

High-end physician migration from India

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Objective To examine the relation between the quality of physicians and migration among alumni of All India Institute of Medical Sciences (AIIMS), New Delhi, India over the period 1989–2000.

Methods In a retrospective cohort study, data on graduates of AIIMS were collected from entrance exam qualifier lists, the AIIMS alumni directory, convocation records, the American Medical Association and informal alumni networks. The data were analysed by use of 2x2 contingency tables and logistic regression models.

Findings Nearly 54% of AIIMS graduates during 1989–2000 now reside outside India. Students admitted under the general category are twice as likely to reside abroad (95% confidence interval: 1.53–2.99) as students admitted under the affirmative-action category. Recipients of multiple academic awards were 35% more likely to emigrate than non-recipients of awards (95% confidence interval: 1.04–1.76). Multivariate analyses do not change these basic conclusions.

Conclusion Graduates from higher quality institutions account for a disproportionately large share of emigrating physicians. Even within high-end institutions, such as AIIMS, better physicians are more likely to emigrate. Interventions should focus on the highly trained individuals in the top institutions that contribute disproportionately to the loss of human resources for health. Our findings suggest that affirmative-action programmes may have an unintended benefit in that they may help retain a subset of such personnel.

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Une traduction en français de ce résumé figure à la fin de l'article. Al final del artículo se facilita una traducción al español. الترجمة العربية لهذه الخلاصة في نهاية النص الكامل لهذه المقالة.

Introduction

The migration of skilled professionals from developing to developed countries has long attracted attention from researchers and policy-makers.^{1,2} The literature on the subject encompasses a vast area, including assessments of the implications of skilled labour migration for equity and efficiency in economic outcomes, examinations of the links between growth in international trade and trends in international migration, and optimum strategies to address losses to sending countries due to emigration.^{3,4} Migration of medical professionals has attracted concern in light of their impact on health policy goals.^{5–7} In a seminal 2004 report, the Joint Learning Initiative (JLI) devoted an entire chapter to international flows of doctors and nurses, and their potentially harmful effects on the less well off in developing countries. As the report points out, “while the absolute numbers may not be very large, the outflows can be ‘fatal’ for disadvantaged people in source countries”.⁸ *The world health report 2006*:

working together for health, also reached a similar conclusion.⁹

Considerable information exists on the “push and pull” factors operating in different countries and the number of doctors migrating from India to other countries, particularly towards Europe and the United States of America.^{10,11} However, much less is known about the quality of medical professionals who migrate, compared with those who remain. The issue of the quality of professionals emigrating is important both for destination countries where these physicians eventually practice,^{12,13} but also for source countries. While the number of physicians emigrating is one dimension of the human capital involved in migration,¹⁴ simple head counts are insufficient if the individuals who emigrate are academic leaders or better-skilled physicians than those who remain. This set may include institution builders who are trainers, professors in medical schools, or physician leaders who influence positively, by example or collaboration, the quality of health services provided by others who remain in

the country. By adversely affecting the training, leadership, and possibly even managerial capacity, the emigration of high-quality medical professionals adversely affects the health system in a way that cannot be captured in statistics on the numbers of migrants among medical professionals.

Among developing countries, India is the biggest exporter of trained physicians with India-trained physicians accounting for about 4.9% of American physicians and 10.9% of British physicians.¹⁰ We assess the relation between physician quality and emigration with information on graduates of the All India Institute of Medical Sciences (AIIMS), India’s top ranked medical school, over the period 1989–2000. Because there are no readily available objective measures for assessing the long-term academic or leadership potential of newly trained physicians, we used several indicators of quality. First, we compared overall emigration rates among AIIMS graduates to those for medical schools in India as a whole, on the assumption that acceptance into an

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exclusive institution on the basis of their performance in medical admission tests is an indicator of both greater academic preparedness for medical school and overall ability.¹⁵ Related to this point, we also inquired whether students admitted under an affirmative-action quota, whose scores in the AIIMS entrance examination were generally lower than those of other entrants, have a lower likelihood of emigrating. Finally, we considered whether individuals who received academic awards at the time of graduation from AIIMS were more likely to emigrate.

Methods

AIIMS admits students through an objective exam, in which 45 students from a typical pool of 30 000 applicants (0.15%) are selected. We assembled a cohort of AIIMS graduates who entered AIIMS from 1989 through 2000, and extracted information on their state of residence at the time of entry and whether admission was made under the affirmative-action programme from entrance-exam notifications and national newspapers where exam results are published.

