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Capacity constraints to the adoption of new interventions: consultation time and the Integrated Management of Childhood Illness in Brazil

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Information on how health workers spend their time can help programme managers determine whether it is possible to add new services or activities to their schedules and at what cost. One set of interventions with the potential to reduce under-five mortality is training of facility-based health workers according to the guidelines for Integrated Management of Childhood Illness (IMCI), along with improvements to supervision, procurement and information systems that are part of the IMCI strategy. Although it has been shown that IMCI is associated with improved quality of care, it is important to determine if it also requires additional consultation time. To investigate the amount of time required to provide clinical care to children under 5 years based on IMCI compared with routine care, a time and motion study was conducted in Northeast Brazil.

IMCI-trained providers spent 1 minute and 26 seconds longer per consultation with under-fives than untrained providers, holding confounding factors constant at the mean levels observed in the sample. The difference was greater when patient load was low, and decreased as the number of patients a provider saw per day increased. This has three implications. First, the ability of the system to absorb new technologies depends on current capacity utilization. Secondly, the cost of treating a child also depends on the level of capacity utilization, at least in terms of provider time. Thirdly, where patient loads are high it is important to determine if the quality of care required for IMCI can be maintained.

Key words: IMCI, time and motion, capacity, provider productivity, under-five children, Brazil

Introduction

The decision to provide a new intervention, or to modify an old one, poses important questions regarding the resources required, one of which is staff time. At the margin, if health workers are currently fully occupied, it will not be possible to incorporate new activities that require additional time inputs unless new staff are employed or existing activities are eliminated or reduced. Information on how health workers currently spend their time can help programme managers determine whether it is possible to add new services within existing capacity constraints on health worker time.

The World Health Organization (WHO) has estimated that almost 50% of global childhood deaths are due to pneumonia, diarrhoea, measles or malaria, in combination with malnutrition, all of which are preventable or treatable (WHO 1999). One of the interventions that has been shown to improve the quality of child care and has the potential to reduce under-five mortality is the Integrated Management of Childhood Illness (IMCI) (Black et al. 2003; Amaral et al. 2004; Armstrong Schellenberg et al. 2004; Gilroy et al. 2004; Gouws et al. 2004). The strategy includes three components: improving case management skills of health workers, improving health system support, and improving family and community practices (Gove 1997; Lambrechts et al. 1999).

The first and most developed component of the strategy focuses on improving the skills of health workers through training and reinforcement of correct assessment and management of sick children. Training is based on a set of locally adapted algorithms that guide the health worker through a process of assessing signs and symptoms, classifying the illness, providing appropriate treatment and counselling the child's caregiver about how to administer medicines, provide appropriate home care, and the conditions under which the child should be brought back to the facility. The training emphasizes supervised clinical practice and recommends that each participant receive a follow-up visit from their trainer within 4 to 6 weeks after the initial training to reinforce their new skills (Tulloch 1999).

IMCI started to be introduced in Brazil in 1996 and is moving ahead in several states, particularly in the northeast and northern regions that exhibit the country's poorest socioeconomic and health indicators

(Victora et al. 2003). The strategy adopted by Brazil focused on care at the level of the primary health facility, and no community component specific to IMCI has yet been implemented (Cunha et al. 2001).

At the time IMCI was developed, it was expected to have a positive impact on health outcomes (Gove 1997), but it was also expected to be more costly than routine care, partly because it involves more clinical tasks which would take more time for a provider to deliver (Khan et al. 2000). To investigate the amount of time required to provide clinical care to under-fives based on IMCI in a setting where it has been incorporated into primary health care facilities, as opposed to a trial setting, a time and motion study was conducted in Northeast Brazil, one of five sites participating in the Multi-Country Evaluation of the Effectiveness, Cost and Impact of IMCI (MCE). (See the website [http://www.who.int/imci-mce/] for more details on IMCI and the MCE.) In order to isolate the effect of IMCI from other causal factors, the study also sought to identify other determinants of variations in consultation time across providers.

IMCI in Brazil has been implemented in the context of a Family Health Program (FHP), supported by the World Bank and the Ministry of Health (MoH). The FHP teams are based in first-level government facilities and include a family physician, a registered nurse, two health auxiliaries, and 4–6 community health workers (CHW). IMCI training in Brazil is provided over a shorter period than the recommended 11 days; on average 6 to 8 days depending on practices adopted in different states. Supervision also varied widely by state, both in terms of frequency and content. For more information about IMCI implementation in Brazil see Amaral et al. (2004).

