**ONLINE SUPPLEMENT**

**Under-estimation of self-reported occupational exposure by questionnaire in hospital workers**

C Donnay1, M-A Denis2,3, R Magis4, J Fevotte3,5, N Massin6, O Dumas7,8, I Pin9, D Choudat1,4, F Kauffmann7,8, N Le Moual7,8

1Université Paris Descartes, AP-HP, Paris, France

2Hospices Civils de Lyon, Groupement Hospitalier Est, Médecine du Personnel, Bron, F-69677, France

3UMRESTTE UMR T9405 (INRETS; Université de Lyon; Université Lyon 1; Institut de Veille Sanitaire), Bron, F-69500, France

4Service central de médecine du travail, AP-HP, Paris, France

5Institut de veille sanitaire, Département santé travail (DST/InVS), Saint Maurice, F-94415, France

6Département Epidémiologie en Entreprise, INRS, Vandœuvre-lès-Nancy, France

7Inserm, CESP Centre for research in Epidemiology and Population Health, U1018, Respiratory and environmental epidemiology Team, F-94807, Villejuif, France

8Université Paris Sud 11, UMRS 1018, F-94807, Villejuif, France

9Inserm, U823, Centre de Recherche Albert Bonniot, La Tronche, France

Online supplement : 4 tables + the specific occupational questionnaires

**Table E1: Comparison of self-reported exposure to expert exposure assessment according to age**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  |  | Self-reported exposure | Expert exposure assessment | Mc Nemartest | Kappa | Phi | Sensitivity | Specificity |
|  | n§ | % | % | p |  |  |  |  |
| **< 45 years (n=113 jobs)** |
| Formaldehyde# | 94 | 7.4 | 14.9 | 0.01 | 0.63 | 0.68 | 50.0 | 100.0 |
| Bleach, chlorine | 111 | 39.6 | 43.2 | Ns | 0.85 | 0.85 | 87.5 | 96.8 |
| Alcohol | 108 | 54.6 | 92.6 | <0.0001 | 0.14 | 0.24 | 58.0 | 87.5 |
| Quaternary ammonium# | 86 | 5.8 | 73.3 | <0.0001 | -0.02 | -0.07 | 4.8 | 91.3 |
| Ammonia | 106 |  2.8 | 17.9 | <0.0001 | 0.24 | 0.36 | 15.8 | 100.0 |
| Sprays | 111 | 52.3 | 47.8 | 0.06 | 0.87 | 0.88 | 98.1 | 89.7 |
| Latex gloves | 105 | 86.7 | 81.9 | 0.06 | 0.75 | 0.76 | 98.8 | 68.4 |
| **> 45 years (n=214 jobs)** |
| Formaldehyde# | 193 | 35.7 | 41.4 | 0.09 | 0.55 | 0.56 | 67.5 | 86.7 |
| Bleach, chlorine | 212 | 48.1 | 52.4 | 0.05 | 0.80 | 0.80 | 86.5 | 94.1 |
| Alcohol | 205 | 70.2 | 93.2 | <0.0001 | 0.26 | 0.37 | 74.9 | 92.9 |
| Quaternary ammonium# | 179 | 21.8 | 69.8 | <0.0001 | 0.14 | 0.23 | 28.0 | 92.6 |
| Ammonia | 203 | 9.8 | 19.2 | <0.0001 | 0.63 | 0.68 | 51.3 | 100.0 |
| Sprays | 211 | 32.7 | 29.4 | 0.09 | 0.81 | 0.81 | 91.9 | 91.9 |
| Latex gloves | 195 | 77.4 | 65.6 | <0.0001 | 0.67 | 0.69 | 98.4 | 62.7 |

