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## ***Time of attendance and diarrhea incidence in infants who attended a day care center.***

**Original Article**

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### **SUMMARY.**

**Objective.** To examine the relationship between the Time of Attendance (TA) and the Incidence Rate of Diarrhea (IRD) in a group of infants who attended a Day-Care Center (DCC) in Merida, Yucatan, Mexico.

**Design.** Observational, and prospective epidemiological study.

**Subjects.** Infants from 1.5 to 23 months old, who attended a DCC since the 1<sup>st</sup> of August 1996 until the 31<sup>st</sup> of July 1997.

**Measurements.** The number of episodes of diarrhea, and the time at risk of diarrhea in a group of infants classified as exposed if TA ≤ 30 days, and as unexposed if TA > 30 days.

**Results.** Taking into account the age variable, the IRD is 41% higher in the exposed group compared to the unexposed, and the Incidence Rate Ratio of Diarrhea (IRRD) has an average decrement of 49% across the groups of age when the IRRD from a Group of Age (GA) is compared to the IRRD of the next group of older age.

**Conclusions.** TA has a detrimental effect over the

IRD in infants with TA ≤ 30 days, and GA has a protective effect over the IRD when infants change from a GA to the next group of older age.

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**Key words:** Day-care center, infantile diarrhea, cohort studies.

### **RESUMEN.**

**Tiempo de asistencia e incidencia de diarrea en infantes que asisten a una guardería.**

**Objetivo.** Examinar la relación entre el tiempo de asistencia (TA) y la tasa de incidencia de diarrea (TID) en un grupo de infantes que asistieron a una guardería en Mérida, Yucatán, México.

**Diseño.** Estudio epidemiológico observacional y prospectivo.

**Sujetos.** Infantes de 1.5 a 23 meses de edad que asistieron a una guardería desde el 1 de agosto de 1996 hasta el 31 de julio de 1997.

**Mediciones.** El número de episodios de diarrea y el tiempo en riesgo de diarrea en un grupo de infantes

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clasificados como expuestos si TA $\leq$ 30 días y como no expuestos si TA $>$ 30 días.

**Resultados.** Tomando en consideración la variable edad, la TID es un 41% mayor en el grupo expuesto comparada con la de los no expuestos y la Razón de Tasas de Incidencia de Diarrea (RTID) decrece en promedio un 49% entre grupos de edad al comparar la RTID de un Grupo de Edad (GE) con la del siguiente grupo de mayor edad.

**Conclusiones.** El TA tiene un efecto perjudicial sobre la TID de los infantes con TA $\leq$ 30 días y el GE tiene un efecto protector sobre el comportamiento de la TID cuando los infantes cambian de un GE al siguiente grupo de mayor edad.

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**Palabras clave:** Guarderías, diarrea infantil, estudio de cohortes.

## INTRODUCTION.

Diarrhea is among the diseases, which occurs most frequently, and with a higher frequency in DCC (1-5). Among the most affected children are those under 2 years old (6-8) with diarrhea episodes that vary in number according to the environmental conditions of the DCC (9-11), and also in relation to the personal characteristics of the children (12). This is the case when the frequency of infantile diarrhea is compared between day-care centers that are located in countries with different levels of economic development (11-13).

In this investigation, we examine the effect of the TA over the IRD. The TA has been studied before (14), but this time we are interested in the magnitude of their influence over the IRD in a DCC located in a developing country. The purpose of this study is to quantify the magnitude of the relationship between the TA and the IRD in a cohort of infants who attended a DCC center from August 1996 to July 1997. The DCC is located in Merida, Yucatan, Mexico, and we observed a group of infants from 1.5 to 23 months old who give a total of 8823 children-day of observation. The objective was to compare the rates of diarrhea incidence between the exposed and the

unexposed group; for that matter we use stratify analysis and Poisson regression in order to obtain estimators of the rate ratios according to the levels of attendance, and from that estimators derive our conclusions.

## MATERIAL AND METHODS.

We observed a dynamic cohort who was composed of 151 infants, and whose ages vary from 1.5 to 23 months old; these infants began attending the DCC since the first day of August of 1996, and followed up for a year. In order to be included in the study cohort, we select from the pool of infants those who met the following inclusion criteria: to be registered to the DCC, to be between 1.5 and 23 months old at the time of registration, and to be free of any chronic illness. In order to collect the information about the required variables, we visited the facility once a week, and we obtained information about the number of episodes of diarrhea, the time at risk of diarrhea by infants by day, and the TA to the DCC; we were also interested in the effect of the age variable over the IRD, and for that matter we divided the studied population into four age groups; these groups have the same distribution by age that the DCC use for their purposes of the distribution of infants to the classrooms. Then a database was elaborated, and the information obtained was resumed, and analyzed using the STATA (15) software. From this analysis we obtained the statistical tests, and confidence intervals about the estimators of the IRD, and the IRRD.

**Variable definition.** Time of assistance. This is the total of days the infant attended to the day care center since the day of registration, and for any day to be counted, the infant must stay in the facility for at least one hour, and based on the data that IRD is higher in the first 4 weeks after registration (14) this variable was dichotomized with respect to the exposure: the exposed were those infants who stayed in the facility for 30 days or less, and the unexposed were those who stayed in the facility more than 30 days. Incidence Rate Ratio of Diarrhea. This is the ratio of the IRD between the exposed and unexposed infants. Definitions of diarrhea, diarrhea episode, child-day, time at risk,

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**Table 1**  
Episodes and time at risk of diarrhea by attendance and age.

