

# Rheumatic Fever in Samoa: Education As Prevention

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## **Abstract:**

*The incidence of acute rheumatic fever (ARF) and its sequela rheumatic heart disease (RHD) is disproportionately high among the children of Western Samoa. Basic symptoms of ARF include fever, joint pain, and a sore throat. The condition of strep throat, if left untreated, may initiate an immune response which can damage the heart and become RHD. Primary prevention currently consists of educating locally trained nurses to detect strep throat and dispense antibiotics as necessary. The concept of targeting proximal caregivers with prevention information has not been explored.*

*Health behavior theories offer methodology for the development, implementation, and evaluation of health promotion programs. This study incorporates the interpersonal level of the ecological model (EM) in conjunction with the four elements of the social change model (SCM) which are critical thinking, fundamental skills, cultural sensitivity, and action. The purpose of this study was to test the hypothesis that an educational prevention program can be effective in disseminating pertinent information regarding ARF prevention. This study followed a matched-pairs, same subject design, using a pre-/post-survey as the observational tool in which to measure the effectiveness of the presentation.*

*The question that targeted trust of health care workers showed a statistically significant increase ( $p < .0001$ ) from approximately 50% in the pre-survey to 73% in the post-survey. The question regarding antibiotic treatment was slightly significant for the pre-survey ( $p = 0.0428$ ), but showed increased statistical significance for the post-survey ( $p < 0.0001$ ). Responses targeting the contagious factor changed in significance between the pre- and post-survey from  $p = .009$  to  $p < .001$ . The response change for the question targeting the possibility of a child contracting a sore throat as school changed from  $p = .0123$  to  $p < .0001$ . These findings support the use of a basic and inexpensive educational prevention program.*

## **Introduction**

Acute rheumatic fever (ARF) and its sequela rheumatic heart disease (RHD) are diseases with potential life changing results. Despite documented decreases, the prevalence of these diseases remains a major problem in tropical regions and resource-poor countries<sup>1</sup>. Western Samoa (Samoa) is a country considered to be among those tropical and resource-poor countries grappling with ARF and RHD. The prevalence of cases found in Samoa is among the highest reported in the world<sup>2</sup>. International agencies, including the World Health Organization (WHO) and the World Heart Federation (WHF), have recognized the need to



address this issue. Collaborating with local officials and physicians, a coordinated effort has been underway to decrease its prevalence<sup>3</sup>.

Although Samoa has the ability to disseminate an intervention, it is a country with limited resources. The burden of ARF and RHD, and its associated costs, are placing a heavy and increasing drain on the economy of Samoa<sup>4</sup>. It is incumbent, therefore, that a preventative intervention be developed and for planners to be aware of the resources and limitations, and design a program accordingly. The purpose of this study is to explore an elemental and inexpensive health education intervention which targets the most proximal influence on the children of Samoa. The conclusions of this study will not only provide valuable information for Samoan officials, but will also demonstrate the value of an educational intervention.

## Background

It required the first six decades of the 20th century to establish the etiology for ARF is the sore throat, or pharyngeal infection with Group A streptococcus (GAS), as reported by Stollerman and other experts<sup>5</sup>. In addition, contact or close proximity to a GAS carrier perpetuates the spread of GAS infection and increases the potential for ARF cases<sup>1</sup>. Other symptoms are listed among the Jones Criteria<sup>6</sup>. To date, the governing bodies of international organizations, as well as regional and local officials, are pursuing the proven antidote to combat ARF, which is the use of penicillin for strep throat<sup>3,5</sup>.

## Relative to Samoa

The empirical data exposing the prevalence of ARF and RHD in Samoa are substantial and compelling, ranking Samoa as one of the highest in the world<sup>4</sup>. The prevalence of RHD in school children is approximately 77.8 per 1000, compared to 9.6 in neighbouring Australia and 6.5 among the Maoris population of New Zealand<sup>2</sup>. During the years 1997-2004, 87% of the admissions at the government hospitals were due to ARF and RHD. Of the 87%, approximately 72% were children between ages 5-14 years<sup>3</sup>. Children age 5-15 years constitute the highest at-risk population for ARF, which accounts for up to 60% of all cardiovascular disease diagnoses in that sector<sup>4</sup>. Approximately 92.6% of the Samoan population is indigenous; with over 39% aged less than 15 years and only 4% aged 65 years and over<sup>7</sup>.