In this paper we report the results of the time and motion study conducted early in 2003. The main objectives were to identify the length of time spent by providers in consultations with under-fives, to isolate the effect of IMCI training on the length of consultations from the impact of other possible determinants, and to determine if any additional time that IMCI providers devoted to under-fives was related to constraints on the amount of time they had available. Other types of capacity constraints, such as the availability of consulting rooms or equipment, were not explored.

Methods

Methods of the time and motion study

Two methods have been used in time and motion studies in health services research: continuous observation (CO), and work sampling (WS) (Finkler et al. 1993). In CO, an observer measures, on a continuous basis, the time consumed by the observed person in carrying out the different activities of the day. This method requires a constant physical presence of the observer with the person being observed. In the WS method, one or more health workers can be observed at a time. The observer records what each person is doing at a certain point in time either at fixed intervals – perhaps every 5 or 10 minutes – or on a random basis. Typically, an inference is made about the portion of overall work time spent on an activity, based on the percentage of observations that relate to that activity. The observer does not need to follow the member of personnel but can be located at a presumably unobtrusive observation point (Wirth et al. 1977).

We used the CO method as it has the advantage of providing an exact estimate of the time spent on each patient encounter, which is the main purpose of this analysis. In addition, the WS method is more appropriate when health workers are in a circumscribed area such as a hospital ward setting (Finkler et al. 1993), whereas in the primary health facilities we visited, there were no obvious places where an observer could have good visual access to most of the health workers at a particular point in time.

One of the main limitations of time and motion studies is the bias introduced via the Hawthorne effect, where observed health workers, being conscious of the fact they are being observed, may change their usual working patterns. This is an inevitable consequence of any time and motion study, perhaps more in the CO method due to the direct observation (Finkler et al. 1993). However, this does not change the fact that time and motion studies are considered to be the most accurate method of measuring staff time compared with the alternatives of personnel interviews, self-administered time sheets and patient flow analysis methods (Bratt et al. 1999). In addition, it can be argued that busy health workers will not be able to change their normal practice patterns for a long period of time, so after the initial observation period they soon return to their normal working patterns. To allow for a possible short-term Hawthorne effect, in the analysis we tested whether the results from the first day of observation differed significantly from those of subsequent days.

Selection of the study facilities and providers

The larger evaluation of IMCI in Brazil (i.e. the MCE) has a mixed retrospective-prospective design, since IMCI was already well implemented in many municipalities at the time the study was designed. Four states in Northeast Brazil – Bahia, Ceará, Paraíba and Pernambuco – were included based on the fact that IMCI implementation was reported to be strong in selected municipalities in those states. Health workers would, therefore, be more likely to have developed long-term practice patterns based on IMCI. The initial IMCI training had lasted 8 days in Bahia and Pernambuco and 6 days in the two other states. For more detail on sampling methods and the rationale see Amaral et al. (2004).

The time and motion study was performed in only three of the four states included in the MCE: Ceará, Paraíba and Pernambuco. Preliminary information from Bahia

suggested that IMCI had not yet been implemented widely enough to warrant the comparison. Data were collected from a sub-sample of facilities included in the Health Facility Survey (HFS) conducted in 2002 for the evaluation of IMCI. The sample size was determined using the mean and standard deviation estimates of consultation times for IMCI- and non-IMCI-trained providers from the MCE study in Tanzania, the only other site which had undertaken such a study, with an alpha of 5% and acceptable error of 2 minutes. Data were collected from a total of 32 facilities, of which half were practising IMCI. In each state, facilities were selected at random from those included in the HFS, stratified by the availability or not of an IMCI-trained provider. At the time of data collection, the observer selected one provider at random from those available at the first day of observation and who reportedly examined under-five children. Where the selected provider was absent on one of the subsequent days of observation, the observer was required to randomly select another provider, who would then be observed for the remaining days of observation.

Health facilities in Northeast Brazil have two modes of service delivery: *integrated*, where the health worker offers all types of health services every day of the working week; and *vertical*, where a different kind of health service is offered each day – for example, prenatal care on Monday, sick children on Tuesday; etc. Therefore, two methods of observation were used, one for vertical and another for integrated-service facilities.