Age (months)	Exposed Attendance ≤ 30 days		Unexposed Attendance > 30 days		Total	
	Episodes	Child-days	Episodes	Child-days	Episodes	Child-days
1.5-5	12	299	31	931	43	1230
6-11	10	352	30	1632	40	1984
12-17	7	561	17	1902	24	2463
18-23	2	254	9	2897	11	3146
Total	31	1466	87	7357	118	8823

and IRD were given in a previous study (16).

## RESULTS.

From August 1996 to July 1997 the studied population gave a 8823 child-day of observation from a total of 151 observed infants. Data about the distribution and frequency of diarrhea episodes, and the time at risk of diarrhea are summarized in table 1. This table shows the distribution of the diarrhea episodes, and the time at risk of diarrhea by the time of assistance to the DCC. The number of episodes of diarrhea shows an increase at the time that the age group is decreasing, and there is also an increase in the number of child-day at risk of diarrhea that is directly related to an increase in the AG; from this data we derive the incidence rates, and the incidence rate ratios of diarrhea, which are presented in tables 2 and 3. Table 2 shows the IRD by the level of exposure; the IRD were higher in the exposed group compared to the unexposed, and this parameter has a decrement in

an inverse manner to an increment in the GA. Table 3 compares the IRRD by age group; in this table, the Poisson regression estimates of the IRRD shows that for the youngest age group the IRD is 9 times higher than the IRD for the reference group, and the average IRRD across the groups of age is 0.49 episodes/child-day (95% CI 0.41-0.59); from the stratify analysis, there is no significant change in the IRRD among the age groups, and the summary measure of effect is 1.41 episodes/child-day (95% CI 0.94-2.14).

## DISCUSSION.

In this study, the TA has a detrimental effect over the IRD in the group of infants with TA ≤ 30 days, and the total IRD for these exposed infants is about 80% higher than the IRD for the infants with TA > 30 days. After adjusting for the age of the infants, the IRD for the exposed was 41% higher than the IRD for the unexposed; this comparison was not significant, and suggests that the age variable behaves as a confusing

**Table 2**  
Incidence rate of diarrhea by attendance and age with 95% CI.

Age (months)	Exposed Attendance ≤ 30 days	Unexposed Attendance > 30 days	Total
	IR (CI)	IR (CI)	IR (CI)
1.5-5	14.65 (14.17-15.13)	12.15 (12.01-12.29)	12.76 (12.65-12.87)
6-11	10.37 (10.03-10.71)	6.71 (6.65-6.77)	7.36 (7.31-7.41)
12-17	4.55 (4.41-4.70)	3.26 (3.23-3.30)	3.56 (3.53-3.59)
18-23	2.87 (2.62-3.12)	1.13 (1.12-1.15)	1.28 (1.26-1.29)
Total	7.72 (7.65-7.79)	4.32 (4.31-4.33)	4.88 (4.87-4.89)

IR = Incidence Rate

CI = 95% Confidence Interval

**Table 3**  
**Estimators of the incidence rate ratio of diarrhea with 95% CI.**

Age (months)	IRR <sub>D<sub>SRT</sub></sub> (CI)	IRR <sub>D<sub>REG</sub></sub> (CI)	IRR <sub>D<sub>M-H</sub></sub> (CI)	IRR <sub>D<sub>AGE</sub></sub> (CI)
1.5-5	1.21 (0.56, 2.41)	9.39 (4.82, 18.30)		
6-11	1.55 (0.67, 3.25)	5.55 (2.84, 10.84)		
12-17	1.40 (0.49, 3.54)	2.63 (1.28, 5.40)		
18-23	2.53 (0.27, 12.22)	Reference group		
Total	1.79 (1.15, 2.72)		1.41 (0.93, 2.12)	0.49 (0.41, 0.59)

CI = 95% Confidence Interval

IRR<sub>D<sub>SRT</sub></sub> = Estimator of the Incidence Rate Ratio of Diarrhea using stratify analysis.

IRR<sub>D<sub>REG</sub></sub> = Estimator of the Incidence Rate Ratio of Diarrhea using Poisson Regression.

IRR<sub>D<sub>M-H</sub></sub> = Summary Estimator of the Incidence Rate Ratio of Diarrhea using Mantel-Haenszel.

IRR<sub>D<sub>AGE</sub></sub> = Estimator of the Incidence Rate Ratio of Diarrhea across the groups of age using Poisson Regression.

variable, and then the summary measure of effect among the age groups was derived. Another important aspect about the age variable is the fact that the GE has a protective effect over the IRD; this is evidenced when we compare the IRRD from any age group to IRRD of the next older age group, and the average magnitude of this change is about a 50% reduction in the IRD; in practical terms it means that when an infant gets older, and changes to the next older age group, then this new age group to which the infant belongs experiences 50% reduction in the IRD in relation to his/her old group of age.

With respect to the behavior of the IRD, data shows that this parameter is higher in all age groups in the exposed group compared to the unexposed. Considering the relationship between the IRD and the GE, we found that they are inversely related in both groups of exposure, and the magnitude of the change between the youngest and the older age group is about nine-fold.

With respect to the IRRD we found that the magnitude of this measure of effect is directly related to the GE, and consequences from this relationship is that the differences between exposed and unexposed with respect to the IRD become greater as the GE change to the next level of older age; this has some implications if we are interested in the search for etiological clues about the possible causes of the diarrhea in the DCC, that is more likely to see a difference between the rates of diarrhea when the

selection of the groups for study include the older age groups instead of younger groups; but if the interest is in the impact of the disease in the DCC, then the suggestion is to select the younger age groups to study instead of the older groups.

In summary, the TA has a detrimental effect over the IRD in the infantile group with TA £30, and the AG has a protective effect over the IRD when we compare any age group to the next older age group.

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