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Impact of Massage Therapy on Health Outcomes Among Orphaned Infants in Ecuador

Results of a Randomized Clinical Trial

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Diarrhea is the second leading cause of death among infants and young children in the developing world. This project investigated whether therapeutic infant massage could reduce diarrheal episodes and decrease overall illness of infants. Infants living in 2 orphanages in Quito, Ecuador, were matched by age and randomly assigned to an experimental or a control condition. The experimental group received an intervention, daily infant massage therapy by orphanage staff or volunteers, which lasted an average of 53 days, and symptoms of illness data were documented daily by volunteers in the orphanages. Results indicated that control group infants had a 50% greater risk of having diarrhea than experimental infants (rate ratio [RR] = 1.54, 95% confidence interval [CI] = 1.18, 2.03, $P < 0.001$). Control group infants were also 11% more likely than experimental infants to experience illness of any kind (RR = 1.11, 95% CI = 0.96, 1.28, $P = 0.17$). The implications for the use of therapeutic infant massage, a remarkably inexpensive intervention, are discussed, and the need for further research is highlighted. **Key words:** *diarrheal disease*, *infant massage*, *intervention*, *infants in orphanages*

ACCORDING TO a recent World Health Organization report, during the 2000–2003 period, diarrhea remained the second most common factor responsible for mortality of children younger than 5 years in the world[1] and the fourth most common factor responsible for mortality of all persons worldwide.[2] In fact, approximately 2 million children younger than 5 worldwide die each year as a result of diarrhea and associated dehydration[3] while the total number of persons dying because of diarrhea was 2.4 million,[4] indicating that approximately 83% of deaths due to diarrhea occur in the first 5 years of life.

Diarrhea is quite common in institutions such as orphanages where infants come in close contact with each other for prolonged periods of time.[4] In developing countries, the provision of zinc[5–8] and improvements in water quality and sanitary conditions[9–13] have proven effective in decreasing diarrhea in many circumstances. Such interventions have not universally been implemented in orphanages, where diarrhea is common. In fact, a lack of improvement in water quality and sanitary conditions accounts for 88% of deaths from diarrhea in developing countries.[14]

In industrialized countries, such as the United States, diarrhea is common in day care settings, where infants are cared for in group settings for many hours each day.[15] Diarrhea is

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Table 1. Infant demographic information

	Experimental group ($n = 14$)		Control group ($n = 16$)		
Variable	***M***	**SD**	***M***	**SD**	***P***
Age of infants, mo	10.6	8.16	10.4	5.90	0.90
Age at entry to orphanage, mo	3.1	8.40	2.4	5.87	0.77
Infants entering orphanage in first 2 weeks of life, *n*	10		10		
Bayley Mental Score (*pretest*)	67.4	12.71	72.9	13.10	0.26
Bayley Motor Score (*pretest*)	76.4	15.87	81.6	15.09	0.36
Female, %	29		63		0.06

the second most common illness seen in children in child care settings,[16] although death as a result of diarrhea is not common. The estimated cost burden of diarrhea is more than $200 million per year in the United States,[17] where the risk of diarrheal disease is 2 to 3 times higher in children attending child care facilities than in children cared for at home.[18] Interventions in child care settings, such as increased handwashing among children and staff, have been effective in reducing the incidence of diarrhea for children older than 2 years, but such interventions have not universally been implemented in child care centers, and they have not shown consistently positive effects for infants younger than 2 years.[19] Thus, diarrhea has a human and potentially economic effect in developing countries where death due to diarrhea is high, and it has a high cost in the United States, where parents often miss work because of this problem. It is imperative that interventions with the potential to decrease the incidence of diarrhea be developed and tested to decrease the likelihood of diarrhea in infants and young children.

Massage therapy is one intervention with such potential as it has been linked to positive health outcomes in a variety of populations. For example, massage positively affects the immune system by increasing the natural killer cells present in human immunodeficiency virus–positive adolescents[19] and adults.[20] Massage therapy has also been shown to have positive effects on the health status of premature infants through increased weight gain and earlier hospital release in comparison with premature infants who were not massaged,[21–23] children with diabetes by decreased glucose levels,[24] and children with asthma by increased performance on all clinical indicators of asthma such as peak air flow.[25] The purpose of this study was to determine whether infant massage would decrease the incidence of diarrhea and overall illness in infants living in orphanage settings.

