

National survey of oral health status of children and adults in Turkey

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Objectives: To estimate the severity of dental caries and the periodontal status of children and adults in Turkey. **Basic research design:** This cross-sectional study was undertaken between September 2004 and February 2005. The Turkish Statistics Institute (TSI) selected a representative sample using the proportional stratified sampling method. The selected ages/age groups were 5, 12, 15, 35–44 and 65–74. At the end of the study, 7,833 individuals had been reached. Dental students were calibrated and examinations were done according to World Health Organization (WHO) guidelines during home visits. **Results:** Only 30.2% of the 5-year-old group was caries-free, and the mean dmft was 3.7. Mean DMFT was 1.9 in 12-year-olds, 2.3 in 15-year-olds, 10.8 in 35–44-year-olds, and 25.8 in 65–74-year-olds. In both adolescents and adults, the prevalence of caries was higher among females than in males. In rural areas, the prevalence of caries was high among 5-year-olds, while DMFT was high in the elderly. The prevalence of dental caries was similar for 12- and 15-year-olds in urban and rural areas. Slightly less than half (48.0%) of 65–74 year-olds were edentulous. Healthy periodontal tissue was noted in 56.2% of fifteen-year-olds. In the 35–44 yr-old age group, calculus problems were high (62.6%), and 1.2% had attachment losses of 6mm or greater. Rural subjects had more severe periodontal problems than their urban counterparts. **Conclusion:** Community-based oral disease prevention programs are needed urgently for the promotion of oral health in Turkey.

Key words: Adult, caries, children, DMFT, edentulousness, prevalence, Turkey.

Introduction

Over the past two decades, the prevalence of dental caries has significantly declined among both children and adults in most developed countries (Marthaler *et al.*, 1996, Marthaler, 2004). The main causes of this development are associated with changes in lifestyle, adoption of better oral hygiene habits, effective use of fluoride, and implementation of school-based preventive oral care programs (Petersen, 2003).

In developing countries, the downtrend in caries prevalence has been slow (Bonecker and Cleaton-Jones, 2003), but as dental health services and preventive programmes become introduced in some developing countries, the prevalence of caries begins to decrease (Szöke and Petersen, 2000). Dental caries remains a major public health problem even in the most developed countries, affecting 60%–90% of schoolchildren and the vast majority of adults (Petersen, 2005, Petersen *et al.*, 2005). In the majority of Nordic countries, DMFT is relatively high for both children and adults (Holst *et al.*, 1997). In developing countries, the D-T component of the index is high among children, whereas in adults the M-T component is prominent (Brukiene *et al.*, 2005). Epidemiological data on oral health are scarce in Turkey. No representative data on the status of the population's oral health existed in Turkey before 1988, when the first national study was conducted (Saydam *et al.*, 1990). According to that 1988 study, both children and adults

had high caries prevalence; at age 5–6, only 12% of children were caries-free. The mean DMFT was 2.73 for 12-year-olds, 4.14 for 15–19 years, 11.59 for 35–44 years, and 28.76 for 65 years or older (Saydam *et al.*, 1990).

The world population is aging not only in developed countries, but increasingly so in developing countries. Consequently, greater emphasis on the early management of root caries is crucial to ensure the retention of natural teeth through advanced stages of life (Imazato *et al.*, 2006).

Over the last decades, several countries have provided CPI data to be stored in the World Health Organization's (WHO) Global Oral Health Databank (WHO, 2003). The CPI Databank was recently updated, revealing that the lowest score of periodontal health (CPI score 4) was limited to between 10% and 15% of the adult population worldwide (Petersen and Ogawa, 2005), whereas in Turkey, as many as 18.75% of the population aged 65 and older had CPI 4 (Saydam *et al.*, 1990).

In developed countries, like other oral health indices, the frequency of edentulousness has been declining (Hugoson *et al.*, 2005). In contrast, there was substantial prevalence of edentulousness of the elderly in Turkey; even among people aged 35–44, 2.74% were edentulous (Saydam *et al.*, 1990).

The aim of the present survey was to determine the oral health status of Turkish children and adults, to provide a baseline for monitoring the effectiveness of future interventions.

