not found studies that conduct a detailed regional analysis of the potential differences in effects of remittances on health expenditures across the highly heterogenous regions of Mexico. These effects are likely associated with variations in the penetration of the migratory phenomenon and with economic and social vulnerabilities in the country. In some areas, remittances can be a crucial source of income and development, while effects may be more limited in other areas. Thus, regionalization of the analysis allows for the evaluation of these variations in impacts, heterogeneity that could remain concealed when conducting simply a national-level analysis. In this sense, our analysis is aimed at contributing to a more profound understanding of the nexus between remittances and development indicators in the diverse areas of Mexico, as it facilitates the identification and design of better-targeted policies that address the specific needs of the various regions within the country.

Overall, our main findings show that both types of remittances have a positive impact on healthcare expenditures, especially on ambulatory care. Additionally, the effect of remittances received from abroad seems to be higher than the impact of internal remittances, although internal remittances reach a larger number of households. Disaggregating the impacts at the regional level reveals differences that have not been highlighted before in the literature. International remittances have a larger impact in the west of the country, while the greatest effect of internal remittances is found in the northern and central regions. In the context of the south-southeast region, it is noteworthy that international remittances have almost double the impact on total health expenditures compared to internal remittances.

The remainder of this paper is organized as follows. The next section reviews the relevant literature. The research methodology, including data and empirical strategy, are presented in Section 3, while Section 4 reports and discusses the main results. Finally, the conclusions are in Section 5.

2 Literature review

The literature review is divided into three sections. The first examines the differentiated impact of national and international remittances on development indicators, especially household expenditure behavior. The second section revises the evidence on the relationship between remittances and health expenditure, while we end with a brief review of the importance of territorial characteristics on the impacts of remittances.

2.1 Differentiated impacts of international and internal remittances on expenditure patterns

For many developing countries, remittances are a crucial component of households' incomes. Typically, money sent home by migrant workers is deployed to reduce income risk and can act as insurance against economic problems; in other words, the potential benefits of remittances are manifold (Zhang et al., 2022; Lim and Khun, 2022; Adams, 2011; Taylor, 1999). Previous research has provided evidence of the positive impact of remittances on disposable income, showing that remittances relax budget constraints and modify expenditure patterns of recipient households, especially in low- and middle-income countries (Mishra et al., 2022; Ajefu and Ogebe, 2021; Démurger and Wang, 2016; Mora-Rivera and Arellano González (2016); Göbel, 2013; Clément, 2011; Adams, 1998). Effects vary depending on whether remittances are derived from international or internal sources (Aguayo-Téllez et al., 2021; Randazzo and Piracha, 2019; Thapa and Acharya, 2017; Mahapatro et al., 2017).

Most of the literature provides empirical evidence supporting the impact of international remittances on expenditure patterns within migrant-sending countries (Kakhkharov and Ahunov, 2022; Manic, 2017; Parida et al., 2015; Adams and Cuecuecha, 2010). However, relatively few studies incorporate the effects of internal remittances in their analyses (Shair and Anwar, 2023; Adeseye, 2020; Kamal and Rana, 2019; Clément, 2011; Castaldo and Reilly, 2007). On one hand, research focusing solely on the impacts of international remittances reveals more pronounced effects on specific consumption categories, such as durable goods and investments in capital and housing (Raihan et al., 2022; De and Ratha, 2012). On the other hand, research that incorporates the effects of both types of remittances has observed that internal remittances have a greater impact on daily consumption and housing, but less than international remittances in areas such as education and health (Aguayo-Téllez et al., 2021; Randazzo and Piracha, 2019; Mora-Rivera and Arellano González (2016)).

Randazzo and Piracha (2019) suggest that the divergent effects of remittances may be attributed to how recipient households perceive these financial inflows; in particular, if they are seen as a permanent or temporary source of income. Some scholars suggest that migrant-sending households consider international remittances to be a transitory or temporary source of income due mainly to high transaction costs and the possibility that such transfers may end when the migrant decides to return to the home country, a common scenario among international migrants; therefore, these remittances are used for durable goods and more productive activities, including investments in human and physical capital (Adams and Cuecuecha, 2010; Ahmed et al., 2018). Meanwhile, the sending of internal remittances has lower transaction costs, and tends to be a more permanent source of income. The recipient households perceive internal remittances as part of their lifelong income leading to a greater allocation of funds towards services and current consumption. Various studies conclude that internal remittances satisfy short-term needs by enabling households to meet their basic consumption levels. Examples include Randazzo and Piracha (2019) in Senegal, Clément (2011) in Tajikistan, and more recently, Aguayo-Téllez et al., 2021 in the Mexican context.

In summary, previous research consistently suggests that remittances have a positive and significant impact on spending related to human capital, particularly in the fields of education and health, with indications that internal and international remittances are perceived differently.

2.2 Remittances and health expenditures

In the empirical literature, there are at least two prevailing perspectives regarding the impact of remittances on household health expenditures: a positive viewpoint supported by studies such as García-Amador et al. (2023), Ajefu and Ogebe, 2021, and Mohanty et al. (2014); and a contrasting negative perspective, as indicated by Nguyen et al. (2017) and Adams and Cuecuecha (2010). The narrative of the first perspective is based on the multifaceted transmission mechanisms of remittances. These mechanisms often bolster household liquidity, thereby expanding the range of possibilities for household expenditures (Berloffa and Giunti, 2019; Chezum et al., 2018; Amuedo-Dorantes and Pozo, 2011). Additionally, remittances frequently serve as a buffer against adverse shocks, enabling household members to mitigate the challenges faced in their communities of origin (Cuadros-Meñaca, 2020; Yang, 2011).

For example, in Mexico, García-Amador et al. (2023), using the Propensity Score Matching technique and household survey data, observed that international remittances positively and significantly impact health expenditures. Using the same methodological strategy, Mahapatro et al. (2017), in India, and Thapa and Acharya, 2017, in Nepal, found similar results. These studies reveal the importance of remittances in improving a household's access to healthcare services.

The second group detected that remittance-receiving households spend less on healthcare than households that do not receive remittances, because less investment in human capital is observed in the absence of the heads of household. For instance, Nguyen et al. (2017) utilized a fixed-effects panel data model for Vietnam, finding that the impacts of remittances on per capita expenditures for food, education, and healthcare are not statistically significant. Their results suggest that remittances are more likely to be allocated toward housing and other non-food items rather than toward long-term investments. On the other hand, Adams and Cuecuecha (2010) utilized a selection model, drawing on data from Guatemala, to find that households receiving international remittances allocate more of their expenditures to education and less to healthcare compared to households that do not receive remittances. These kinds of results could be associated with the idea of remittances as a substitute for the income they would earn in the local labor market, creating a culture of dependence on remittances (Castaldo and Reilly, 2007). It is possible that the discrepancy in the conclusions obtained by these investigations depends on the territory analyzed, temporality, and other methodological aspects such as the origin and treatment of the data and the techniques used.

