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Microbiological and heavy metal contamination of drinking water sources in South Luangwa Valley, Zambia

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Objective: We investigated the microbiological and heavy metal contamination of drinking water sources in the South Luangwa Valley in rural Eastern Zambia. The aims are i. to provide data on water quality for local people as well as for tourists, and ii. to give recommendations on water hygiene and by this to improve access to safe drinking water.

Material and methods: Sample collection took place in four different chiefdoms of Mambwe District. In total, 186 water samples were tested, they stemmed from piped distribution systems at the lodges (47), boreholes (46) and wells (93). The test on scene included temperature, pH and turbidity. Microbiology was tested according to WHO standards (Dual Core incubator at 37°C and 44°C).

Results: Out of 138 samples 94 (68.1%) were according to WHO risk category A (no coliform bacteria in 100 ml), 29 (21%) risk category B (moderately contaminated water), 15 (10.9%) risk category C, and 2 (1.4%) risk category D (highly contaminated). Of all boreholes and wells 21% showed perfect sealing status, 31% well sealing status, 28% minor defects, – 18% major seal-

ing defects, and 2% no sealing. Manganese and iron were the only metals exceeding their threshold values.

Conclusions: The water of all lodges and camps investigated was safe (Risk category A). The analysis by the Dual Incubator cannot discover viruses (Hepatitis A, Rotavirus, Norovirus) and protozoa (Cryptosporidium, Entamoeba histolytica, Giardia lamblia). People used water cans for transportation. Secondary contamination is possible.

Lead Reference Values of the Southern Ghanaian Population: Elaboration of Reference Values for Lead in Blood

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Objective: The project establishes toxicological reference values for lead in the Ghanaian population in order to enable scientists and government to interpret the results of biomonitoring, e.g. at Agbogbloshie, an e-waste recycling site in Accra, correctly. Due to logistical reasons the North of the country could not be considered yet.

Material and methods: Blood samples were taken at Offinso, Eikwe and Accra. The three age groups were 15–24, 25–34 and 35+. These groups correlate with the previous project at the Agbogbloshie e-waste recycling site. Sample size was planned to be 40 participants at each location and of each age group (360 samples, 120 from each location). Due to external factors the final sample size was as follows: total 292 subjects, Offinso = 124, Eikwe = 130 and Accra = 38. Additional data concerning

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living, working and feeding habits was acquired by the means of a questionnaire. Graphite furnace atomic absorption spectrometry was used in combination with a standard addition method to extract the levels of lead in each sample ($\lambda=283.3060$ nm; LOD: approximately 10 $\mu\text{g/L}$).

Results: The total mean lead content of the Southern Ghanaian population was 43.31 $\mu\text{g/l}$ with a mean of 48.28 $\mu\text{g/l}$ for men and a mean of 38.14 $\mu\text{g/l}$ for women ($P= 2.92547-10$). The German reference values consist of the 95th percentile, currently 40 $\mu\text{g/l}$ for men and 30 $\mu\text{g/l}$ for women. The 95th percentiles of the Ghanaian population are 81 $\mu\text{g/l}$ and 76 $\mu\text{g/l}$ for men and women respectively. The Southern Ghanaian reference values are thus twice as high in the case of men and 2.5 times as high in the case of women. Without having the raw data for the German reference values and using the four reference values, the two distributions between Germany and Ghana are not significantly different at the 0.05 level ($p\text{-value} = 0.24528$).

Conclusions: We suggest a provisional lead reference value in blood of 81 $\mu\text{g/l}$ for men and 76 $\mu\text{g/l}$ for women until more detailed data are available.

How safe is sports climbing during pregnancy?

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Objective: To evaluate whether health problems occur when pregnant women continue sports climbing and to estimate the risk.

Material and methods: Anonymized data based on a retrospective online interview. Statistics was performed descriptive and with nonparametric tests (Chi^2 test).

Results: 56 climbers were included (mean age 35.9y (+5.7), mean BMI 21.3 (+2.5). Mean climbing experience before pregnancy was 11.1y (+5.6) with a minimum of 2.4y. 53.6% rated themselves as sports climbers (21.4% indoor, 10.7% alpinists). Climbing style was adjusted to the pregnancy. Most were climbing until 7th month and belayed until the 6th month. The women reduced the climbing level for 1 to 2 grades of UIAA scale and the number of leading was reduced significantly ($p<0.001$) while top roping increased significantly ($p<0.001$). Characteristics of the climbs chosen changed significantly with less overhanging terrain in the 2nd and 3rd trimester ($p<0.001$) and towards a sig-

nificant increase of vertical climbs.

In total there was one minor health problem in the 1st trimester (she continued climbing later without problems) and one injury, again of minor relevance. With a total of 7104 hours of climbing an injury risk of 0.28/1000 hrs was calculated. And probability of incident was 3.6%. There was no major health problem by any participant, neither of the mother or of the fetus.