In integrated-service facilities, data were collected for two consecutive days, selected at random. This was to ensure that some days where there might be high levels of utilization were included, and some where there could be low levels. The sample of integrated-service facilities included 16 facilities (8 IMCI and 8 comparison) with a total of 32 observation days.

In vertical-service facilities, data were collected for one working week (5 days) in each of the sampled facilities. Facilities were selected at random, and the order of data collection weeks was selected on the basis of logistic considerations. The one-week data collection period was to explore whether sick children sought care on non-children days and to explore variation in the use of staff time on the different days of the week, and the effect of this form of service delivery on the availability and duration of 'down' time. The sample included 16 vertical-service facilities (8 IMCI and 8 comparison), with a total of 80 observation days. As described above, only the provider seeing patients on the day of the visit was observed. This resulted in 47 providers observed in all types of facilities, 34 physicians and 13 nurses. Only two providers had to be replaced due to absence on one of the observation days. The analysis reported here focuses on physician providers, the main providers of curative care, because the number of observations for nurses was too low to carry out the analysis.

Data collection

The study took place in April-May 2003. The data collection tool was developed and pre-tested in English by the MCE team. A full field test of the survey instrument, which was translated into Portuguese, was carried out during the 1 week training of the survey teams. Three surveyors collected data, one in each state, to avoid problems of inter-rater variability within states. All of them were qualified nurses and had spent part of their working career in health facilities. Each surveyor recorded the time at which every activity, including all breaks and pauses, began and ended, and what activity was being carried out. Before the data collection started, the observer used a standard, field tested, introduction to explain the purpose of the study to the person in charge of the facility and to the randomly selected provider. The introduction emphasized that the purpose of the observation was to record the usual types of activities performed by the health worker during a routine working day; that it was not concerned with the quality of work involved; that he/she was selected at random to represent their facilities. Finally, their consent to participate in the study was obtained.

Quality control

Supervision visits were made to all three states at least twice during the 2-month data collection period to check that the surveyors were carrying out the observation and were filling in the forms correctly, and for solving data-related problems. The supervisors checked all the forms for completeness and consistency during the supervisory visits and when data were being entered. Through this mechanism we sought to reduce the inter-rater variation across states.

Methods of analysis

As described above, the aim of the time and motion study was to record the time health workers who examined under-fives spent on the different activities in primary health facilities. Following Bratt et al. (1999), the main activities are classified into three categories: contact time, non-contact productive time, and non-productive time. Contact time, or time spent with patients (or healthy people for preventive services such as immunization) is further divided into time spent caring for over-fives and for under-fives.

This paper focuses on consultation time with under-five children. Consultation time was estimated in two ways. The first computes the average consultation time for IMCI and non-IMCI providers, by state, without controlling for any possible confounders. The second uses regression analysis to explore and control for other possible determinants of consultation time. Stata software was used for the analysis (Stata Corporation 2003).

Table 1. Variables used in multivariate modeling of determinants of length of outpatient consultations with children under five in three Brazilian states*

Variable name	Definition
IMCI	IMCI-trained = 1, otherwise = 0
Single visit	Single or multiple persons presenting at the same visit: single visit = 1, otherwise = 0
Interruption	Whether the consultation was interrupted by another consultation or activity: interrupted = 1, otherwise = 0
Home visit	Consultation took place at the patient's home: home visit = 1, otherwise = 0
Outreach visit	Indicates a consultation at an outreach site (usually a small health post in remote areas): outreach = 1, otherwise = 0
Day one	First day of observation (to assess a possible Hawthorne effect): day one = 1, otherwise = 0
Morning–afternoon	Whether consultation occurred during the morning or the afternoon shift: morning = 1, afternoon = 0
Facility type	Indicates facility size: 1 = small facility, 0 = health centre, serving more than one facility
Sex	Sex of provider: male = 1, female = 0
Ceará	Observation is from Ceara state: Ceara = 1, otherwise = 0
Paraíba	Indicates observation is from Paraíba state: Paraíba = 1, otherwise = 0
Ln visits per provider per day	Natural log of consultations per provider per day
Ln hours per provider per day	Natural log of working hours per provider per day
Ceará_lnvisits	Joint effect of Ceará with natural log of consultations per provider per day
Paraíba_lnvisits	Joint effect of Paraíba with natural log of consultations per provider per day
Ceará_lnhours	Joint effect of Ceará with natural log of working hours per provider per day
Paraíba_lnhours	Joint effect of Paraíba with natural log of working hours per provider per day

*Only those variables included in the final model are shown in the Results section.