Method

The study design and implementation complied with Hacettepe University's ethical guidelines for conducting studies, and informed consent of the adult participants and the parents of participating children was obtained orally. This national cross-sectional survey sought to observe oral health conditions in urban and rural locations (Gökalp and Güçiz Doğan, 2006). Turkey has a surface area of 783,577 km² and, according to the last census, it has a population of 67,803,927, with 29.8% under the age of 15 years. One-third of the population lives in rural areas (TSI, 2006). The Turkish Statistics Institute (TSI) created the study sample by identifying 250 clusters in rural and urban settings, in 68 out of a total of 81 provinces in the country, to represent the national population. The sample was selected based on the urban-rural ratio of the Turkish population; a proportional stratified sampling process was used, which included five index ages/age groups: 5, 12, 15, 35-44 and 65-74 years. The distribution of the sample by place of residence was self-weighted; no different method was used for the selection of any age/age group. In addition, to meet the primary objective of the survey, the results were given separately for each age/age group. For these reasons, reporting the figures in unweighted form does not constitute a handicap. For each age group, the aim was to reach at least 1,500 individuals. The original report of the survey presented comprehensive information on data reproducibility (Gökalp and Güçiz Doğan, 2006). During June 2004, 27 fourth- or fifth-grade dental students were trained for four weeks, and calibrated to the criteria used in the survey against four experienced dentists. The experienced dentists—one periodontist, one pedodontist and two conservative dentistry specialists—served as gold standards for each index age/age group. These experts had been calibrated among themselves for each index before calibrating the student examiners. Each examiner examined five persons, previously examined by the experts, per index age/age group. Calibration exercises were conducted in groups of five index-aged subjects having different oral health conditions, such as no caries, untreated caries, fillings, recurrent caries and fillings, and periodontal disorders. All 27 examiners had good inter-examiner consistency, but were not checked for intra-examiner reliability. The estimated inter-examiner Kappa value was >0.80. Refresher training was provided for the students for one week before the survey began in September 2004. The data collection process of the study was carried out from September 2004 through February 2005.

Clinical data on oral health status were collected according to WHO methods and criteria (WHO, 1997). Clinical examinations were undertaken to record coronal and root caries, and the periodontal health status of adolescents and adults, under natural daylight in an outdoor setting, using mirrors and ball-ended WHO/CPI (WHO 973/80 - Martin, Solingen, Germany) periodontal probes. An asepsis protocol was developed and strict procedures were followed for infection prevention. Coronal caries was recorded only when a lesion had an unmistakable cavity, detectably softened floor, undermined enamel, or a sense of softened wall when probed.

For each filled or crowned tooth, the examiner was required to indicate the status of restoration as "filled and

sound," or "filled with recurrent caries." Root caries was recorded when a lesion felt softened or leathery (WHO, 1997) during examination with the CPI probe. Any fillings in the roots were also recorded. Radiography was not used.

DMFT scores were computed from the data obtained (WHO, 1997).

Only dentate persons were included in the analyses of periodontal conditions. CPI and loss of attachment were assessed for ages 15, 35-44 and 65-74 only. The CPI scores were: 0 = healthy, 1 = gingival bleeding, 2 = calculus, 3 = shallow pocketing of 4-5 mm, and 4 = deep pockets of 6 mm or more (WHO, 1997).

The codes for loss of attachment were: 0 = loss of attachment 0-3 mm (CEJ not visible and CPI score 0-3), 1 = loss of attachment 4-5 mm, 2 = loss of attachment 6-8 mm, 3 = loss of attachment 9-11 mm, and 4 = loss of attachment 12 mm or more (WHO, 1997).

The final study population reached and examined was 7,833 participants; the non-response rate was below 1% for each age/age group. The data from the clinical examinations were collected and checked for logical errors, and then analysed at Hacettepe University, Ankara, Turkey. The findings are presented as frequency distributions and contingency tables, and CPI and loss of attachment scores were computed according to the recommendations of WHO. The Chi-square test and analysis of variance were applied to compare groups, where appropriate.

Results

As can be seen in Table 1, more than two-thirds of 5-, 12- and 15-year-olds had at least one decayed crown, and the situation was worse for adults and the elderly. In contrast to the 5-year-olds, the prevalence of coronal caries was higher for females than males in the other age groups. For all ages except 15-year-olds, caries prevalence was higher in rural than in urban areas. Root caries prevalence was higher in 15-year-old female rural residents and among rural residents in the 35-44 and 65-74 age groups, but in contrast, it was lower among females in these groups of adults and the elderly.

