Does outsourcing improve immunisation coverage among children aged 12–24 months in Pakistan?

Shiraz Shaikh[1] and Kashif Shafique[1]

[1]School of Public Health, Dow University of Health Sciences Karachi, Pakistan (Correspondence to Shiraz Shaikh: shiraz.shaikh@jsmu.edu.pk).

Abstract

Background: In 2017, Pakistan outsourced to a non-government organisation the management of its vaccination programme in 2 Sindh Province districts.

Aim: To determine the impact on coverage of outsourcing vaccination programme in 2 districts of Sindh Province, Pakistan.

Methods: Between August and October 2024, we interviewed parents or caregivers of 1600 children aged 12–24 months from 4 (2 outsourced and 2 non-outsourced) districts in Sindh Province, to collect sociodemographic and immunisation data. We analysed the data with STATA version 17, using chi-square test and Man-Whitney U test to compare the participants' characteristics and immunisation status, and regression model to estimate the difference in immunisation rates between the 2 groups at 9 months.

Results: Full immunisation coverage was slightly higher in the outsourced (78.8%) than the non-outsourced (75.8%) districts, but there was no statistically significant difference ($P = 0.067$). At 9 months, a significant difference ($P = 0.036$) was observed in immunisation rates: 15.0% decrease in compliance in the outsourced, compared to 19.7% in the non-outsourced, districts.

Conclusion: There was a partial improvement in vaccination coverage due to outsourcing: coverage was better only in one of the outsourced districts. There is a need for further research to understand the reasons for the slight differences in immunisation coverage between the outsourced and non-outsourced districts, and the cost-effectiveness of outsourcing.

Keywords: childhood immunisation, vaccination, outsourcing, public-private partnership, Pakistan

Introduction

Under-5 mortality rate has decreased by 59% globally, from an estimated 93 deaths per 1000 livebirths in 1990 to 38 in 2021 (1). However, Pakistan lags significantly behind the global average, with an under-5 mortality rate of 68 per 1000 livebirths estimated for 2021 (2). The Pakistan Demographic Health Survey (PDHS) 2018–2019 estimates that under-5 mortality is significantly higher in rural than urban areas (3). And most of these deaths occur during the first year of life due to birth complications, anomalies and common infections like acute respiratory tract infection and diarrhoea (4). The majority of the deaths are preventable with simple affordable interventions like adequate nutrition, safe water, sanitation, hygiene, antenatal care, safe delivery, and immunisation (5).

Immunisation is the most important and most cost-effective public health intervention for reducing child mortality. It is estimated that annually around 4 million deaths are averted globally through immunisation (6). The World Health Assembly in 2012 endorsed the Global Vaccine Action Plan (GVAP) 2011–2020, which requires > 90% vaccination coverage in all the countries (7).

In 2021, the global immunisation coverage estimate was 81%, with almost all non-vaccinated children living in low and low middle income countries (6). The latest surveys in Pakistan have reported a 66–76.5% range of complete immunization coverage (3,8), while coverage in Sindh Province is lower (49–64.7%) (3,8,9). The Multiple Indicator Cluster Survey (MICS) in Sindh also estimates a lower coverage in rural than urban areas (9).

Several factors contribute to the low uptake of vaccines in Pakistan, including a lack of knowledge, low sensitisation of parents about the importance of vaccination, and poor performance of vaccination centres (10,11). More than 50% of vaccination failures or zero vaccinations have been attributed to health care provider or facility management issues (12).

Outsourcing the management of services to non-government organisations (NGOs) in the health sector has proven to be useful in improving the overall performance and optimising delivery (13). This strategy was first piloted in the Pakistani primary health care (PHC) system in 2003 in Rahimyar Khan District, Punjab Province (14). It was first adopted in Sindh Province in 2007, and gradually the primary health facilities were handed over to an NGO, the People's Primary Healthcare Initiative Sindh (PPHIS). Initially, only the management of curative

facility-based services were handed over to PPHIS, while services under the vertical programmes, including vaccination services, were operated autonomously by the Sindh Government. In 2017, the Expanded Programme on Immunization (EPI) was also handed over to PPHIS in 2 districts of Sindh (15). They were authorised to hire, train and monitor programme managers and vaccinators in the outsourced districts while the government supplied the vaccines.