We identified the country of residence, gender and year of graduation for AIIMS graduates from published¹⁶ and online alumni directories,¹⁷ with follow-up contacts with individual graduates and their classmates for whom information was not accessible in these directories. We ensured consistency of this information with physician registration data in the United States of America, where many AIIMS graduates migrate. With the exception of two inconsistencies (which we addressed), our information on country of residence, gender and year of graduation matched exactly with information on residence available from the American Medical Association data set. However, the American Medical Association data set does not include information on physicians who are currently enrolled in graduate programmes (e.g. masters and doctoral courses) and research positions, for instance, and constitute an important avenue for migration of new graduates. Moreover, there is a lag of 1–2 years in updating American Medical Association data sets even after physicians join residency programmes. Thus, we believe that our data set is more up to date than the American Medical Association database. Information on academic awards received by

AIIMS graduates for the years 1989–2000 was collected from convocation booklets (graduation records) published annually by the institution.

At least 11 of the 45 students are admitted to AIIMS each year under a distinct admission track for two population subgroups: scheduled castes and scheduled tribes that are considered particularly deprived under the Indian Constitution. Some 800 castes (of a total of 3000 in India) are categorized as belonging to scheduled castes, with another 250 groups designated as scheduled tribes.¹⁸ The defining criterion for these groups includes economic and social deprivation, more fully described in an Indian government commission report.¹⁹ Students from these groups whose scores exceed this minimum become part of the general pool, irrespective of their social background. While we were unable to obtain admission scores for the entire group 1989–2000, we were able to do so for a group of 394 new students from 1998 through 2006. Our data show that the affirmative-action group had a mean score of 56.5 (standard deviation = 4.5), whereas the general group (excluding affirmative-action candidates) had a mean score of 69.4 (standard deviation = 3.8), out of a maximum of 100. Thus, we used admission under affirmative-action category as a proxy for lower academic preparedness and ultimately lower quality.

The use of entrance examination marks, or admission under the quota, as an indicator of quality is problematic as entrance examination scores might not truly reflect ability among socially disadvantaged people and the decision to emigrate might be based on social networks and economic ability that can vary across different admission categories. We also used the receipt of academic awards as a distinct proxy for quality, and compared emigration rates among award recipients and non-recipients.

In general, because physicians practicing at AIIMS and other public institutions are shielded from medical malpractice suits by virtue of working in the public sector,¹⁹ malpractice suits are probably not a good indicator of quality, since some AIIMS graduates end up at public institutions. Furthermore, the onerous nature of the Indian legal system discourages such suits.²⁰ The

use of clinical-vignette-based standardized examination, such as United States Medical Licensing exams, in assessing physicians, even for residency positions, is discouraged. In the absence of available and accepted indicators of physician quality, particularly of international medical graduates, most of whom emigrate soon after graduation, we believe that academic achievement can be used as an indicator of quality.²¹

We compared emigration rates among groups for alternative indicators of quality, using proportions and multivariate logistic models for assessing the relative likelihood of migrating. Because some individuals might have better access to, desire for, and information about opportunities for migration, confounding might occur. If this propensity to migrate is randomly distributed across individuals, our results will be unaffected. However, if this propensity were positively correlated with academic performance,⁴ it would bias the magnitude of the relationship between emigration and graduate quality upwards. Other elements of heterogeneity (patriotism or closer family ties) may bias the relationship in the opposite direction. We sought to partly address such concerns by using information on the region of origin of AIIMS graduates and their gender in a multivariate regression analysis to potentially control for such biases.

A total of 564 students graduated from AIIMS during 1989–2000. We could not obtain information on either the affirmative-action status or province of origin for 136 graduates. This left us with a sample of 428 individuals. Of this, 21.2% belonged to the affirmative-action category, very close to the proportion admitted under affirmative action (22.5%). We used this sample to assess the proportion of graduates emigrating by gender, region of origin, and affirmative-action category (Table 1) and used multivariate logistic regression to assess the likelihood of emigration (Table 2). The dependent variable in all of the four regression specifications in Table 2 took the value 1 if the individual resided abroad and was 0 otherwise. For explanatory variables in multivariate regressions, we included sex, time since graduation, the square of time since graduation and indicator variables for region of origin in all models. The main difference in the four regression models

used in this paper is the indicator of quality used: an indicator variable indicating whether admission was under the affirmative-action category or not (model 1), the logarithm of entrance exam scores for students for the years they were available (1998–2000; model 2), an indicator variable for any award received (model 3), and indicators, respectively, for exactly one award and for receiving more than one award (model 4).