No clear differences were observed between the total numbers of teeth present by sex and place of residence among 5-year-olds. However, the mean dmft in 5-year-old females was lower than in males. While the mean DMFT was higher in females aged 15, 35-44 and 65-74 years, no definite difference between the sexes was observed in the DMFT of 12-year-olds (Table 2). For all ages, dmft/DMFT was slightly higher in rural than in urban residents (Table 3).

The prevalence of edentulousness among 35-44-year-olds was 2.6%, which climbed to 48.0% in elderly subjects. Based on the definition that a functional dentition requires having at least 20 teeth, 81.4% of the adult group and 14.2% of those aged 65-74 were functionally dentate, and in both age groups, the rate was lower for females and rural participants.

More than 50% of 15 year-olds had healthy periodontal tissue; this trend gradually declined in 35-44- and 65-74-year-olds. Calculus was the most prevalent component of CPI; females had a lower prevalence in all age groups. In rural areas the prevalence of healthy tissue was lower (Table 5).

Attachment loss prevalence rose in tandem with age, as seen in Table 6. Females in the adult and elderly

groups presented a better picture than the males in the same age groups. Loss of attachment was lower in urban settings than in rural.

Discussion

A healthy and reliable information recording system to determine the national oral health status in Turkey is lacking, and oral health records should be updated. In Turkey, as in some other developing countries, oral diseases have been neglected and were not prioritized by health planners. Consequently, oral health care programs have not been integrated into national and community health programs. Epidemiological surveys can improve the monitoring of trends in population-level oral health.

The index age groups, as recommended by WHO, were included in this survey to allow comparison with the results of similar studies carried out in other countries and in Turkey.

Only one representative oral health survey for Turkey has previously been undertaken, in 1988 (Saydam *et al.*, 1990). It included 57 sampling sites in 5 out of 67 provinces and used WHO's methods and criteria (WHO, 1987). The prevalence of caries and DMFT/dmft scores in the present national study were lower than reported in the earlier Turkish study (Saydam *et al.*, 1990).

The WHO oral health goals have not been reached, except for the DMFT of 12-year-olds. Although a greater proportion of 5-year-olds was observed to be caries-free compared with the 1988 study (16.2%), it is clear that the global goal of oral health by the year 2000 (50% caries-free population), as advocated by WHO, has not been accomplished (at 30.2%). The dmft has remained high (3.7 ± 0.1) and the highest component of the index was decayed teeth (3.6 ± 0.1). Caries experience was more frequent among boys than girls, and in rural areas than in urban. Many Turkish children are in need of dental care. More research is needed to identify the reasons for this failure to reduce the incidence of decay in the primary teeth of children.

When compared with the results of the 1988 study (DMFT=2.73 in 12 year-olds) (Saydam *et al.*, 1990), it can be seen that one of WHO's goals for the year 2000, which sets a DMFT not greater than 3.0, has been achieved (DMFT=1.9 in 2004). Although there remains a large gap between the current situation and the rest of

the goals, comparison of the findings of the two national studies indicates improvement since the year 1988.

Mean caries experience in the present study was 2.3 ± 2.5 DMFT for 15-year-olds, which was lower than WHO's global goal for the year 2000 for 12-year-olds. The Adult Dental Health Survey, undertaken in UK in 1998 reported no root caries in the 16-24 age group (ADHS, 1998). In another national study in Australia, the percentages of untreated root decay were between 0.3% and 2.4% among 15-34 year-olds, according to the state or territory (Roberts-Thomson and Do, 2007). Since information related to root caries prevalence among 15-year-olds is not available, it is difficult to present a comparative discussion of our figures.

Tooth loss and impaired oral function are public health problems in Turkey, as in many developing countries (Shah and Sundaram, 2004). In Turkish adults aged 35-44 years, the most prominent component of DMFT was missing teeth, and few teeth were filled. There was a high-risk group among adults, with a concentration of untreated coronal and root caries. Although great care was taken to achieve balanced data collection by gender and place of residence throughout the study, it was difficult to recruit the desired number of men during home visits, because most of them were working. Consequently, our participants did not match the true Turkish male-female ratio for the adult age group (35-44).