Conclusions: Although the collective size is limited sports climbing during pregnancy should be safe. Risk should be further reduced by exclusively top rope climbing, avoidance of overhanging routes (vertical walls or slabs preferred) and avoiding of „pushing the limits“ (climbing 1–2 grades UIAA under the individual limit).

Sleep phases and sleep architecture during maximal fractured sleep and continuous exercise

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Objective: To investigate whether there is an adaptation of sleep architecture when sleep is extremely fractured and the person exercises continuously. The results may indicate new perspectives to care for frequent travelers who suffer from jet-lag.

Material and methods: A world record in continuous downhill skiing for 264 hours was investigated. Data was obtained according to AASM recommendations. A total of 96.5% of the 264 hours could be analyzed.

Results: At day 1 no sleeping pattern was found, first sleep occurred at day 2, later also sleep stages IV and REM sleep. Sleep stage IV and REM phases were found as „sleep-onset-REM“ and „sleep-onset-deep sleep“. Summed up over the time measured mean amount of stage IV and REM was normal. Change of sleep stages was increased.

Conclusions: After initial sleep deficiency sleep architecture changed by shortening of the sleep cycles and the latency of the sleep stages while total sleeping time, slow wave sleep and REM sleep were normal. Obviously „power napping“ does not exist. Results indicate that after an adaptation phase extremely fractured sleep may be sufficient. For frequent travelers the consequence would be that an active use of any possible chances to sleep – even for short moments – may be sufficient for recovery.

Does sleep with increased upper-part of the body reduce Acute Mountain Sickness? – an echokardiographic study at 5300 m (Gorak Shep, Mt. Everest region, Nepal)

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Introduction: In German literature such it is often recommended to sleep with increased upper body, probably to reduce pulmonary pressure.

Objective: To evaluate whether the position during sleep has any effect on the risk to develop acute mountain sickness (AMS).

Material and methods: Analysis of systolic pulmonary pressure (PAPs) and the maximum regurgitation flow (vmax) by echocardiography at the evening + morning before probands stand up after sleep with or without increased bed-head (13 cm), assessment of AMS (clinical investigation and Lake Louise Score). Study design: cohort study (N=44, 19 females, 25 males, BMI 23.8 (±3.4), mean age 42.9 yrs (±15.9), mean ascent to Gorak Shep 8.9 (±2.9) days (202–330 m/day)

Results and conclusions: The risk of pulmonary hypertension rises with increasing altitude because of rising PAPs. During ascent in moderate and high altitude (1500–5300 m) PAPs rises significantly less compared to extreme altitude (>5300 m). In some cases this led to “critical” PAPs and a potential risk for pulmonary edema. No correlation was found between the increase of PAPs and the load of the backpack, the speed of the ascent during the hour before measurement, the BMI and the age. No conclusion was possible concerning pre-existing diseases because it was an exclusion criterion.

Trekkers don't have teeth? The need for dental First Aid knowledge when traveling abroad

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Objective: Although the number of trekkers increases since decades, there are no data about dental problems and emergencies. Therefore no specific advice can be given how to prevent or to treat such emergencies.

Material and methods: 309 trekkers (56% males, 16–70 years, mean age 32.8y) were investigated at Manang / Annapurna Circuit (3,500 m): questionnaire (history, dental hygiene), plaque index according to Quingley and Hein (QH), papillary bleeding index. The data were combined with the data of the National Park Service to estimate the total risk of trekkers to suffer from dental emergencies.

Results: 50 (16.5%) reported dental problems during the actual trek, which lasted for 5 days only until Manang. Most of which might have been treated with a dental emergency kit. Oral hygiene decreased during the trek and QH increased significantly (women: 2.25, men: 2.36). Persons who were checked by a dentist <6 months before trek showed significantly less problems.

Conclusions: A pre-trek-check and a dental emergency kit is a “must” when people plan any kind of trekking. Dental emergencies should be included in the curricula of travel and mountain medicine.

Changes of pressure and volume of the pulmonary circulation during acute exposure to high altitude and physical stress

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Objective: To evaluate whether the combination of acute exposure to high altitude (from 5300 to 5675 m) and exercise of different intensity (ascent speed and/or heavy load) increases pulmonary pressure to levels which predispose the person to (high altitude) pulmonary edema

Material and methods: Analysis of systolic pulmonary pressure (PAPs) by echocardiography, correlation of the data with ascent profile, load & BMI. Study design: prospective cohort study, participants: 33, 20–65 years, 16 females/17 males in health condition: healthy condition and normal BMI.

Results and conclusions: While there is an increase of PAPs of 8.0%/1000m at moderate and high altitude there is a sharp increase of 45.6%/1000 m at extreme altitude. During ascent in moderate and high altitude (1500–5300 m) PAPs rises significantly less compared to extreme altitude (>5300 m). In some cases this led to “critical” PAPs and a potential risk for pulmonary edema. No correlation between the increase of PAPs and the load of the backpack, the speed of the ascent during the hour before measurement, the BMI and the age.