Because the information we possess is on the current residence of physicians, some individuals in our sample might have returned after a stay abroad, whereas others may have moved both back and forth. If so, the correct interpretation of dependent variable is that it reflects the cumulative probability of net emigration of graduates. In fact, the number of returning migrant doctors from AIIMS appears to be miniscule. For AIIMS graduates during the years 1996–2000, for which we have more detailed information, only one of the emigrating AIIMS graduates returned to India and that was for just 1 year.

Results

Nearly 54% of AIIMS students who graduated during 1989–2000 now reside outside India. Of the total alumni emigrating in this group, 85.4% emigrated to the United States of America with no significant gender differences in the proportion emigrating. This conclusion is in line with our preliminary examination of AIIMS alumni records showing that roughly 730 out of a total of 1440 AIIMS graduates, dating all the way back to the early 1960s, reside abroad, suggesting emigration of at least 51%. Of the 428 students in our sample, 53 received at least one award, with some receiving more than one, amounting to a total of 116 awards. Only one student of 87 (or 1.2%) in the affirmative-action category received an academic award at the time of graduation, compared to 15.2% in the general category, supporting the argument that this category may reflect a lower level of academic skill.

Table 1 presents cumulative emigration rates of AIIMS students graduating during 1989–2000 by gender, admission and award category. Among graduates over this period, we find that students from the general group are nearly two-times more likely to be resid-

Table 1. Demographic, award and emigration information on AIIMS graduates, 1989–2000

Characteristic	Category	Total	Emigrated % (n)	P-value ^a (2-sided)
Gender	Men	350	54.9 (192)	0.436
	Women	78	50.0 (39)	–
Region	1 ^b	101	61.4 (62)	0.090
	2 ^c	30	63.3 (19)	–
	3 ^d	132	46.2 (61)	–
	4 ^e	165	53.9 (89)	–
Affirmative action		87	28.7 (25)	< 0.0001
No awards		375	53.6 (201)	0.096
One award		28	42.9 (12)	–
Two or more awards		25	76.5 (18)	–

^a P-values based on χ^2 test and assess whether the proportion of students migrating differs across groups.

^b Region 1: Punjab, Haryana, Himachal Pradesh, Chandigarh.

^c Region 2: Maharashtra, Andhra Pradesh.

^d Region 3: Bihar, Madhya Pradesh, Uttar Pradesh, Rajasthan.

^e Region 4: Karnataka, Tamil Nadu, Kerala, North Eastern States, Jammu & Kashmir, West Bengal, Delhi.

ing abroad (95% confidence interval: 1.53–2.99, $P < 0.0001$) compared with students from the affirmative-action category. Male graduates of AIIMS were 12% more likely to emigrate than female graduates (95% confidence interval: 0.88–1.43, $P = 0.436$). Individuals who received exactly one academic award were not more likely to migrate than individuals without any awards. By contrast, individuals receiving two awards, or more, were 35% more likely to migrate than non-recipients of any award (95% confidence interval: 1.04–1.76, $P < 0.05$).

Table 2 presents the results of our multivariate regression analysis. The estimates of model 1 show that admission under affirmative action is negatively associated with the likelihood of migration. Because entrance examination marks were also available for 3 years (1998–2000) for a total of 113 people in our sample, we used admission entrance marks as an additional variable in place of admission category (model 2). The results suggest that these two indicators of academic quality are strongly related to the likelihood of migration.

In models 3 and 4, we used the receipt of awards as an indicator of quality. We found that the mere receipt of an award is not related to the likelihood of migration. However, the likelihood of migration of individuals receiving two or more awards is significantly higher than of individuals receiving no awards. These findings change only slightly if we limit our analyses only to individuals

admitted under the general admission category.