§ Number of jobs with data for self-reported and for expert exposure assessment

# Job classified by experts as environmentally exposed to formaldehyde and quaternary ammonium components were excluded

from the analyses of each specific exposure

**Table E2 : Comparison of exposure estimates – jobs without reported similar tasks (n=155 jobs)**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  |  | Self-reported exposures | Expertexposure assessment | Mc Nemartest | Kappa | Phi | Sensitivity | Specificity |
|  | n§ | % | % | p |  |  |  |  |
| Formaldehyde | 131 | 22.1 | 29.8 | 0.008 | 0.72 | 0.74 | 69.2 | 97.9 |
| Bleach, chlorine | 151 | 55.0 | 58.3 | 0.06 | 0.91 | 0.91 | 93.2 | 98.4 |
| Alcohol | 148 | 64.2 | 91.2 | <0.0001 | 0.26 | 0.37 | 69.6 | 98.3 |
| Quaternary ammonium | 133 | 18.0 | 73.7 | <0.0001 | 0.10 | 0.19 | 22.4 | 94.3 |
| Ammonia | 144 | 11.8 | 29.2 | <0.0001 | 0.49 | 0.57 | 40.5 | 100.0 |
| Sprays | 151 | 49.7 | 47.0 | 0.05 | 0.95 | 0.95 | 100.0 | 95.0 |
| Latex gloves | 135 | 80.0 | 76.3 | 0.06 | 0.85 | 0.85 | 99.0 | 81.3 |

§ Number of jobs with data for self-reported and for expert exposure assessment

**Table E3: Comparison of exposure estimates according to high or low expert estimates to cleaning and disinfecting tasks (n=240 jobs)**

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  |  | Tasks exposure level\* | Self-reported exposures | Expert exposure assessment | Mc Nemartest | Kappa | Phi | Sensitivity | Specificity |
|  | n |  | % | % | p |  |  |  |  |
| Formaldehyde | 141 | low | 26.9 | 34.0 | 0.03 | 0.67 | 0.68 | 68.7 | 94.6 |
|  |  71 | high | 25.3 | 47.9 | <0.001 | 0.43 | 0.48 | 47.1 | 94.6 |
| Bleach, chlorine | 152 | low | 52.6 | 58.6 | 0.02 | 0.80 | 0.81 | 86.5 | 95.2 |
|  |  86 | high | 64.0 | 73.3 | 0.005 | 0.79 | 0.80 | 87.3 | 100.0 |
| Alcohol | 147 | low | 75.5 | 95.9 | <0.0001 | 0.18 | 0.28 | 78.0 | 83.3 |
|  |  84 | high | 65.5 | 92.9 | <0.0001 | 0.19 | 0.28 | 69.2 | 83.3 |
| Quaternary ammonium | 140 | low | 20.0 | 82.9 | <0.0001 | 0.10 | 0.23 | 24.1 | 100.0 |
|  |  76 | high | 10.5 | 89.5 | <0.0001 | -0.01 | -0.02 | 10.3 | 87.5 |
| Ammonia | 145 | low | 4.8 | 13.1 | <0.001 | 0.50 | 0.58 | 36.8 | 100.0 |
|  |  84 | high | 14.3 | 41.7 | <0.0001 | 0.38 | 0.48 | 34.3 | 100.0 |
| Sprays | 152 | low | 42.8 | 44.1 | ns | 0.87 | 0.87 | 91.0 | 95.3 |
|  |  87 | high | 58.6 | 54.0 | 0.05 | 0.91 | 0.91 | 100.0 | 90.0 |
| Latex gloves | 148 | low | 77.0 | 74.3 | ns | 0.85 | 0.86 | 98.2 | 84.2 |
|  |  68 | high | 91.2 | 76.5 | 0.004 | 0.37 | 0.44 | 98.1 | 31.2 |

§ Number of jobs with data for self-reported and for expert exposure assessment

\* Low exposure (expert estimate) : high probability and low intensity of exposure to disinfecting or cleaning tasks (153 jobs);
High exposure (expert estimate): high probability and moderate to high intensity, in fact all these jobs were also exposed at least one day per week (87 jobs);
The 87 other jobs (not described here) were classified with a low probability of exposure to cleaning or disinfecting tasks