A country like Samoa, with limited resources indicated by an annual gross domestic product (GDP) per capita of \$5,600, must bear the burden of outside referrals that are frequently required during the course of treatment<sup>8</sup>. The 2004/2005 National Health Account (NHA) reports health expenditures to be 23.8% of the total government budget, which is 5.4% of the gross domestic product. Once RHD has advanced to require surgical intervention, patients are referred to New Zealand for procedures that are not available locally, including cardiac surgery resulting from RHD<sup>3</sup>.

## Theoretical Analysis

Qualitative research methods are suitable for exploring complex social processes and to uncover beliefs, values, and motivations that underlie individual health behaviors<sup>9</sup>. The Ecologic Model (EM) and

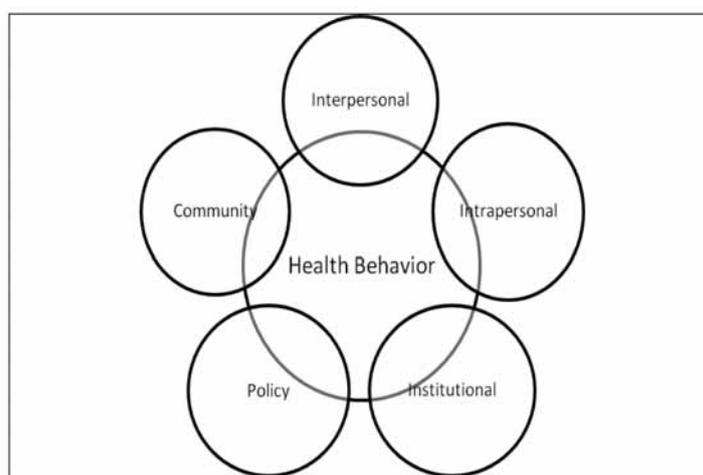


the Social Change Model (SCM) health behavior model offer a reliable and valid theoretical framework for the development of health promotion programs and are well suited for the present study. The survey and presentation created using these two theories allows for comprehension and duplication by other researchers<sup>10</sup>. These theories identify the targets for change and the methods, or operationalized constructs, for accomplishing the changes<sup>11</sup>. The specific targets for this program follow the levels of the EM and require the progression outlined in the SCM. For the purposes of this study, the inter-personal level will be targeted by activating the influences at the community, or village, level in conjunction with the four factors of the SCM, moving from fundamental skills to action<sup>11</sup>.

### ***Ecological Model***

Oftentimes, health behavior models do not consider the environmental context of behavior change as a different level of intervention. Developed by Rudolph Moos (1980), the EM offers a social ecological model of health-related behavior to study the influence of the outside environment on an individual<sup>11</sup>. Health is influenced by multiple components of personal and social situations, therefore the need to develop health promotion interventions capable of altering the environmental factors that facilitate or hinder appropriate health behaviors (Figure 1). The EM gives a framework with which to study the consequence of the caregiver opinions and beliefs. The classification of intrapersonal level intervention in which health promotion programs can be developed, implemented, and evaluated through the participation of the community level influence of the health care services is included in the EM.

**Figure 1: Ecological model – levels of intervention**

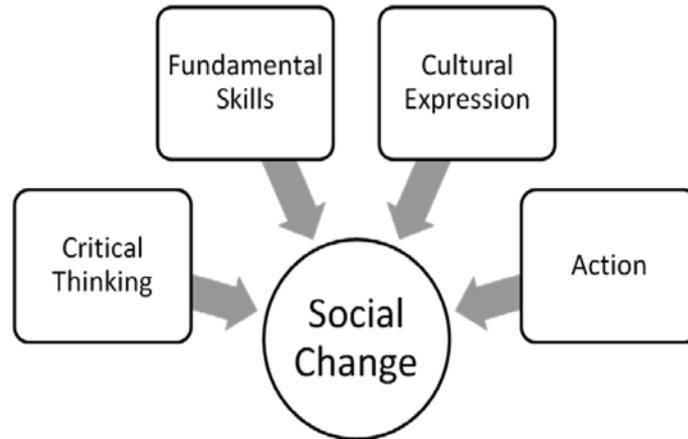


The target audience for this study is the interpersonal, or family and friends, relationships associated with Samoan children at risk for ARF and RHD. The family is the main institution of Samoa<sup>12</sup>; therefore, familial structure needs to be incorporated into education programs<sup>13</sup>.