Rickettsioses in Travel Medicine

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Rickettsial diseases occur worldwide. There are a variety of different rickettsial species which infect humans commonly via vectors such as ticks, fleas, mites or lice. Rickettsia (R.) are gram negative intracellular bacteria which are clustered in four phylogenetic groups: Firstly, the Spotted Fever Group Rickettsia consists of tick-borne rickettsioses. This group includes among others R. rickettsii the famous agent of Rocky Mountain Spotted Fever and R. africae which causes African Tick-Bite Fever. The Transitional Group Rickettsia contains the mite-borne rickettsial pox by R. akari. The Typhus Group Rickettsia comprises epidemic typhus by R. prowazekii transmitted via lice and murine typhus by R. typhi transmitted via fleas. Finally, the Ancestral Group Rickettsia covers nonhuman pathogenic R. bellii and R. canadensis.

In humans rickettsioses have the following trias of symptoms: fever, rash and eschar. Moreover, patients may come along with a history of travel, contact to ground vegetation or compromised hygiene. Some patients only show a fever, exceeding the usual

duration without an eschar or a rash. Therefore, rickettsioses can be a reason for fever of unknown origin. Lethality of different rickettsioses varies between zero to about 40 percent. Humans with chronic diseases have a higher risk for severe complications.

Rickettsioses pose an underestimated risk to tourists' and locals' health. This disease is far more common in ill returning travelers than malaria. Therefore, health advice for tourists should include tick, flea, mite and louse protection strategies. Rickettsioses should be considered for differential diagnosis in travelers returning ill.

Experiences of international travelers and consequences for Travel Medicine

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Introduction: International travel is continually increasing. There is limited published data on international travelers and the experiences they gained. Our aim is to provide an actual assessment of the problems international travelers face during and after travel regardless of the trip.

Material and methods: A pilot study was realized by an internet-based anonymous questionnaire in German and English. It comprised a total of 33 questions (experiences of the travelers; questions on general problems, health problems / treatment and how likely an illness will occur).

Results: The >200 participants were aged between 18–80 years, the main origin-country was Germany. Travel reasons were tourism (95%) followed by expeditions, VFR (visiting friends and relatives), military, work, immigration, medical tourism, science, study, missionary/volunteer/aid work.

Participants could list up to five illnesses. 100% of them suffered from at least one while 5 illnesses were reported by less than 10%. The most common were gastrointestinal diseases, skin, ENT (ear, nose, throat), psychic disorders, animal bite, toothache, headache, fever.

Overall, there were more outpatient than inpatient treatments, most frequently self-treatment and at least by telemedicine. Almost all were treated locally, less than 20% after return – mainly chronic illnesses. 3/5 of all diagnoses were predominantly travel-related.

The poor quality of food, equipment, infrastructure, vehicles, as well as hygienic issues and security, but also freedom were criticized. The sun exposure, air humidity, smog and sunshine duration were perceived as more strenuous compared to the home country. The worst experience of international travelers was mainly crime, followed by accident/injury and illness. This

was followed by safety losses, invasions of privacy, negative work experiences, animal experiences and private causes.

Self-rating showed that travelers will benefit personally from their stay abroad as well professionally.

Conclusions: Depending on the country of destination, the main negative experiences are crime, security, health, work issues, animals or private reasons. The most frequent reason for travel was tourism, the most frequent travel-related illnesses gastrointestinal and skin diseases.

Regardless of the reasons for the stay abroad, there is no systematic evaluation of travelers or of returnees in the literature, nor by insurers or assistances. Further studies are necessary and justified in order to effectively develop travel medicine and to adapt travel medical advice.

Emergencies of climbers on „Klettersteigen“ (via ferrata, iron ways) and First Aid knowledge of the mountaineers

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Objective: To evaluate whether First Aid (FA) knowledge of climbers is adequate for the spectrum of emergencies when climbing via ferratas and to develop a target-group specific training curriculum.

Material and methods: 391 data sets were obtained at Tuckett Hut (2272 m, Brenta Mountains, Italy) and Fiederepass Hut (2070 m, Allgäuer Alpen/Germany) by questionnaire. It included basic data about the person, mountain experience, accidents and other emergencies where the person was involved, followed by 18 multiple choice questions concerning FA. These questions were based on accident analysis. Finally the probands were asked to rate their FA knowledge.

Results: Knowledge and needs differ significantly, e.g. while knowledge about FA of cardiac emergencies is quite good, it is worse in case of fractures. As common problems the probands reported sunburn, contusion, wounds, exhaustion, sprain, and

fractures. The risk of lightning was underestimated. Knowledge how to manage thorax or back injuries, resuscitation, hypothermia, fractures and the rescue operation were not sufficient. This was also true for persons with any kind of professional medical training.

Conclusions: Most mountaineers on via ferrata are not fit to provide specific FA. Target-group addressing specific FA trainings should be established.

Borg's Scale at High Altitude

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Objective: Borg Scale was never validated for hypo-xic conditions. But the correct estimation of perceived exertion is of extraordinary importance for travelers with pre-existing disease at high altitude.