No assessment has been conducted to evaluate the performance of the vaccination programme under 2 different management structures. This study was therefore conducted to determine the impact of outsourcing on immunisation coverage in Sindh Province. We hypothesised that immunisation coverage would be better in the outsourced than non-outsourced districts. This was to provide evidence for possible improvement or upscaling.

Methods

This cross-sectional study was conducted in 2 outsourced (Khairpur Mirs, Dadu) and 2 non-outsourced (Sukkur and Larkana) districts of Sindh Province between August and October 2024. The non-outsourced districts were selected because of their similar immunisation coverage and sociodemographic characteristics to the outsourced districts, based on the Pakistan Social Living Standards Measurement (PSLM) Survey 2019–2020 (16). The 4 districts are located in the northern part of Sindh Province with populations ranging from 1.7 to 2.5 million and almost two-thirds living in rural areas.

The sample size was estimated with the WHO sample size calculator for comparing immunisation coverage (17). At an expected 64.7% coverage of full immunisation in non-outsourced and 79.7% in outsourced districts (15% difference), confidence level of 95%, power of 80%, design effect of 2, intra-class correlation of 0.167, and non-response inflation of 10%, the sample size was 761 children in each of the 2 groups (overall = 1522). Therefore, data was collected on 1600 children, including 400 from each district.

Forty clusters (union councils), with 10 children in each cluster, were selected from each district. Within each cluster, 2 villages were randomly selected (one within 3 km and another one more than 3 km away from the vaccination facility). Households in each village were marked, and the first household was selected randomly by spinning the bottle from a central point. Depending on the total number of households in the village, a kth number was calculated by dividing the total number of households by 5. In case there was no child within the inclusion criteria, the next household was approached. Parents of one child in the age range of 12–24 months were interviewed. Children who had migrated from other districts or were registered for immunisation at another district were excluded.

We used the adapted WHO standard questionnaire for EPI cluster survey to assess vaccination coverage (18). The questionnaire was translated into the local language, Sindhi, back-translated, and pretested on a sub-sample of 20 households. It was then revised for better understanding based on their feedback. It contained questions on age, gender, area of residence, household monthly income, education level of parents, distance from immunisation centre, and immunisation status. Immunisation status was categorised as non-vaccinated (if the child did not take any vaccine included in the immunisation programme from birth to 9 months), partially vaccinated (if the child missed at least one dose of any vaccine included in the immunisation programme from birth to 9 months), and fully vaccinated (if the child did not miss any dose of vaccine included in immunisation programme from birth to 9 months). If a child was not immunised or partially immunised, we asked the reason for not being immunised.

The questionnaire was administered by trained data collectors with at least a bachelor's degree. A list of union councils and households was obtained from the EPI micro plan and each survey team (male and female) was assigned randomly to selected villages. The data collectors engaged the local community facilitators before approaching any household in the community. After obtaining informed consent, interviews were conducted with the parents or caregivers of the child present at the time. The child's immunisation information was verified through the immunisation card. If a parent or caregiver was unable to provide an immunisation card, the data collector moved to the next household that had an eligible child. Where there were more than one eligible child in a household, the youngest eligible child was selected to minimise memory bias. Data collection was supervised daily by the principal investigator, who checked the forms for completeness and accuracy.

Ethics approval

The study was approved by the Institutional Review Board of Dow University of Health Sciences (IRB No. DUHS/IRB/2024/198).