**Appendix : specific occupational questionnaires**

|  |
| --- |
| Nurse, personnel care or laboratory workers  |
| *Recall here:* 1. Number of the job: I\_\_I\_\_I 2. Beginning, year: I\_\_I\_\_I\_\_I\_\_I 3. Ending, year: I\_\_I\_\_I\_\_I\_\_I |
| 4. What was your job ? Identify the principal work. | **No** | **Yes** |
| a) Nurse in general practitioner’s surgeryb) Clinical nurse in a hospitalc) Nursing assistant in a hospitald) Anaesthesia assistante) Technician in a hospitalf) Carer in private homes of patientsg) Carer in a service flat or old people’s homeh) Midwifei) Maternity nursej) Dental hygienist or assistantk) physicianl) Surgeonm) Other, specify : …………………………………………………………………… | ⬜ | ⬜ |
| ⬜ | ⬜ |
| ⬜ | ⬜ |
| ⬜ | ⬜ |
| ⬜ | ⬜ |
| ⬜ | ⬜ |
| ⬜ | ⬜ |
| ⬜ | ⬜ |
| ⬜ | ⬜ |
| ⬜ | ⬜ |
| ⬜ | ⬜ |
| ⬜ | ⬜ |
| ⬜ | ⬜ |
| 5. On how many days a week did you perform the following working tasks?  |  | **Number of days per week** |
| Never | <1 d | 1-3 d | 4-7 d |
| a) Assistant of general practitioner  | ⬜ | ⬜ | ⬜ | ⬜ |
| b) Work in medical outpatient clinic | ⬜ | ⬜ | ⬜ | ⬜ |
| c) Work in paramedics | ⬜ | ⬜ | ⬜ | ⬜ |
| d) Work in emergency room | ⬜ | ⬜ | ⬜ | ⬜ |
| e) Work in critical care unit | ⬜ | ⬜ | ⬜ | ⬜ |
| f) Work in operating theatres | ⬜ | ⬜ | ⬜ | ⬜ |
| g) Work in endoscopy | ⬜ | ⬜ | ⬜ | ⬜ |
| h) Work in oncology | ⬜ | ⬜ | ⬜ | ⬜ |
| i) Work in radiology /nuclear medicine | ⬜ | ⬜ | ⬜ | ⬜ |
| j) Preparation of medicines | ⬜ | ⬜ | ⬜ | ⬜ |
| k) Administration of medicines | ⬜ | ⬜ | ⬜ | ⬜ |
| l) Work in a medical analysis laboratory  | ⬜ | ⬜ | ⬜ | ⬜ |
| m) Work in a chemistry /biology laboratory | ⬜ | ⬜ | ⬜ | ⬜ |
| n) Work in a pathology laboratory | ⬜ | ⬜ | ⬜ | ⬜ |
| o) Disinfection | ⬜ | ⬜ | ⬜ | ⬜ |
| 6. On how many days a week did you use powdered latex (natural rubber) gloves?  | ⬜ | ⬜ | ⬜ | ⬜ |
| 7. On how many days a week did you use non-powdered latex gloves ? | ⬜ | ⬜ | ⬜ | ⬜ |
|  | Number of pairs of gloves used per day |
| 8. How many pairs of powdered latex gloves | None | 1-2  | 3-5 | 6-10 | > 10 |
|  did you use per day ? | ⬜ | ⬜ | ⬜ | ⬜ | ⬜ |
| 9. How many pairs of non-powdered latex gloves did you use per day? | ⬜ | ⬜ | ⬜ | ⬜ | ⬜ |
| 10. On how many days a week did you use the following cleaning products at work? | Number of days per weekNever <1 d 1-3 d 4-7 d |
| a) Washing powders (detergents) | ⬜ | ⬜ | ⬜ | ⬜ |
| b) Liquid multi-use cleaning products | ⬜ | ⬜ | ⬜ | ⬜ |
| c) Bleach, chlorine | ⬜ | ⬜ | ⬜ | ⬜ |
