Introduction

From 25 to 30 July 2011, a team from Medical Checks for Children (MCC) checked and treated 722 children, aged 18 years and below, free of cost. The mission was organized on invitation by and in collaboration with the local non-governmental organization PranaPlanet, and with approval of the Hill Council of the Ladakh region. The mission's objective was to assess the general health status of children in the region, starting in a number of schools selected by PranaPlanet.

The MCC team consisted of ten members from The Netherlands most of whom had already participated in earlier MCC checks elsewhere (marked with an asterisk below). Medical doctors on the team were Karlien Bongers (general surgeon*), Anne Vlietstra (general physician*), Eva Bouwsma (resident gynaecology*), Evelien Resing (general physician*), and Luc Coffeng (M.D., epidemiologist; *). Dental checks were performed by Mariette van Spronsen (dentist and dental hygienist*) and Hetty Garrelfs (dentist*). The team was completed by Iris van de Gevel (toxicologist*), Suzanne van Peppel (paediatric nurse*), Dax Vendrig (veterinary pharmacologist), Margot van Spronsen (medical student), and Hans van Loon (consultant for children with special needs*). The team was coordinated and led by Hans van Loon (logistic mission leader) en Luc Coffeng (medical mission leader).

Technical equipment for the health checks was brought from Europe by MCC team members. Medication and other supplies such as gauzes were ordered through the internet from Sonam Dawa, pharmaceutical wholesaler in Leh, Ladakh.

This report summarizes the medical findings of MCC's mission in the Ladakh region and aims to provide a first set of recommendations and action points for improving the health of children in the Ladakh region. Although these recommendations are primarily directed to PranaPlanet, these recommendations may be also be appreciated directly by schools and policy makers in the region.

Check-up procedure

The medical checks where performed in two locations: a community building in Alchi (25-27 July 2011) and the New Millennium school in Leh (28-30 July 2011). Prior to the start of the mission, PranaPlanet announced the mission at schools in the area, asking that children be presented in presence of their guardians. Also during the mission, PranaPlanet and local volunteers again went to the candidate schools and communities, asking local leaders to present the communities' youngest and sick children first, in presence of their guardians. During the mission, children came to the mission location by foot or were picked up by a school bus and brought there.

Table 1: School or place of stay of checked children.

School or place of stay	Date of checks	Number of children examined
Alchi Institute	25-27 July 2011	68
Likir, Alchi and surroundings	25-27 July 2011	144
New Millennium school	28-30 July 2011	218
Riglam school	28-30 July 2011	65
Drug Padma school	28-30 July 2011	117
BVN school	28-30 July 2011	75
Kunfan model school	28-30 July 2011	29
Leh and surroundings	28-30 July 2011	6
Total	25-30 July 2011	722

Once the children had arrived at the mission location, they were given a numbered case report form and were admitted to the first station where their name, age and a preliminary medical history were written on the form by PranaPlanet voluneers. If the child went to school, the school was recorded; if the child did not go to school, the place where the child lived

was recorded. Table 1 describes the number of children that were seen at each location, subdivided by school and place of stay. A unique MCC-number was allocated to each child and a digital photo was made to make future follow-up possible. The case report form was then given to the child who kept it until his or her medical check-up had been completed. At the next station, children had their weight, height, and haemoglobin levels (Hemocue) assessed. The CDC criteria for anaemia[1] were used for assessing haemoglobin levels, adjusted for long-term altitude exposure.[2] A complete physical examination was done by one of the medical doctors who prescribed treatment when needed. Medication was dispensed on site (if necessary and available) upon turning in the case report form. In addition, every child got a toothbrush, toothpaste, and a bar of soap on site upon turning in the case report form. In case of toothache, children got a dental check-up and treatment after medication had been dispensed. All data was digitally registered on location. Every evening all case report forms were evaluated digitally.

As with all medical missions, we made efforts to include local volunteers (medical workers, teachers, students etcetera) in helping with translation during the check-up and taking care of the children. We greatly respect their vast knowledge and experience.

