Principles and Practice of Occupational Health Research

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8th lesson

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Learning objectives

- Able to select an appropriate scientific study design for an actual question in Occupational or Environmental Health

- Able to educate students in selecting an appropriate study design for various questions

- (Able to describe learning objectives, project prescriptions & limitations and assessment criteria for a Master program thesis or another comprehensive assignment)
Exercise

What study design is used?

• One or more abstracts are disseminated

• The question for group discussion:

  What study design is used?

• Plenary discussion
For each question from practice, one of more appropriate study designs are available

• **Question is on intervention effectiveness ?:**
  (may be of therapy or prevention or rehabilitation or health promotion):

  – Randomized Controlled Trial (RCT)
  – not-random controlled studies
  – interrupted time series
  – before-after studies (+ or - control group)
For each question from practice, one of more appropriate study designs are available

- **etiology:** what designs?
- **diagnostics:** what designs?
- **prognostics:** what designs?
- **intervention effectiveness studies:** therapy/ prevention/ rehabilitation/ health promotion: Randomized Controlled Trial (RCT); not-random controlled studies; interrupted time series; before-after studies

- **epidemiologic figures**
  - prevalences, incidences, trends
- **opinions:** what designs?
- **quality of health care, interventions and tools:** what aspects to study?
For each question from practice, one of more appropriate study designs are available

- **etiology**: cohort studies, case-control studies... but cross-sectional studies are most common ...
- **diagnostics**: studies comparing two diagnostic methods showing predictive values of positive and negative test results
- **prognostics**: cohort study including potential prognostic factors
- **opinions**: interviews, focus groups, concept mapping, Delphi study
- **quality of health care, interventions and tools**: demands/needs/feasibility/accessibility/implementation and usage/coverage of workers/quality of professionals/quality of tools/performance indicators/communication/costs/cost-benefit study/......

For all studies: choice **literature, experimental or field study approach**
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Learning objectives of a thesis in a Master program

For example, competencies are developed to

• find and use adequate national and international literature and other sources, to describe the social and technical context of the issue, and to clarify available evidence from scientific publications
• formulate one good study objective and a few specific study objectives, with motivation
• organize a good study
• analyze data adequately
• write a good structured and well-written report: the thesis

Many courses have concrete formats that course participants must use
Example of a format

Content Table of a Masters Thesis (LMU University in Munich, Germany)

1. Resumen (Abstract in Spanish)
2. Abstract
3. Introduction
4. Material and methods (also ethics)
5. Results
6. Discussion
7. Acknowledgments
8. References
9. Tables and figures
10. Importance of this thesis for occupational safety and health in your own country
11. Annexes
Assessment criteria

Assessment criteria of LMU University (Munich, Germany) for the thesis in the International Master course in Latin America for Applied Research in Occupational Safety and Health

- Literature used
- Personal contribution
- Formal structure and layout
- Quality of writing
- Content (according to a standard e.g. STROBE for cross-sectional studies)
Prescriptions and limitations of Master thesis project

Prescriptions

• The subject is occupational and/or environmental health
• The topic is actual (relevant)
• Project focuses on one study objective; in addition e.g. three related more specific objectives

Limitations

• The project is not too complex
• The project can be completed in a limited number of hours (ECTS)
• It is accepted that the project has a pilot character as
  – a low numbers of participants can cause a power problem
  – making mistakes is part of learning process
  – time and experience are limited
Group assignment

Teacher-supported group work

1. Describe one actual knowledge question in your module

2. Propose for this question one appropriate study design
Abstracts from Central-Asia and India for exercises

BACKGROUND: Occupational studies of associations of exposures with impaired lung function in mining settings are built on exposure assessment and far less often on workplace approach, so the aim of this study was to identify vulnerable occupational groups for early lung function reduction in a cohort of healthy young miners.

METHODS: Data from annual screening lung function tests in gold mining company in Kyrgyzstan were linked to occupations. We compared per cent predicted forced expiratory volume in one second (FEV1), forced vital capacity (FVC) and FEV1/FVC between occupational groups and tested selected occupations in multivariate regression adjusted for smoking and work duration for the following outcomes: FEV1 < 80 %, FEV1/FVC < 70 % and both.