2.3 Regional differences in the impacts of remittances

The need for regional research has been disclosed in a variety of social science areas, especially when the phenomenon analyzed is not homogeneous within a territory

(Chen and Schintler, 2023; Garcia-Mora and Mora-Rivera, 2023; Delajara et al., 2022; Alvarez and Royuela, 2022; Jung and López-Bazo, 2020; Mahapatro et al., 2017). Regional controls are often included in the studies on the impacts of remittances (Cruz-Salas et al., 2023; Aguayo-Téllez et al., 2021; Wang et al., 2021; Randazzo and Piracha, 2019; Kapri and Jha, 2020; Berloffa and Giunti, 2019; Manic, 2017; Thapa and Acharya, 2017; Mora-Rivera and Arellano González (2016); García-Zárate, 2015), capturing regional variation in the dependent variable only through differences in the intercepts, but where differentiation between regions in households' reactions to factors related to receiving remittances is not analyzed.

To date, the only study we have found that effectively estimates the impacts of international remittances on spending categories at the regional level is Mahapatro et al. (2017). Employing Propensity Score Matching, they highlighted significant regional differences in the impact of remittances, particularly in certain expenditure categories. These findings are linked to the heterogeneity present in India concerning the scale of migration and the country's socio-cultural and economic conditions. For Mexico, similar to India, migration abroad varies widely throughout the national territory, with the largest proportion of emigrants concentrated in specific states, while less pronounced migratory movements are observed in other states (Chávez and Serrano, 2003; Durand, 2016). This unequal distribution naturally extends to the recipients of remittances, as observed by Valdivia-López and Lozano-Ascencio (2010) in their study on the impacts of international remittances on regional growth in Mexico.

It is essential to consider that previous research that has attempted to estimate the impact of remittances on health expenditure in Mexico (García-Amador et al., 2023; Amuedo-Dorantes and Pozo, 2011) may be influenced by regional factors related to differences in traditional migratory patterns. There is still a gap in understanding how these effects may vary across different regions. Specifically, these studies have not explored the distinct contributions of internal and international remittances in addressing healthcare expenditure challenges. Therefore, it is imperative to examine regional disparities within Mexico, as they can result in divergent impacts on healthcare expenditure.

3 Research methodology

3.1 Data

The data used in this research comes from the ENIGH, Mexico's National Household Income and Expenditure Survey, for the year 2020 (INEGI, 2021a). The main objective of this survey, conducted every two years by the National Institute of Statistics and Geography (INEGI) since 1984, is to provide detailed information about the amount, structure, and distribution of household income and expenditure. Additionally, the survey collects data on the occupational and sociodemographic characteristics of household members, as well as details regarding housing infrastructure and equipment. For the 2020 ENIGH, data was collected from a sample of 105,483 households distributed throughout Mexico; a response rate of 83.3% was achieved. The ENIGH is a direct observation survey, and given its methodological

design (probabilistic, two-stage, stratified, by clusters, and sample size), it is considered representative at the national and state levels, encompassing both rural and urban areas.[1]

Although the survey was not designed for the study of remittances, it permits us to identify and classify international and internal remittances. In particular, the ENIGH questions regarding remittances allow the determination of: (1) money received from another household in a different country; (2) money received from another household in the same country. The former is considered as international remittances, and the latter as internal remittances. A third scenario where the household receives both internal and international remittances is (sparsely) observed. In these cases, we verified which of the two had the greater weight on income and then classified them as recipients of international or internal remittances.[2]

The survey also allows us to disaggregate healthcare expenditures into three main types of spending. As the dependent variable we consider not only the total *healthcare expenditures*, but we also disaggregate expenses into *expenses in primary or ambulatory care*, which refer to expenditures on services that do not require hospitalization, mainly outpatient consultations and prescription drugs; *hospitalization expenses*, defined as expenses for inpatient services including doctors' fees and other costs that come with a hospital stay, and *expenses for non-prescription medicines*, including expenses for vitamins, contraceptives and alternative medicines. Finally, healthcare expenditure as a proportion of total household expenditures is analyzed as our fifth dependent variable.

The selection of independent variables to estimate propensity scores is based on the literature of remittance determinants, and grouped into three types of covariates.[3] The first group includes variables associated with the characteristics of the household head, while the second corresponds to the socioeconomic characteristics of the household, and the last group pertains to regional characteristics. The characteristics of the household head play a decisive role in sending remittances; this group includes specific attributes such as gender (Niimi et al., 2009), age (García-Zárate, 2015; Holst and Schrooten, 2006), education (Mazumder (2021); Arun and Ulku, 2011), marital status (Heo and Kim, 2019; Pardo and Dávila, 2017), belonging to an ethnic group (Mora-Rivera and Fierros-González, 2020), and employment status (Cox et al., 1998).

According to the New Economics of Labor Migration, the socioeconomic conditions of the household from which migrants originate—our second group of variables—constitute a critical factor influencing the decision to send remittances (Taylor and Castelhano, 2016). Variables such as the income decile and the human capital are included (Manic, 2017), as well as characteristics such as the construction

[1] Since 2016, the ENIGH is representative at the state level, which allows estimations at the regional level with the necessary statistical significance. The 2020 ENIGH data was collected between August 11 and November 18, 2020, and therefore does not identify specific periods of the year that may reflect seasonal variations in income and expenditures in general, or remittances in particular. We note that the ENIGH is the single dataset for Mexico that permits our analysis with representativity at various levels and aspects.

[2] According to the 2020 ENIGH data, only 1.3% of the Mexican households received both type of remittances.

[3] The definitions of the variables can be found in Appendix Table 7.

material of the home, access to the drainage system, and ownership of durable goods (Pardo and Dávila, 2017; Mora and Taylor, 2006). These characteristics relate to the investment needs in housing as well as the ability to finance migration costs (Mora-Rivera and Fierros-González, 2020; Asad and Hwang, 2019). Furthermore, indicators of the household composition are included: the household size, the proportion of women, and the number of economic dependents (young children and older adults) in the household (Mazumder (2021); Niimi et al., 2009). Variables related to access to information and communication technologies are considered, as they facilitate maintaining contact between migrants and their homes of origin; for example, internet access and the availability of a landline telephone at home have been included (Asongu and Odhiambo, 2020; Mora-Rivera and Fierros-González, 2020). Health needs can also be expected to play a crucial role in remittance behavior; therefore, we include the proportion of household members with health issues (Rapoport and Docquier, 2006; Lucas and Stark, 1985), and moreover a distance variable measuring the time it would take household members to reach the hospital, capturing costs of access to healthcare services (Berloffa and Giunti, 2019).