Diagnoses and treatments

A total of 722 children were checked during the mission (Table 2). Due to the high risk of mortality and morbidity under five years of age in developing areas, the focus of MCC is checking young children. Off all checked children, 68% of the children were twelve years or younger and only 7% of the children were below five years of age (table 2). The majority of the cases that received our attention were anaemia (74%) and growth retardation (31%). Most ailments could be treated on the spot. However, a number of children were referred to the government hospital in Leh for further diagnoses and/or treatment. Below we will describe these matters in more detail.

Table 2: Number of checked children per age category, gender, and school or area.

	Alchi Institute	Likir / Alchi	New Millennium school	Riglam school	Druk Padma school	BVN	Kunfan Model school	Leh other	Total	
Total	68	144	218	65	117	75	29	6	722	100%
Age										
<1	0	1	0	0	0	0	0	0	1	0%
1 – <5	0	33	2	3	9	2	2	0	51	7%
5 – <7	17	15	23	7	17	1	3	1	84	12%
7 – <9	15	10	26	9	38	1	4	0	103	14%
9 – <12	30	33	64	36	45	19	16	1	244	34%
12 – <18	6	51	97	10	8	52	4	4	232	32%
Boy	42	66	110	34	53	37	17	2	361	50%
Girl	26	78	108	31	64	38	12	4	361	50%

Growth retardation

We assessed the growth status of each child by measuring its height and weight. Growth retardation was suspected when the measurements were very different from expected height and weight, given a child's age and gender. In developing areas, growth retardation is most often a sign of insufficient nutrition. Therefore, all cases of growth retardation were regarded as cases of malnutrition, unless there were signs for other possible explanations (e.g., tuberculosis, thyroid dysfunction, or heart murmurs). Growth retardation was assessed in three ways: 1) comparing height to expected height, given a child's age (possible up to the

[1] *CDC criteria for anaemia in children and childbeating age women*. MMWR, 1989, 38:400-404.
[2] Adapted from Hurtado et al. *Influence of anoxemia on haematopoietic activities.* Archives of Internal Medicine, 1945 75:284-323.

age of 18); 2) comparing weight to expected weight, given a child's age (possible up to age 10); 3) comparing the weight to expected weight, given a child's height (possible up to height of 120 cm). Growth retardation was diagnosed when a child's height and weight were among the bottom 3% lowest expected values (≤ P3; meaning that about 97% of all healthy children in the world are probably taller and heavier).

Overall, 31% of the checked children were not tall enough for their age, indicating chronic insufficient nutrition. In the children up to the age of 10, 27% was not heavy enough for their age, again indicating chronic insufficient nutrition. Of the children up to height of 120 cm, 10% was not heavy enough, indicating that they had recently lost weight; most of the time, this condition was present in addition to chronic insufficient nutrition. These numbers are summarized in Table 3.

Possible remedies for growth retardation are: 1) better nutrition, including more vegetables and fruit in the daily diet; 2) treat and prevent intestinal worm infection (hand washing), especially in children under five; 3) introduction of solid food in a baby's diet at six months of age (breastfeeding is good, but not if it is given on its own for too long because then the baby will miss nutrients from solid foods) ; 4) educate children, teachers, and parents about the above.

Table 3: Growth abnormalities, per school or area.

	Alchi Institute	Likir / Alchi	New Millennium school	Riglam school	Druk Padma school	BVN	Kunfan Model school	Leh other	Total (n / N and %)	
Height for age ≤ P3	22%	23%	42%	32%	29%	17%	52%	33%	223 / 718	31%
Weight for age ≤ P3	29%	22%	30%	29%	27%	21%	35%	0%	110 / 406	27%
Weight for height ≤ P3	13%	8%	14%	7%	11%	0%	10%	0%	25 / 246	10%

Height for age was evaluated in all children; weight for age was evaluated in children up to the age of 10 years; weight for height was evaluated in children up to a height of 120 cm.