Unadjusted average consultation time

The average consultation time was estimated as the total minutes a provider spent with children under-five divided by the number of children seen. Because there were instances where more than one person presented for a given consultation or the health worker was interrupted to perform another activity (e.g. to examine another emergency case or resolve urgent administrative issues), the average time was estimated separately for consultations with and without these factors. This information is used in the regressions.

Regression analysis: model specification

The possible determinants of consultation time for which information could be collected are included in Table 1. The choice of explanatory variables was partly related to economic theory and partly determined by the nature and purpose of the exercise. For example, the number of consultations per provider per day is used as a measure of workload or the constraints on provider time; the total hours a provider works per day is also a measure of time availability, in particular as an indicator of whether the provider works part or full time, something that might modify behaviour. We also controlled for factors such as: morning versus afternoon shifts, to explore if patterns of behaviour changed during the day; the sex of provider; where multiple people presented for a particular consultation; and whether the consultation was interrupted for any reason.

The inclusion of state-specific variables makes it possible to control for differences in state characteristics that might affect the behaviour of health providers, such as the duration of IMCI training, degree of financial and political support to child health services and frequency of supervision. It was not possible to obtain information on these variables specific to each facility and provider, so the state variable was used instead.

Finally, we explored the joint effect of key variables on consultation time (Greene 2000); for example, if the relationship with number of consultations per provider per day varies by state. Only those which were included in the final model are presented here.

Double log transformation was used to normalize the dependent variable and to linearize the regression model (Kleinbaum et al. 1998). Log transformation has the added advantage that coefficients can be readily interpreted as elasticities (Gujarati 1999). Natural logs were used. Finally, robust estimation methods were used to control for clustering associated with having multiple observations per provider. The functional form can be written as:

$$T_{u5} = \alpha_0 + \sum_{i=1}^{n} \alpha_i X_i + \sum_{i=1}^{n} \sum_{j=1}^{n} \alpha_{ij} X_i X_j \quad n = 13 \qquad (1)$$

where T_{u5} is the natural log of time per consultation with an under-five child (in minutes); α_0 is the intercept; α_i are the estimated parameters for the n explanatory variables X_i; $\alpha_{ij} (\alpha_{ij} = \alpha_{ji},\ j \neq i)$ are the estimated parameters for the joint effect of selected X variables, as described in Table 1. Only those variables included in the final model are shown in the Results section.

Regression analysis: model fit

Regression diagnostics were used to judge the goodness-of-fit of the model. They included the tolerance test for

Table 2. Average time (in minutes) spent by physicians in consultations at health facilities in three Brazilian states – presented separately for children under 5 and over 5 years of age

	Under 5 years			Over 5 years		
	IMCI Mean (SD)	Comparison Mean (SD)	P (t)	IMCI Mean (SD)	Comparison Mean (SD)	P (t)
Ceará	7.27 (3.20)	7.56 (3.52)	0.53 (0.62)	5.58 (3.23)	8.34 (6.34)	<0.0001 (5.43)
Paraíba	8.57 (5.01)	6.16 (3.36)	0.002 (−3.11)	7.17 (5.14)	5.35 (3.13)	<0.0001 (−4.10)
Pernambuco	13.44 (6.22)	6.29 (3.21)	<0.0001 (−11.27)	13.12 (7.29)	8.03 (4.36)	<0.0001 (−8.46)
Average	11.08 (6.15)	6.46 (3.34)	<0.0001 (−9.04)	7.55 (5.51)	7.56 (5.09)	0.12 (−1.56)

Table 3. Final multivariate model for determinants of length of outpatient consultations with children under five in three Brazilian states [Dependent variable is natural log of time (minutes) per consultation with under-five child]

Variable	$\bar{\beta}$ coef.	S E	t	P	95% CI	
					Low	High
IMCI	0.36	0.04	9.11	<0.0001	0.28	0.43
Interruption	0.14	0.08	1.74	0.081	−0.02	0.30
Single visit	−0.40	0.05	−8.65	<0.0001	−0.49	−0.31
Ln visits per provider per day	−0.50	0.05	−10.34	<0.0001	−0.60	−0.41
Ceará	−2.96	0.63	−4.69	<0.0001	−4.20	−1.72
Paraíba	−13.04	4.81	−2.71	0.007	−22.48	−3.59
Ceará_lnhours	1.32	0.28	4.69	<0.0001	0.77	1.88
Paraíba_lnhours	5.84	2.18	2.68	0.008	1.56	10.13
Sex	−0.09	0.04	−2.27	0.024	−0.17	−0.01
Constant	4.12	0.19	22.08	<0.0001	3.75	4.48

Adjusted $R^2 = 0.32$; F-statistic = 38.92; $p < 0.0001$; $n = 730$.

multi-collinearity, its reciprocal variance inflation factors and estimates of adjusted R-square and F statistics of the regression model.