Discussion

Ours is the first detailed study on the quality of migrating physicians from India. Our estimates of the “emigration factor” for AIIMS graduates are significantly higher than the 11% estimate reported in the recent study by Fitzhugh Mullan for all graduates of all medical schools in India,¹⁰ suggesting that better students and better institutions account for a disproportionately large share of emigrating physicians. The number of AIIMS graduates who emigrated is comparable to that in the schools of the poorest countries in Africa.^{22,23} These migration rates and the preference for the United States of America as a destination country are comparable to results from a previous study for India.²⁴ Our results highlight the deficiencies of both absolute numbers and emigration factors in quantifying the movement and significance of human capital. In accordance with previous studies, we have shown that elite medical schools contribute disproportionately to the ranks of emigrant physicians.²⁵ Moreover, even within the elite school examined in our study, we have found that the students with the highest academic achievement have the greatest likelihood of migrating. We know of only one previous study on this topic and our results are similar though not directly comparable.²⁶ These results suggest that better

quality of these physicians might be a latent factor influencing the desire for better training and increased access to enhanced technology and equipment that are important reasons for migration.¹¹ Our conclusion is also supported by a recent study indicating that compared with physicians trained in the United States of America, physicians from Lebanon are more likely to be engaged in research and receive board accreditation.²⁷

Our study has various limitations. We collected data retrospectively and therefore do not have complete information on push and pull factors that would have influenced emigration on an individual basis. Moreover, because over 50% of graduates of AIIMS emigrate, factors that influence emigration from this group are likely to operate equally effectively over all the students. We also used data on region of origin of individual graduates and gender in modelling to overcome the lack of information on individual-level confounders, but including these variables did not affect our findings from multivariate regression. Given our data are from only one institution with a small intake of students, extrapolation of these findings to other institutions is difficult. For instance, we are unable to test for the possibility that the historically high emigration rates of AIIMS graduates might well have resulted in strong international ties and created an additional impetus for migration among new AIIMS graduates compared with graduates from other Indian medical institutions. We also could not assess the impact of international scholar exchanges and foreign visiting lecturers in migration. At AIIMS, visiting lecturers do not participate in the direct teaching of medical students. Moreover, most professors at AIIMS are graduates from India and typically spend only a limited time abroad.

The issues outlined in the previous paragraph notwithstanding, our focus on AIIMS simultaneously helps overcome various problems in studying the question under consideration, that of factors driving migration. The reputation of AIIMS and its alumni assists individuals in overcoming differential distribution of pull factors, such as family ties, to developed countries. Moreover, the small class size and closely knit alumni, we believe, has helped our analysis in that we

Table 2. Quality and emigration among AIIMS graduates 1989–2000: logistic regression results

Explanatory variable	Dependent variable: indicator of emigration (standard error of the logistic regression estimates)			
	model 1	model 2	model 3	model 4
<i>N</i>	428	113	428	428
Constant	0.06 (0.35)	-30.80 ^a (10.81)	-0.37 (0.34)	-0.40 (0.35)
Sex (male = 1, 0 otherwise)	0.08 (0.27)	-0.71 (0.53)	0.15 (0.26)	0.16 (0.26)
Time (since graduation)	0.24 ^a (0.11)	-1.91 ^b (1.02)	0.25 ^a (0.11)	0.25 ^a (0.11)
Time squared	-0.02 ^a (0.01)	0.87 ^b (0.48)	-0.02 ^a (0.01)	-0.02 ^a (0.01)
Affirmative action (yes = 1, 0 otherwise)	-1.42 ^a (0.28)	–	–	–
Log (entrance marks)	–	7.47 ^a (2.58)	–	–
Indicator variable (one or more awards)	–	–	0.25 (0.30)	–
Indicator variable 1 (one award)	–	–	–	-0.36 (0.41)
Indicator variable 2 (two awards or more)	–	–	–	0.99 ^a (0.47)
Dummy for region 1 ^c	0.20 (0.27)	0.43 (0.54)	0.35 (0.26)	0.38 (0.26)
Dummy for region 2 ^d	0.76 ^b (0.45)	0.02 (1.58)	0.35 (0.42)	0.43 (0.42)
Dummy for region 3 ^e	-0.25 (0.25)	-0.28 (0.53)	-0.26 (0.24)	-0.24 (0.24)
χ^2	43.21	15.41	14.68	20.03

AIIMS, All India Institute of Medical Sciences.

^a $P < 0.05$; P -values based on logistic regression (Wald test).

^b $P < 0.10$; P -values based on logistic regression (Wald test).