Finally, the third group of variables includes specific regional characteristics. Incorporating regional aspects serves to identify heterogeneity associated with remittance receipt and its diverse impacts. It also aims to highlight regional factors that could influence the treatment and outcomes of remittance receipt, such as rural residence, unemployment rates, inflation rate, GDP, population size, homicide rates, and available medical infrastructure[4] (Silverio-Murillo and Balmori de la Miyar (2022); Manic, 2017).

3.2 Descriptive statistics

Table 1 presents a detailed breakdown of household income derived from remittances across regions in Mexico. This data provides insight into how remittances contribute to Mexican household economies, emphasizing regional disparities in the distribution of amounts and the relative importance of internal and international remittances. Nationally, a higher percentage of households receive internal remittances (19.6%) compared to those receiving international remittances (3.8%). However, when focusing exclusively on households receiving remittances, it becomes evident that households receiving income from abroad receive on average nearly twice as much as those receiving domestic remittances (Table 1, row 5). At the regional level, the south-southeast stands out with the highest percentage of households receiving internal remittances (25.6%), while the western region has the highest proportion of households receiving international remittances (8.2%) (Table 1, row 1). In terms of the relative importance of remittances within the total income of receiving households, at the national level as well as in each region, international remittances represent more than 20%, with the west having the highest percentage (Table 1, row 6). Concerning the total expenditure of Mexican households, this source of income covers around 40% of spending (Table 1, row 7). Internal remittances, on average,

[4] The *medical infrastructure* variable was constructed at the state level using data from the Mexican Ministry of Health (Secretaria de Salud, 2024). It includes public and private establishments, such as hospitals, clinics, health centers, and pharmacy-adjacent consultation offices.

Table 1 Household income from remittances in Mexico: a regional breakdown

Variable	*National*		*West*		*North*		*Central*		*South-Southeast*	
	Internal	International	Internal	International	Internal	International	Internal	International	Internal	International
Share of remittance-receiving households (RRHh)[a]	19.6	3.8	20.6	8.2	18.2	2.5	15.8	1.9	25.6	3.6
Total amount of remittances[b]	37,318	14,324	8790	7117	9122	2714	10,731	2305	8677	2188
Average income from remittances in the total sample[c]	1062	416	1128	913	1159	350	933	209	187	285
Total number of RRHh[d]	7004	1373	1647	657	1446	200	1836	222	2075	294
Average income from remittances in RRHh[c]	5328	10,433	5338	10,837	6310	13,560	5843	10,362	4181	7453
Remittances as share of total income in RRHh[a]	13.1	24.5	12.4	25.4	12.5	23.8	14.0	24.4	12.8	23.9
Remittances as share of total expenditure in RRHh[a]	20.6	38.9	19.0	38.8	21.5	41.4	22.3	39.7	18.1	35.1
Spatial distribution of remittance flows[a]	100.0	100.0	23.6	49.7	24.4	18.9	28.8	16.1	23.3	15.3
No. of observations	18,270	4687	4938	2522	5153	759	3240	692	4939	714

Source: Authors' calculations based on ENIGH 2020 (INEGI, 2021a)

[a]Percentages

[b]Millions of Mexican pesos

[c]Quarterly income in current prices (Mexican pesos)

[d]Thousands

Table 2 Healthcare expenditure in Mexico by remittances recipient

Variable	Total	Non-recipient	Internal	International
Total household expenditure[a]	29,910	31,116	25,816	27,317
Healthcare expenditures[a]	1266	1200	1401	1892
Ambulatory[a]	869	796	1032	1500
Hospitalization[a]	155	170	100	128
Medicines[a]	242	234	269	264
Proportion[2]	4.2	3.9	5.4	6.9
No. of observations	88,889	65,932	18,270	4687

Source: Authors' calculations based on ENIGH 2020 (INEGI, 2021a)

[a]Quarterly expenditures in current prices (Mexican pesos). See Appendix Table 7 for the definitions of the expenditure categories

[b]Proportion of household budget allocated to health (healthcare expenditures/total household expenditure)

represent 13% of total household income and 20% of total household expenditure in Mexico.

Regarding the regional distribution of the amounts of remittances received by Mexican households, important differences are observed among the four regions studied. As previously mentioned, nearly 50% of the total amount of international remittances is concentrated in the western region (Table 1, row 6), with the rest distributed among the other regions. Internal remittances are more equally distributed; the major receiver, the central region, records 29% of the total. The south-southeast—the most deprived region in social and economic terms—receives the lowest percentage of remittances, both nationally and internationally, with 23% and 15%, respectively.

In summary, although Mexican households receive a higher income from international remittances, a larger share of households benefit from internal remittances. This pattern is consistent across Mexico, but substantial regional differences are notable, both in terms of the amounts received and the relative importance of these monetary flows related to total household income and expenditure.

Table 2 provides comparative descriptive statistics on the amounts of the total and disaggregated health expenditures as well as of healthcare expenditures as a proportion of total expenditure across three different types of households: without income from remittances (non-recipients), recipients of internal remittances, and recipients of international remittances. The figures highlight a substantial disparity in spending between remittance-receiving households, both internal and international, when compared to households that do not receive remittances. Notably, international remittance recipients exhibit the highest healthcare expenditures. A closer examination of expenditure categories reveals that, on average, remittance-receiving households allocate a larger portion of their total health expenses towards ambulatory care, accounting for approximately three-quarters of their health spending. This initial descriptive analysis prompts two critical questions. Firstly, it underscores the significance of healthcare spending for all households, regardless of whether they

receive remittances. Secondly, it sheds light on patterns that indicate potential vulnerabilities within households receiving remittances, particularly those receiving international remittances, associated with a more limited access to healthcare services.

Based on the data in Table 2, it is possible to observe the general importance of remittances in health expenditures. However, in Table 3, when disaggregating the expenses according to the categorization of regions for migratory reasons (CONAPO, 2012), a heterogeneous distribution of health expenditures is encountered[5] Households that reside in the western region, the one with the longest-standing migratory tradition, and the households of the south-southeast, the poorest region of the country, spend the most on healthcare. In addition, across all regions, healthcare expenses are concentrated on ambulatory issues.

Beyond regional issues, the receipt of remittances and decisions to make health expenditures may be associated with various economic, demographic, and social characteristics that define households and their members within Mexico. The first three columns of Table 4 present descriptive statistics of control variables of Mexican households at the national level, categorized by their remittance receiving status. In addition, columns 4, 5, and 6 present statistical tests of differences in sample means of these variables across the groups of households. When contrasting the sociodemographic and contextual characteristics among the three groups of households, most variables show intrinsic significant differences in their mean values.

In terms of human capital, it is notable that the heads of households that do not receive remittances have, on average, a better level of schooling than the heads of households that receive remittances, both internal and international. Furthermore, significant differences are also observed when contrasting households that receive remittances; households receiving international remittances have lower levels of schooling than internal recipient households.