METHODS

Subjects

Thirty-seven infants from 2 orphanage nurseries in Quito, Ecuador, were randomly assigned to an experimental ($n = 17$) or a control ($n = 20$) group after matching by age. Infants ranged in age from 2 to 33 months ($M =$ 10 months). No congenital birth defects were apparent in any of the infants at the time of assignment. Descriptive data are presented for 30 infants in Table 1. Seven infants (3 experimental and 4 control) were lost to follow-up at the first orphanage as a result of leaving the orphanage nursery before the conclusion of the study.

A series of independent-samples *t* tests (for continuous variables) and chi-square tests (for categorical variables) indicated that the groups were balanced on basic demographic

characteristics, except that the proportion of male and female infants varied significantly between the experimental and control groups, with a higher percentage of male infants, who are more vulnerable biologically than female infants, in the experimental group. Approval to conduct the study was obtained from the Utah State University institutional review board and the administration of both orphanages.

Site descriptions

Site 1 was a Catholic orphanage that, at the time, had 31 infants living in the nursery. Infants were either brought in by their parents or found abandoned and brought in by the police. Sanitary conditions were optimal, with an emphasis placed on cleanliness in most areas. The floors in the nursery area, which included 6 rooms and 1 hallway, were mopped twice daily. Infants' clothing was washed on a daily basis, as were their crib sheets. However, the toys that the infants played with daily were washed only on a monthly basis. Normally, 17 to 26 infants older than 6 months played in one large room where they were supervised by 3 to 4 staff members or volunteers. Infants younger than 6 months were cared for in another room and removed from their cribs for diaper changes and baths, but not for individual stimulation.

Site 2 was a private orphanage that, at the time, had 8 infants and young children in its care. Infants in this orphanage were brought in by their parents. Sanitary conditions were similar to those found at Site 1. Normally, two volunteers supervised 6 to 8 infants and young children during their "playtime." Similar to Site 1, infants younger than 6 months were normally taken out of their cribs for diaper changes and baths, but received no further individual stimulation.

Intervention

Infants in the experimental group received a 15-minute full-body (including the legs, stomach, chest, arms, face, and back) massage daily, usually in the morning, delivered by orphanage volunteers or staff, all of whom were trained in infant massage by a PhD-level, certified instructor using techniques endorsed by Infant Massage USA.[26] Infants in the control group received no intervention.

Interventions for the infants began after group assignment and the collection of pretest information. As such, infants' first day of symptom of illness data collection differed according to whether all pretest data were collected: some infants began on 1 day while others might not begin for 2 weeks. Orphanage volunteers recorded daily observations, usually each morning, of all visible symptoms of illness experienced by the infants. Symptoms appearing later in the day were recorded whenever possible. Symptoms checked included the following: upper respiratory symptoms, including clear-runny or snotty nose, yellow-runny or snotty nose, congestion, cough and crusty eyes or nose; symptoms of infection, including diarrhea and vomiting; and general symptoms of illness, including abnormal whining or fussiness.

Statistical analyses

Person–time incidence rates for diarrhea (defined as watery stool that takes the shape of the container that holds it) and overall illness (including all symptoms of illness) were computed for each group, with number of days as the unit of time. Thus, in each group, the total number of days that either (*a*) diarrhea or (*b*) any illness was documented was calculated and divided by the total number of days that documentation existed for each infant. To determine whether the person–time incidence rates differed significantly between the experimental and control groups, the incidence rate ratio was tested for statistical significance (2-tailed, $\alpha = .05$) using the software package *COMPARE2*.[27] In addition, a prevented fraction was also computed for both diarrhea and any illness, defined as the hypothetical proportion of diarrhea or illness in the target population that can be