| d) Ammonia | ⬜ | ⬜ | ⬜ | ⬜ |
| e) Solvents, stain removers | ⬜ | ⬜ | ⬜ | ⬜ |
| f) Any cleaning products in spray-form | ⬜ | ⬜ | ⬜ | ⬜ |
| g) Other cleaning products, specify : …………….…… | ⬜ | ⬜ | ⬜ | ⬜ |
| 11. On how many days a week did you perform the following working tasks with disinfectants?  | Number of day per weekNever <1 d 1-3 d 4-7 d |
| a) Preparation/mixing of disinfectants | ⬜ | ⬜ | ⬜ | ⬜ |
| b) Filling of devices before use | ⬜ | ⬜ | ⬜ | ⬜ |
| c) Actual disinfections | ⬜ | ⬜ | ⬜ | ⬜ |
| d) Cleaning equipment after use | ⬜ | ⬜ | ⬜ | ⬜ |
| 12. On how many days a week did you disinfect the following places ? |
| a) Sanitary *(toilets, bathrooms, …)* | ⬜ | ⬜ | ⬜ | ⬜ |
| b) Kitchens | ⬜ | ⬜ | ⬜ | ⬜ |
| c) Medical instruments  | ⬜ | ⬜ | ⬜ | ⬜ |
| d) Laboratory equipment | ⬜ | ⬜ | ⬜ | ⬜ |
| e) Operating room | ⬜ | ⬜ | ⬜ | ⬜ |
| f) Other places, specify : ………………………………………. | ⬜ | ⬜ | ⬜ | ⬜ |
| 13. On how many days a week did you did you use the following methods of disinfections ? |
| a) Spraying | ⬜ | ⬜ | ⬜ | ⬜ |
| b) Rinsing manually | ⬜ | ⬜ | ⬜ | ⬜ |
| c) Washing by machine | ⬜ | ⬜ | ⬜ | ⬜ |
| d) Clean surfaces with a sponge or a cloth | ⬜ | ⬜ | ⬜ | ⬜ |
| e) Mopping or scouring the floor | ⬜ | ⬜ | ⬜ | ⬜ |
| f) Other methods, specify : ……………………………………. | ⬜ | ⬜ | ⬜ | ⬜ |
| 14. On how many days a week did you did you use the following disinfectants ?  |
| a) Formaldehyde | ⬜ | ⬜ | ⬜ | ⬜ |
| b) Glutaraldehyde  | ⬜ | ⬜ | ⬜ | ⬜ |
| c) Bleach, chlorine | ⬜ | ⬜ | ⬜ | ⬜ |
| d) Chloramine-T  | ⬜ | ⬜ | ⬜ | ⬜ |
| e) Alcohol *(ethanol, methanol)* | ⬜ | ⬜ | ⬜ | ⬜ |
| f) Ammonia | ⬜ | ⬜ | ⬜ | ⬜ |
| g) Quaternary ammonium compounds  | ⬜ | ⬜ | ⬜ | ⬜ |
| h) Ethylene oxyde  | ⬜ | ⬜ | ⬜ | ⬜ |
| i) Halamid  | ⬜ | ⬜ | ⬜ | ⬜ |
| **If you don’t know the active compound:**j) Fill in the brand name below |
| ………………………………………………… | ⬜ | ⬜ | ⬜ | ⬜ |
| ………………………………………………… | ⬜ | ⬜ | ⬜ | ⬜ |
| k) Other products; don’t know the name | ⬜ | ⬜ | ⬜ | ⬜ |
| 15. On days with disinfectant use, how many hours did you on average use disinfectants?  |
| ⬜ <1 hour per day⬜ 1−4 hours per day⬜ >4 hours per day |
| 16. On how many days per week did you wear a face mask or another respiratory protection at work? ⬜ Never ⬜ <1 day/week ⬜ 1−3 days/week⬜ 4−7 days/week |
| 17. Have you ever had to clean after an accidental chemical spills? ⬜ no ⬜ yes |
| 18. Have you worked as a personnel care or a laboratory worker during another period? ⬜ no ⬜ yes |

