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Abstract*

Studies of the effects of pre-school programs on child development in developing countries have found scant impact. This study was conducted to reconcile the importance of daycare for child development with the empirical estimates of small effects. Using a random sample of 500 children from 100 daycare centers in the Municipality of Rio de Janeiro (Brazil), the study combines a flexible function relating child development to daycare center quality. A hedonic cost function permits an evaluation of the cost-effectiveness of better-quality daycare centers. The study finds that the developmental age of children attending high-quality services is greater than that of children attending low-quality centers. It also finds that quality improvement can be measured in a number of ways, with different cost implications or impacts on child development.

JEL Classification: I21, I22, D61

Keywords: Early childhood education, Child development, Cost-effectiveness, Daycare center

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1. Introduction

Several studies have shown that even though pre-school (targeting children 4 to 6 years old) has sizeable and lasting effects,¹ large-scale evaluations of daycare centers (targeting children 0 to 3 years old) tend to find smaller and shorter-lived impacts.² As the literature has recognized, there are many alternative empirical and substantive explanations for the limited impact of daycare centers found in these studies. The empirical explanations range from poor identification strategy to limited and poor-quality data.

Among the substantive interpretations, the sensitivity of daycare centers' efficacy to the quality of the services delivered deserves special attention.³ According to this interpretation, while high-quality, well-designed daycare centers do have substantial impact, this impact may be very sensitive to the quality of the services provided. Since in developing countries most evaluations measure the impact of ill-designed, low-quality services, it is not surprising that only small impacts have been found. Hence, to reconcile the theoretical importance of daycare for child development with the empirical estimates of small effects, it is paramount to shed some empirical light on the relationship between efficacy and quality of daycare services.

In this study we estimate two basic relationships. First, we estimate a flexible function relating child development to daycare center quality, controlling for family background and children's personal characteristics. The estimated relationship will shed light on the importance of quality for the efficacy of daycare center in promoting child development. Second, we estimate a hedonic cost function relating daycare center quality and costs. By combining the two estimated relationships, it is possible to evaluate the cost-effectiveness of better-quality daycare centers.

To estimate these two relationships, we use an extensive and underutilized data set covering a sample of 100 publicly funded daycare centers in the city of Rio de Janeiro.⁴ This data set contains information on quality and cost of daycare centers as well as on measures of child development and family background.

¹ Barros and Mendonça (1996), Young (2002), Barnett (1992), Berlinski, Galiani and Manacorda (2008), Berlinski, Galiani and Gertler (2009) and Magnuson et al. (2004).

² Barros and Mendonça (1996).

³ Belsky (2008, 2009), Duncan (2001), Gilliam and Zigler (2001), Howes (2003), Peisner-Feinberg et al. (2001), Vandell and Wolfe (2000) and NICHD Early Child Care Research Network (1999).

⁴ Exceptions are the studies by Pacheco et al. (2002), Pacheco and Dupret (2004), Pacheco, Meller and Teixeira (2004) and Pacheco (2009).

2. Data Source and Empirical Strategy

Traditionally, the Municipality of Rio de Janeiro provides free daycare services through two channels: i) municipality-owned and operated daycare centers and ii) NGOs and community-based services partially funded by the municipality. In 2001, the system comprised roughly 200 municipal centers and 200 NGOs and community-based services receiving public funds. Out of this total, a 25 percent sample (around 100 daycare centers) was randomly selected for the study. For each of the Rio de Janeiro daycare centers in the sample, a comprehensive evaluation of the cost and quality was conducted. A five-day visit to each daycare center was organized with the aim of filling out a detailed, objective questionnaire involving both observational information and interviews with key actors. In order to evaluate the economic cost of the services, a complementary price search was conducted for all main inputs in production.

At the end, the annual economic cost of each daycare center in the sample was estimated as well as a set of almost 500 individual indicators of quality structured along five macro-dimensions, 15 dimensions and 50 sub-dimensions. Based on this information, it was possible to estimate a hedonic cost-function relating unit costs with quality.

In addition, for each daycare center in the survey, a sample of 10 children was selected and subjected to a psychological test designed to evaluate their developmental stage.⁵ Specifically, this test provides information on the developmental age of each child, in months, along three dimensions (mental, social, and physical) and yields an overall measure of the child's developmental age. The gap between the developmental age and the chronological age is a proper measure of child development.