Statistical analysis

The data was analysed using STATA version 17. Descriptive statistics of all variables were presented as means, standard deviations and frequency or percentage. The chi-square test and Man-Whitney U test was used to compare the sociodemographic characteristics and vaccination status of participants in the outsourced and non-outsourced districts. Cochrane Q test was used to test the significance of immunisation uptake dropout from birth to 9 months in the 2 groups. Difference in difference method using a regression model was conducted to estimate the difference in immunisation rates at 9 months between the 2 groups.

The association of various factors (contracting status, age, gender, distance from immunisation centre, household monthly income, and parents education level) with the likelihood of being fully immunised was determined through multivariable logistic regression

analysis in which categories of the non-immunised and partially immunised were combined and taken as reference.

Odds ratios and their 95% confidence intervals were estimated and the standard error was adjusted for clustering effect of union councils in the final model. $P < 0.05$ was considered significant for all statistical analyses.

Results

The mean age ($P = 0.020$) and monthly household income ($P < 0.001$) of the enrolled participants was significantly higher in non-outsourced districts (Table 1) than the outsourced. No significant difference was observed in the gender, education of parents and place of birth between the 2 groups.

Full vaccination coverage was slightly higher in outsourced (78.8%) than non-outsourced (75.8%) districts but was statistically insignificant ($P = 0.067$) (Table 2). Among the non-outsourced districts, full vaccination coverage was 78.5% in Larkana and 73.0% in Sukkur while in the outsourced, it was 83.5% in Khairpur and 74.0% in Dadu.

Dropout from BCG uptake at birth to measles-1 at 9 months was significant ($P < 0.001$) in non-outsourced (-19.7%) and outsourced (-15.0%) districts (Table 3), and a significant positive difference of 4.7% ($P = 0.036$) was observed in vaccination rates at 9 months in the outsourced districts.

The main reasons for non-vaccination and partial vaccination in all the districts were: the vaccine caused

Table 1 Sociodemographic characteristics of study participants, Sindh Province, Pakistan (N = 1600)

Characteristic	Outsourced (*n* = 800) % (number)	Non-outsourced (*n* = 800) % (number)	*P*
Age of child (months)	Mean = 16.98, SD = 3.35	Mean = 17.43 SD = 3.68	0.020
12–18	63.4 (507)	61.1 (489)	
19–24	36.6 (293)	38.9 (311)	0.353
Gender of child			
Male	54.6 (437)	52.9 (423)	
Female	45.4 (363)	45.4 (377)	0.483
Place of birth of child			
Home	23.6 (189)	20.6 (165)	
Private facility	15.9 (127)	13.9 (111)	
Government facility	60.5 (484)	65.5 (524)	0.117
Years of mother's education			
No formal education	62.0 (496)	62.4 (499)	
1–5	28.8 (230)	29.1 (233)	
6–10	5.1 (41)	4.8 (38)	
≥11	4.1 (33)	3.8 (30)	0.963
Year of father's education			
No formal education	42.6 (341)	38.9 (311)	
1–5	29.1 (233)	29.2 (234)	
6–10	13.2 (106)	16.4 (131)	
≥11	15.0 (120)	15.5 (124)	0.252
Household monthly income (PKR)	Mean = 26138.12, SD = 9189.9	Mean = 28092.50, SD = 8197.47	<0.001
Lower	41.8 (334)	24.9 (199)	
Middle	34.0 (272)	40.2 (322)	
Upper	24.2 (194)	34.9 (299)	<0.001
Distance from facility (km)			
≤3	48.9 (391)	51.1 (409)	
>3	51.1 (409)	48.9 (391)	0.368

Man-Whitney U test applied for comparing average age and household monthly income. Chi-square test applied to compare proportions.