Anaemia

Anaemia (low level of hemoglobin) is the most prevalent micronutrient disorder in developing areas. The most important causes of anaemia are malnutrition and worm infection, and more rarely chronic infectious diseases such as tuberculosis and HIV. Anaemia causes fatigue, reduced ability to concentrate and learn in school, and consequent delay in a child's cognitive development. Therefore, anaemia has significant effect of the future of a child. In India, no national policy has been implemented to provide iron supplements to pregnant women or young children. Furthermore, even though there are worm-treatment programs in India, none of the children that we checked reported receiving regular anti-worm treatment.

Table 4: Anaemia prevalence among children from whom successful blood samples were obtained.

School / area	Number of anaemic children / number of examined children	Prevalence of anaemia (%)
Total	536 / 720	74%
Alchi Institute	47 / 68	68%
Alchi, Likir and surroundings	95 / 143	66%
New Millennium school	167 / 218	77%
Riglam school	51 / 64	80%
Druk Padma school	99 / 117	85%
BVN school	49 / 75	65%
Kunfan Model school	24 / 29	83%
Leh and surroundings	4 / 6	67%

In all age categories in all schools and areas, prevalence of anaemia was >60%.

About three quarter of the checked children had low levels of haemoglobin. Boys and girls, and children of all ages were affected similarly, indicating the magnitude of the problem. If Standard treatment for anaemia was iron suppletion (3 months). If a child also suffered from growth retardation or showed signs of a chronic infection, multivitamins were prescribed instead of iron (based on prior field experience). If a baby was anaemic, multivitamin drops were prescribed for the baby and iron supplements for the mother.

Possible remedies for anaemia are: 1) better nutrition, including more vegetables and fruit in the daily diet; 2) treat and prevent intestinal worm infection (hand washing), especially in children under five; 3) introduction of solid food in a baby's diet at six months of age; 4) educate children, teachers, and parents about the above.

Worm infections

Intestinal worm infections are an important cause of anaemia and growth retardation in developing area. Intestinal worm infection can be contracted by contact with stools or soil that is contaminated with worm eggs (oral or skin contact such as walking bare feet). Soil becomes contaminated by stools of infected persons (i.e., lack of sanitation). Worm eggs in contaminated soil stay infective for years! A major preventive measure for worm infection (and concomitant anaemia) is hygiene: washing of hands with soap after toilet visits and before meals or preparation of food; enclosed, clean toilet facilities; hygienic food preparation; combined with treatment of active worm infections (bloated bellies; see a doctor) and preventive treatment of all children of age 2 to 12 with albendazol (400 mg) or mebendazol (200 mg) twice a year. Preventive treatment is most important for children under five.

In the Ladakh region, we identified only one case of major worm infection (bloated belly). This may have been due to the typical Ladakhi toilet that is clean by its nature and may prevent worm infections. However, due to the extremely high prevalence of anaemia and growth retardation, and the lack of a regular anti-worm treatment program, we suspected that many children carried intestinal worms. Therefore, all checked children were given preventive treatment (albendazol 400 mg). We recommend that schools and PranaPlanet repeat this treatment after 6 months.

Possibly, if we had been able to check more children under the age of five, we would have seen more cases of major worm infection (major worm infection is more likely in younger children). A next mission should therefore be able to check more children up to the age of five.

Table 5: Disease in the examined children, per school / area (number of cases with prevalence between brackets).

	Active worm inf.	**Scabies**	**Vitamin deficiency**	**Pneumonia**	**TBC**	**Path. Murmur**	**Proteinuria**
Alchi institute	0 (0)	0 (0)	1 (1%)	0 (0)	0 (0)	0 (0)	0 (0)
Alchi, Likir and surroundings	1 (<1%)	1 (<1%)	1 (<1%)	3 (2%)	0 (0)	0 (0)	0 (0)
New Millennium school	0 (0)	0 (0)	0	0 (0)	0 (0)	1 (<1%)	0 (0)
Riglam school	0 (0)	0 (0)	1 (2%)	0 (0)	0 (0)	1 (<1%)	1 (<1%)
Druk Padma school	0 (0)	0 (0)	6 (5%)	0 (0)	2 (2%)	0 (0)	0 (0)
BVN school	0 (0)	0 (0)	1 (<1%)	0 (0)	0 (0)	0 (0)	0 (0)
Kunfan Model school	0 (0)	0 (0)	0	0 (0)	0 (0)	0 (0)	0 (0)
Leh and surroundings	0 (0)	0 (0)	1 (17%)	0 (0)	0 (0)	0 (0)	0 (0)
Total	**1 (<1%)**	**1 (<1%)**	**11 (2%)**	**3 (<1%)**	**2 (<1%)**	**2 (<1%)**	**1 (<1%)**