### ***Social Change Model***

The development of the survey and the educational presentation were guided by the four levels of the SCM, as well as other factors including financial and language barriers. As a result, the educational presentation developed for this study was designed to be inexpensive, unthreatening, and culturally sensitive. The concept of social change was championed by Lynn Curtis, PhD, with literacy project<sup>14</sup>. The heuristic elements defined by Curtis crossover easily to this study (Figure 2).



**Figure 2: Social Change Model**

Consideration of community issues, problems, skills, culture, and language should be part of health promotion program development and evaluation. When health behavior improves in the family or community, the probability of sustained success is increased<sup>14</sup>. The first component of SCM, critical thinking, was applied in this study by advancing the concept of associating a sore throat with possible future serious complications and understand the meaning of what these complications are, which in turn provoke participants to feel motivated to seek beneficial action, are also embedded within the presentation and evaluated by a pre- and post-survey design. Fundamental skills is the second level of the SCM, which is operationalized in this program by informing participants to recognize a sore throat as a serious condition and to know their connection to proper medical help. The third level, cultural expression, is defined as “The most important realities of individual and community life... and must be understood, shared, and celebrated”<sup>11</sup>. The educational presentation was designed to teach concepts by using Samoan dialect, concepts, illustrations, and associations. Furthermore, the presentation is unassuming and required no electronic equipment or technical support. The fourth level, action, is a cumulative effect of the entire project to instill among the participants motivation to actively seek medical attention when a village child has a sore throat.

## Methods

The procedural process for the current study included both a pre-survey and a post-survey, with an interim education presentation. Considered cost effective and efficient, this method of scientific inquiry is adaptable for developing countries such as the Independent State of Samoa<sup>15</sup>. Questions and concepts were kept simple and culturally appropriate in order to avoid potential confusion, misinterpretation, misrepresentation, and intimidation<sup>16</sup>. A pilot group was assembled prior to taking the program to Samoa, and the feedback received was incorporated in the final presentation and survey. Parent groups on the island of Upolu, Samoa, were convened to conduct this study; participation was voluntary. Locations were at schools in the capital city of Apia and churches located in rural villages. The pre-survey was administered, followed by a 15-minute oral/visual presentation. The program finished with the completion of a second and identical post-survey. No questions were fielded until all surveys were collected. A follow-up survey was administered to a small sample size of the original participants six months post-presentation in order to assess retention. Participant inclusion consisted of the following criteria: (a) age 20+ years, (b) permanent village resident, (c), willingness to participate and stay for the entire presentation, and (d) ability to complete survey.



Each question was guided by the EM and SCM models<sup>17</sup>. Questions were designed to test the hypothesis that a culture specific educational presentation can effectively inform interpersonal relations of Samoan children age 5-15 years about signs and symptoms associated with ARF through community meetings. The 15-minute intervention presentation consisted of 30 posters that targeted the following concepts:

1. Although a common condition, a sore throat can have serious consequences.
2. It is necessary to seek appropriate medical care in order to obtain antibiotics.
3. The condition of a sore throat is contagious; children can be exposed at school.
4. An untreated sore throat can be fatal.
5. A properly treated sore throat can be completely cured with no lasting effects.

In deference to previous research, the survey and presentation were produced in both the Samoan and English languages in order to accommodate both indigenous and immigrant participants<sup>18</sup>. The current study was conducted under the Samoan title *Mo le Fanau*, interpreted as *For the Children*.

## Research Design

This study is an example of nonrandomized qualitative research in the natural setting, which generated numeric data through a standardized process with predetermined response categories<sup>9</sup>. This study followed a matched-pairs, same subject design, using a pre-/post-survey as the observational tool in which to measure the effectiveness of the presentation. Similar designs have been used previously with health behavior studies in which subjects were asked comprehensive questions regarding particular health behaviors, then exposed to pertinent information, followed by a second inquiry, follow-up with final questioning after a period of time to test for retention<sup>17</sup>. The final group of participants represents a convenience sample of possible attendees. In order to test the hypothesis of this study, survey questions were constructed to determine before and after comprehension of the symptoms, the characteristics, and the seriousness of ARF, along with obtaining demographic information. Meetings began with an overview of the participant consent, followed by the pre-survey.