RESULTS: 1550 tests of permanent workers of 41 occupations (mean age 40.5 ± 9.2 years, 29.8 % never smokers) were included in the analysis. The mean overall VC was 103.0 ± 12.9 %; FVC 109.1 ± 13.0 % and FEV1 100.2 ± 25.9 %. Drillers and smoking food handlers had the lowest FEV1%. In non-smokers, the lowest FEV1 was in drillers (94.9 ± 11.3 % compared to 115.2 ± 17.7 % in engineers). Drillers (adjusted odds ratio (OR) 1.53 (95 % confidence interval (CI) 1.11-2.09)) and mill operators (OR 2.01 (1.13-3.57)) were at greater risk of obstructive ventilation pattern (FEV1/FVC < 70 %).

CONCLUSIONS: Drilling and mill operations are the highest risk jobs in an open-pit mine for reduced lung function. Occupational medical clinic at site should follow-up workers in these occupations with depth and strongly recommend smoking cessation.

Using a global database of contaminated sites, toxic hotspots in eight former Soviet countries were analyzed to identify the prevalence, types and sources of toxic pollution, as well as their associated potential public health impacts. For this analysis, polluted sites in Armenia, Azerbaijan, Kazakhstan, Kyrgyzstan, Russia, Tajikistan, Ukraine, and Uzbekistan were compiled and analyzed. The levels of contamination of seven key pollutants were assessed in each country. 424 contaminated sites were identified using data from Blacksmith Institute. Pesticides, lead (Pb), radioactive metals, arsenic (As), mercury (Hg), chromium (Cr), and cadmium (Cd) were the most commonly identified key pollutants. Collectively, these sites pose health risks to an estimated 6.2 million residents. The existing data on toxic hotspots in former Soviet countries likely captures only a small percentage of actual contaminated sites, but suggests potentially severe public health consequences. Additional assessments are needed to understand the risks posed by toxic pollution in the region.

OBJECTIVE: To explore the prevalence of malignant tumors in the adult population through 2003-2014 in parts of the Aral Sea region: a zone of ecological disaster, a zone of ecological crisis and a zone of precritical conditions.

METHODS: The long-time average annual levels of cancer morbidity stratified by zones of the Aral Sea region and trends of long-time average annual incidence indicators of malignant tumors were identified. Leading cancer localizations in the adult population was established and associations between cancer incidence and environmental pollution were analyzed. In addition, associations between individual risk factors and cancer incidence in the adult population was established. Correlations between a hazard index and the cancer incidence in the adult population were calculated.

RESULTS: In all three Aral Sea regions, as well as in Zhanaaarkinskii district, leading cancer in adult population was esophageal, stomach, tracheal, lung, hepatobiliary, and breast. Long-time average annual levels of cancer morbidity in adult population living in the Aral sea region is 1.5 times higher comparing to the control region. In particular, long-time average annual levels of cancer morbidity in adult population living in the zone of ecological disaster was 57.2% higher, in the zone of ecological crisis - 61.9% higher, and in the zone of precritical condition – 16.8% higher. Long-time average annual levels in the adult population of the Aral Sea region significantly exceeded control levels for brain and central nervous system cancer, cancer of bone and articular cartilage, and thyroid cancer.

CONCLUSION: It has was established that the total cancer morbidity depended on the total hazard index associated with the inhalation of nickel and the combined cadmium intake (r=0.8).
Eastern European and Central Asian countries are undergoing rapid socioeconomic and political reforms. Many old industrial facilities are either abandoned, or use outdated technologies that severely impact the environment. Emerging industries have less regulation than in developed countries and environmental and occupational problems seem to be increasing. Under a US National Institutes of Health pilot grant, we developed an interdisciplinary One Health research network in Southeastern Europe and West-Central Asia to identify environmental and occupational problems. From 2012 to 2014, this GeoHealth Hub engaged 11 academic centers and 16 public health institutions in eight different countries: Albania, Armenia, Georgia, Kazakhstan, Kyrgyzstan, Moldova, Romania, and the United States with a goal of strengthening environmental and occupational research and training capacities. Employing face-to-face interviews and large group meetings, we conducted an evidenced-based needs and opportunities assessment focused on aquatic health, food safety, and zoonotic diseases. Comprehensive reviews of the published literature yielded priority research areas for each of the seven GeoHealth Hub countries including heavy metal and pesticide contamination, tick-borne diseases, rabies, brucellosis, and inadequate public health surveillance.