Given the observational nature of the study, to supplement the evaluation, an interview was conducted with the family of each child in the sample in order to collect extensive information on their living conditions, including family income, parents' education and labor market activities, access to durable goods, housing conditions, and access to public services such as electricity and piped water. Additionally, as a secondary measure of quality, information was collected on parents' subjective perception of the quality of daycare services.

⁵ The scale used was *Cartão da Criança*, an instrument developed by IPHEM (Instituto de Pesquisas Heloísa Marinho) used to track child growth and development from zero to six years old.

Based on the available information on child development, quality of daycare centers, family background and child characteristics, it is possible to estimate, under certain hypotheses,⁶ the impact of quality on child development by regressing child development on daycare center quality, controlling for family background and children's personal characteristics (age, race, and gender). By combining the hedonic cost-function with the relationship between quality and child development, it is possible to evaluate the cost-effectiveness of better-quality daycare centers (see Figure 1). The richness of the available information in this data set contrasts sharply with the small sample size. For instance, there are more indicators of quality (nearly 500) than daycare centers in the sample (around 100). Consequently, reductions in the dimensionality of all empirical concepts in the study are a prerequisite for any meaningful estimation. The main challenge is to reduce the dimensionality of daycare center quality.

This study follows four basic empirical steps:

1. It reduces the dimensionality of daycare quality through the construction of a concise measure.
2. It evaluates the identification hypothesis (quality conditional exogeneity) by analyzing the relationship between daycare quality and family background.
3. It estimates the impact of quality on child development.
4. It estimates the impact of quality on the costs of daycare services.

3. Reducing the Dimensionality of Quality

With the number of basic indicators of quality (500) far exceeding the number of daycare centers in the sample (100), it is imperative to obtain concise measures of quality. Since the basic indicators of quality are naturally structured along five macro-dimensions, 15 dimensions and 50 sub-dimensions, we proceed in four steps. First, we obtain a concise quality measure for each sub-dimension, aggregating all basic indicators in each sub-dimension. Next, we aggregate these sub-dimension measures into indicators for each dimension. Thirdly, we further aggregate to obtain a scalar measure for each macro-dimension. Finally, we aggregate all five macro-dimensions into an overall concise index.

⁶ Essentially, depending on child and family characteristics, daycare center quality and other factors influencing child development are unrelated. We refer to this hypothesis as *quality conditional exogeneity*.

Ideally, the weights given to distinct indicators of quality should have a substantive explanation. To the extent that quality is an input to enhance child development, it would be natural to weight indicators of quality according to their importance for child development, with the weights being obtained from theory or empirical studies. A simple procedure to empirically obtain these weights would be to regress a measure of child development on indicators of quality, controlling for child characteristics, family background, and exposure to services (months in daycare since birth).

To represent each of the 5 macro-dimensions, we have, on average, 100 measures of quality, typically structured into 3 dimensions and 15 sub-dimensions. Given the limited number of daycare centers (around 100) in the sample, it is not feasible to obtain weights for all these indicators from their conditional association with child development.

Hence, to aggregate indicators within sub-dimension, sub-dimensions into dimensions, dimensions into macro-dimensions, and the five macro-dimensions into an overall scalar measure of quality, we use two alternative procedures. First, we construct concise measures simply, giving equal weights to all basic indicators under consideration. Second, we use statistical procedures (principal components, correspondence analysis, and factor analysis) to find the best linear combination in the sense of responding for the largest portion of the total variation in the data. Even though these procedures have greater statistical appeal than simple averaging, they ended up empirically generating weights close to a simple average. Hence, we decided to use the simpler approach. It should be borne in mind that the weight assigned to each indicator by these procedures is not necessarily related to its importance for child development.

As a final result, for each daycare center in the sample, we obtained an overall concise measure of quality and a set of specific indicators of quality, measuring quality along the following five broader categories: (a) infrastructure, (b) health and sanitation, (c) activities and program structure, (d) human resources, and (d) parents and community relations.