A 6-month follow-up was scheduled to demonstrate retention and/or relapse. During the interim months, Western Samoa was struck by a devastating tsunami, which hit the southwestern villages of Upolu that were visited for this study. Due to these extenuating circumstances a convenience sample of original participants, situated in the capitol city of Apia, were contacted for the 6-month follow-up. Of the 95 initial participants from Apia, 36 were located and agreed to complete the survey for the final follow-up with no additional information being given.

## Analysis

Data collection. Basic demographics were counted and compared. The responses were coded to assist in the analysis. The participants in this study represent a convenience sample of potential participants in the geographical area canvassed. Considering the challenges of travel to and communication with outlying villages, this sample (n=204) was adequate for the purpose of this study. Before and after counts were recorded for Questions (Q) 7-9, along with statistical significance for a "Yes" response and the associated 95% confidence intervals (CI).



Changes in probabilities for Q10-Q17 were measured using a mixed model logistical regression 19. Changes in proportions for Q10-Q17 were measured using a two-sample test for proportions. Data entry was done within an Excel spreadsheet and calculations were obtained using SAS statistical software applying  $\alpha=.05$ . The restricted number of participants for the 6-month follow-up limited the reporting to a basic discussion of trends demonstrated among those who could be contacted (n=36).

## Results

Demographic counts are displayed in Table 1. The majorities of respondents were female, and most were mothers aged 30-39 years. There is, however, a good representation from all age groups, and city and village dwellers are equally represented. Village dwellers were located on the south to south western side of the main island of Upolu.

**Table 1: Participant Demographics**

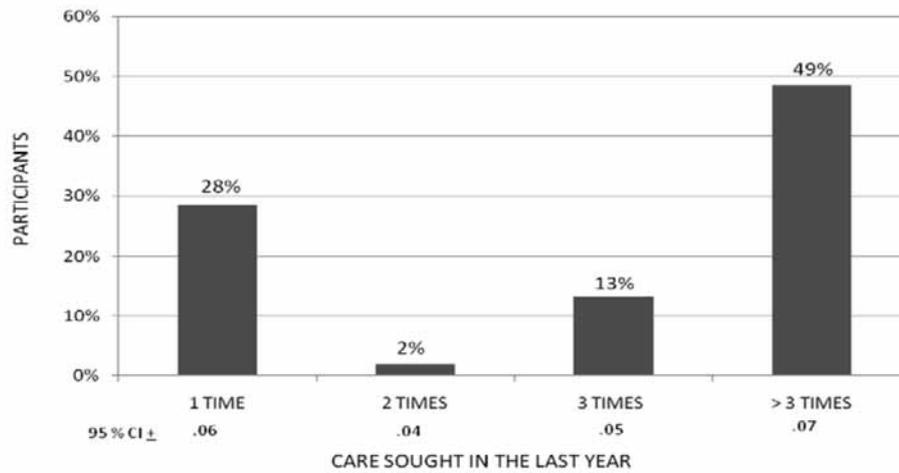
Variable	Count	% (n=204)
Age (years)		
<30	34	16.8
30-39	70	34.3
40-49	37	18.1
50-59	36	17.6
≥60	27	13.2
Gender		
Female	169	82.8
Male	35	17.2
Contact with Children		
Mother	148	72.5
Father	33	16.2
Teacher	9	4.4
Other	14	6.9
Residential Location		
City of Apia	95	46.6
Village	109	53.4
Education		
Elementary (<8 years)	35	17.2
High School (13 years)	124	60.8
*College (15 years)	26	12.7
Advanced (≥ 1 yr post college)	11	5.4
None	8	3.9