**Purpose:** Treatment-seeking behaviors and economic burden because of health expenditure are widely discussed issues in India, and more so in recent times. The aim of this study is to identify health problems of tannery workers and their treatment-seeking behavior and their health expenditure.

**Data and Methods:** The primary data used in this article were collected through a cross-sectional household survey of 284 male tannery workers in the Jajmau area of Kanpur city in the state of Uttar Pradesh, during January-June 2015.

**Results:** Findings of the study revealed that around 36% of the tannery workers and 42% of non-tannery workers received treatment as outpatients in government/municipal hospital in the first spell of treatment. The secondary source of treatment was pharmacy/drug stores for 30% of the tannery workers and 24% of the non-tannery workers, an indication that a substantial proportion takes treatment without consulting a qualified medical practitioner; it also highlights that almost one-third of the tannery and non-tannery workers visited private health facility despite poor economic condition. It is evident that a substantial proportion of tannery and non-tannery workers are visiting private/non-governmental organization/trust hospital despite their poor financial situation.

**Conclusion:** There is an urgent need to reinstate people's faith in public health facilities by developing professionalism, integrity, and accountability among different levels of health functionaries and frontline workers with the support of credible, transparent, and responsible regulatory environment.

Rice mill workers constitute a special group from the perspective of occupational health. Unprotected dust exposure among them adversely affects their respiratory health, which needs to be evaluated. Adequate evidence is still lacking in many parts of India including West Bengal. Burdwan is one of the main rice-producing districts in the state with abundant rice mills.

**Aim:** The aim of the study was to find out the prevalence and pattern of respiratory morbidity and associated background characteristics of rice mill workers.

**Settings and Design:** A descriptive cross-sectional study was conducted at Burdwan municipality area during July-December 2016.

**Materials and Methods:** Considering 44.2% prevalence, 95% confidence interval, 15% allowable error, 10% non-response, a sample of 252 directly engaged rice mill workers were selected through multistage random sampling. With prior consent, the subjects were interviewed, clinically examined, and underwent spirometry; relevant records were also reviewed using a pre-designed schedule. Any abnormal spirometry finding was considered as respiratory morbidity. Ethical approval was obtained from institutional ethics committee.

**Statistical Analysis:** Data were analyzed using SPSS version 20. Chi-square test and multiple logistic regression were applied.

**Results:** Prevalence of respiratory morbidity was 40.73% with obstructive and restrictive respiratory morbidity being 24.60% and 16.13%, respectively. Non-use of any protective measure, duration (years) of working in rice mill and average daily working hours were significant predictors of respiratory morbidity.

**Conclusion:** Respiratory morbidity is quite high in the area. Proper health education and provision of personal protective equipments need to be provided.

**BACKGROUND:** Petrol pump workers are occupationally exposed to gasoline and its fumes consisting of several mutagenic chemicals.

**OBJECTIVE:** To evaluate the genotoxic effects of exposure to gasoline fumes on petrol pump workers.

**METHODS:** The study groups included 70 petrol pump workers (exposed group) and 70 healthy age-matched individuals with no known exposure (comparison group). Buccal micronucleus cytome assay (BMCyt) was performed to check the genotoxicity caused due to inhalation of gasoline fumes.

**RESULTS:** The frequencies of micronucleated cells, nuclear bud, condensed chromatin cells, karyorrhectic cells, pyknotic cells, and karyolytic cells were significantly higher in the exposed workers compared to the comparison group.

**CONCLUSION:** Exposure to gasoline fumes is associated with increased frequency of cell abnormalities. This may lead to various health consequences including cancer in those occupationally exposed to gasoline fumes.

BACKGROUND: Occupational injuries are a major problem in agriculture worldwide. In the Northeast region of India, most of the farm operations are carried out manually with hand operated tools and equipment. These tools also cause some nonfatal accidents. In the absence of reliable data on accidents in this region, injury prevention policy cannot be made.