Table 2 Comparison of vaccination status in the outsourced and non-outsourced districts, Sindh Province, Pakistan (N = 1600)

Group/district	Non-vaccinated % (*n*)	Partially vaccinated % (*n*)	Fully vaccinated % (*n*)	*P*
Group				
Non-outsourced (*n* = 800)	3.1 (25)	21.1 (169)	75.8 (606)	
Outsourced (*n* = 800)	4.2 (34)	17.0 (136)	78.8 (630)	0.067
District				
Sukkur (non-outsourced) (*n* = 400)	3.8 (15)	23.2 (93)	73.0 (292)	
Larkana (non-outsourced) (*n* = 400)	2.5 (10)	19.0 (76)	78.5 (314)	
Khairpur (outsourced) (*n* = 400)	2.0 (8)	14.5 (58)	83.5 (334)	<0.001
Dadu (outsourced) (*n* = 400)	6.5 (26)	19.5 (78)	74.0 (296)	

Chi-square test applied to compare proportions

Table 3 Vaccination status of enrolled children at birth, 6th week, 10th week, 14th week and 9 months in the outsourced and non-outsourced districts, Sindh Province, Pakistan (N = 1600)

Group	BCG at birth (%)	Penta 1 at 6 weeks (%)	Penta 2 at 10 weeks (%)	Penta 3 at 14 weeks (%)	Measles 1 at 9 months (%)	Dropout (95% CI) BCG-measles	P
Non-outsourced (*n* = 800)	96.6	93.8	86.6	81.4	76.9	-19.7	<0.001
Outsourced (*n* = 800)	95.5	92.9	89.0	83.3	80.5	-15.0	<0.001
DiD estimate						4.7 (3.0-9.1)	0.036

Cochrane Q test applied to test the difference in uptake of vaccines from birth to 9 months. Difference in difference method using a regression model used to estimate the difference in dropout between the 2 groups.

fever or pain to child, the vaccine was ineffective, the vaccines are harmful, and lack of knowledge regarding the importance of vaccination (Figure 1).

After adjustment with different factors and clustering effects in the multivariable model, outsourced districts had a significantly higher likelihood of full vaccination up to 9 months (adjusted OR = 1.35, 95% CI = 1.00–1.83) (Table 4). With reference to home birth, giving birth at private (adjusted OR = 5.47, 95% CI = 3.22–9.28) and public (adjusted OR = 2.72, 95% CI = 2.06–3.58) health facility showed a significant positive relationship with the outcome. Distance of > 3 km to the vaccination facility was significantly negatively associated with the outcome

(adjusted OR = 0.61, 95% CI = 0.48–0.77). Fathers with ≥11 years education showed significant positive odds with the outcome. Age, gender, mother's education, and household monthly income had no significant relationship with being fully vaccinated.