Table 1 presents for each of these measures of quality the overall average and the average for high-quality (top 20 percent) and low-quality (bottom 20 percent) daycare centers. As this table reveals in our universe of analysis, the average quality is around 0.43, varying from 0.28 for the low-quality group to 0.57 for the high-quality group. These results indicate the existence of a large degree of quality heterogeneity across daycare centers. Without this sizeable degree of

variability, it would be empirically impossible to obtain precise estimates of the impact of daycare quality on child development.

The heterogeneity is also quite large in all five macro-dimensions. It is, however, relatively smaller for infrastructure and particularly larger for parents and community relations. An analysis of the correlation among these macro-dimensions of quality reveals a substantial degree of association. This high degree of correlation makes it difficult to isolate the impact of each macro-dimension of quality on child development.

4. Assessing the Exogeneity of Quality

To evaluate the impact of daycare quality on child development, it would be ideal if the distribution of daycare centers were unrelated to other factors also determining child development. To assess the strength of this relationship we regressed the logit of the overall index of quality on a set of child and family characteristics (see Table 2). As this table reveals, despite the large variation in quality among government funded daycare centers, quality is not related to any observed measure of family background or child characteristics.

To a large extent, this lack of correlation results from three factors. First, better-quality daycare centers in the city of Rio de Janeiro are not located in particularly poor neighborhoods. High- and low-quality centers are actually quite dispersed throughout the city's low-income areas. In principle, even if daycare centers were randomly allocated throughout the city, within each neighborhood a self-selection mechanism could still lead to bias. If better-quality daycare centers are demanded by all, while lower-quality centers are left exclusively for the use of the poorest, quality and family background could still be correlated, even though the geographical distribution of daycare centers is not related to community socioeconomic conditions. The results presented in Table 2, however, are clear evidence against this conjecture.

Second, there is clear evidence that families tend to use the nearest facility. In fact, the average time families spend going from home to the daycare centers attended by their children is 14 minutes, with almost three-fourths claiming to take less than 15 minutes (see Table 3). Moreover, the municipality application files indicate that 84 percent of all new applicants live in the neighborhood where the daycare center to which they apply is located.

Finally, the weak relationship between daycare quality and family resources results from families' highly limited knowledge of the quality of the daycare centers. In fact, a comparison

between the quality perceived by families and an objective measure (see Figure 2) indicates that families' perception of quality is quite unrelated to the actual quality of the services. As Figure 2 indicates, families' subjective perception of quality is quite unrelated to our concise objective measure and seriously overestimates quality. Without proper knowledge of the quality of daycare services, families in general and better-off families in particular could not purposely choose better-quality centers—hence the lack of any clear relationship between daycare center quality and family resources.

Consequently, there is no great need to control for disparities in family background when estimating the impact of daycare quality on child development. Moreover, since quality is unrelated to family background, it may also be unrelated to other unobserved factors responsible for child development. A signal that indicators of quality are likely to be exogenous is a central assumption required for the consistency of our estimates of the impact of daycare centers' quality on child development.

5. Estimating the Impact of Quality on Child Development

The next step is to estimate the impact of daycare quality on child development. We consider two approaches. In both cases we assume that, among children with identical personal characteristics and family background, the quality of the daycare center they attend is not related to any other variable determining child development. The two approaches differ only in how the quality of daycare centers is measured.

5.1 Methodology

First, we consider only the impact of the overall measure of quality. In this case, we give the relationship between child development and quality a flexible form. Specifically, we estimate the following regression:

$$f(y_i) = a + b.h(Q_{j(i)}) + c.x_i + e_i$$

where y_i denotes an indicator of child development, x_i a vector of child and family characteristics and $Q_{j(i)}$ the quality of the daycare center, j , that child i attends; a , b , and c are parameters to be estimated and f and h are known functions. We consider two alternative function-forms for f (linear and logarithmic) and three for h (linear, logarithmic and logistic).

Hence, a total of six alternative specifications were estimated. The results are presented in Table 4. In evaluating the impact of the quality of daycare services on child development, we consider both the impact on overall child development and the impacts on each of its three main components: social, mental, and physical.