OBJECTIVE: The aim of this study was to survey injury causing agricultural accidents occurring during 2010 to 2013 in Arunachal Pradesh of the northeast region to know their magnitude, causes and severity.

PARTICIPANTS: In this study, four districts of Arunachal Pradesh namely Papum Pare, Lower Subansiri, West Siang and East Siang were chosen using purposive sampling. From each district, 15 villages were selected. In these villages, a total of 50614 agricultural workers participated and 174 and 48 injuries were found for male and female workers respectively.

METHOD: A case-control study was carried out in Arunachal Pradesh. The questionnaire-based approach was used for data collection. The questionnaire contains detailed information on the demographic and injury characteristics. The Demographic information included gender, age, educational background, etc. and injury characteristics included the nature of the injury, the body part injured, and type of tools and equipment that caused the injury.

RESULTS: The results showed that farm tools and equipment-related accidents were maximum i.e. 144 (60%) caused due to dao followed by 19 from spade (8%), 18 from sickle (7%) and 8 from axe (3%). The foot and legs were the most frequently injured body parts. From this study, it was also revealed that male agricultural workers are more affected as compared to their female counterparts.

CONCLUSIONS: Agricultural accident incident rate (AIR) was found to be 589 per 1,00,000 workers per year. The AIR for males is 462 per 100,000 workers per year which is 3.6 times higher than female workers. The root causes of accidents are the use of traditional tools and equipment in various agricultural activities. Therefore, any ergonomic interventions in designing tools and equipment will significantly improve the occupational health and safety of workers.

Context: Carpal tunnel syndrome (CTS) is one of the musculoskeletal disorders that is often described as an occupational hazard, including occupations involving computer use. However, clear consensus is lacking as far as the association between the use of computer and risk of possible CTS is concerned.

Aim: To assess the association between CTS and computer use.

Settings and Design: A case-control study.

Materials and Methods: A sample size of 411 (137 cases and 274 controls) was calculated using Epi Info (version 6). Thus, 137 confirmed cases of CTS and 274 controls (matched for age and sex) were studied using a structured questionnaire.

Statistical Analysis Used: Odds ratio (OR) with 95% confidence interval was calculated between the two groups to analyze the association. For control of confounding factors, logistic regression analysis was done.

Results: Current use of computer was found to be significantly higher in controls rather than cases (OR = 0.47, CI = 0.27-0.84, P = 0.009). Similarly, past use of computer was also found to be higher in controls. However, the difference was not statistically significant (OR = 0.38, CI = 0.11-1.35, P = 0.20). On applying logistic regression, variables found to be significantly associated with CTS were education (OR = 0.79, CI = 0.66-0.94, P = 0.01), obesity (OR = 3.11, 95%CI = 1.92-5.04, P = 0.00), and short stature (OR = 1.06, 95%CI = 1.02-1.1, P = 0.00). Although current use of computer (OR = 0.33, CI = 0.16-0.67, P = 0.00) was significantly associated with CTS in multivariate model, OR of value less than one does not indicate positive association between this variable and CTS.

Conclusion: The study did not demonstrate any positive association between computer use and CTS.

PURPOSE: Handicraft manufacturing appears to be an occupation where work-related musculoskeletal disorders (WMSDs) are a major threat to workers. For the multifactorial nature and varying prevalence of WMSDs between different body areas, the current study aimed to evaluate the prevalence of WMSDs and associated risk factors among handicraft workers.

METHODS: This review was based on literature collected from three electronic databases, and the retrieved articles were screened following the inclusion/exclusion criteria. After applying the literature selection criteria to 182 articles, 30 citations were selected and examined in detail.

RESULTS: The findings suggest that the prevalence of musculoskeletal symptoms among handicraft workers is 38.5-100%, and the most affected body areas were the neck, back, knees and upper limbs. Risk factors including working posture, daily working hours, repetitive and forceful movements, work experience, age, gender and working under stressful conditions were found to be highly associated with the occurrence of WMSDs. However, higher educational qualification of the workers led to a reduction in the odds of developing WMSDs.