Discussion

The outsourced districts showed a marginally significant positive association with full vaccination after adjustment with different socio-demographic factors and clustering effects. Although literature on the effect of outsourcing on immunisation coverage and volume
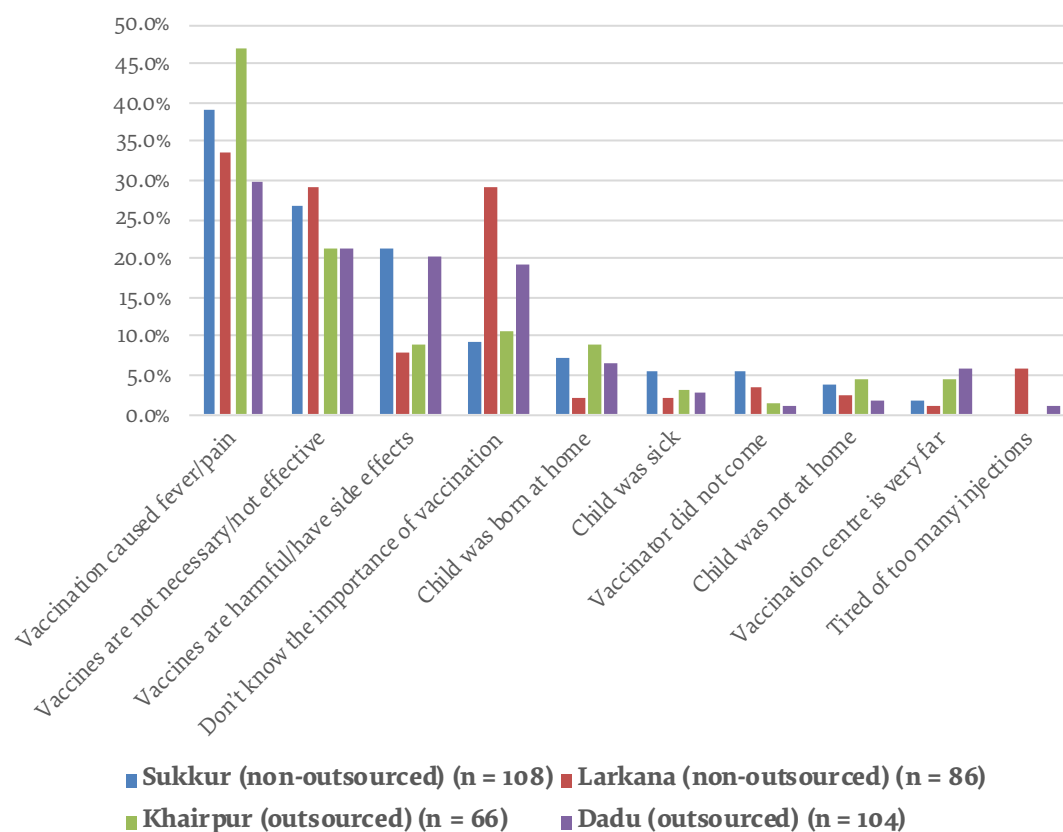
Figure 1 Reasons for non-vaccination and partial vaccination, Sindh Province, Pakistan (n = 364)

Sukkur (non-outsourced) (n = 108)   Larkana (non-outsourced) (n = 86)
Khairpur (outsourced) (n = 66)   Dadu (outsourced) (n = 104)

Table 4 Relationship between various factors with likelihood of the child being fully vaccinated up to 9 months, Sindh Province, Pakistan (n = 1600)

Factor	Unadjusted OR (95% CI)	Adjusted OR (95% CI)	P
Group			
Non-outsourced (n = 800)	1.00	1.00	
Outsourced (n = 800)	1.18 (0.93–1.49)	1.35 (1.00–1.83)	0.044
Age of the child			
12–18 (n = 996)	1.00	1.00	
19–24 (n = 604)	0.96 (0.75–1.22)	0.95 (0.72–1.25)	0.727
Gender of child			
Male (n = 860)	1.00	1.00	
Female (n = 740)	1.19 (0.94–1.51)	1.19 (0.92–1.54)	0.168
Place of birth of child			
Home (n = 354)	1.00	1.00	
Private facility (n = 238)	8.57 (5.12–14.33)	5.47 (3.22–9.28)	<0.001
Government facility (n = 1008)	3.12 (2.40–4.05)	2.72 (2.06–3.58)	<0.001
Years of mother's education			
No formal education (n = 995)	1.00	1.00	
1–5 (n = 463)	1.92 (1.45–2.54)	1.19 (0.84–1.68)	0.311
6–10 (n = 79)	4.67 (2.00–10.86)	1.92 (0.74–4.92)	0.174
≥11 (n = 63)	4.45 (1.76–11.21)	1.21 (0.37–3.69)	0.736
Year of father's education			
No formal education (n = 652)	1.00	1.00	
1–5 (n = 467)	1.47 (1.12–1.93)	1.31 (0.96–1.71)	0.085
6–10 (n = 237)	2.19 (1.50–3.22)	1.28 (0.78–2.08)	0.318
≥11 (n = 244)	4.36 (2.73–6.98)	2.17 (1.21–3.89)	0.009
Household monthly income			
Lower (n = 533)	1.00	1.00	
Middle (n = 594)	1.44 (1.10–1.87)	1.26 (0.93–1.70)	0.126
Upper (n = 473)	2.92 (2.11–4.04)	1.46 (0.97–2.18)	0.065
Distance from facility (km)			
≤3 (n = 800)	1.00	1.00	
>3 (n = 800)	0.61 (0.48–0.77)	0.61 (0.46–0.80)	<0.001

is scarce, previous studies suggest a significant positive effect (*20–23*).

