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Interest of using multiple imputations. Assessment of work-related risk factors for the incidence of lateral epicondylitis

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CONTEXT

• Increasing concern on missing data with low participation rates in recent studies
  ⇒ Estimations on available data could be strongly biased
  ⇒ Problem of statistical methods to deal with missing data
• Multiple imputations = effective method to incorporate the knowledge of investigators and extract the maximum potential of available data (1)
  ⇒ Multiple imputation can reduce bias of estimation on available data

OBJECTIVES

To analyze the effects of occupational risk factors, measured twice, on incidence of lateral epicondylitis using multiple imputations analysis.

ORIGINAL DATA

Study population

• Large sample of workers in the Loire Valley district of Central West France in two successive surveys in 2002-2005 and in 2007-2010 with self-assessment of occupational exposures (AQ) and physical examination on lateral epicondylitis (EC) by an occupational physician (2)
• 3710 workers included in 2002-2005
 ⇒ Study population = 3231 workers without elbow pain or lateral epicondylitis in 2002-2005
• For the 1881 male workers:
  Complete case workers (N=491)
  Physical examination only
  Self-reported questionnaire only (N=573)
  Lost of follow-up (N=511)

Risk factors

Previously found on prevalence in the literature and in the same population (3):
• Age in 3 class (<30, 30-44, ≥ 45)
• Repetitive Tasks (<4 hours a day)
• Specific elbow combined physical exposure: high physical exertion associated with elbow flexion/extension or extreme wrist bending (<2 hours a day)

Missing variables at second survey (2007-2011)

• Outcome: lateral epicondylitis at physical examination
• Risk factors: time between the physical examinations (offset), high physical exertion, elbow flexion/extension, extreme wrist bending, high repetitiveness, low social support,
• Auxiliary variables: job change, self-assessment of elbow pain

METHODOLOGY

To be continued...

MULTIPLE IMPUTATIONS

We used Multiples Imputations by Chained Equation algorithm (MICE) to impute the 9 missing variables using the following variables:
• in 2002-2005: year of first questionnaire, department, body mass index, occupations, socio-economic category, type of contract combined with working experience, lifting and carrying objects, past history of upper-extremity musculoskeletal disorders, rotator cuff syndrome, lateral epicondylitis
• in 2007-2010: professional change since 2002, the declaration of pain at elbow, having a second physical examination, lateral epicondylitis

Missing Not At Random hypothesis (MNAR)

Missing values on lateral epicondylitis depended on previous measured variables and on unmeasured variables at second examination:
• Health status
• Working condition
• Employment stability

STATISTICAL ANALYSIS

Poisson models were performed to assess the incidence rate ratios (IRRs) of risk factors separately by sex:
• Main analysis: assessment in complete-case workers and MAR imputed workers
• Complementary analysis: analysis on MNAR imputed workers

The results presented here are restricted to men.

COMPLEMENTARY ANALYSIS

• MAR hypothesis (dashed bars)
  ⇒ Prevalence of epicondylitis similar between the three categories of causes of absence
  ⇒ Effect of age identical between categories of causes of absence
• Sensitivity analyses with MNAR hypothesis (solid bars)
  ⇒ First scenario (first column): Prevalence of epicondylitis chosen by causes + Effect of age identical
  ⇒ Second scenario (second column): Prevalence of epicondylitis chosen by causes + Effect of age chosen

Sensitivity analyses indicated that the results were robust.

REFERENCES:

Annual incidence rate of lateral epicondylitis = 1.0[0.7;1.3] per 100 men

Interest of multiple imputations when the proportion of missing data is large, in order to reduce the effect of attrition (potential bias)

Checking robustness of results with comparison with complete-case analyses and sensitivity analyses could be recommended

CONCLUSION