Material and methods: Prospective randomized cross-over study (N=16 mountaineers). Spiroergometry with additional lactate analysis and rating of the perceived exertion were performed at sea level, at 3,000 m, and at 4,560 m. For validation of the scale Maloney-Rastogi-test and Bland-Altman-Plots were used to compare the Borg ratings at each intensity level at the three altitudes. P<0.05 was defined as significant.

Results: Maximum workload decreased with altitude as expected. Borg rating was reproducible at all altitudes. More than 95% of all Borg ratings were within the interval of 1.96x standard deviation. The covariance model showed the increase of systolic blood pressure as the most important parameter which indicates the individual's perceived exertion.

Conclusions: The Borg Scale for perceived exertion gives valid results at moderate and high altitude – at least up to 5,000 m.

Climbing Capabilities and Alpine Emergencies – Minimal Requirements for the Employees of Alpine Rescue Organizations

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Objective: Effective and safe work during alpine rescue operations need some capabilities in rock and ice climbing but the minimal requirements were not yet investigated.

Material and methods: A total of 2,731 alpine rescue operations of two regions (Oberwallis / Switzerland, n = 1,082; Tirol / Austria, n = 1,649) were analyzed with special regard to the type of terrain at the site of the accident.

Results: 99.7% of the accidents could be analyzed. 62.2% of rescue operations were performed in alpine terrain of – for experienced mountaineers – moderate difficulty (NACA d, e; fig. 4). 5.9% took place in difficult or extreme terrain (NACA f, g). During summertime there were significant more operations in hard terrain than in winter. The NACA d–g classes correlate to 7.1% of accidents on steep glaciers, 9.1% high-alpine tours (ridges, walls), 4.6% rock terrain up to III° UIAA, 6.0% rock terrain UIAA III-IV°, 2.4% >IV UIAA, and 1.5% in ice steeper than 50°.

Conclusions: Advanced “alpine experience” is a “must” for any person involved in alpine rescue operations – physicians, too. Minimal alpinistic requirements of medical personnel includes: Capability of absolute control of rock climbing UIAA III°, safe climbing (as second) IV° UIAA, absolute control of 50° in ice, safe climbing (as second) of 60°. Special alpine knowledge is a “must” for situations like avalanche rescue.

Cold Exposure During Alpine Rescue Operations – Consequences for the Rescuer's and Patient's Safety

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Objective: The study evaluates the cold exposure of the personnel and patients when accidents in an alpine environment happen.

Material and methods: Rescue operations of 15 months in Oberwallis (CH) were analyzed for chill temperature (ChT) and duration of exposure. Several independent models were used. “Mean exposure” as well as „worst case situation“ were calculated.

Results: Assuming “worst case conditions” the Siple-Passel-model showed 87.1% of the operations at chill temperatures >-30°C, 12.1% in the range of -30 to -45°C, and 0.8% <-45°C. The lowest temperature was -54.6°C. According to ISO 11079 clothing with 2.0 clo is sufficient in 40.2% resp. 23.9% of the operations (summer, IREQ min. and IREQ neutr.), in winter: 0.3% and 0.0%. The main risk for the personnel is frostbite, special advices have to be given to the crews.

Conclusions: Because of the limited time of exposure during the majority of the operations the most important danger for rescue personnel is frostbite although hypothermia cannot be excluded in cases of prolonged operations. Special advice should be given to mountaineers and rescuers to take the high risk of the patient into account who may suffer from cold-induced emergencies. This is even more important when such emergencies happen in non-alpine regions with much less or even missing rescue infrastructure.

Noise Exposure During Alpine Helicopter Rescue Operations

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Objective: We estimated the noise exposure of the crews working in alpine helicopter rescue systems and of the patients transported by helicopter after alpine accidents.

Material and methods: Noise levels of Alouette III, Alouette II “Lama”, Ecureuil and Bk117 were measured with a device according to class 2 DIN IEC 651. These data were combined with the flight data of the personnel to evaluate the equivalent noise level Leq8h according to DIN 45645–2.

Results: While the risk for the patients should be limited to temporary threshold shifts the crew members are regularly exposed to equivalent noise levels of more than 85 dB(A) (up to more than 100 dB(A)) and therefore at risk for permanent threshold shift especially with the confounding factor “hypoxia”. The main problem of noise prevention in alpine helicopter rescue operations is work outside the aircraft while the engines are running (“hot loading” or winch operations).

Conclusions: For both, crew and patients, noise protection is a “must”, also for short operations.

Does modern helicopter construction reduce noise exposure in helicopter rescue operations?

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Objective: We estimated the noise exposure of the personnel used for rescue operations in the Alps with special regard to advanced helicopter types to compare the noise exposure.

Material and methods: 2,731 rescue operations were analyzed for noise exposure. Noise levels were measured at defined points inside and outside the aircrafts according to the European standard (Richtlinie 2003/10/EG Amtsblatt) and to Class 1 DIN/IEC 651. With both data sets the equivalent noise level Leq8h was calculated and with this model calculations for noise exposure by different helicopter types were performed.