The marginal effect observed in this study may be due to variations in the performance of the 2 outsourced districts. The effect was more pronounced in Khairpur where coverage was 83.5%. Coverage in the other outsourced district of Dadu (74.0%) was similar to the non-outsourced districts (Larkana 78.5%, Sukkur 73.0%). Comparing these results with the 2017 Pakistan social living standards measurement and the 2020 third party verification immunisation survey report (TPVICS), there was a remarkable improvement in Khairpur (PSLM 44%, TPVICS 75.5%), Larkana (PSLM 71%, TPVICS 56.8%) and Sukkur (PSLM 39%, TPVICS 46.1%) districts, while coverage remained almost the same in Dadu District (PSLM 73%, TPVICS 70.3%) (*16,19*). The overall improvement in these 3 districts may be attributed to improvements in vaccines supplies and cold chain management, including solarisation of facilities and purchase of ice-lined refrigerators, which have reduced wastage throughout the province in recent years.

Reasons for non-vaccination or partial vaccination were mainly related to misconceptions and reactions to pain or fever developed by the child after vaccination, while limited vaccines supplies was less common. Higher coverage in the outsourced district of Khairpur could be a result of better training and monitoring of vaccine managers and vaccinators, translating into improved

efforts to reduce dropouts. This can be further explained by the low dropout of children (13%) in the district from first BCG dose to MR1 dose at 9 months, compared to 17.6% and 21% in the non-outsourced districts. The static result in the outsourced district of Dadu may be due to the 2022 floods, which caused damage to health infrastructure and displacement of people.

Father's higher education status and baby's birth in a health facility showed significant positive association with full vaccination, while distance from vaccination facility was negatively associated. These findings are consistent with previous report from other developing countries (*24-26*).

Age, gender, maternal education and household monthly income did not show any significant association. Our findings on age and gender are consistent with previous literature (*27-29*), while maternal education and household monthly income have been important positive predictors of vaccination in previous studies (*28,30-32*), except a few rural settings where insignificant association were reported (*33,34*). A possible explanation for the lack of association with mother's education in this study may be because the study was conducted in rural areas where fewer mothers have more than primary education. The lack of association with household monthly income may be attributed to the poor rural setting where income variations are low.

Study limitations

The strength of this study lies in the fact that it covered almost all the villages of the union councils in the selected districts, except a few villages that were not covered because of high security risk. This may have overestimated the actual coverage. Children's vaccination status was verified through the vaccination cards, therefore, any discrepancies in the data in those cards may have affected our results. The sociodemographic data shared by the participants may be subject to response bias. Building multiple models based on multinomial regression for different levels of partial vaccination was beyond the scope of this study. A more pronounced effect of flooding in one of the outsourced districts (Dadu) may have limited the effectiveness of outsourcing.

Conclusion

Vaccination coverage was found to be better in only one of the outsourced districts, indicating a partial improvement due to outsourcing. Further research is needed to explore the reasons for the lack of improvement in the low performing outsourced district, as well as the cost-effectiveness of outsourcing the vaccination programme.

L'externalisation des services permet-elle d'améliorer la couverture vaccinale chez les enfants de 12 à 24 mois au Pakistan ?

Résumé

Contexte : En 2017, le Pakistan a confié à une organisation non gouvernementale la gestion de son programme de vaccination dans deux districts de la province du Sindh.

Objectif : Déterminer l'impact de l'externalisation du programme de vaccination sur la couverture vaccinale dans deux districts de la province du Sindh (Pakistan).