The prevalence of edentulous individuals in the 35-44 year group (2.6%) was similar to the findings of the 1988 national study (2.74%) (Saydam *et al.*, 1990), suggesting that this group had undergone tooth extraction as a radical form of treatment, as had been the case 20 years earlier.

Among the elderly (aged 65-74 years), missing teeth made up nearly the entire DMFT index. This finding indicates that empowerment programs targeted at senior Turkish citizens may help increase awareness of oral disease and thus reduce the need for resorting to radical interventions. The prevalence of decayed roots was high among the elderly, and even higher in those living in rural areas (32.5%). Approximately half of the 65-74-year-olds were edentulous, which is lower than the previous findings of Saydam *et al.*, 1990 (75%) and Ünlüer, 2007 (67.4%); however the fact remains that this group still had fewer remaining teeth (7.0 ± 9.1) than desired. Functional dentition (at least 20 natural teeth) was present in 14.2% of this group. Finally, the relatively

Table 1. The prevalence (%) of crown and root caries among Turkish children and adults, by gender and place of residence (Turkey, 2004)

Gender and place of residence	5 year			12 year			15 year			35-44 year*			65-74 year*		
	Crown caries	Root caries	n	Crown caries	Root caries	n	Crown caries	Root caries	n	Crown caries	Root caries	n	Crown caries	Root caries	n
Male	73.1	-	793	60.6	-	848	37.2	4.3	793	74.9	22.5	494	55.8	29.9	391
Female	66.2	-	746	61.6	-	763	59.5	6.3	714	76.2	19.0	1095	62.7	26.9	413
Urban	67.8	-	1030	60.4	-	1074	61.6	4.7	994	73.9	18.1	1059	56.4	26.0	512
Rural	73.9	-	509	62.4	-	537	60.6	6.2	513	79.4	24.0	530	64.4	32.5	292
Total	69.8	-	1539	61.1	-	1611	61.2	5.2	1507	75.8	20.1	1589	59.3	28.4	804

*Edentate persons were excluded.

Table 2. Mean DMFT/dmft, by age and gender (Turkey, 2004)

<i>Age/age group</i>	<i>Total # of teeth X±SE, CI*</i>	<i>DT/dt X±SE, CI*</i>	<i>MT/mt X±SE, CI*</i>	<i>FT/ft X±SE, CI*</i>	<i>DMFT /dmft X±SE, CI*</i>
5 years					
Male	20.4 ± 1.2, 20.3-20.5	4.0 ± 4.0, 3.8-4.3	0.07 ± 0.4, 0.0-0.1	0.06 ± 0.5, 0.0-0.1	4.2 ± 4.1, 3.9-4.4
Female	20.6 ± 1.3, 20.5-20.7	3.2 ± 3.6, 3.0-3.5	0.03 ± 0.2, 0.0-0.1	0.03 ± 0.3, 0.0-0.1	3.3 ± 3.7, 3.0-3.6
Total	20.5 ± 0.3, 20.4-20.5	3.6 ± 1.0, 3.5-3.8	0.05 ± 0.1, 0.0-0.1	0.05 ± 0.4, 0.0-0.1	3.7 ± 3.9, 3.5-3.9
12 years					
Male	26.3 ± 2.0	1.7 ± 2.1	0.1 ± 0.5	0.1 ± 0.5	1.9 ± 2.2
Female	26.8 ± 1.7	1.7 ± 2.1	0.1 ± 0.4	0.1 ± 0.6	1.9 ± 2.2
Total	26.5 ± 1.9	1.7 ± 2.1	0.1 ± 0.5	0.1 ± 0.5	1.9 ± 2.2
15 years					
Male	27.6 ± 0.9	1.8 ± 2.1	0.2 ± 0.5	0.3 ± 1.1	2.2 ± 2.4
Female	27.6 ± 1.0	1.9 ± 2.4	0.3 ± 0.6	0.3 ± 1.0	2.5 ± 2.7
Total	27.6 ± 1.0	1.8 ± 2.3	0.2 ± 0.6	0.3 ± 1.0	2.3 ± 2.5
35-44 years					
Male	24.5 ± 5.8	2.7 ± 2.9	6.4 ± 6.0	0.7 ± 1.8	9.5 ± 6.4
Female	23.2 ± 6.8	3.0 ± 3.1	7.8 ± 7.1	1.1 ± 2.3	11.4 ± 7.0
Total	23.6 ± 6.6	2.9 ± 3.1	7.4 ± 6.8	0.9 ± 2.2	10.8 ± 6.9
65-74 years					
Male	7.6 ± 9.6	1.0 ± 2.1	24.0 ± 9.9	0.3 ± 1.5	25.3 ± 9.0
Female	6.4 ± 8.6	1.0 ± 2.0	25.1 ± 8.9	0.1 ± 0.7	26.3 ± 8.0
Total	7.0 ± 9.1	1.0 ± 2.1	24.6± 9.4	0.2 ± 1.1	25.8 ± 8.5