CONCLUSION: Handicraft workers are at high risk of developing WMSDs. Further research, preferably longitudinal studies, with more emphasis on work-related factors should now be undertaken to thoroughly investigate WMSDs in this occupational group.

**Background:** Occupational exposure to polycyclic aromatic hydrocarbons (PAHs) has been shown to be associated with lung cancer in various epidemiological studies in industries such as aluminium reduction/smelting, coal gasification, coke production, iron/steel foundries, coal/coke and related products and carbon/graphite electrodes production.

**Aims:** To update data on the association between PAH exposure and morbidity and mortality due to lung cancer among workers in different occupations, including smoking data.

**Methods:** A comprehensive literature search was conducted to retrieve relevant papers for meta-analysis. Cohort studies with standardized mortality ratios or standardized incidence ratios and calculated overall risk ratio with their corresponding 95% confidence intervals (CIs) were included in the analysis. Chi-square test for heterogeneity was used to evaluate the consistency of findings between the studies.

**Results:** A significant risk of lung cancer was observed among the coal/coke and related product industry 1.55 (95% CI 1.01-2.37) and the iron/steel foundry industry 1.52 (95% CI 1.05-2.20). There was a wide variation in smoking habits and PAHs exposure among studies.

**Conclusions:** Coal/coke industry and iron/steel industry workers showed a higher risk of lung cancer compared with other occupations exposed to PAHs. The confounding effects of smoking and individual exposure levels of PAH should be taken into account.

PURPOSE: The purpose of this study was to determine the effectiveness of preventing eye injury with the use of safety eyewear in agriculture workers.

METHODS: A sample group of 575 agricultural workers (Group A) engaged in harvesting paddy were provided with goggles with side covers. Following harvesting, a questionnaire-based survey was carried out to determine the frequency of their eye injuries. Workers with goggles were asked about the duration for which they used the goggles and also list barriers or difficulties with the same. The frequency of eye injuries in this group was compared with another group of agriculture workers (Group B) who did not use any safety eyewear.

RESULTS: The frequency of eye injuries in Group A was 4 (0.7%) and Group B was 61 (11.3%) which was highly significant (P = 0.0001). The relative risk calculated was 0.06 (95% confidence interval: 0.02-0.2). Agricultural workers in Group A had 94% less risk of ocular trauma compared to those in Group B. Injuries in both groups were caused by parts of the paddy plant. A significant number (76.2%) of workers used the goggles all or most of the time during work. Impaired vision when wearing goggles was the most frequent barrier reported by the workers. Other barriers were discomfort, shyness, forgetfulness, apathy, slowing of work pace, awkward appearance, and breakages.

CONCLUSION: Safety eyewear conferred significant protection against work-related eye injuries in agriculture. Although safety eyewear was widely adopted by the workers, barriers reported by them will need to be addressed to make such programs more effective.
**INTRODUCTION:** Calcium carbide used in fruit ripening industry as a cheap alternative to natural plant hormone ethylene produces highly inflammable acetylene gas. Inadvertent ignition of this gas can cause severe ocular burn injury with unilateral or bilateral blindness.

**OBJECTIVE:** To determine the characteristics and visual outcome of ocular burn injuries from calcium carbide during mango ripening season of West Bengal, eastern India.

**MATERIALS AND METHODS:** A prospective study of all cases of calcium carbide related ocular burn injury attending a tertiary care hospital during mango ripening season was carried out. The demographic features, characteristics of the injury, management and outcomes were recorded.

**RESULTS:** Fifty five eyes of 33 patients were studied. Males were more commonly affected (20 patients, 60.6%) than females. The injury was bilateral in 22 patients (66.66%). Seventeen patients (51.51%) were below 20 years of age. Ten eyes had open globe injuries and 45 eyes had closed globe injuries. One eye of a patient had to be enucleated (3%). Children below 14 years of age were mainly injured while playing with indigenous fireworks of shooting carbide. Middle aged women were affected particularly during ignition of evening lamps. Carbide lamp was another source of injury.

**CONCLUSION:** Males are more commonly affected by calcium carbide related ocular injuries. Children and young adults are the common victims. Such injuries can involve both the eyes and cause a permanent visual disability.

INTRODUCTION: Agricultural workers are predisposed to corneal injuries, which, if neglected, can lead to corneal blindness.