Another demographic characteristic that distinguishes recipient households from non-recipients is their knowledge of native languages, with a higher proportion of heads of households receiving internal remittances possessing this characteristic. In terms of employment, approximately 60% of heads of household receiving remittances report having some type of paid employment, whereas this figure rises to 79% among heads of household that do not receive remittances. Additionally, while most household heads are males, an analysis of households receiving either internal or international remittances reveals a higher percentage of female-headed households, reaching 50% among those receiving internal remittances; no significant differences are noted compared to households receiving international remittances.

Regarding housing characteristics, we see that households receiving remittances generally have less access to basic services and the use of information technologies compared to non-recipient households. When analyzing the dependency rate, households receiving international and national remittances tend to

[5] Expenditures are recorded according to the region of residence of the household, which does not necessarily coincide with the region where the payments are made. However, given the size of the regions and the categorization of the expenses, we do not expect that cross-border flows are a core issue in our sample, and less so for our analysis focused on the regions of residence of the (remittance-receiving) households.

Table 3 Healthcare expenditure in Mexico by remittances recipient and region

Variable	*West*			*North*			*Central*			*South-Southeast*		
	Non-recipient	Internal	International	Non-recipient	Internal	International	Non-recipient	Internal	International	Non-recipient	Internal	International
Total household expenditure[a]	33,252	28,098	27,952	34,017	29,335	32,738	32,117	26,191	26,079	24,112	23,138	21,220
Healthcare expenditures[a]	1284	1466	2047	1205	1453	1762	1213	1439	1441	1091	1281	1975
Ambulatory[a]	896	1134	1602	729	1055	1404	813	1007	1091	741	958	1646
Hospitalization[a]	172	106	148	285	154	110	132	71	134	107	84	92
Medicines[a]	216	226	297	190	245	248	268	360	216	243	238	237
Proportion[b]	3.9	5.2	7.3	3.5	5.0	5.4	3.8	5.5	5.5	4.5	5.5	9.3
No. of observations	16,230	4938	2522	21,063	5153	759	15,034	3240	692	13,605	4939	714

Source: Authors' calculations based on ENIGH 2020 (INEGI, 2021a)

[a]Quarterly expenditures in current prices (Mexican pesos). See Appendix Table 7 for the definitions of the expenditure categories

[b]Proportion of household budget allocated to health (healthcare expenditures/total household expenditure)

Table 4 Descriptives statistics, differences between remittances recipients at national level

Variable	Non-recipient	Internal	International	*t*-test (1) *vs* (2)	*t*-test (1) *vs* (3)	*t*-test (2) *vs* (3)
	(1)	(2)	(3)	(4)	(5)	(6)
Characteristics associated with the head of the household						
Male	0.75	0.50	0.56	50.72***	28.71***	0.02
Age (yrs.)	50.08	54.89	55.13	−37.39***	−25.45***	3.70***
Indigenous	0.07	0.08	0.05	−7.06***	7.99***	−10.61***
Married	0.69	0.54	0.66	36.50***	5.15***	13.20***
Schooling (yrs.)	10.11	8.59	7.45	30.61***	30.76***	−13.45***
Paid employment	0.79	0.60	0.61	49.51***	30.51***	−1.74*
Economic and social characteristics associated with the household						
Household size	3.60	3.40	3.60	10.94***	2.41**	3.17***
Household schooling (yrs.)	8.52	7.40	6.70	25.57***	22.03***	−7.78***
Prop. health problems	0.65	0.68	0.68	−11.13***	−6.19***	0.02
Internet	0.56	0.50	0.40	17.73***	12.37***	−2.41**
Fixed Phone	0.30	0.30	0.31	9.54***	1.50	3.50***
Piped water	0.78	0.70	0.70	−4.12***	−5.29***	2.72***
Dirt floor	0.02	0.03	0.03	−1.50	1.20	−1.65*
Sewer system	0.80	0.70	0.70	10.68***	10.63***	−4.21***
Cellphone	0.91	0.90	0.90	18.69***	9.95***	0.55
Computer	0.34	0.20	0.20	19.47***	15.47***	−4.89***
Income decile	5.36	4.40	4.70	37.57***	12.65***	7.68***
Prop. women	0.50	0.60	0.60	−38.61***	−17.01***	−3.97***
Dependent members	0.26	0.40	0.40	−37.91***	−23.86***	1.97**
Time to hospital	18.76	18.31	18.29	0.85	−0.96	1.29
Regional characteristics						
Rural	0.19	0.30	0.50	−6.36***	−32.80***	26.64***
Unemployment	5.25	4.90	4.40	12.40***	18.84***	−11.34***
Homicides	0.02	0.00	0.00	9.54***	−5.93***	10.63***
Inflation	3.58	3.70	3.70	−6.98***	−5.97***	2.01**
Log GDP	13.34	13.20	12.80	14.74***	26.38***	−18.46***
Population	3070.68	5677.30	1804.40	10.61***	21.80***	−15.88***
Medical infrastructure	710.91	687.63	614.96	6.24***	14.02***	−10.6***

Source: Authors' calculation based on ENIGH 2020 (INEGI 2021a); INEGI, 2021b; INEGI, 2021c; INEGI, 2021d

have a greater number of members aged over 65 years and under 12 years. This could be indicative of higher financial needs to cover expenses related to healthcare. Similarly, smaller but significant differences between remittance-

receiving and non-receiving households are encountered for the proportion of household members reporting health problems. However, there are no significant differences between the three types of households in terms of the time needed to reach the nearest hospital.

Finally, it is worthwhile to emphasize that significant differences exist in the averages of the regional context variables among the three groups of households analyzed. Key differences include place of residence (rural vs. urban), unemployment rate, and insecurity levels. Also, the state-level GDP and available medical infrastructure—the number of health sector establishments for outpatient services and hospitalizations—differ, with remittance-receiving households generally being worse off.

In summary, the information presented in Table 4 provides evidence that households receiving remittances (internal or international) exhibit, on average, distinct demographic, economic, social, and contextual characteristics compared to non-recipient households. Additionally, significant differences are observed among households receiving remittances (internal vs international) in the majority of control variables. This highlights the need to conduct studies that identify the differing impacts of remittances among these population groups with statistically distinct attributes.