* Confidence interval

Table 3. Mean DMFT/dmft (X±SD) by age and place of residence (Turkey, 2004)

<i>Age/age group</i>	<i>Total number of teeth</i>	<i>DT/dt</i>	<i>MT/mt</i>	<i>FT/ft</i>	<i>DMFT /dmft</i>
5 years					
Urban	20.5 ± 1.3	3.5 ± 3.8	0.03 ± 0.2	0.05 ± 0.4	3.6 ± 3.9
Rural	20.4 ± 1.3	3.9 ± 3.9	0.08 ± 0.4	0.03 ± 0.4	4.0 ± 3.9
Total	20.5 ± 1.3	3.6 ± 3.9	0.05 ± 0.3	0.05 ± 0.4	3.7 ± 3.9
12 years					
Urban	26.5 ± 1.9	1.6 ± 2.0	0.1 ± 0.4	0.2 ± 0.6	1.9 ± 2.1
Rural	26.6 ± 1.9	1.8 ± 2.2	0.2 ± 0.5	0.04 ± 0.3	2.0 ± 2.2
Total	26.5 ± 1.9	1.7 ± 2.1	0.1 ± 0.5	0.1 ± 0.5	1.9 ± 2.2
15 years					
Urban	27.6 ± 1.0	1.8 ± 2.2	0.2 ± 0.5	0.4 ± 1.1	2.3 ± 2.0
Rural	27.6 ± 0.9	2.0 ± 2.4	0.2 ± 0.6	0.2 ± 1.0	2.4 ± 2.6
Total	27.6 ± 1.0	1.8 ± 2.3	0.2 ± 0.6	0.3 ± 1.0	2.3 ± 2.5
35-44 years					
Urban	23.9 ± 6.3	2.7 ± 2.9	7.0 ± 6.5	1.1 ± 2.4	10.5 ± 6.6
Rural	22.9 ± 7.0	3.4 ± 3.4	8.1 ± 7.2	0.6 ± 1.7	11.6 ± 7.2
Total	23.6 ± 6.6	2.9 ± 3.1	7.4 ± 6.8	0.9 ± 2.2	10.8 ± 6.9
65-74 years					
Urban	7.2 ± 9.3	0.9 ± 2.0	24.5 ± 9.6	0.3 ± 1.2	25.6 ± 8.7
Rural	6.6 ± 8.7	1.2 ± 2.2	25.0 ± 9.0	0.2 ± 0.9	26.3 ± 8.0
Total	7.0 ± 9.1	1.0 ± 2.1	24.6± 9.4	0.2 ± 1.1	25.8 ± 8.5

Table 4. Percent distribution of adult subjects by number of teeth, age, gender, and place of residence (Turkey, 2004)

<i>Age group and number of teeth</i>	<i>Gender</i>		<i>Place of residence</i>		<i>Total</i>
	<i>Male</i>	<i>Female</i>	<i>Urban</i>	<i>Rural</i>	
35-44 years	n=502	n=1129	n=1083	n=548	n=1631
0	1.6	3.0	2.2	3.3	2.6
1-9	1.4	1.9	1.7	1.8	1.7
10-19	9.6	16.5	12.8	17.3	14.3
20, +	87.5	78.7	83.3	77.6	81.4
65-74 years	n=722	n=823	n=1003	n=542	n=1545
0	45.8	49.8	49.0	46.1	48.0
1-9	21.5	22.0	19.6	25.6	21.7
10-19	16.2	16.0	16.3	15.9	16.1
20, +	16.5	12.2	15.2	12.4	14.2

Table 5. Percent distribution of CPI scores by age, gender, and place of residence* (Turkey, 2004)