Results

Univariate analysis

Results of the univariate analysis are shown in Table 2. IMCI-trained providers spent on average 7.27, 8.57 and 13.44 minutes in consultation with under-five children in Ceará, Paraíba and Pernambuco, respectively. The range was much smaller in the comparison group where they spent 7.56, 6.16 and 6.29, respectively. Although IMCI-trained providers spent less time per consultation on average than the comparison group in Ceará, the difference is small and not statistically significant. In addition, these results did not hold after controlling for confounders, as described below. In the two other states, Paraíba and Pernambuco, IMCI-trained providers spent significantly longer than their counterparts in the comparison group, the difference being greatest in Pernambuco at almost 7 minutes per consultation. Taken together, and without adjusting for confounders, IMCI-trained providers spent almost 4 more minutes per average consultation than providers in the comparison group ($p < 0.0001$).

These results raise the question of whether IMCI-trained providers in Paraíba and Pernambuco compensated for spending more time with under-fives by spending less time with over-fives. Table 2 shows that this was not the case. IMCI-trained providers in those states also spent significantly more time with patients over 5 years of age than their counterparts who were not trained in IMCI.

This was not found in Ceará, however, where IMCI-trained providers spent significantly less time with over-fives compared with their counterparts (5.58 and 8.34 minutes, respectively, $p < 0.0001$). As in the case of the time spent in consultation with under-fives, it would be important to determine if this is due to IMCI or other possible determinants of consultation time. The purpose of this paper is to focus on children under-five, so that analysis is not undertaken here.

Regression analysis

The results of the best fit model to explore whether consultation time remains correlated with the presence of IMCI even after controlling for potential confounders are presented in Table 3 (see Table 1 for description of variable names). The adjusted R-square was 0.32, with an F statistic of 38.92 ($p < 0.0001$). Residual plots showed a uniform distribution of the model residuals with a mean of zero and no specific pattern of distribution.

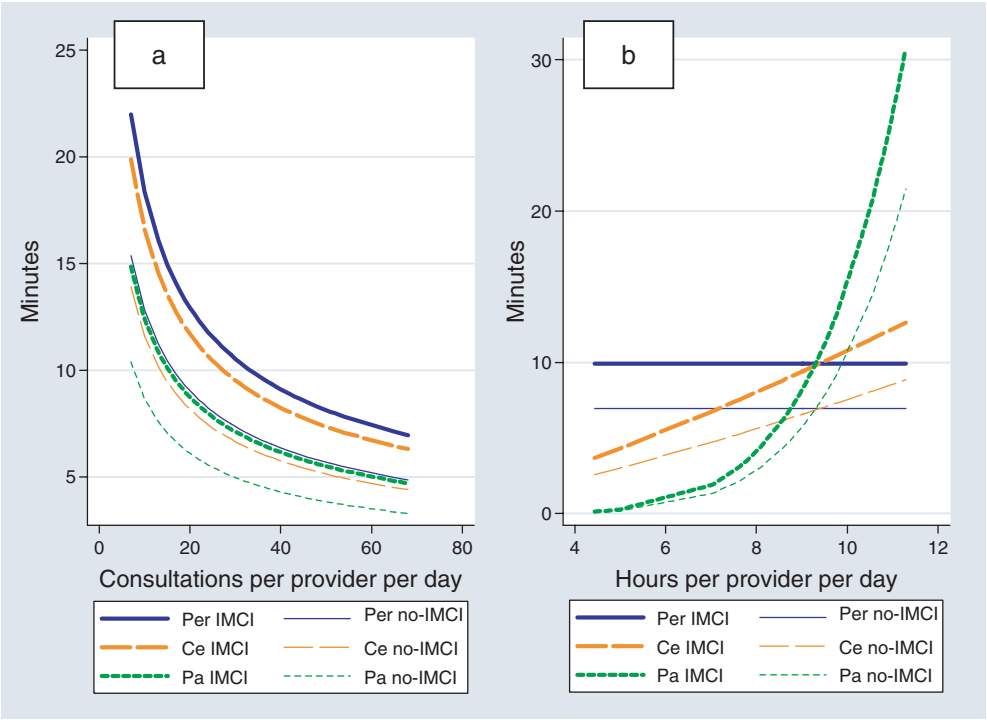

Figure 1. Effect of (a) number of consultations per provider per day and (b) hours worked per day (X axes) on consultation time with under-fives (Y axis), estimated separately for each state and for IMCI-trained and non-trained providers