Results and conclusions: Modern technologies (e.g. Fenestron® tail rotor) have reduced noise exposure significantly. Nevertheless noise prevention, which includes the patient and also noise intermissions in spare time, is essential. Medical checks of the crews by occupational medicine are still mandatory. The results are also important for the evaluation of hearing impairment as occupational disease. Recommendations for noise protection do not yet include the effect of hypoxia.

Climbing Capabilities and Alpine Emergencies – Minimal Requirements for the Employees of Alpine Rescue Organizations

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Objective: The study was performed to obtain data about aerobic and anaerobic workload of personnel involved in alpine rescue operations. The results are discussed with special regard to preventive medicine.

Material and methods: Parameters to quantify workload were obtained by telemetry during simulated rescue operations at sea level, 3,000 m, and 4,559 m. At each altitude a standard spiroergometry was performed for comparison.

Results and conclusions: Persons involved in rescue operations at (high) altitude should be able to provide a PWC170 of at least 3.0 W/kg body weight at sea level (preferred: 4.0 W/kg). This requires regular aerobic endurance training and a regular medical check by occupational medicine. While these minimum requirements are a „must“ for professional rescuers, mountaineers can go with less aerobic power if the group size is at least three persons.

Emergencies while Travelling: Risk Management in Trekking

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Introduction: Although the situation may have improved since Shlim and Gallie published their data with a risk of fatal outcomes of organized trekkers being 5-fold increased compared to individual trekkers, risk assessment and risk management is still an important part of responsible trekking. Unfortunately there is a lack of proper risk management, e.g. shown by an incidence of acute mountain sickness of 50 to 84%.

Materials and methods: A survey was performed by two partial standardized questionnaires for organized or individual trekkers. The study site was Manang (about 3,500 m; Annapurna region, Nepal). All trekkers passing the study site and willing to join the study were included. For evaluation descriptive statistical methods were used.

Results: 457 datasets (organized trekkers 33.9%, individual trekkers 62.8%) could be evaluated with special regard to those topics of risk management, which can be easily realized either by the organizations or by the individuals (return rate 91.4%).

Emergencies while Travelling: Risk Management in Trekking

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Although the situation may have improved since Shlim and Gallie published their data 1992 with a risk of fatal outcomes of organized trekkers being 5-fold increase compared to individual trekkers, risk assessment and risk management is still an important part of responsible trekking. Unfortunately there is a lack of proper risk management, e.g. shown by an incidence of acute mountain sickness of 50–84%.

Based on previous pilot studies in the Khumbu region (Nepal) and on the risk management preached by the leading German trekking operators a survey was performed by two partial standardized questionnaires, one for organized or individual trekkers. The study site was Manang (about 3,500 m; Annapurna region, Nepal). All trekkers passing the study site and willing to join the study were included. The design was proved by the ethical commission of Salzburg University (Austria). For evaluation descriptive statistical methods were used.

We report the results of 457 evaluated datasets with special regard to those topics of risk management, which can be easily realized either by the organizations or by the individuals.

Drinking water hygiene in the Solu Khumbu Region, Nepal

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Objective: Investigation of the water quality of the sources in the Solu Khumbu-Region, Himalaya, Nepal (bacterial (coliform) contamination).

Material and methods: 80 specimens from sources between 2,608 m and 5,180 m (springs, public water standpipes and storage at private homes. For tests DelAqua Dual Incubator was used which fulfills WHO criteria for water testing.

Results: Thermotolerant fecal coliform bacteria were not found. This indicates that there is no fecal contamination of the water sources. However, bacterial contamination was found in 57.5% of the specimens. With increasing altitude there was less contamination. Contamination of the storage containers was a major problem in 6 households.

Conclusions: Storage containers in households as the main source of bacterial exposure of people in the Solo Khumbu region should be disinfected regularly.

KETE – Knowledge and Education of Trekking Emergencies

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Objective: i. To develop and evaluate first aid (FA) and emergency knowledge of trekkers in the Nepalese Himalayas, and ii. To develop strategies for preventive care prior, during and after treks also including authoring a curriculum for specific first aid training for trekkers.

Material and methods: A prospective cohort study in Manang (3550 m, Annapurna Circuit/Nepal) included 457 trekkers. A questionnaire about first aid and emergency knowledge focusing trek-king emergencies included 20 multiple choice questions with 5 answers each. The results of an earlier study with the same approach was used as control group.

Results: Altitude experience was virtually non existing in 49.9%. FA knowledge was poor. In total 29.395 of 49.400 possible correct answers were given (59.5%). In average one (5.4%) of 20 questions was answered completely correct. Worst results were in: hypothermia and resuscitation 2.2%, rescue strategies 2.2% and rip fractures 2.2%. The best results were found in HACE 31%, cranio-cerebral injury 30.8%, angina pectoris / heart attack 29.1%, and hypovolemic shock 26.3%.

Conclusions: There are significant and probably life threatening deficiencies in FA knowledge of trekkers. Target group specific FA trainings should be organized which are based on curriculum which should be established with the data now available.