^c Region 1: Punjab, Haryana, Himachal Pradesh, Chandigarh.

^d Region 2: Maharashtra, Andhra Pradesh.

^e Region 3: Bihar, Madhya Pradesh, Uttar Pradesh, Rajasthan.

have been able to assess physician quality and confirm emigration status through multiple channels. For the same reason and also because of high rates of emigration since establishment, we believe that the institutional memory of potential opportunities in other countries, study material and planning needed to emigrate can overcome most individual barriers to emigration.

Our results also suggest a silver lining. Specifically, we found that students who were admitted to AIIMS through the affirmative-action programme have a greater likelihood of staying than those who did not receive this benefit. Irrespective of quality relative to their classmates who migrate, the training received by affirmative-action students at a top institution, such as AIIMS, would

likely translate into a high absolute level of competence at the time of graduation. That these physicians stay in the source country, either because of their social situation or because they continue to receive affirmative-action support at the level of postgraduate (residency) training, indicates possible avenues to slow emigration.

Notwithstanding this, the departure of the very best students is a serious loss of human capital, which is not captured simply in the public subsidies provided for their training or statistics on the proportion of migrating medical professionals. From this standpoint, our analysis suggests the need for mechanisms that help retain the best talent from top public institutions. One approach is to rely on the market

mechanism in the expectation that emerging phenomenon of trade in health services (including medical tourism) would raise economic returns to health professionals, thereby reducing incentives to migrate. Measures that help facilitate such trade, including land subsidies, loans for setting up high-end health facilities or tax breaks for foreign investments in health, would be an obvious policy response from this perspective. However, as pointed out both in the recent *World health report*, as well as the 2004 JLI report, purely financial incentives may not be enough to retain the very best trained individuals. To ensure that these individuals continue

to work in teaching institutions may well need the provision of better opportunities for research, international scholar exchange programmes and so on. Beyond these measures, we hope that *The world health report 2006* continues to draw the attention of public and professionals to issues of physician migration and to promote discussion on retention policies and incentives, their implementation and evaluation. ■

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Competing interests: Manas Kaushik and Abhishek Jaiswal are alumni of All India Institute of Medical Sciences, India. Naseem Shah is Professor of Dental Surgery at All India Institute of Medical Sciences, India.

Résumé

Emigration des médecins indiens de haut niveau

Objectif Etudier la relation entre qualité de la formation en médecine et émigration chez les anciens élèves de l'ensemble des facultés de médecine indiennes, à New Delhi (Inde), sur la période 1989-2000.

Méthodes Dans le cadre d'une étude rétrospective de cohorte, nous avons recueilli des données sur les diplômés de ces facultés à partir des listes d'étudiants ayant réussi les examens d'entrée, des annuaires d'anciens élèves et des registres de convocation, ainsi qu'auprès de l'American Medical Association et de réseaux informels d'anciens élèves. Nous avons analysé ces données à l'aide de tables de contingence 2 x 2 et de modèles de régression logistique.

Résultats Près de 54 % des anciens élèves des facultés de médecine indiennes diplômés entre 1989 et 2000 résident actuellement dans un pays autre que l'Inde. Les étudiants admis dans la catégorie générale avaient une probabilité deux fois plus forte de résider à l'étranger (intervalle de confiance à 95 % :

1,53-2,99) que ceux admis grâce à la discrimination positive (*affirmative action*). Pour les étudiants titulaires de plusieurs distinctions universitaires, la probabilité d'émigrer était supérieure de 35 % à celle des étudiants sans distinction de ce type (intervalle de confiance à 95 % : 1,04-1,76). Ces conclusions de base restent non modifiées à l'issue d'analyses multivariées.

Conclusion Les diplômés d'établissements de haut niveau représentent une part disproportionnée des médecins émigrés. Et même au sein des établissements d'élite, telles que les facultés de médecine, ce sont les meilleurs médecins qui ont la plus forte probabilité d'émigrer. Les interventions doivent viser les individus ayant reçu une formation de haut niveau dans les meilleurs établissements, qui contribuent de manière disproportionnée à la perte de ressources humaines pour le secteur de la santé. Nos résultats laissent à penser que les programmes d' « affirmative action » pourraient avoir un bénéfice non visé au départ, en contribuant à retenir une partie de ce personnel.