In the second approach, the individual impact of each dimension of quality on child development is estimated. In this case, linearity was assumed. Hence,

$$y_i = \alpha + \sum_k \beta_k . q_{k,j(i)} + \delta . x_i + \varepsilon_i$$

where, $q_{k,j(i)}$ is an indicator of the k macro-dimension of quality of daycare center $j(i)$. In this case, β_k is an estimate of the impact of k macro-dimension of quality on child development. As already mentioned, we group all indicators of quality into five categories: (a) infrastructure, (b) health and sanitation, (c) activities and program structure, (d) human resources, and (e) parents and community relations. The estimates we obtain are presented in Table 5.

5.2 The Impact of Overall Quality on Overall Development

Since all six specifications reported in Table 4 produced very similar results, we focus our attention on the simpler linear specification. These estimates reveal that a percentage point increase in the overall measure of quality would lead to an improvement of 0.04 month in the overall developmental age of a child benefiting from this daycare center, with this estimate being marginally significant (p-value equal to 11 percent).

In our universe of analysis, when daycare centers are ordered by their overall level of quality, the average quality for the low-quality centers (bottom 20 percent) is 0.28 and the corresponding average for the high-quality centers (top 20 percent) is 0.57 (see Table 1). Hence, as a goal for improving quality we take this difference (29 percentage points) between low- and high-quality groups. To the extent that a percentage point increase in quality would lead to a 0.04 month improvement in overall child development, a corresponding 29 percentage points would lead to a 1.2 months improvement. In other words, we estimate that children attending high-quality daycare centers are going to have a developmental age 1.2 months greater than those attending low-quality daycare centers. Since the standard deviation of the developmental age among children at the same age is almost 7.0 months, we estimate that attending a high-quality

as opposed to a low-quality daycare center would increase the developmental age of the child by almost 0.2 standard deviations.

One could consider our estimated impact of 1.2 months or 0.2 standard deviations as modest, even though it is not clear how large one would expect this impact to be. It is worth mentioning, however, that this magnitude is not very distinct from traditional estimates obtained for the impact of school quality on learning. In fact, the best estimates available for the impact on learning of having a high-quality teacher (top 20 percent) as opposed to a low-quality teacher (bottom 20 percent) is also 0.2 standard deviations.

5.3 The Impact of Overall Quality on the Three Components (Social, Mental and Physical) of Child Development

In Table 4 we also present estimates of the impact of overall quality of daycare centers on each component of child development. This table reveals that these impacts vary considerably across components.

Our estimates indicate that quality has sizeable and statistically significant impacts on mental and, particularly, on social development. We estimate that children attending high-quality daycare centers are going to have a mental and social developmental age 1.8 and 2.3 months (0.18 and 0.23 standard deviations) greater than those attending low-quality daycare centers.

Children's physical development, on the other hand, is quite insensitive to the quality of daycare centers, with our impact estimates being statistically insignificant (p-value of 70 percent) and very small in magnitude.

In sum, we found evidence that daycare center quality has a substantial impact on children's social and mental development but none on their physical development.

5.4 The Impact of the Dimensions of Quality on Child Development

In Table 5 we present estimates of the impact of quality on overall development as well as on each of its components disaggregated by macro-dimensions of quality. The results indicate that the statistical significance and magnitude of the impacts vary considerably across dimensions of quality.

Of the five macro-dimensions considered, only activities and program structure has a significant, sizeable, and consistent impact on overall, social and mental development. In this case, our estimates indicates that children attending high-quality daycare centers are going to

have a mental and social developmental age is around 3.0 months (0.32 standard deviations) greater than those attending low-quality daycare centers. The impact on the overall measure of development is around 2.5 months, or 0.35 standard deviations.

The quality of infrastructure seems to have a sizeable and statistically significant impact on social and physical development but not on mental development. Neither human resources nor relationship with parents show up as having statistically significant impact on social or mental development. Human resources, however, seems to have a sizeable and significant impact of physical development. We also found no evidence that improved attention to health and sanitation has any positive impact on any of the three dimensions of child development studied.