The positive signs of the coefficient of the variable denoting IMCI-trained providers and interrupted consultations, and the negative signs of the coefficients of number of consultations per provider per day and single visit, are consistent with *a priori* expectations. The results show that, holding all other variables constant at the mean levels observed in the sample, IMCI-trained providers spent 1 minute and 26 seconds more on average in consultation with under-fives than untrained providers, $p < 0.0001$). Consultation time was negatively correlated with the number of consultations per provider per day; each 1% increase in the number of consultations per provider per day results in a 0.5% reduction in consultation time per under-five child ($p < 0.0001$) (see Table 3 and Figure 1a).

It is worth noting that the number of consultations per provider per day may be mediated by IMCI, i.e. people may choose to use IMCI providers due to perceived higher quality associated with IMCI training. This did not seem to be the case in our sample, as the mean consultations per provider per day were similar in facilities with and without an IMCI-trained provider (31 and 36 per day, respectively; $p = 0.09$). Accordingly, we treat this variable as a potential exogenous confounder rather than endogenous to the model.

Consultation time was lower in Ceará and Paraíba than in Pernambuco, for both IMCI-trained and comparison providers. It is also worth noting that controlling for confounding factors showed that IMCI-trained providers spent longer per consultation with under-fives than the comparison group in Ceará as well as in the other states. This means that the findings of the univariate analysis presented in Table 2, that IMCI providers seemed to spend less time with under-fives than the comparison group, were due to confounding factors and not IMCI.

The effect of the number of consultations per provider per day did not vary by state, but the number of working hours per day did. This is illustrated in Figure 1b. The lines show the estimated consultation time based on the reported regression, controlling for all variables except hours worked per day, shown on the X axis in natural units. Consultation time (Y axis) was converted into natural units (minutes) using the antilog of the dependent variable, and was estimated separately for IMCI-trained and comparison groups and for each of the three states. It was estimated for a single visit, uninterrupted and performed at the health facility (e.g. not a home or outreach visit). The number of visits per provider per day was set at the mean value from the sample (34 per day).

The figure shows that working more hours per day did not have an impact on consultation time in Pernambuco but did in Ceará and Paraíba (confirmed by the fact that hours per day was not significant in the final model while the joint effect of hours per day and the state variables was significant for Ceará and Paraíba). In those states, each 1% increase in hours worked per day per provider led to 1.32 and 5.84% increases in consultation time per under-five child, respectively (Table 3).

Finally, the results show that male providers spent around 30 seconds less per consultation with under-fives than female providers at the mean values of the explanatory variables observed in the sample ($p = 0.02$). No statistically significant differences were found in consultation time between vertical- versus integrated-service facilities, for 'under-five' days versus 'other' days within vertical-service facilities, for day one versus subsequent days of observation, or for home and outreach visits compared with consultations which took place at health facilities.

Discussion

The main purposes of this study were to explore the effect of IMCI training on the length of consultation time with under-five children, and to examine how providers cope with any capacity constraints on their time. The multivariate analysis confirms that IMCI-trained providers spent more time on the average consultation than non-IMCI-trained providers. After controlling for other determinants, the difference was 1 minute and 26 seconds per consultation ($p < 0.0001$). This is substantially less than the difference of 4 minutes suggested by the univariate analysis and emphasizes the need to control for confounders in studies such as this.

The size of the difference is, however, crucially determined by constraints on providers' time. The higher the workload, the lower the difference: to the extent that the difference is relatively small where the workload exceeds 50 consultations per provider per day. This has key policy and methodological implications. In terms of policy, the average quality of care of IMCI providers has been shown to be higher than that of non-IMCI providers (Black et al. 2003; Amaral et al. 2004; Armstrong Schellenberg et al. 2004; Gouws et al. 2004). It is important to determine if quality is also a function of the time spent per consultation, and if the quality of IMCI providers still exceeds that of non-IMCI providers where workload is high.