Resumen

Migración de médicos de alto nivel de la India

Objetivo Examinar la relación existente entre la calidad de los médicos y su tendencia a migrar entre los antiguos alumnos del All India Institute of Medical Sciences (AIIMS), Nueva Delhi, India, durante el periodo 1989-2000.

Métodos En un estudio retrospectivo de cohortes, se reunieron datos sobre los graduados del AIIMS a partir de las listas de los clasificados en el examen de ingreso, el directorio de antiguos alumnos del AIIMS, registros de convocatorias, la Asociación Médica Estadounidense y redes informales de ex alumnos. Los datos fueron analizados mediante tablas de contingencia (2x2) y modelos de regresión logística.

Resultados Casi un 54 % de los graduados del AIIMS correspondientes al periodo 1989-2000 residen hoy fuera de la India. Los estudiantes admitidos conforme al sistema general tienen el doble de probabilidades de residir en el extranjero (intervalo de confianza del 95%: 1,53-2,99) que los estudiantes

admitidos en virtud de las medidas de discriminación positiva. Los adjudicatarios de varios premios académicos tenían un 35% más de probabilidades de emigrar que los alumnos que no recibieron premios (intervalo de confianza del 95%: 1,04-1,76). Los análisis multifactoriales no alteran esas conclusiones básicas.

Conclusión Los graduados de las instituciones de mayor nivel constituyen una parte desproporcionada de los médicos que emigran. Incluso dentro de las instituciones de alto nivel, como el AIIMS, los mejores médicos son los que más tienden a emigrar. Las intervenciones en este campo deberían centrarse en las personas altamente calificadas de las instituciones más prestigiosas, que nutren desproporcionadamente la masa de recursos humanos perdidos para la salud. Nuestros resultados llevan a pensar que los programas de discriminación positiva pueden tener un efecto beneficioso no previsto, como es la retención de una parte de ese personal.

ملخص

هجرة الأطباء الأكفاء من الهند

هجرة الحاصلين على جوائز أكاديمية متعدّدة يزيد على مثيله بالنسبة لغير الحاصلين على جوائز بنسبة 35% (عند فاصلة ثقة 95%) ويمدى يتراوح من 1.04 – 1.76). ولم تتغير هذه الاستنتاجات الأساسية عند إجراء التحليل المتعدّد المتغيرات.

الاستنتاج: يمثّل خريجو المعاهد العالية الجودة نسبة أكبر في الأطباء المهاجرين إلى خارج الهند. وفي المعاهد الرفيعة المستوى أيضاً، مثل معهد عموم الهند للعلوم الطبية، يزيد احتمال هجرة الأطباء الأعلى كفاءة. وينبغي أن تركز التدخلات اللازمة في هذا الصدد على الأفراد ذوي التدريب العالي ممن يعملون في المؤسسات الرفيعة المستوى التي تسهم إسهاماً كبيراً في استنزاف الموارد البشرية المطلوبة للصحة. وتشير نتائج الدراسة إلى أن برامج الإجراءات الإيجابية قد تفيد عن غير قصد، بالمساعدة على بقاء مجموعة فرعية من هؤلاء العاملين الأكفاء.

الغرض: استهدفت هذه الدراسة استطلاع العلاقة بين مستوى كفاءة الأطباء ونزوحهم إلى الهجرة، وذلك بين خريجي معهد عموم الهند للعلوم الطبية، في نيودلهي، بالهند، خلال الفترة 1989 – 2000.

الطريقة: في إطار دراسة أترابية استعدادية، تم جمع بيانات عن خريجي المعهد من قوائم دخول اختبار التأهيل، ودليل خريجي المعهد، وسجلات الدعوات، والجمعية الطبية الأمريكية، وشبكات الخريجين غير الرسمية. وتم تحليل البيانات باستخدام جداول الطوارئ 2×2 ونماذج التحوّل اللوجستي. **الموجودات:** تبين أن حوالي 54% من خريجي المعهد في الفترة 1989 – 2000 يقيمون حالياً خارج الهند. كما تبين أن احتمال إقامة الطلاب، الذين التحقوا بالمعهد تحت الفئة العامة، خارج الهند (عند فاصلة ثقة 95%: ومدى يتراوح من 1.53 – 2.99) يزيد بمقدار الضعف على مثيله بالنسبة للطلاب الذين التحقوا بالمعهد تحت فئة الإجراءات الإيجابية. وكان احتمال

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