6. Estimating the Impact of Daycare Quality on the Cost of Services

Since for each daycare center j in the survey we also have information on its annual cost, C_j , we also estimate the relationship between cost and quality. As in the previous section, two approaches will be used. In the first approach, we estimate a flexible relationship via the following regression:

$$\text{Ln}(C_j) = \kappa + \phi \cdot g(Q_j) + \lambda \text{Ln}(s_j) + v_j \quad (2)$$

where s_j is a measure of the scale of the daycare center, such as number of children attending the center. It is included to capture any economies or diseconomies of scale that might be present. In this expression, g is a known function and the parameter ϕ indicates the impact of daycare quality on unit costs; κ and λ are additional parameters to be estimated. The estimated parameters are presented in Table 6.

Our second approach attempts to measure the individual impact of each macro-dimension of quality on the cost of daycare centers. In this case, linearity is assumed, leading to the estimation of the following regression:

$$\text{Ln}(C_j) = \theta + \sum_k \phi_k \cdot q_{k,j} + \pi \cdot \text{Ln}(s_j) + \eta_j \quad (3)$$

In this case, ϕ_k is an estimate of the impact of quality dimension k on daycare center costs. In this expression, θ and π are additional parameters to be estimated. The estimated parameters are also presented in Table 6.

Table 6 shows that unit cost declines with size. Hence, we have evidence of economies of scale. We also encounter clear evidence that higher quality has a cost. Each extra percentage point in quality increases unit cost by 1.9 percent. Since the quality gap between high-quality and low-quality daycare services is 29 percentage points in the quality scale, the unit cost of high-quality services is 72 percent higher than the corresponding unit cost for low-quality services.

Not all dimensions of quality are equally expensive. As shown in Table 7, only extra space and better human resources have a statistically significant impact on unit costs. Each percentage point improvement in the quality of human resources in the scale we use would increase unit costs by 1.6 percent, while a corresponding one percentage point improvement in space availability (infrastructure) would increase unit costs by 1.4 percent.

The quality gap in human resources and space availability between the bottom 20 and top 20 percent is, according to our scale, 35 and 24 percentage points, respectively. Therefore, the unit cost of a daycare center ranking high in human resource quality would be 72 percent higher than the corresponding cost for a daycare center ranking low in human resources quality. The corresponding gap in costs for space availability is 40 percent.

7. Conclusions

In this study, we use a rich data set containing information on the cost and quality of daycare services, on the one hand, and measures of child development and family background, on the other. Based on this information, we estimate the impact of daycare service quality on i) child development and ii) daycare costs.

To summarize our findings, we compare the impacts on child development and daycare costs of increasing quality from the average for the bottom 20 percent (low-quality services) to the average for the top 20 percent (high-quality services). With respect to the overall quality measure, this gap is 29 percentage points on our scale.

We found, on the one hand, that the cost of providing high-quality services is 72 percent higher than providing low-quality services. On the other hand, we also found that the developmental age of children attending high-quality services is 1.2 months greater than what they would attain if they attended a low-quality center.

Thus, in order to increase the impact of a daycare center on child developmental age by a month through an improvement on quality, it is necessary to increase the quality of services by

26 percentage points and consequently its unit cost by 60 percent. This is the cost-effectiveness ratio we obtain for improvements in the quality of daycare centers: a 60 percent increase in costs per extra month in children's developmental age.

The quality of daycare centers, however, could be improved along many dimensions, and not all have the same cost or impact on child development. Actually, only a few dimensions, particularly the quality of activities and program structure, have sizeable impacts on child development. More importantly, in general, the dimensions with greater impacts on child development are those with a smaller impact on costs. Hence, when improvements in quality can be implemented by carefully choosing the dimensions to be improved, their cost-effectiveness can be greatly enhanced.

For instance, an overall increase in quality would increase child developmental age by 1.2 months and would require a 72 percent increase in cost. However, if the increase in quality focused on improving activities and program structure, it would lead to an increase in child developmental age of 3.0 months and require a mere 6 percent increase in cost. Consequently, with one-twelfth of the resources one could achieve an impact almost three times larger. Hence, compared to a general increase in quality, the cost-effectiveness of improvements in the quality of activities and program structure is 36 times greater.