**If yes with very different tasks, complete « Nurse, personnel care or laboratory workers »**

 **If yes with similar tasks,**

 **19. Please indicate the associated job number : …………………**

|  |  |
| --- | --- |
| Cleaning workers |  |
| *Recall here:* 1. Job number: I\_\_I\_\_I 2. Beginning, year: I\_\_I\_\_I\_\_I\_\_I 3. Ending, year: I\_\_I\_\_I\_\_I\_\_I |  |
| 4. What/where did you clean ? Identify your principal working places | **No** | **Yes** |
| a) Private homes | ⬜ | ⬜ |
| b) Schools | ⬜ | ⬜ |
| e) Shops | ⬜ | ⬜ |
| f) Cafés, restaurants | ⬜ | ⬜ |
| g) Kitchens | ⬜ | ⬜ |
| h) Factories, production sites | ⬜ | ⬜ |
| i) Outside | ⬜ | ⬜ |
| j) Animal laboratory  | ⬜ | ⬜ |
| k) Abattoir, food industry, butchery | ⬜ | ⬜ |
| l) Pig, hen house (in a farm) | ⬜ | ⬜ |
| m) Others *(swimming pool …)*, specify :……………………………… | ⬜ | ⬜ |
| 5. On how many days a week did you perform the following cleaning tasks? | **Number of days per week** |
| Never | <1 day | 1-3 days | 4-7 days |
| a) Dusting, sweeping, hovering, rug beating | ⬜ | ⬜ | ⬜ | ⬜ |
| b) Mopping, wet cleaning, damp wiping  | ⬜ | ⬜ | ⬜ | ⬜ |
| c) Cleaning the toilet bowl | ⬜ | ⬜ | ⬜ | ⬜ |
| d) Polishing, waxing, shampooing | ⬜ | ⬜ | ⬜ | ⬜ |
| e) Cleaning windows or mirror | ⬜ | ⬜ | ⬜ | ⬜ |
| f) Cleaning the kitchen, excluding doing the dishes | ⬜ | ⬜ | ⬜ | ⬜ |
| g) Washing clothes by hand | ⬜ | ⬜ | ⬜ | ⬜ |
| h) Washing clothes by machine | ⬜ | ⬜ | ⬜ | ⬜ |
| i) Industrial cleaning *(regular maintenance, cleaning of process machinery)* | ⬜ | ⬜ | ⬜ | ⬜ |
| 6. On how many days a week did you use the following cleaning products ? |  |
| a) Washing powders  | ⬜ | ⬜ | ⬜ | ⬜ |
| b) Liquid multi-use cleaning products, except for dishes and washing | ⬜ | ⬜ | ⬜ | ⬜ |
| c) Polishes, waxes *(floor, furniture)* | ⬜ | ⬜ | ⬜ | ⬜ |
| d) Bleach, chlorine  | ⬜ | ⬜ | ⬜ | ⬜ |
| e) Ammonia | ⬜ | ⬜ | ⬜ | ⬜ |
| f) Decalcifiers, acids | ⬜ | ⬜ | ⬜ | ⬜ |
| g) Solvents, stain removers | ⬜ | ⬜ | ⬜ | ⬜ |
| h) Other cleaning products, specify : …………………. | ⬜ | ⬜ | ⬜ | ⬜ |
| 7. On how many days a week did you use the following sprays ? |  |
| a) Furniture sprays | ⬜ | ⬜ | ⬜ | ⬜ |
| b) Glass cleaning sprays for windows and mirrors | ⬜ | ⬜ | ⬜ | ⬜ |
| c) Sprays for carpets, rugs or curtains | ⬜ | ⬜ | ⬜ | ⬜ |
| d) Sprays for mopping the floor | ⬜ | ⬜ | ⬜ | ⬜ |
| e) Oven sprays  | ⬜ | ⬜ | ⬜ | ⬜ |
| f) Ironing sprays | ⬜ | ⬜ | ⬜ | ⬜ |
| g) Air refreshing sprays  | ⬜ | ⬜ | ⬜ | ⬜ |
| h) Other sprays, specify : ……………………………………. | ⬜ | ⬜ | ⬜ | ⬜ |
| 8. On how many days a week did you use perfumed or scented cleaning products ? | ⬜ | ⬜ | ⬜ | ⬜ |