OBJECTIVE: To study the prevalence and mode of agriculture related corneal injuries in the village of Badkali, MuzaffarNagar, Western Uttar Pradesh, India in 2005 - 2006.

SUBJECTS AND METHODS: Adult population of village Badkali, MuzaffarNagar, Uttar Pradesh. A door-to-door survey was carried out by paramedical ophthalmic assistants in October and November 2007. The main outcome measure was occurrence of corneal trauma in the fields from January 2005 until December 2006, its mode of injury, symptoms, treatment taken and outcome.

RESULTS: The study area comprised of 718 people, of whom 584 were engaged in agricultural activities and 481 were male. While working on the fields, 221 persons sustained corneal injuries and out of them four were injured more than once. The number of injuries caused due to sugarcane leaves, wheat, cattle tail/ear, 'cheri leaves' and others were 83(36.7 %), 24(10.6 %), 60(25.5 %), 31(13.7 %) and 28(12.4 %) respectively. All were closed globe injuries except for two. Out of the 221 injured, 117 (51.7 %) took treatment and 95(42.2 %) had a best corrected visual acuity less than 6/18.

CONCLUSION: The majority of the population in Badkali were employed in farming. Logistic regression shows that the occurrence of injuries was more in those engaged in farming and related activities as compared to other occupations (OR = 0.012, p = 0.000, 95 % CI = 0.02, 0.09) and the maximum number of injuries being caused by sugar cane leaves followed by cattle tails.

BACKGROUND: Cadmium (Cd) is an important metal with both common occupational and environmental sources of exposure. Although it is likely to cause adverse respiratory effects, relevant human data are relatively sparse.

METHODS: A cross-sectional study of 133 workers in jewellery workshops using Cd under poor hygienic conditions and 54 referent jewellery sales staffs was performed. We assessed symptoms, performed spirometry, measured urinary Cd levels in all study subjects and quantified airborne total oxidant contents for 35 job areas in which the studied workforce was employed. We tested the association of symptoms with exposure relative to the unexposed referents using logistic regression analysis, and tested the association between urinary Cd levels and lung function using multiple regression analysis, adjusting for demographics, smoking and area-level airborne oxidants.

RESULTS: Exposed workers had 10 times higher urinary Cd values than referents (geometric mean 5.8 vs 0.41 µg/dl; p<0.01). Of the exposed subjects, 75% reported respiratory tract symptoms compared with 33% of the referents (OR=3.1, 95% CI 1.4 to 7.3). Forced vital capacity (FVC) and forced expiratory volume in 1 s (FEV1) were also lower among the exposed workers than the referents (>600 ml decrement for each, p<0.001). For every 1 µg increase in urinary Cd there was a 34 ml decrement in FVC and a 39 ml decrement in FEV1 (p<0.01), taking into account other covariates including workplace airborne oxidant concentrations.

CONCLUSIONS: This cohort of heavily exposed jewellery workers experienced frequent respiratory symptoms and manifested a marked deficit in lung function, demonstrating a strong response to Cd exposure.

Organophosphate (OP) compounds are widely used in different applications including agriculture. The widespread use of OP insecticides, however, brings high risks of severe health problems. Besides occupational poisoning in industrial production and agricultural application, instances of acute organophosphate poisoning (OPP) also include suicide, homicide, and accidental overdose. Cardiovascular manifestations frequently accompany exposure to these organophosphorus compounds, but their exact nature is not fully elucidated. In this study, we evaluated 20 patients who presented to our emergency department with organophosphorus (OP) poisoning and discussed their associated electrocardiographic (ECG) abnormalities. Over 3 months, 20 patients with OP poisoning were included in this prospective study. ECG analysis included the rate, ST-T abnormalities, conduction defects, and measurement of PR and "QTc" intervals. Our results show that 12 patients were having prolonged QTc interval i.e., >0.43 s. Eight patients were having mild elevated ST segment and low-amplitude "T" waves. Most of the patients have shown increased heart rate, whereas some has shown decreased value. From this study, we conclude that acute organophosphorus poisoning is associated with ventricular arrhythmias, tachycardia and bradycardia, and attributes mild myocardial ischemia.