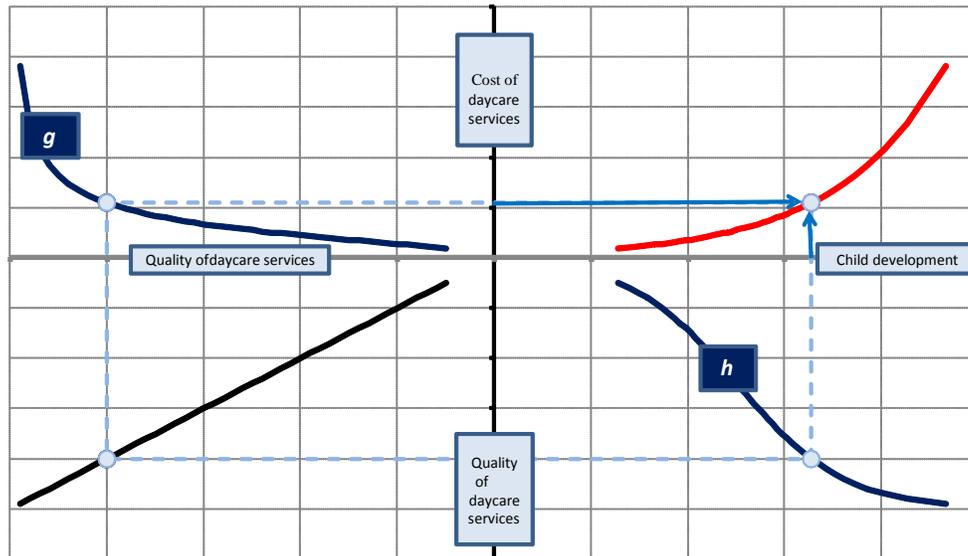
Finally, improvement in daycare center quality does not impact all domains of child development equally. Our evidence indicates that quality has sizeable effects on children's social and mental development, but none on their physical development.

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Figure 1. Relationship between Quality and Cost of Daycare Services and Child Development



Source: Authors' compilation.

Table 1. Average Quality of Publicly Funded Daycare Centers in the Municipality of Rio de Janeiro, 2001

Dimension	Overall average	Low quality (bottom 20%)	High quality (top 20%)	Quality gap
Overall synthetic measure	0.43	0.28	0.57	0.29
Infrastructure	0.39	0.27	0.51	0.24
Health and sanitation	0.45	0.27	0.62	0.34
Activities and program structure	0.46	0.26	0.68	0.42
Human resources	0.30	0.16	0.51	0.35
Parents and community relations	0.60	0.33	0.83	0.49

Source: Estimates based on the study "Evaluation of Daycare Services in the Municipality of Rio de Janeiro, 2001."

Table 2. Relationship between Logit of Daycare Center's Overall Quality, Child Characteristics and Family Background, Municipality of Rio de Janeiro 2001

Variable	Coefficient	P-value (%)
<i>Intercept</i>	-0.272	6
Child characteristics		
Gender (male)	-0.039	21
Race (white)	-0.018	59
Family background		
Presence of the mother	-0.109	15
Years of schooling of the person responsible for the child	0.002	68
Ln family per capita income (R\$/month)	0.017	50
Number of observations	752	
R² - adjusted	0.00	

Source: Estimates based on the study "Evaluation of Daycare Services in the Municipality of Rio de Janeiro, 2001."