|  |  |
| --- | --- |
| 9. On how many days a week did you perform the following working tasks with disinfectants? | Number of days per week |
| Never | <1 day | 1-3 days | 4-7 days |
| a) Preparation/mixing of disinfectants | ⬜ | ⬜ | ⬜ | ⬜ |
| b) Filling of devices before use | ⬜ | ⬜ | ⬜ | ⬜ |
| c) Actual disinfections | ⬜ | ⬜ | ⬜ | ⬜ |
| d) Cleaning equipment after use | ⬜ | ⬜ | ⬜ | ⬜ |
| 10. On how many days a week did you disinfect the following places ? |
| a) Sanitary *(toilets, bathrooms …)* | ⬜ | ⬜ | ⬜ | ⬜ |
| b) Kitchens | ⬜ | ⬜ | ⬜ | ⬜ |
| c) Medical instruments  | ⬜ | ⬜ | ⬜ | ⬜ |
| d) Laboratory equipment | ⬜ | ⬜ | ⬜ | ⬜ |
| e) Industrial machinery | ⬜ | ⬜ | ⬜ | ⬜ |
| f) Cooling towers | ⬜ | ⬜ | ⬜ | ⬜ |
| g) Animal houses / stables | ⬜ | ⬜ | ⬜ | ⬜ |
| h) Greenhouses | ⬜ | ⬜ | ⬜ | ⬜ |
| i) Agricultural soil | ⬜ | ⬜ | ⬜ | ⬜ |
| j) Abattoir, slaughterhouses | ⬜ | ⬜ | ⬜ | ⬜ |
| k) Butcher’s shops | ⬜ | ⬜ | ⬜ | ⬜ |
| l) Other food shop | ⬜ | ⬜ | ⬜ | ⬜ |
| m) Stores | ⬜ | ⬜ | ⬜ | ⬜ |
| n) Other places, specify : …………………………………………… | ⬜ | ⬜ | ⬜ | ⬜ |
| 11. On how many days a week did you did you use the following methods of disinfections ? |  |
| a) Spraying | ⬜ | ⬜ | ⬜ | ⬜ |
| b) Rinsing manually | ⬜ | ⬜ | ⬜ | ⬜ |
| c) Washing by machine | ⬜ | ⬜ | ⬜ | ⬜ |
| d) Clean surfaces with a sponge or a cloth | ⬜ | ⬜ | ⬜ | ⬜ |
| e) Mopping or scouring the floor | ⬜ | ⬜ | ⬜ | ⬜ |
| f) Other methods, specify : ……………………………………. | ⬜ | ⬜ | ⬜ | ⬜ |
| 12. On how many days a week did you did you use the following disinfectants ? |  |
| a) Formaldehyde | ⬜ | ⬜ | ⬜ | ⬜ |
| b) Glutaraldehyde  | ⬜ | ⬜ | ⬜ | ⬜ |
| c) Bleach, chlorine | ⬜ | ⬜ | ⬜ | ⬜ |
| d) Chloramine-T  | ⬜ | ⬜ | ⬜ | ⬜ |
| e) Alcohol *(ethanol, methanol)* | ⬜ | ⬜ | ⬜ | ⬜ |
| f) Ammonia | ⬜ | ⬜ | ⬜ | ⬜ |
| g) Quaternary ammonium compounds  | ⬜ | ⬜ | ⬜ | ⬜ |
| h) Ethylene oxyde  | ⬜ | ⬜ | ⬜ | ⬜ |
| i) Halamid  | ⬜ | ⬜ | ⬜ | ⬜ |
| **If you don’t know the active compound:**j) Fill in the brand name below |  |
| ………………………………………………………………………….…. | ⬜ | ⬜ | ⬜ | ⬜ |
| ………………………………………………………………………….…. | ⬜ | ⬜ | ⬜ | ⬜ |
| k) Other products; don’t know the name | ⬜ | ⬜ | ⬜ | ⬜ |
| 13. On days with disinfectant use, how many hours did you on average use disinfectants? |
| ⬜ <1 hour per day⬜ 1−4 hours per day⬜ >4 hours per day |
| 14. On how many days per week did you wear a mask or another respiratory protection at work?  ⬜ Never ⬜ <1 day/week ⬜ 1−3 days/week ⬜ 4−7 days/week  |
| 15. Have you worked as a cleaning worker, in an agricultural farming, an animal house in a laboratory, in industrial food, in a slaughterhouse or in a butcher’s shop, during another period? ⬜ no ⬜ yes**If yes with very different tasks, complete « Cleaning workers », .If Yes with similar tasks,**  **16. Please indicate the associated job number :** **…………………**  |