3.3 Identification strategy: Inverse Probability of Treatment Weighting (IPTW)

In recent years, the use of multitreatment methodologies has been incorporated into research analyzing the impacts of remittances on various economic and social indicators. (Ali et al., 2024; Wellalage and Locke, 2020; Mora-Rivera et al., 2019). These studies suggest that receiving remittances can be seen as a 'treatment', and more precisely, that a multitreatment analysis is needed to examine the potentially different impacts of internal and international remittances. For a multitreatment analysis, it is common to use an Inverse Probability of Treatment Weighting (IPTW) framework (Imbens, 2000; McCaffrey et al., 2013), as it is better equipped than the propensity score matching (PSM) or instrumental variable (IV) techniques for identifying the different values that the treatment indicator can take. In particular, where in a binary setting explicit matching of treated with control observations works well, in a multitreatment setting different treatments may have different observations that serve as best controls, obfuscating comparisons between the various treatments. [6] Instead, in the IPTW approach, the complete observed sample is reweighted by the probabilities that treatment was received, to construct synthetic samples of potential outcomes under each treatment, generating reweighed samples in which treatment assignment can be considered independent of the observed characteristics.

The IPTW method, like matching techniques (Rosenbaum and Rubin, 1983), is based on a potential outcome framework, and in non-randomized studies such

[6] Similarly, with a binary treatment, a regression-based instrumental variable (IV) strategy hinges closely on the potential outcomes framework underlying the PSM and IPTW methods. In a multitreatment setting as ours, an IV setting however becomes less tractable as we would need specific requirements for the IVs to identify the (three) different remittance-receiving statuses that we are interested in.

as ours, identification of treatment effects is achieved by invoking two broad assumptions. The first reestablishes the *unconfoundedness* of the treatment, which implies that conditional on observable characteristics $\mathbf{X}$, differences in outcomes are due only to the implementation of the treatment regime t. That is, the treatment indicator $D(t)$ is independent of the outcome under that treatment, $Y(t)$, when conditioning on the *generalized* propensity scores (GPS) (Imbens, 2000):

$$\text{Assumption 1: } Y(t) \perp D(t)|p_t(\mathbf{X})\forall t \in T,$$

where $p_t(\mathbf{X}) \equiv P(D(t) = 1|\mathbf{X})$ is the probability of receiving treatment level t conditional on the vector of characteristics $\mathbf{X}$, for each $t \in T = \{$no remittances, internal remittances, international remittances$\}$. While in a binary treatment setting, propensity scores—probabilities of treatment for each observation—can be obtained using a probit or logit model, a multinomial logit model distinguishing the three unordered outcomes in T is a natural choice to obtain the *generalized* propensity scores $p_t(\mathbf{X})$. The second requirement rules out perfect predictability of participation in any of the treatment regimes, conditional on the characteristics vector $\mathbf{X}$ summarized by the GPS:

$$\text{Assumption 2: } 0 < p_t(\mathbf{X}) < 1 \forall t \in T.$$

In general, under the stated assumptions, the potential (counterfactual) outcomes $Y(t)$ for each treatment level $t \in T$ are obtained as (McCaffrey et al., 2013):

$$\hat{E}[Y(t)] = \hat{E}\left[\frac{D(t)Y}{p_t(\mathbf{X})}\right] = \frac{1}{N}\left(\sum_{i=1}^{N}\frac{D(T_i = t)Y_i}{p_t(\mathbf{X_i})}\right),$$

that is, the observed outcomes of those who received treatment t are weighted by the probability of this treatment given the characteristics $\mathbf{X_i}$.[7]

Assumption 1 essentially states that the set of covariates $\mathbf{X}$ contains all the variables that not only explain treatment regime D but also outcome Y, and that there are no confounders that are not included in $\mathbf{X}$ (McCaffrey et al., 2013; Austin and Stuart, 2015). Moreover, these covariates should not be affected by the treatment. A common way to evaluate the balancing properties of the GPS is by looking at the standardized differences between the means in the reweighted treated and untreated samples, while additional information is obtained by the variance ratios (Austin, 2009). The aim is to obtain standardized differences equal to 0 and variance ratios equal to 1, which would imply perfectly balanced samples. Although consensus does not exist, as a rule-of-thumb, a standardized difference of 10–20% is often considered as negligible or small imbalance (Austin, 2009).

For the calculation of the *average treatment effect on the treated* (ATT) it matters which outcomes are considered 'treated' and 'control'. In general terms, the ATT can be expressed as (McCaffrey et al., 2013):

$$\widehat{ATT}(t_1, t_2; t_3) = \hat{E}[Y(t_1)|D(t_3) = 1] - \hat{E}[Y(t_2)|D(t_3) = 1],$$

[7] In the end, normalized weights for each treatment regime will be implemented to improve the properties of the estimators of $Y(t)$ (McCaffrey et al., 2013).

measuring the difference between the expected outcomes with treatment t_1 and treatment t_2, respectively, for households that received treatment t_3.[8] It is natural to consider $t_1 = t_3$ —where the treated are the households that receive either internal or international remittances—and compare them with households that do not receive remittances (t_2). However, nothing stops t_1 and t_3 from being different. For example, calculating the difference in potential outcomes receiving internal vs. international remittances for households that effectively received international remittances, will tell us if they would have been better off had they obtained internal instead of international remittances.

If $t_3 = t_1$, the first term is the (observable) average outcome under treatment t_1 for those that indeed received treatment t_1, and there is no need to condition on the GPS:

$$\hat{E}(Y(t_1)|D = t_1) = \frac{1}{N_1}\left(\sum_{i=1}^{N} D(T_i = t_1)Y_i\right),$$

where N_1 is the number of observations that received treatment t_1. The second term, however, is not observable and must be estimated by considering the potential outcomes under treatment t_2 for those that in reality were in treatment regime $t_3 = t_1$. Weighting by the ratio of the GPSs of both outcomes assures that the distribution of characteristics in the sample with treatment t_2 is comparable with those with treatment t_1:[9]

$$\hat{E}(Y(t_2)|D = t_1) = \frac{1}{N_1}\left(\sum_{i=1}^{N} \frac{p_{t_1}(\mathbf{X_i})}{p_{t_2}(\mathbf{X_i})} D(T_i = t_2)Y_i\right).$$

4 Results and discussion

In this section we discuss the results obtained using the data and the empirical model outlined in the previous section. First, we present the average impacts at a national level of remittances on the healthcare expenditures in the remittances-receiving households, while the second part disaggregates the results at a regional level.

4.1 National results

The first column of Table 5 shows the impact of internal remittances on various healthcare-related dependent variables compared to households that do not receive

[8] In addition to the IPTW aimed at achieving balance between the treated and untreated, we apply treatment-specific outcome regression models using the same set of explanatory variables, a technique known as regression-adjusted IPTW that further reduces remaining differences between the treated and untreated samples before the average potential outcomes and implied treatment effects are calculated. This IPTW-RA technique is known in the literature as a doubly-robust technique, and requires that one of the GPS or outcome specifications is correct (Cattaneo, 2010; Vansteelandt and Daniel, 2014).

[9] Also here, normalized weights will be implemented. Note that, in general, the ATTs in the multiple treatment case are not symmetric; given that the groups of treated and non-treated differ, we may expect that $ATT(t_2, t_1) \neq ATT(t_1, t_2)$.