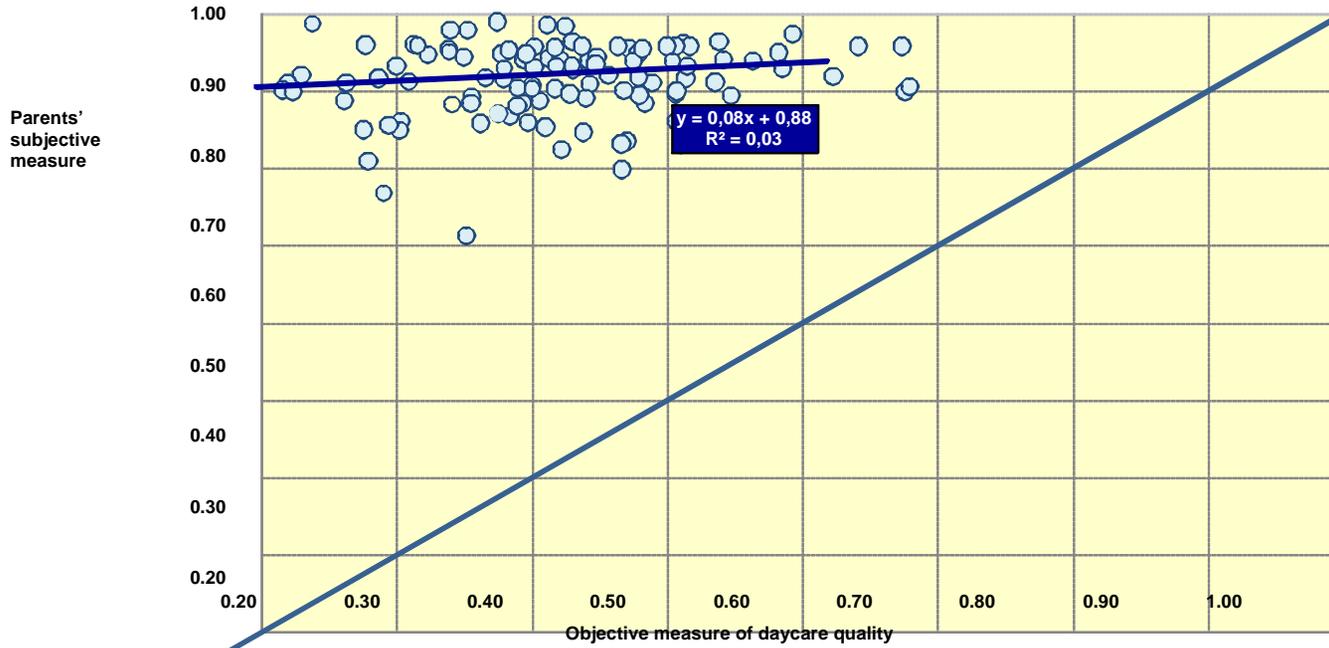
**Table 3. Distance from Home to Daycare Centers,
Municipality of Rio de Janeiro**

<i>Average time spent to daycare centers (minutes)</i>	14
<i>Percentage of children taken from home to daycare center at most¹ (%):</i>	
15 minutes	73
30 minutes	96
<i>Percentage of children applying to daycare centers who live in the same neighborhood the daycare center is located² (%):</i>	84

Source 1: Estimates based on the study "Evaluation of Daycare Services in the Municipality of Rio de Janeiro, 2001."

Source 2: Estimate based on "Cadastro da Pré-Matricula das Creches Municipais da Secretaria Municipal de Educação da Cidade do Rio de Janeiro – 2009."

Figure 2. Relationship between Objective and Parents' Subjective Measure of Quality, Rio de Janeiro, 2001



Source: Estimates based on the study "Evaluation of Daycare Services in the Municipality of Rio de Janeiro, 2001."

**Table 4. Impact of Daycare Center Quality on Child Development,
Municipality of Rio de Janeiro, 2001**

Specification	Overall				Social				Physical				Mental							
	Regressio coefficient	Impact of High-quality as opposed to quality daycare center			P-value (%)	Regressio coefficient	Impact of attending High-quality as opposed to low- quality daycare centers			P-value (%)	Regressio coefficient	Impact of High-quality as opposed to low- quality daycare centers			P-value (%)	Regressio coefficient	Impact of attending High-quality as opposed to low- quality daycare centers			P-value (%)
		Months	Standard deviation				Months	Standard deviation				Months	Standard deviation				Months	Standard deviation		
Age of development																				
Quality	4.13	1.2	0.17	11	7.9	2.2	0.23	3	1.03	0.30	0.04	70	6.06	1.8	0.18	9				
Log	1.78	1.3	0.18	9	3.1	2.2	0.22	4	0.00	0.00	0.00	100	2.54	1.81	0.18	9				
Logit quality	0.97	1.2	0.17	11	1.8	2.2	0.22	3	0.17	0.21	0.03	78	1.44	1.74	0.18	9				
Log age of development																				
Quality	0.103	1.3	0.18	17	0.206	1.0	0.11	7	-0.009	1.32	0.18	92	0.10	1.54	0.16	30				
Log	0.043	1.3	0.18	16	0.079	1.1	0.11	9	-0.017	1.36	0.19	65	0.04	1.58	0.16	30				
Logit quality	0.024	1.2	0.18	17	0.047	1.0	0.11	7	-0.004	1.29	0.18	85	0.02	1.51	0.15	30				

Source: Estimates based on the study "Evaluation of Daycare Services in the Municipality of Rio de Janeiro, 2001."