Hajj – the pilgrimage of muslims – archetype of a mass gathering in a religious context

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Introduction: Muslims have to respect five pillars of Islam: Shahadah (declaration of confession), sala'at (prayer), zakat (pittance), saum (fasting), and thehajj (pilgrimage at least once in the person's life). Every year about 2–3 Mio Muslims attend the hajj.

The extremely diverse population from about 185 countries perform the same activities within 6 days in a state of purity and holiness (Ihram). Due to financial restrictions many of these people haven't been able taking part in the hajj before getting old and so are often restricted in their health conditions.

Women are subject to strict regulations concerning the access to the Great Mosque during their menstruation and must be accompanied by the husband or a male member of their family.

The main holy sites of the hajj are:

- Great Mosque at Mekka: seven walks around the holy monument Kaaba in the middle of the inner court
- Sa'i: seven walks between two hills near by the Great Mosque in reminiscence of Hagar and her son Ishmael (whose father was Abram)
- Mina: tents to accommodate
- Plain of Arafat: praying from noon to sunset and climbing on the hill where Mohammed did his last prayers
- Jamarat bridge: stoning the devil.

Local situation: The security at the holy sites and health care of millions pilgrims during their pilgrimage is a huge challenge for the Saudi-Arabian authorities. Possible and probable health risks are:

Communicable diseases: poliomyelitis, malaria and other VBD, hepatitis A, B and E, cutaneous leishmaniasis, invasive meningococcal meningitis, tuberculosis, influenza, gastroenteritis, diarrhea and others.

Non-communicable diseases are: sunstroke/heat exhaustion/cramps, circulatory collapse, coronary syndrome, renal failure as result of dehydration, panic attack and other psychiatric disorders due to mass gathering, exacerbation of preexisting diseases like diabetes or coronary heart disease.

Other relevant risks are: road accidents, stampede, injuries (e.g. by falling down), and acts of terrorism.

The possible health hazards of communicable and non-communicable diseases, traffic injuries etc. with respect to the holy sites is given in a matrix. This method of risk-stratification should be applicable to other mass-gatherings.

To minimize or prevent these risks, Saudi-Arabian authorities

(e.g. Ministry of Hajj) have given plenty of regulations, instructions and advices

Obligatory vaccinations against meningococcal meningitis ACYW, poliomyelitis, YF of people from endemic regions, Recommended vaccinations against influenza, dPT, HepA/B, measles, PNC.

Measures of health care: air-conditioned rooms, sun protection, offering drinking water, mobile hospitals, ambulances and ambulatory health services, >20,000 members of medical staff, intensive care and dialysis units.

Gate control (Jeddah, Great Mosque), extended presence of police, fire brigade, security staff, fireproofed tents, extended transport system, compulsory visa contingents.

Results: Despite national and international preventive measures like vaccination and heat protection, and a variety of healthcare measures, a multitude of health risks is immanent to the hajj. The knowledge of the rules of attendance, rites, holy sites and the preexisting health state of the traveler will allow adequate advice to pilgrims.

Long-term Radiographic Adaptations to the Stress of High-Level and Recreational Rock Climbing in young Athletes

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Objective: As a higher rate of osteoarthritis in long time climbers (>5 years) (Figure 1) is reported the long-term effects of this high impact and stress onto the finger joints of these youngsters cannot be predicted. With the inclusion of sport climbing into the Olympic program of Tokyo 2020 a further increase in training intensity is to be expected. The purpose of the study is to evaluate whether the documented radiographic adaptations lead to the early onset of osteoarthritis and whether radiographic adaptations are related to specific training regimes such as e.g. campus board or training with additional weights.

Material and methods: 19 members of the German Junior National Team (GJNT, age 16.5 ±1.9 years) and 18 recreational climbers (RC, age 14.7 ±2.3) were examined clinically and through radiographs in 1999 and re-examined 2011–12. For comparison with normal radiograph results, the visual guide

lines given in the Atlas of Standard Radiographs were used. For evaluation of the physiologic adaptations to high stress, an adopted Barnett Nordin index (cortical thickness of the middle phalanx/total osseous thickness of the middle phalanx [cortical and cancellous bone] in AP view) was used (normal range, 0.35–0.66).

Results: 15 out of 19 climbers of the GJNT and 13 out of 18 climbers of the RC team could be re-evaluated. Stress reactions were found in 12 of 15, 80%, of the GJNT and in 6 of 13, 46% in the RC. There was no significant difference ($p>0.05$) for the Barnett Nordin Index between the GJNT and the RC. Signs of an early stage of osteoarthritis was seen in 6 climbers, 4 (27%) in GJNT and 2 (17%) in the RC. Significant statistical influences for the development of early onset osteoarthritis could be found for the overall sum of training-years ($p<0.01$), use of campus board training in 1999 ($p<0.05$) and the climbing level in 1999 ($p<0.05$).

Conclusions: We could also demonstrate, that a high UIAA climbing level correlates with the risk for early onset osteoarthritic changes of the hand and therefore may be seen as a high-risk factor for developing early onset osteoarthritis of the finger joints.