Table 5 ATT of remittances, national level

Dependent variable	Internal	International	International vs Internal
Healthcare expenditures[a]	520.0	1024.1	503.8
	(6.19)***	(7.26)***	(3.26)***
Ambulatory[a]	468.0	937.9	469.9
	(6.13)***	(6.99)***	(3.21)***
Hospitalization[a]	−16.8	−1.8	15.0
	(−0.67)	(−0.07)	(0.47)
Medicines[a]	69.1	88.5	18.9
	(3.74)***	(3.64)***	(0.66)
Proportion[b]	1.1	1.8	0.7
	(9.37)***	(9.35)***	(3.35)***

Source: Authors´ calculations based on ENIGH 2020

[a]Quarterly expenditures in current prices (Mexican pesos)

[b]Proportion of household budget allocated to health (healthcare expenditures/total household expenditure)

Numbers in parentheses are z values. ***, **, *: 1, 5, and 10% level of significance, respectively

remittances, while column two shows the coefficients representing the influence of international remittances in comparison to non-recipient households. Lastly, column three compares the impacts of international and internal remittances on the dependent variables.

Similar to the findings of García-Amador et al. (2023) and Amuedo-Dorantes and Pozo (2011), our results confirm that, at the national level in Mexico, remittances have a positive and significant impact on healthcare expenditures (Table 5, first row). However, our findings go a step further by showing that the magnitude of the effect varies depending on the source of the remittances, with external remittances having a greater impact than domestic ones. This aligns with previous research suggesting that international remittances have a greater impact than internal remittances (Aguayo-Téllez et al., 2021; Randazzo and Piracha, 2019). Nonetheless, domestic remittances reach a significantly larger number of households—about five times more than those receiving international remittances (Table 1).

Consistent with the total impact, international remittances have a greater influence on outpatient care expenses and over-the-counter medicine than internal ones (Table 5, rows 2 and 4). Notably, distinct effects by remittance type are observed primarily in the category of outpatient care. When considering expenses on non-prescription medicines, both types of remittances show a positive and significant impact, but without a significant difference between them. In other words, averaged at the national level, the origin of the remittances appears to be inconsequential when it comes to household spending for medicine; however, for total, ambulatory, and the proportion of health spending, the origin matters. In addition, it is important to note that for hospitalization expenses (Table 5, row 3) remittances have no effect, a finding that highlights that hospitalization expenses, which often involve

prolonged treatments or specialized interventions, remain beyond reach for households with the income generated from any form of remittances.[10]

Additionally, we point out that the impacts of remittances on spending patterns, reflected in particular by the proportion of healthcare in the total spending (Table 5, final row), are statistically significant, positive, and robust; in remittances-receiving households, a larger share of the expenditure is directed towards health. In developing countries, remittances are a crucial source of external financing that helps households raise their income levels to cope with market failures in their home countries. This increase in income from transfers including remittances often results in a change in spending patterns (Kakhkharov and Ahunov, 2022; Manic, 2017; Parida et al., 2015), with a notable rise in household investment expenditures, particularly in health expenses (Ajefu and Ogebe, 2021; Amuedo-Dorantes and Pozo, 2011).

4.2 Regional results

Summarizing the results at the national level (Table 5) and across all regions (Table 6), we can say that both internal and international remittances positively and significantly impact total health expenditures (row 1). However, it is important to note that the magnitudes of the effects vary depending on the specific zones of the country and the type of remittance received, and that moreover there are some significant differences in the categories of health expenditures. A higher impact of international remittances is found in the west and south-southeast of the country (Table 6, first row), in the former case primarily due to the region's migratory history and tradition (Durand, 2016), and to the growing degree of international migration in recent decades in southern Mexico in the latter. Nevertheless, the estimated impact of international remittances on total health expenditures in the south-southeast region is quite similar to that of the northern region, a possible reflection of its proximity to the United States and the prevalence of cross-border migration. This leads to a substantial inflow of international remittances, a trend that has been exacerbated by stricter US-Mexico border controls (Barrios and Cruz, 2022).

The impact of internal remittances on health expenditures is most pronounced in the north and south-southeast, primarily due to significant interurban mobility. In the northern region, the export manufacturing industry (EMI) acts as a major draw for internal migration. As an illustration, in the mid-nineties, there was a notable increase in the incorporation of states in the south-southeast of Mexico into internal migratory flows, with their primary destination being the northern border states, where a significant portion of the EMI is concentrated (Hjorth, 2009). Noteworthy, however, is the consistent impact of internal remittances across all regions. This could be

[10] Table A.8 of the Supplementary Material shows that the national results for 2020 resemble those for 2018 and 2022. The impacts of both types of remittances on hospitalization expenses in 2020 and 2022 are not statistically significant. However, in 2018, there is a slight positive impact of international remittances on hospitalization expenses, which could be attributed to *Seguro Popular* (Conti and Ginja, 2023; Nikoloski and Mossialos, 2018). Although this program did not cover all (additional) expenses, hospitalization became even less affordable after its abolishment in early 2020. Hence, we consider that this difference is most likely not driven by the COVID pandemic but by a changed prioritization of expenditures, with a prolonged effect due to the lack of viable alternatives of healthcare access, rendering 2020 less atypical than what one's intuition might suggest.

Table 6 ATT of remittances, regional level

Dependent variables	West			North			Central			South-Southeast		
	Internal	*International*	*International vs Internal*	*Internal*	*International*	*International vs Internal*	*Internal*	*International*	*International vs Internal*	*Internal*	*International*	*International vs Internal*
Healthcare expenditures [a]	440.0	1134.0	693.9	671.9	990.9	319.0	474.2	595.0	120.7	614.1	1006.5	392.4
	(3.24)***	(5.41)***	(3.03)***	(3.87)***	(3.24)**	(0.93)	(2.47)**	(2.79)***	(0.45)	(2.79)***	(2.39)**	(0.86)
Ambulatory[a]	394.2	956.7	562.4	642.4	940.7	298.3	406.4	653.1	246.7	571.8	985.6	413.8
	(3.94)***	(4.38)***	(2.61)***	(4.04)***	(3.22)***	(0.91)	(2.22)**	(3.19)***	(0.95)	(2.78)***	(2.44)**	(0.94)
Hospitalization[a]	−37.1	31.3	68.4	−51.8	−73.1	−21.3	−37.3	−38.4	−1.1	44.9	16.5	−27.4
	(−0.96)	(0.70)	(1.48)	(−1.19)	(−1.04)	(−0.32)	(−1.0)	(−0.75)	(−0.02)	(0.70)	(0.30)	(−0.36)
Medicines[a]	82.9	146.0	63.1	81.3	123.2	41.9	105.1	−19.7	−124.8	−1.6	4.4	6.0
	(2.42)**	(3.60)***	(1.24)	(3.41)***	(2.73)**	(0.84)	(2.52)**	(−0.73)	(−2.84)**	(−0.062)	(0.13)	(0.17)
Proportion[b]	1.2	2.0	0.8	1.2	1.8	0.5	1.0	1.7	0.7	1.0	1.2	0.3
	(4.13)***	(6.89)***	(2.58)***	(5.57)***	(4.32)***	(1.17)	(3.18)***	(3.59)***	(1.40)	(2.56)***	(2.71)***	(0.51)