Penumonia and tuberculosis

Pneumonia and tuberculosis are still on the list of leading causes of child mortality. A total of three children were diagnosed with pneumonia and treated with antibiotics. Two cases of suspected tuberculosis were seen and referred to the hospital for confirmation of the diagnosis and treatment if necessary. The number of children with pneumonia and tuberculosis was surprisingly low compared to previous missions in Spiti, a region that is comparable to Ladakh in terms of school and health system. This difference may indicate that Ladakhi children are generally healthier. However this is unlikely given the high prevalence of anaemia and growth retardation. More likely, we saw few cases of pneumonia and tuberculosis because the checked children were relatively old.

Pathologic heart murmurs

Two children were suspected of having a pathological heart murmur. Both children were referred checked by the dentist (a pathologic hear murmer combined with bad dental condition may lead to rheumatic valve disease) and sent to the paediatrician at the government hospital. One of them was examined by means of cardiac ultrasound on the same day. The paediatrician confirmed hearing a murmur, however fortunately ultrasound showed that there were no abnormalities. The other child with a heart murmur was severly growth retarded, anaemic and fatigued. This child was from the Alchi region and parents indicated that they had previously seen a doctor about the child's condition but that they could not afford operation. We were informed that there are local possibilities to support the family in their travelling expenses and that operation and treatment at government hospitals is free of charge. Therefore, we linked the child's parents with the local health post and informed the paediatrician at the government hospital.

Proteinuria

Only one case of proteinuria (protein in the urine) was detected during all medical check-ups. The child was referred to the Leh government hospital for further testing.

Table 6: Results of dental checks among children. Figures are absolute numbers with percentages between brackets.

	Seen by dentist	Inspection only	Extraction permanent tooth	Extraction temporary tooth	Cleaning	Surgical extraction	Filling
Alchi institute	25 (37%)	16 (24%)	1 (1%)	7 (10%)	0 (0)	0 (0)	1 (1%)
Alchi, Likir and surroundings	51 (35%)	32 (22%)	6 (4%)	13 (9%)	1 (<1%)	0 (0)	0 (0)
New Millennium school	69 (32%)	49 (22%)	3 (1%)	15 (7%)	3 (1%)	0 (0)	1 (<1%)
Riglam school	23 (35%)	19 (29%)	0 (0)	4 (6%)	0 (0)	0 (0)	0 (0)
Druk Padma school	53 (45%)	38 (32%)	1 (<1%)	15 (13%)	0 (0)	1 (<1%)	0 (0)
BVN school	17 (23%)	13 (17%)	1 (1%)	2 (3%)	1 (1%)	0 (0)	0 (0)
Kunfan Model school	10 (34%)	7 (24%)	1 (3%)	2 (7%)	0 (0)	0 (0)	0 (0)
Leh and surroundings	2 (6%)	1 (17%)	0 (0)	0 (0)	1 (17%)	0 (0)	0 (0)
Total	**250 (35%)**	**175 (24%)**	**13 (2%)**	**58 (8%)**	**6 (<1%)**	**1 (<1%)**	**2 (<1%)**

Dental health

Dental health is important for the well-being of children in several ways. Low dental health may lead to inflammation and pain, which in turn may lead to reduced appetite (important for anaemia and growth retardation), reduced ability to concentrate in class, and even rheumatic heart disease in children with heart valve defects (heart murmur).

Because most of the time there were too many children for the dentist to be able to see, only those with a toothache were examined. In general, the dental health and hygiene in children was very low in all schools. Most of the children indicated that they only brushed once a day before breakfast. Some children that were staying at school hostels indicated that there was no time to brush after breakfast because of the timing of the daily opening ceremony. Many of the children staying in the school hostels had nomadic parents, meaning that they only see their parents a few times per years. Parents then give their children some money to spend for themselves. Most of the these children spent their money on sweets as these are extremely cheap.