Accident analysis in sport climbing – is sport climbing a „high risk sport“?

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Objective: Climbing is said to be a high risk sport which would include a significant amount of accidents and fatalities. However, since there is no definition of “high risk sport” the classification is based more on subjective impressions than on scientific data.

Material and methods: More than 400 studies concerning the risk of accidents and fatalities in climbing and other popular sport disciplines were analyzed. The risk was calculated for 1000 hours of activity and severity according to NACA score. Definitions of “high risk sport” were compared.

Results: Bouldern, sport and indoor climbing showed significant less risk with less severity of injuries than other popular sports. Fatalities are extremely rare. In alpine climbing fatalities are more common and injuries more severe because of external factors.

Conclusions: With a uniform definition of „high risk sport“ still missing and a low incidence of accidents the classification of climbing as „high risk sport“ is not adequate. In the context of insurance medicine the phrasing should not be used.

Injury risk evaluation in water ice climbing

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Objective: With a series of studies we investigated the injury risk in ice climbing. Here we summarize the results of all studies.

Material and methods: Questionnaires (accidents and injuries, climbing frequency and risk taking behaviour), retrospective design, different target groups (water ice, alpine ice, age groups, sex, beginners vs. experienced climbers). N = 88 participants (3 female, 75 male, mean age 34.6 years), 21606 climbing hours/3 years.

Results: 17 athletes (9%) reported a total of 35 overuse syndromes. 95 acute injuries were reported for a consecutive 3-year period. The incidence and respective grading of the acute injuries were: 67 for NACA 1, 24 for NACA 2, and 4 for NACA 3. Most acute injuries were open wounds (55.2%) and haematoma (21.9%). The incidence of overuse injury syndromes was 0.77/1000 hrs of sports participation. The injury incidence was 4.07/1000 hrs for NACA 1–3 with 2.87/1000 hrs in NACA 1, and none in NACA 4–7. Body mass index (BMI) correlated significantly ($P < 0.05$) with an increased risk of injury. Overuse syndromes correlated significantly with training hours ($P < 0.01$), ice-climbing level ($P < 0.01$) and the risk willingness for lead climbing on

ice ($P < 0.01$). Lifetime incidence: 61% for acute injuries (65% NACA 1, 29% NACA 2, 6% NACA 3, no fatal injury!). 61% of accidents may be prevented.

Conclusions: In contrast to the expected risk of ice climbing the risk is in the same range of popular sports like volleyball. With 61% preventable accidents there is potential for further increase of safety.

On the road to a Ghanaian reference value for nickel in urine

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Objective: To evaluate urinary nickel concentration of non-exposed Ghanaian citizens in three different areas in order to determine a general and reliable Ghanaian reference value of nickel in urine.

Material and methods: 294 urine samples in three different areas of Ghana: Offinso, Eikwe and Accra. The collective consists of 143 female and 151 male probands (details in the following table).

	female	male
15–25 years	45	46
26–35 years	50	55
36+ years	48	50
Total	143	151

Specimens were analyzed via atomic absorption spectrometry for urinary nickel content, the creatinine (Crea) concentration was also determined using an UV/VIS spectrometer.

Results: The BAR (Biologischer Arbeitsstoff Referenzwert) resembles the 95th percentile of the German population not being occupationally exposed to nickel. The German background burden for nickel in urine is 3 µg/l. This value has been exceeded in 149 out of 294 cases (51%) in the Ghanaian samples. Consequently, the background burden in Ghana must be higher than the German one. The difference could be caused by nickel intake through nourishment or inhalation of dusts but has to be subject of further studies.

Following the recommendations of the German Research Foundation (DFG) the Crea concentration of a normal hydrated person should be between 0.5–2.5 µg/g. In our collective 70 out of 294 samples were above 2.5 µg/g Crea (24%). For deriving background concentrations the DFG recommends a range of 0.3–3.0 µg/g Crea. In our collective 11 samples were below 0.3 µg/g Crea (4%) and 46 above 3.0 µg/g Crea (16%). In contrast

to German probands the Ghanaian samples exhibit higher Crea concentrations. This might be explained by dehydration caused by higher temperatures in Ghana compared to Germany and/or different water intake habits. The access to drinking water might also play a major role.

Conclusions: The concentration of nickel in urine of the non-exposed Ghanaian collective was extremely high compared to the non-exposed German population. Therefore the German BAR for nickel should not be used to interpret data from Ghana. This study can be seen as the first step towards the establishment of a Ghanaian reference value for nickel in urine. Based on limited data we suggest a provisional reference value of 4.8 µg/l for Ghana.