Source: Authors´ calculations based on ENIGH 2020

[a]Quarterly expenditures in current prices (Mexican pesos)

[b]Proportion of household budget allocated to health (healthcare expenditures/total household expenditure)

Numbers in parentheses are z values. ***, **, *: 1, 5, and 10% level of significance, respectively

attributed to the lower transaction costs of internal migration in contrast to international migration, making mobility within the Mexican territory more feasible and flexible. Although significant in all regions, the average impact of internal remittances is lower than that associated with international remittances, with only the central region showing rather similar impacts (474 vs. 595 pesos).

Nevertheless, statistically significant differential effects by origin of remittances on total health expenditures, as we encountered at the national level, are found only in the western region. There, the average impact of international remittances is more than double that of internal remittances. This may be attributed to the fact that international remittances are traditionally concentrated in this region, while few households in the rest of the country receive international remittances (Table 1). For the south-southeast, the difference seems substantial, even when insignificant. In this regard, the impact of any type of remittance on healthcare expenditures in the south-southeast could be associated with the high levels of poverty and insufficient medical infrastructure faced by households in this region. Consequently, given the region's vulnerability, the source of the remittances becomes less significant.

These findings suggest that the effects documented in the literature, particularly in the case of Mexico, could be fundamentally driven by the western region with the most significant migratory tradition in the country. However, the impacts appear to differ from the rest of Mexican territory, as indicated by the results in other regions, where the impacts of internal and international remittances are not significantly different. In contrast, although domestic remittances have smaller average impacts, they are disseminated across a larger number of households in all regions of the country, which could indicate the potential for broader-scale multiplier effects.

When analyzing the impact of remittances by healthcare spending category, it becomes apparent that, similar to the national findings, both types of remittances predominantly affect ambulatory outpatient care (row 2 of Table 6). This trend is consistent across all four regions under scrutiny. This suggests that remittances, regardless of their source, primarily serve to address immediate health concerns, such as emergencies or crises within the household, but are not commonly used to manage serious health shocks that require (long-term) hospital care, as seen in the hospitalization category across all regions, for which small and insignificant effects are found (row 3). That is, in all regions, remittances are insufficient to cover hospitalization, primarily due to the high costs involved and the insufficient medical infrastructure in most regions, especially in southern Mexico (Huffman and van Gameren, 2019).

Additionally, we see that differentiated impacts on ambulatory care by type of remittance are observed only in the western region; in the other regions, there are no significant differences between internal and international remittances. This suggests that in most regions, households perceive these transfers indistinctly, and that the increased income and reduced liquidity constraints enable households to use this extra financial support to address urgent health issues, regardless of the remittance's origin.

In some regions we find evidence that the impacts on outpatient care spending are supplemented by impacts on non-prescription drug spending (row 4). In the case of international remittances, this complementarity is found only in the two regions where the greatest impact on healthcare expenses is observed—the western and northern regions. Internal remittances impact three of the four regions analyzed, with no effects identified in the south-southeast. This observation could again be

associated with the area's generalized deficiencies in medical infrastructure. Moreover, the central region shows the most significant impacts of internal remittances on over-the-counter medicine, which could be attributed to the culture of self-medication and the growing proliferation of affordable medicine suppliers (ONU, 2021; López and Flores-Espinosa, 2023). The latter is mainly accredited to the concentration of pharmaceutical clusters in central Mexico; the State of Mexico and Mexico City account for 56% of the gross production in the pharmaceutical industry, while 45% of the sales establishments are located there, which greatly facilitates access and consumption for the local population (INEGI, 2022).

Regarding the impact of remittances on the proportion of healthcare in total expenditures (Table 6, final row), the western, northern, and central regions show impacts that are more similar to the national results, while the differential impact of internal vs. international remittances is significant only in the western region with its longer migrant-sending tradition. The west and the north follow the national results more closely, as they do when analyzing the total health expenditures. That is less the case for the central region, and in particular for the south-southeast; the latter shows a smaller impact of international remittances on the proportion than other regions, while for the total health expenditures the impact has caught up with the other regions.

Our results confirm the findings of studies that have identified positive impacts of international remittances on health expenditures (García-Amador et al., 2023; Amuedo-Dorantes and Pozo, 2011). However, studies that present generalized findings at the national level largely overlook the fact that the effects within the Mexican territory are not homogeneous, as we establish with our regional analysis. Findings at the national level may be influenced by regions with stronger migratory traditions, such as western Mexico, while the dynamics in other regions are found to differ.

5 Conclusions

Over the past decade, Mexico has consistently been one of the top three global recipients of international remittances. This significant influx of funds has spurred numerous studies exploring their impact on the spending patterns in the country, including in the context of healthcare expenses. Nevertheless, there are two under-explored areas for the analysis of remittance impacts. First, given the high proportion of households benefiting from internal or domestic remittances, there is a need for studies that incorporate internal remittances, in addition to international remittances, into their analyses. The second area relates to socioeconomic disparities and the concentration of these income sources in various regions of the country, potentially leading to misconceptions when assessing impacts in a heterogenous nation such as Mexico.

The objective of this article was to estimate the impact of both internal and international remittances on various categories of health-related expenditures at the regional level in Mexico using a quasi-experimental methodology. While prior evidence is conclusive regarding the positive impact of remittances on household health expenditures in Mexico, our findings highlight the significance of analyzing various nuances, in particular the origin of remittances, specific health expenditure classes, and regional disparities.

Our results indicate that both internal and international remittances positively and significantly affect total health expenditures. Moreover, distinct impacts can be observed based on remittance type, expenditure category and region of analysis. In the case of international remittances, the impacts are more pronounced. On the other hand, internal remittances reach five times more households than international remittances. Although their individual impact on healthcare expenses is smaller, they could have a multiplier effect for the seven million households receiving these transfers. We also observe that remittances influence household spending patterns; in particular, they alter the overall distribution of household expenses by increasing the share allocated to healthcare. These results underscore the importance of analyzing both types of remittances separately, while further research could dig deeper into the mechanisms underlying the trade-off between impacts of the extensive margin—receiving (national or international) remittances—and the intensive margin—the amounts households receive.