\*placement according to standardise exam

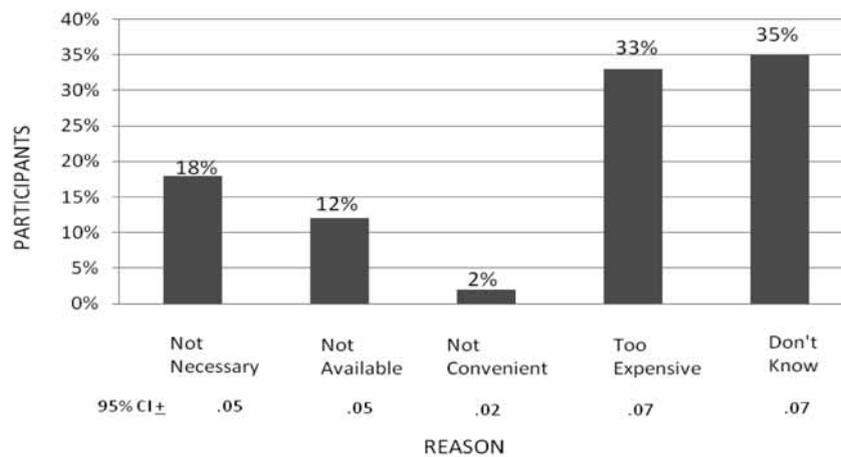
Response percentages for Q5 and Q6 are shown in Figure 3 and Figure 4 respectively. Question 5 asked if medical care had been sought within the past year. Approximately 49% of the participants sought medical help more than 3 times in the past year, and approximately 28% sought care 1 time or less.



**Figure 3: Number of times medical care sought in the last year**



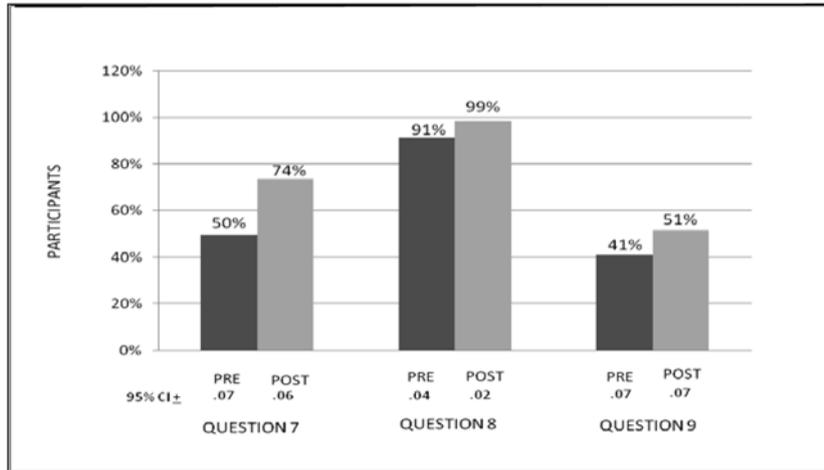
**Figure 4: Reason for not seeking medical care**



Pre- and post-survey counts for Qs 7, 8, and 9 are shown in Figure 5. Q7 addressed trust of health-care workers. Post educational intervention, a change in “yes” responses demonstrated a statistically significant increase in the amount of trust ( $p < .0001$ ) from approximately 50% to 74%.



Figure 5.: Q7-trust, Q8-concern over sore throat, Q9-prior experience



Question 8 indicated participant concern for a child with a sore throat lasting more than two days and remained high. The purpose of Q9 was to expose potential participant bias due to previous experience with ARF or RHD. Interestingly, the increase in “yes” responses showed a significant increase (p=.0068), indicating greater recall.

Questions 10 to 17 were tested for significance in probability both pre- and post-survey, and a comparison was made between the two results. The pre-comparison and psot-comparison of probabilities for a “yes” response are shown in Table 2.

Table 2: Questions 10-17: Mixed Model Logistical Regression (N=204)

QUESTION	TIME	PROPORTION	P-VALUE
Q10	PRE	0.942465	<.0001
Q10	POST	0.997039	<.0001
Q11	PRE	0.70922	0.0229
Q11	POST	0.792605	<.0001
Q12	PRE	0.391098	0.0428
Q12	POST	0.991425	<.0001
Q13	PRE	0.593125	0.009
Q13	POST	0	0
Q14	PRE	0.637331	0.0123
Q14	POST	0.998469	<.0001
Q15	PRE	0.969261	<.0001
Q15	POST	0.99867	<.0001
Q16	PRE	0.843143	<.0001
Q16	POST	0	0
Q17	PRE	0.964899	<.0001
Q17	POST	0.998513	<.0001



With regard to preference of medical services, Q10 shows statistical significance for both the pre- and post-survey ( $p < .0001$ ). The data contained in Table 3 further inform that the increased significance is statistically significant. The increased significance for Q11 demonstrates a higher likelihood that the participants would travel outside their village to seek medical services following the educational presentation.