Disinsection in civil aviation

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For centuries authorities tried – often in vain – to block off the import of contagious diseases from the outside world to their territories. The quarantine had been implemented in the medieval ages already. With the invention of quick transport by air other challenges arose. One is the import of insects to areas where they are not endemic yet. A particular danger is the import of vector-borne diseases like malaria, Dengue fever and other arthropod borne diseases. There are abundant reports of aircraft, runway, airport and baggage malaria, and airport dengue fever. The International Health Regulations stipulate mandatory disinsection methods to prevent the import of vector-borne diseases which all member states have to comply with. The protection of third parties like citizens in a destination country has to be balanced against potential side effects of disinsection like potential toxic or allergenic effects and discomfort to affected passengers. Pyrethroids, synthetical derivatives of the natural insecticide pyrethrum are used as insecticides. WHO makes the use of d-Phenothrin and Permethrin mandatory. These chemical compounds have a „kill“ effect to insects as well as residual and repellent effects to vectors and no significant toxic effect on man. Thus, these compounds are regarded as safe. Depending on the point of application during, before or after the flight different disinsection methods can be distinguished. Blocks away disinsection takes place after boarding of passengers and before take-off, the on-arrival-methods before the doors open for disembarkation. Many passengers have experienced the combination of pre-flight disinsection with top-of-descent-disinsection. Residual treatment takes place during planned maintenance events in intervals of no longer than 2 months. Other methods, not mandated by WHO, are the pre-embarkation method and a 2-step-method consisting of residual treatment during routine

maintenance with distribution of a short acting insecticide less than 1 hour before boarding. Alternative methods like baits for non-flying insects in combination with curtains from fabric or fast blowing air have been discussed but not yet been implemented.

If it really goes wrong – comrade rescue far away from any help

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Mountaineers are at high risk for traumatic injuries. The European Alps already provide a difficult and demanding terrain for mountain rescue, even more it is in higher mountain ranges around the world. On the basis of a case report describing severe craniocerebral injury to a soldier during a military expedition at Huascaran (6878 m), Andes Peru the following topics are discussed:

1. Preparation (establishing contacts in case of need)
2. Communication (cell phone, Iridium satellite phone)
3. First aid (body check, medication)
4. Rescue and transportation (by comrades, helicopter, ambulance aircraft, hospitalization).

The expedition was well prepared and equipped and the rescue process was supported by the German embassy in Lima. This provided the use of a MI-8 helicopter, an ambulance aircraft, the initial surgical treatment in a high standard hospital in Lima and the repatriation to a hospital in Germany of maximum care within 3 days. However, the key to successful rescue and complete recovery of the patient were highly advanced skills of all expedition members in mountain rescue and first aid. This provided a fast evacuation of the patient out of a crevasse and gentle transportation through rough and difficult mountainous terrain to a safe place before nightfall. Despite low temperatures in a glacier environment the patient did not become hypothermic at any time. By now the patient has reached full recovery in his function as a soldier of the German Special Forces.

Keywords: mountain rescue, craniocerebral injury, hypothermia, expedition, high altitude.

Early Diagnosis of High Altitude Illness – Assessment of Acclimatization Status

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Introduction: Latency of high altitude illness is 4 h up to 3 days. A simple test for its early diagnosis and also to assess individual acclimatization status would be very useful especially in cases of occupational (military, business travelers, rescue personnel) altitude exposure.

Method: To give overview of methods that are generally suitable and to evaluate their practicability during real altitude exposure.

Result: Biological markers, pulse rate, heartrate variability, echocardiography, electroencephalography, pulse oximetry and altitude performance test offer a wide range of possible approaches.

Discussion: Biological markers have enormous potential but until their determination is not as easy as blood glucose measurement they have almost no practical use. As pulse rate at rest is easy to measure it can be recommended to get a rough impression of acclimatization status although it is not very specific. Pulse oximetry at altitude is already widely used today even though its proper application is much more difficult than at sea level. Measurements during sleep and during physical exercise (e.g. altitude performance test) increase its value but require an experienced investigator. The other methods cannot be recommended in principle but are useful for special questions.

Experiences with a hand disinfection gel during mountaineering at high altitudes

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Objective: Pilot study to evaluate whether regular hand disinfection with a gel is practicable during trekking or mountaineering to decrease the incidence of traveler's diarrhoea.

Material and methods: 10 participants; Commercial gel (Stoko), licensed for use in nutrition factories in 100 ml plastic holders. Instruction how to use the gel at least prior to meals, after using a "toilet", and after handling boot-laces. Each use, judgement of usefulness and in case of diarrhoea pre- and post questionnaire had to be completed. The study region was Nepal (3 day at Kathmandu (1400 m), then Everest Basecamp Trek for 25 days.

Results: During the whole sojourn 5/10 had an episode of traveller's diarrhoea, but the onset in all of them was in Kathmandu at day 2/3 before the study was started. During the whole trek (25 days) there was no other episode of diarrhoea although hygiene standards were limited. 100ml of the gel was sufficient for about 1 week/participant. Skin-compatibility was fine. Participant 4 had symptoms like an allergy, but a later retest during 2–3 weeks showed no symptoms. Therefore an allergy is not likely (probably cold-induced urticaria).

Recommendation: Disinfection should be always done after using a „toilet“, before eating or preparing food or water, after handling with boot-laces. Disinfection should be done in case of suspicion of bad hygiene in the following situations: insert of contact lenses, contact with dirty materials, cleaning a toilet seat, and before brushing teeth.