Table 2. Summary statistics for time in study and incidence rates by group

		Number of days in study		Total person days in study	Diarrhea		Any illness	
Group	*N*	*M*	SD		No. of days	Person days incidence rate	No. of days	Person days incidence rate
Control	16	52.69	4.87	555	155	0.28	430	0.78
Experimental	14	53.43	3.94	481	87	0.18	336	0.70

prevented by exposure to the intervention, infant massage.[28]

RESULTS

See Table 2 for a summary of infant time in the study and illness rates for the 2 groups. Infants had a mean participation duration of 53 days in the study (experimental infants: $M = 53.4$ days, SD = 3.9; control infants: $M = 52.7$ days, SD = 4.9, $P = 0.65$). A Fisher test of the rate ratio indicated that the diarrhea incidence rate of 0.28 cases per person day in the control group was significantly larger than the rate of 0.18 cases per person day observed in the experimental group (rate ratio [RR] = 1.5, 95% confidence interval [CI] = 1.2, 2.0, $P < 0.001$). Thus, the incidence rate of diarrhea was approximately 50% higher among infants in the control group than in the experimental intervention group. The prevented fraction for the target population was estimated to be 16%, indicating that by participating in the massage intervention, the incidence of diarrhea could possibly be reduced by 16% among similar populations of infants.

Although the person-day incident rate for any illness was larger in the control group (0.78) than in the experimental (0.70) group, this difference as tested by the incidence rate ratio was not statistically significant (RR = 1.11, 95% CI = 0.96, 1.28, $P = 0.17$). The prevented fraction for incidence of *any* illness in the target population was estimated to be 5%, indicating a small reduction in the proportion of cases that would have experienced any illness due to implementation of the massage intervention in a similar population. (The incidence rate of diarrhea or any illness per 2-week period can be computed by multiplying the person-day incidence rates presented in Table 2 in each group by 14.) This would result in a diarrhea incidence rate of 3.92 days per 2-week period in the control group versus 2.52 days in the experimental group and an overall illness incidence rate of 10.92 days per 2-week period in the control group versus 9.8 days in the experimental group.

DISCUSSION

Results of this experimental pilot project were promising in that infants who were massaged daily had significantly fewer days of diarrhea and slightly lower rates of overall illness than infants in the control group. As noted above, other studies have indicated that massage improves immune functioning, and there may have been increased immunity in the infants in the experimental group in this project. Another possibility is that massage improved infants' gastrointestinal functioning through stimulation of the vagus nerve.[29]

If massage can indeed decrease the incidence of diarrhea among orphaned infants, this avenue of intervention should be pursued, particularly given the high risk of mortality associated with this condition in developing countries. This would be particularly important in child care situations, as infants

in child care experience diarrhea more frequently than babies who are not in substitute care. Massage interventions can be inexpensively implemented in resource-poor countries where zinc supplements may not be easily available and improving water quality may be especially difficult to accomplish. In addition, massage therapy can be implemented on a daily basis by mothers and/or institutional staff, and has the advantage of being associated with positive parent–child outcomes such as secure attachments.[30]

Limitations of the current study included a lack of baseline data on preexisting infant illness (although with random assignment it is assumed that an unbiased sample will result as confounding factors are randomly distributed between the groups), missing data on infants, and a lack of researcher blindness to study conditions (ie, volunteers who massaged the infants were also the observers of infants' symptoms). Future work should strive to resolve these issues and to investigate whether and by what mechanisms infant massage positively affects illness status, especially diarrhea. For instance, questions remain as to whether infant massage plays a preventive or a therapeutic role in the context of diarrheal episodes as well as the short- and long-term effects of infant massage therapy on infant outcomes. To address such questions, greater documentation of baseline illness patterns measured before intervention, a longer duration of obtaining symptoms of infants, and assays of levels of various bacteria and viruses in infants are needed.

Results also indicated that infants in the orphanages in this project were sick the majority of the time, even though their living quarters were quite sanitary. These results may reflect an unfortunate reality of institutional care in orphanages where caregivers interact minimally with infants, and infants live in close quarters and are exposed to each other on a regular basis. Efforts should be made to improve the health status of infants living in such environments, and interventions emphasizing physical contact may be key in ameliorating this trend.[31] Future work is warranted in this area.

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