Note 1: The model includes controls for child age, gender and race, presence of parents, household head years of schooling and per capita income.

Note 2: Sample size: 752 children.

Note 3: R2 range from 0.64 to 0.66.

Table 5. Impact of Daycare Center Quality on Child Development, Municipality of Rio de Janeiro, 2001

Dimension	Overall				Social				Physical				Mental			
	Regression coefficient	Impact of attending High-quality opposed to low-quality daycare center			Regression coefficient	Impact of attending High-quality as opposed to low-quality daycare centers			Regression coefficient	Impact of High-quality opposed to low-quality daycare centers			Regression coefficient	Impact of attending High-quality as opposed to low-quality daycare center		
		P-value (%)	Months	Standar deviation		P-value (%)	Months	Standard deviation		P-value (%)	Months	Standar deviation		P-value (%)	Months	Standard deviation
Infrastructure	-3.74	-0.9	-	36	15.71	3.	0.38	1	9.76	2.4	0.33	2	4.92	1.	0.12	39
Health and sanitation	-4.97	-1.7	-	17	-8.11	-2.8	-0.28	11	-8.66	-3.0	-	2	-	-2.9	-0.30	9
Activities and program structure	5.86	2.5	0.35	3	7.60	3.	0.32	4	-0.04	0.0	0.00	9	7.49	3.	0.32	5
Human resources	4.78	1.7	0.24	6	-2.07	-0.7	-0.07	55	5.74	2.0	0.28	3	3.28	1.	0.12	35
Parents and comunity relations	-0.37	-0.2	-	84	-1.83	-0.9	-0.09	47	-1.29	-0.6	-	5	-	-0.5	-0.05	68

Source: Estimates based on the study "Evaluation of Daycare Services in the Municipality of Rio de Janeiro, 2001".

Note 1: The model includes controls for child age, gender and race, presence of parents, household head years of schooling and per capita income.

Note 2: Sample size: 752 children.

Note 3: R² range from 0.64 to 0.66.

Table 6. Relationship between Annual Unit Cost and Daycare Center Quality, Municipality of Rio de Janeiro, 2001

Explanatory	Daycare center quality (specification)					
	Linear		Logarithmi		Logit	
	Coefficien	P-value (%)	Coefficient	P-value (%)	Coefficient	P- (%)
Intercept	8.6	0	10.09	0	9.56	0
Daycare center scale						
Logarithm of size (number of full-time equivalent children)	-0.37	0	-0.37	0	-	0
Daycare centers quality						
Function of the overall measure of quality	1.9	0	0.73	0	0.44	0
Impact on costs of offering a high quality as opposed to a low quality service (%)	72		68		72	
Number of observations	109		109		109	
Adjusted R²	0.33		0.31		0.32	

Source: Estimates based on the study "Evaluation of Daycare Services in the Municipality of Rio de Janeiro, 2001."

Note: Dependent variable: Logarithm of unit

Table 7. Relationship between Annual Unit Cost and Daycare Center Quality, Municipality of Rio de Janeiro, 2001

Explanatory variables	Coefficient	Impact on costs of offering a high-quality as opposed to a Low-quality service (%)		P-value (%)
Intercept	8.55			0
<i>Daycare center scale</i>				
Logarithm of size (number of full-time equivalent)	-0.34			0
<i>Daycare center quality</i>				
Infrastructure	1.40	40		1
Health and Sanitation	-0.49	-15		27
Activities and program structure	0.42	19		21
Human resources	1.55	72		0
Parents and community relations	-0.43	-19		6
Number of observations		109		
Adjusted R ²		0.48		

Source: Estimates based on the study "Evaluation of Daycare Services in the Municipality of Rio de Janeiro,"

Nota 1: Dependent variable: log of unit cost.