Méthodes : Entre août et octobre 2024, nous avons interrogé les parents ou les aidants de 1600 enfants âgés de 12 à 24 mois dans quatre districts de la province du Sindh – deux ayant un programme externalisé et deux un programme non externalisé – afin de recueillir des données sociodémographiques et des informations sur la vaccination. Nous avons analysé les données à l'aide du logiciel STATA version 17, en utilisant le test du chi-carré et le test U de Mann-Whitney pour comparer les caractéristiques des participants et leur statut vaccinal, ainsi qu'un modèle de régression pour estimer la différence des taux de vaccination entre les deux groupes à l'âge de neuf mois.

Résultats : La couverture vaccinale complète était légèrement plus élevée dans les districts disposant d'un programme externalisé (78,8 %) que dans ceux ayant un programme non externalisé (75,8 %), mais il n'y avait aucune différence statistiquement significative (p = 0,067). À l'âge de neuf mois, une différence significative (p = 0,036) a été observée dans les taux de vaccination : une diminution de 15,0 % de l'adhésion au calendrier vaccinal dans les districts bénéficiant d'un programme externalisé, contre 19,7 % dans les districts ne disposant pas de ce type de programme.

Conclusion : Une amélioration partielle de la couverture vaccinale du fait de l'externalisation a été observée ; un seul des districts disposant d'un programme externalisé a enregistré une meilleure couverture. Des recherches supplémentaires sont nécessaires pour comprendre les raisons des légères différences de couverture vaccinale entre les districts où le programme est externalisé et ceux où il ne l'est pas, ainsi que le rapport coût-efficacité de l'externalisation.

هل يمكن أن تُحسِّن التعاقدات الخارجية نسبة التغطية بالتحصين بين الأطفال الذين تتراوح أعمارهم بين عام وعامين في باكستان؟

شيراز شيخ، كاشف شفيق

الخلاصة

الخلفية: في عام 2017، أسندت باكستان إلى منظمة غير حكومية إدارة برنامج التطعيم في مقاطعتين من مقاطعات إقليم السند.

الأهداف: هدفت هذه الدراسة إلى تحديد أثر التعاقدات الخارجية على تحسين التغطية ببرنامج التطعيم في مقاطعتين من مقاطعات إقليم السند، في باكستان.

طرق البحث: في المدة بين أغسطس/ آب وأكتوبر/ تشرين الأول 2024، أجرينا مقابلات مع أولياء أمور أو مقدمي رعاية لأطفال بلغ عددهم 1600 طفل تراوحت أعمارهم بين 12 و24 شهرًا في أربع مقاطعات (مقاطعتين متعاقدتين مع جهات خارجية واثنتين غير متعاقدتين مع جهات خارجية) في إقليم السند، لجمع البيانات الاجتماعية السكانية وبيانات التحصين. وحللنا البيانات بالإصدار السابع عشر من برنامج STATA، باستخدام اختبار مربع كاي واختبار مان–ويتني لمقارنة خصائص المشاركين وحالة التمنيع، ونموذج الانحدار لتقدير الفرق في معدلات التحصين بين المجموعتين عند سن 9 أشهر.

النتائج: كانت نسبة التغطية بالتحصين الكامل أعلى قليلاً في المقاطعات التي تتعاقد مع جهات خارجية (78.8%) منها في المقاطعات التي لا تتعاقد مع جهات خارجية (75.8%)، ولكن لم يكن هناك فرق ذو دلالة إحصائية (قيمة الاحتمال= 0.067). وعند سن 9 أشهر، لوحظ فرق كبير (قيمة الاحتمال= 0.036) في معدلات التحصين: وانخفض الامتثال بنسبة 15.0% في المقاطعات التي تتعاقد مع جهات خارجية، مقارنة بنسبة 19.7% في المقاطعات التي لا تتعاقد مع جهات خارجية.

الاستنتاجات: هناك حاجة إلى إجراء المزيد من البحوث لفهم أسباب الاختلافات الطفيفة في التغطية بالتحصين بين المقاطعات التي تتعاقد خارجيًّا وتلك التي لا تتعاقد خارجيًّا، وفعالية تكلفة التعاقدات الخارجية.

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