Another interesting result is the complementarity observed in the impact of remittances on expenditures on outpatient care and non-prescription drugs and the failure to identify effects on hospitalization expenditures. This suggests that the more common but generally smaller domestic remittances are considered as a more permanent income flow used for ongoing medical costs, while the larger but less common international remittances are considered as transitory income used for (shorter but expensive) ambulatory treatment procedures. In times of need, households use these resources to enhance their health conditions; however, the income received from remittances may not be sufficient to cover (potentially substantial) excessive expenses, such as those related to hospitalizations.

Regionally, we observe heterogeneity in the impact of remittances. In the western, and to a lesser extent in the northern and south-southeast regions, international remittances have a more significant impact on a household's health expenditures. In contrast, internal remittances have a stronger impact in the south-southeast and the north of the country. In the south-southeast, the impacts may be associated with its low development levels and vulnerabilities due to poverty and insufficient medical infrastructure. Therefore, the impacts associated with remittances may be related not only to the amount and origin of the remittances but also to the specific structural problems of each region. This suggests that recipient households' perceptions of remittances as transitory or permanent are shaped not only by the origin of these resources but also by the structural inequalities that characterize each of the regions receiving them.

In conclusion, important regional differences were identified. Therefore, implementing uniform public policies in Mexico for a heterogeneous phenomenon like the impacts of remittances could lead to policy failures. For that reason, it is essential to develop differentiated public policies throughout the nation. In the northern region, where access to healthcare is more extensive, financial inclusion policies could offer greater advantages by reducing transaction costs to improve sending channels and achieve a multiplier effect on remittances. In the western region, which has the highest concentration of remittance-receiving households, it is essential to promote public policies that provide comprehensive medical services, including hospitalization. In addition, in the highly vulnerable south-southeast region of Mexico medical infrastructure investments are needed to improve access to healthcare, such as the construction of specialized hospitals, given this region's limited provision of such services. Lastly, in the central region, it would be advisable to implement programs

that promote greater access to medications, to leverage the ample availability of pharmaceutical products in this area.

Receiving internal and international remittances is an essential source of income for many Mexican households to cover various health expenses. However, these resources should not replace the state's responsibility to provide affordable and reliable medical services for the population. Therefore, the establishment of public policies aimed at enhancing medical infrastructure and ensuring universal access to healthcare should be a top priority for the government. This approach is essential for reducing the economic and social inequalities that prevail in many middle- and low-income countries, in addition to promoting well-being. In the case of Mexico, an example of this initiative would be to guarantee free medical and hospital care for the population lacking social security coverage by strengthening social programs like *IMSS Bienestar*, which replaced *Seguro Popular*. This would enhance the general population's health, reduce out-of-pocket expenses, and allow for the allocation of remittance income to more productive activities.

While this research offers statistically reliable evidence regarding the impact of remittances on health expenditures, it presents only a partial perspective of the problem addressed, inevitably accompanied by limitations associated mainly with the type of data employed in the analysis. First, due to the objectives of the ENIGH, it may not capture all remittances reported by official sources. This highlights the need for more precise surveys of income from internal and international transfers and household usage—surveys that ideally would also address potential seasonality in remittance patterns. Second, the methodological design of the ENIGH does not capture information about the locations where expenditures are made. Having such information would be favorable for conducting research to determine the impact of remittances on regional development in Mexico, a topic that extends beyond the scope of this research and is reserved for future studies. Third, it would be desirable to have panel data to enable tracking the same households at different points in time, thereby allowing for more comprehensive conclusions regarding the dynamics between remittance flows and their effects on health expenditures. Finally, it would be valuable to conduct longitudinal studies that take into account the post-pandemic period to examine its effects on recipient households and to isolate the impacts of remittances on household spending patterns. We must note that due to the cross-sectional characteristics of our database, longitudinal studies on this topic are on the future agenda. These limitations in no way diminish the relevance of our findings, but underscore the need for additional sources of information and alternative methodological perspectives to affirm or contrast the findings of our research.

Data availability No datasets were generated or analysed during the current study.

Supplementary information The online version contains supplementary material available at https://doi.org/10.1007/s11150-024-09752-3.

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Compliance with ethical standards

Conflict of interest The author declares no competing interests.

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6 Appendix

Table 7

Table 7 Definitions and metrics for dependent and independent variables

Variable	Description
Dependent variables, impacts of treatment	
Healthcare expenditures	Total spending of household on healthcare: summation of ambulatory, hospitalization, and medicines
Ambulatory	Expenditures on primary or ambulatory healthcare and prescription drugs
Hospitalization	Expenses for inpatient services including doctors' fees and other costs that come with a hospital stay
Medicines	Spending on non-prescription drugs, including vitamins, contraceptives and alternative medicines.
Proportion	Proportion of household budget allocated to health (healthcare expenditures/total household expenditure)
Dependent variables, multinomial logit models	
Internal remittances	Dummy variable indicating whether the household receives income from households in the same country (1 = Yes)
International remittances	Dummy variable indicating whether the household receives income from households in other countries (1 = Yes)
Independent variables	
Characteristics associated with the head of the household	
Male	Dummy variable, male household head
Age (yrs.)	Age of the household head
Indigenous	Dummy variable indicating whether household head speaks an indigenous language (1 = Yes)

Table 7 continued

Variable	Description
Married	Dummy variable indicating whether respondent is married or cohabitating (1 = Yes)
Schooling (yrs.)	Years of schooling of the household head
Paid employment	Dummy variable indicating household head employment status (1 = Paid job)
Economic and social characteristics associated with the household	
Household size	Number of household members
Household schooling (yrs.)	Average years of schooling in the household excluding household head education
Prop. health problems	Proportion of household members with health issues
Internet	Access to internet (1 = Yes)
Fixed phone	Access to landline telephone (1 = Yes)
Piped water	Access to piped water inside home (1 = Yes)
Dirt floor	Home has a dirt floor (1 = Yes)
Sewer system	Access to sewer system inside home (1 = Yes)
Cellphone	Access to cellphone (at least one household member owns a cellphone) (1 = Yes)
Computer	Access to computer (at least one household member owns a desktop or laptop computer (1 = Yes)
Income decile	Income decile
Prop. women	Proportion of female household members
Dependent members	Proportion of economically dependent household members (aged under 12 or over 65 years)
Time to hospital	Time it takes to get to the nearest hospital
Regional characteristics	
Rural	Dummy variable indicating whether the household is in a rural or urban area (1 = Rural)
Unemployment	Unemployment rate (state level)
Homicides	Number of homicides per 100,000 inhabitants (state level)
Inflation	Inflation rate (state level)
Log GDP	Logarithm of GDP (state level)
Population	Population (municipal level)
Medical infrastructure	Establishments designated for outpatient services and hospitalization (state level)

Source: INEGI (2021a–d); Secretaría de Salud (2024)

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