Overall, 35% of all checked children were seen by a dentist. In about 24% of all children, only inspection of the teeth was performed and brushing instructions were given. In the remaining 11% of all children, one or more interventions such as an extraction were necessary (Table 6).

We advice the following for improvement of dental health of children. Some of these advices were already discussed with school boards during the mission. 1) Ban sweets from school grounds. 2) Schedule moment for toothbrushing at school in the morning, after breakfast and before the daily opening ceremony. 3) Assign upper class students in school as tooth-brushing mentor for younger children in the school, so that they may instruct and help the younger children brushing their teeth. 4) Schedule moment for toothbrushing in the evening after dinner for those children staying at school hostels, making hostel mothers responsible for supervision of the tooth brushing. 5) Children should use toothpaste that contains fluoride and schools supplying toothpaste to their students should check this. 6) Educate children about the importance of dental health.

Table 7: Number of referrals to the hospital.

	Anaemia	**VI**	**Other (specifics per case)**
Alchi institute	0	1	2 (heartmurmur; tonsillitis / candidiasis)
Alchi, Likir and surroundings	0	0	3 (bilateral hydrocele + contraction elbow from burn scar; lipoma blocking the eye; progressive corneal laesion)
New Millennium school	3	8	3 (clumpfeet; heartmurmur; fever + urinary tract infection + retardation)
Riglam school	0	2	3 (heartmurmur; thyroid and/or kidney pathology)
Druk Padma school	0	4	3 (2 cases of suspected TBC; synechiae, possibly history of uveitis)
BVN school	0	1	2 (dacryostenosis; adenotonsillitis)
Kunfan Model school	0	0	0
Leh and surroundings	0	1	0
Anaemia = follow-up for severe anaemia after three months of treatment; VI = get glasses for visual impairment.			

Referrals

A total of 36 children were referred to the Leh government hospital for further evaluation and treatment. Children complaining of trouble reading due to visual impairment (VI) were also referred the ophthalmologist for glasses. For children staying at the New Millennium school hostel, any additional costs for referral, treatment or glasses were vouched for by the school.

Education of health workers, caretakers and other local helpers

One of the important tasks of MCC is to encourage the continuation of education of the caretakers and older children. During our week we had teaching sessions on common diagnoses of frequent illnesses and medication. We especially focused on anaemia and

malnutrition, on balanced diet, hygiene, dental health, infection, parasites and failure to thrive. Our information mainly consisted of knowledge and practical advice about nutritious food and vitamin supplements, as well as hygienic and health promotion issues.

Future medical needs

- On all the locations visited, there is a strong need for comprehensive and systematic health promotion and preventive measures. Special emphasis needs to be put on personal hygiene, dental care, good eating habits and nutritious food (more vegetables and (dried) fruits!).
- It is important that during a next mission, more children under five will be checked. Children of this age are most often the ones that are in need of medical attention and are therefore an important indicator of child health in a population.
- It is important to regularly (half yearly) de-worming off all children up to twelve years of age. For now, we recommend that anti-worm treatment is repeated six months after the mission. During a next mission, we intend to evaluate the worm status of children under five. Further recommendations will be based on these findings.
- There is a need for one or two locals per area that are willing to help make arrangements for and follow-up on children that are referred to the hospital.

Last words

We are grateful to all the schools, parents, care takers and community people for bringing the children and helping to conduct the program. We are happy we got the opportunity to work with and to learn from all volunteers, translators and other supporting members who have helped directly or indirectly, despite their own obligations.

We enjoyed working together with the teachers, health workers and senior students of the New Millennium school. We hope they will continue to inspire their communities in the same way they inspired us. They play a vital role in spreading awareness and knowledge about health and its importance for children in reaching their developmental potential. And last but not least, we would like to thank the children who came to the checks for their inspiring presence.

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Mission leader MCC mission Ladakh 2011

Utrecht, 8th of December, 2011