There is already some evidence that quality might well be a function of the time spent per consultation. The average time per consultation in Pernambuco was higher than that in the two other states. At the same time, the component of the MCE study exploring quality of care found that IMCI providers in Pernambuco consistently made a higher percentage of correct disease classifications than IMCI providers in the other states. Significant differences between health workers who were trained or not trained in IMCI were found in the assessment of the sick child, classification of illness, treatment, as well as in communication with the caretaker (Amaral et al. 2004). Whether this is due to more frequent supervision and more regular availability of drugs and vaccines in Pernambuco (Amaral et al. 2004), to the fact that Pernambuco implemented IMCI earlier than the other states, to the strong support for IMCI from the State Health Secretariat in Pernambuco, or to the higher time per consultation, is yet to be determined. It is important that the answer is found rapidly so as to design strategies to support providers facing capacity constraints on their time, if necessary, in all parts of Brazil where IMCI is being introduced.

Methodological implications relate to the way costs are estimated for the purposes of cost-effectiveness analysis, for estimating the costs of benefits packages for health insurance, or for budgeting for the scale up of interventions (Adam et al. 2003a,b). As illustrated in this study, the cost per visit depends on the throughput of the health facility. Where patient load is high, unit costs are relatively low because providers must spend less time per patient, and vice versa. Moreover, the incremental cost of expanding is always less than the average cost of providing existing services, as expected from theory, and falls more rapidly where patient load is low. General policy implications should not be based on the results of costing studies that do not report capacity utilization, and studies of scale-up costs will not be useful to policymakers if they are based on the current costs of providing care.

This result is also important for policy relating to child health. Where current case loads are relatively low, providers spend additional time to provide child health services based on IMCI as part of their current activities. In our sample, the mean number of consultations per provider per day was 34, and 95% of the providers had case loads lower than 54 patients per day. If this is representative of the rest of Brazil, it would be possible to introduce IMCI relatively easily throughout the country without encountering capacity constraints in terms of provider time. Interestingly, an unthinking cost analysis would suggest the opposite. Because the observed additional time is greater in areas of low workload, it would suggest that the incremental financial costs of IMCI are higher where workload is low than where workload is high. We believe the results can best be interpreted as showing that IMCI can be introduced without significant financial implications when capacity constraints on time are relatively low.

It is interesting to find no evidence that the time spent per child in vertical-service facilities differed from that in integrated facilities, or that time spent per child on 'under-five' days differed to the time spent on other days in vertical-facilities. Indeed, we could find no evidence that the mix of patients varied by day in vertical-service facilities, which is a relief from the medical perspective; it implies that patients in need of urgent care could obtain it on any day of the working week. This is useful information for future research in this region of Brazil, where it might not be necessary to account for the two different types of facilities in the design of future research.

Another interesting finding is that there are sex differences in average consultation time by providers. It would be useful to explore the possible reasons for this in future studies. Of particular interest are questions such as the effect and suitability of IMCI-training materials to both

sexes, and if the difference in time is also associated with difference between the sexes in quality of care.

Finally, the fact that the times reported here are consistent with those observed in the MCE study in Tanzania, the only available comparative study, gives us some confidence in the results (Adam et al. 2005). The average consultation time with under-fives in Paraíba and Ceará were very close to the 8.2 minutes observed in Tanzania, and only the consultation time in Pernambuco was somewhat longer. In addition, Tanzanian workers spent longer on average with children under-five than with older people, something also observed in general in Brazil. The times are lower than those reported in an earlier study from Bangladesh (Khan et al. 2000), where IMCI providers spent on average 16 minutes per consultation with under-fives. That study did not try to determine how long they would have spent had they not been trained in IMCI. It is not strictly comparable to the Brazilian study as it was undertaken immediately after training, while the Brazilian study was undertaken in settings some years after the introduction of IMCI when the immediate effects of training are likely to have waned.

In conclusion, the critical implication of this study is that at relatively low patient load, adoption of new interventions that improve quality can promote efficiency at primary care facilities; they can be delivered by the already available human resource capacity of the health system without the need to hire additional staff or to reduce other activities. At high patient load, IMCI-trained providers do not spend as much additional time with children as providers with low patient loads. It is important to determine if the quality of IMCI-trained providers is maintained in those settings. This is an urgent need as countries move to scale with their delivery of child health services based on IMCI.

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