**Table 3: Questions 10 to 17: Matched-pairs pre to post-survey (N=204)**

QUESTION	PRE	PROPORTION	POST	PROPORTION	P-VALUE
Q10	171	0.838235294	196	0.960784314	<.0001
Q11	134	0.656862745	146	0.715686275	.0229
Q12	89	0.43627451	196	0.960784314	<.0001
Q13	121	0.593137255	201	0.985294118	--
Q14	120	0.588235294	202	0.990196078	<.0001
Q15	178	0.87254902	197	0.965686275	<.0001
Q16	172	0.843137255	202	0.990196078	--
Q17	176	0.862745098	196	0.960784314	<.0001

Questions 12 to 14 demonstrated the most dramatic increase in statistical significance with regard to the need for proper medical care and contagion factor associated with a sore throat. Question 12 targeted proper medical protocol (Table 2) and was only slightly significant for the pre-survey ( $p = .0428$ ), but showed increased statistical significance for the post-survey ( $p < .0001$ ). Questions 13 and 14 targeted contagious qualities and were also significant (Table 2). Questions 16 and 17 targeted the fatal and curative factors associated with ARF, and both were significant (Table 2). Table 3 shows that changes between pre and post were also significant.

**Six-month follow-up** A summary of the responses to the 6-month follow-up (Table 4). Questions 7 to 17 were included in the follow-up. Overall, the trends are favorable to the effectiveness of the educational intervention. The results for Q10 are encouraging. Five of the 36 participants gave the same "yes" response as they gave in the post-survey, indicating retention regarding appropriate medical care. It is notable that for all five of these participants their responses on the pre-survey indicated the village healer.



Table 4. Summary Table for Follow-up (n=36)

Question	F = PRE	# of YES	F = POST	# of YES	DIFFER	# of YES	NO DIFF	# of YES
7	6	0	6	3	7	3	17	13
8	0	0	1	1	1	0	34	34
9	3	0	2	2	1	1	30	17
10	0	0	5	5	1	0	30	30
11	3	1	1	1	12	2	20	14
12	4	0	14	14	3	0	15	15
13	1	0	11	11	11	0	13	13
14	0	0	12	12	8	0	16	16
15	1	0	0	0	1	0	34	34
16	3	0	4	0	0	0	29	29
17	1	1	1	1	2	1	32	32

No Diff: no difference from pre- to post- to follow-up survey

F = Pre: follow-up the same as pre-survey

F = Post: follow-up the same as post-survey

Differ: follow-up different from pre- and post-survey

## Discussion

The results show improved comprehension among this sample group of Samoan adult caregivers with regard to factors associated with ARF. Responses for Qs 5 and 6 are important for decision makers involved with the Samoan health-care system. Approximately 28% of participants did not seek regular health services; the reasons indicated were uncertainty or expense. Uncertainty could indicate confusion about where and what type of medical services are available or required. The contagion property associated with ARF is not only critical to know, but is also carries a certain motivational influence to take appropriate action. The statistically significant improvement in responses indicates an increased understanding of this concept and an increased probability of acting when a child presents with a sore throat.

The 6-month follow-up survey, although small, was useful for observing and discussing trends present over time. An increased understanding of the concept of appropriate medical protocol for a sore throat, to any degree, carries important practical significance. Furthermore, the 5 follow-up participants who initially selected the village healer and subsequently changed to appropriate medical practitioners could show empirical benefit through lifting the financial burden caused by RHD, among more individual benefits.

## Limitations

Limitations include: challenge of locating and communicating with this population, participation was voluntary and non-randomized. Considering potential participants, the sample size was relative small; and due to natural disasters, the follow-up was limited to discussion information and not analytical data.



## Conclusion

These findings are encouraging for future ARF cases among the children of those who participated in this study. The conclusions from the current study can be used as supportive evidence that primary prevention is worth the diminutive investment of resources. Further, this study would not only promote the opportunity of decreasing the incidence of ARF and RHD, but would also promote good will between constituents and leadership. The framework for this study was guided by the EM and SCM models of health behavior. Future research could expand to other levels of EM and target community leaders and policy makers. This initial step was necessary to have as the foundation those most closely associated with the children, who in the end are the true benefactors.

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*“There is no strength without unity.”*

*Irish Proverb*