<i>Age, gender and place of residence</i>	<i>Healthy</i>	<i>Bleeding</i>	<i>Calculus</i>	<i>Shallow pocket (4-5 mm)</i>	<i>Deep pocket (³ 6mm)</i>	<i>Total number</i>
15 years						
Urban	59.4	18.6	21.4	0.6	-	978
Rural	50.1	23.9	25.8	0.2	-	511
Male	53.1	21.0	25.5	0.4	-	781
Female	59.6	19.8	20.1	0.6	-	708
Total	56.2	20.4	22.9	0.5	-	1488
35-44 years**						
Urban	18.7	15.3	60.8	4.3	0.9	1047
Rural	9.6	17.0	66.1	5.4	1.9	522
Male	8.8	11.6	70.9	6.5	2.2	491
Female	18.8	17.8	58.8	3.8	0.7	1078
Total	15.7	15.9	62.6	4.7	1.2	1569
65-74 years**						
Urban	16.4	19.9	56.2	5.5	2.1	422
Rural	10.5	20.1	52.4	16.2	0.9	229
Male	14.0	17.4	55.5	11.8	1.2	321
Female	14.5	22.4	54.2	6.7	2.1	330
Total	14.3	20.0	54.8	9.2	1.7	651

* Sextants with no teeth, or teeth that could not be examined for various reasons were excluded.

** Among dentate persons.

high number of missing teeth in adults and the elderly underlines the need for dental caries prevention initiatives and effective interventions.

In developing countries, the age profile implies that the age groups of 15-19 years and 35-44 years are the most important for assessment of periodontal health status. Only half of 15-year-olds (56.2%) had healthy periodontal tissue; calculus was the most frequent problem for all ages/age groups, which is evidence of poor oral health practices. This study demonstrated that the proportion of individuals with periodontal disease increased with age, and was higher among men than women, and that periodontal conditions tended to be relatively poor among people living in rural areas.

Dental services are predominantly provided by private dentists since the state allocates limited resources to fi-

nance dental services. The emphasis is placed on curative rather than preventive services and fees are charged for services. Currently there are neither community-oriented oral health promotions nor organized preventive programs.

Although caries levels could be considered low for 12- and 15-year-olds, the high level of untreated caries for all ages/age groups is cause for concern. The high prevalence of edentulousness among adults has significant implications for oral health services. The observation of widespread calculus accumulation illustrates the necessity of a comprehensive oral hygiene program. National health authorities should give priority to improving the oral health of all ages/age groups; and a number of community-based, especially prevention-oriented, projects should be implemented. Efforts should be made at all levels to increase awareness of dental diseases and im-

Table 6. Percent distribution of attachment loss scores, by age, gender, and place of residence* (Turkey, 2004)

Age, gender and place of residence	0-3 mm	4-5 mm	6-8 mm	9-11mm	12,+ mm	Total
15 years						
Urban	98.8	0.9	0.2	0.1	-	979
Rural	99.0	1.0	-	-	-	509
Male	99.2	0.6	0.1	-	-	781
Female	98.4	1.3	0.1	0.1	-	707
Total	98.9	0.9	0.1	0.1	-	1488
35-44 years**						
Urban	71.4	21.1	5.9	1.3	0.3	1042
Rural	61.0	26.4	9.5	2.7	0.4	518
Male	56.8	28.3	10.9	3.5	0.6	488
Female	73.0	20.4	5.3	1.0	0.2	1072
Total	67.9	22.9	7.1	1.8	0.3	1560
65-74 years**						
Urban	42.4	34.7	15.3	5.7	2.0	406
Rural	31.1	33.8	26.3	5.7	3.1	228
Male	33.7	35.3	21.5	7.1	2.6	312
Female	42.9	33.5	17.1	4.3	2.2	322
Total	38.3	34.4	19.2	5.7	2.4	634

* Sextants with no teeth, or teeth that could not be examined for various reasons were excluded.

** Among dentate persons.

prove oral hygiene practices, by using the existing public health system. The results of the present survey may serve as a baseline for the evaluation of such projects.

Acknowledgements

The authors are grateful to Hacettepe University for funding (FON 02/7), and the Ministry of Health, for supporting the study. We offer our special thanks to the Turkish people who volunteered to participate in the effort.

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