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1 **Household cleaning and poor asthma control among elderly women**

2

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43

44 **Competing interests**

45 The authors declare they have no actual or potential competing interests.

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49

50 **Abstract**

51

52 **Background.** Asthma control is suboptimal in nearly half of adults with asthma. Household
53 exposure to disinfectants and cleaning products (DCP) has been associated with adverse
54 respiratory effects, but data on their association with asthma control are scant.

55 **Objectives.** To investigate the association between household use of DCP and asthma control
56 in a large cohort of French elderly women.

57 **Methods.** We used data from a case-control study on asthma (2011-2013) nested in the E3N
58 cohort. Among 3,023 women with current asthma, asthma control was defined by the Asthma
59 Control Test (ACT). We used a standardized questionnaire to assess the frequency of cleaning
60 tasks and DCP use. We also identified household cleaning patterns using a clustering approach.
61 Associations between DCP and ACT were adjusted for age, smoking status, body mass index
62 and education.

63 **Results.** Data on ACT and DCP use were available for 2,223 women (70±6 years old). Asthma
64 was controlled (ACT=25), partly controlled (ACT=20-24) and poorly controlled (ACT≤19) in
65 29%, 46% and 25% of the participants, respectively. Weekly use of sprays and chemicals were
66 associated with poorly controlled asthma (odds ratio [95%CI]: 1 spray: 1.31 [0.94-1.84], ≥2
67 sprays: 1.65 [1.07-2.53], P-trend: 0.01; 1 chemical: 1.24 [0.94-1.64], ≥2 chemicals: 1.47 [1.03-
68 2.09], P-trend: 0.02). Risk for poor asthma control increased with the patterns “very frequent
69 use of products” (1.74 [1.13-2.70]) and “infrequent cleaning tasks and intermediate use of
70 products” (1.62 [1.05-2.51]).

71 **Conclusion.** Regular use of DCP may contribute to poor asthma control in elderly women.
72 Limiting their use may help improve asthma management.

73

74 **Abstract word count:** 250

75 **Highlights**

76 **1. What is already known about this topic?**

77 Although avoidance of environmental triggers is recommended in asthma management,
78 environmental determinants of poor asthma control are insufficiently known. Cleaning products
79 may have adverse respiratory effects, but data on their association with asthma control are scant.

80 **2. What does this article add to our knowledge?**

81 In this study of 2,223 elderly women with asthma, weekly use of sprays or chemicals for home
82 cleaning, and frequent use of multiple disinfectants and cleaning products, were associated with
83 poor asthma control.

84 **3. How does this study impact current management guidelines?**

85 Limiting the use of disinfectants and cleaning products may help improve improving asthma
86 control in adult patients. Given the ubiquitous use of these products, our results may have
87 important impact in asthma management.

88

89 **Key words**

90 Asthma, Asthma control, Cleaning products, Disinfectants, Environmental exposures,
91 Household exposure, Chemicals, Sprays, Women

92

93 **Abbreviations:**

94 ACT: asthma control test

95 BMI: body masse index

96 CI: confidence interval

97 DCP: disinfectants and cleaning products

98 E3N: Etude Epidémiologique auprès des femmes de la Mutuelle Générale de l'Education
99 Nationale

100 EGEA: Epidemiological study on the Genetics and Environment of Asthma

101 OR: odds ratio

102

103 **Introduction**

104 The primary goal of asthma management is to achieve and maintain the control of the
105 disease, through the control of the environment and optimal asthma treatment.^{1,2} However,
106 asthma control may be suboptimal in 40–50% of adults with asthma, with even higher rates
107 among women.^{3,4} In elderly patients with asthma, the disease may be more difficult to control
108 because of comorbidities, aging of the lungs and the immune system, and potentially low
109 treatment adherence.^{5,6} Uncontrolled asthma is associated with a substantial economic and
110 health burden, which is largely preventable.⁷ Although avoidance of environmental triggers is
111 strongly recommended in asthma management guidelines,⁸ environmental determinants of poor
112 asthma control are insufficiently known.²

113 Concerns regarding the health effects of chemical exposures from consumer products
114 used in everyday life such as disinfectants and cleaning products (DCP) are growing.^{9–11} DCP
115 have been identified as an important source of volatile organic compounds emission and poor
116 air quality.^{12,13} Respiratory health hazard associated with DCP exposures are increasingly
117 recognized, especially among women who are more exposed than men.^{14,15} Associations with
118 respiratory disorders such as asthma have first been evidenced in occupational health studies,
119 mainly among cleaners or healthcare workers.^{15–18} An increasing number of studies suggest that
120 respiratory effects of DCP are not restricted to populations with high exposure level at work,
121 but are also observed in relation to common household exposures.^{14,19,20} Use of DCP at home,
122 in particular cleaning sprays and irritant products, has been associated with asthma
123 incidence,^{21,22} current asthma, or asthma symptoms,^{23–25} and more recently with lung function
124 decline.¹⁹ To our knowledge, only one study examined the association between DCP exposure
125 at home and asthma control.²⁴ In this French cohort, the use of at least two types of cleaning
126 sprays at home was associated with poorly controlled asthma in middle-aged women.

127 While avoidance of DCP exposures is increasingly recommended,¹⁰ a better knowledge
128 of specific tasks and chemicals that put subjects at risk is needed to establish targeted strategies
129 to improve asthma control. Household cleaning implies various tasks and the possibility of
130 using many chemicals, which makes challenging to disentangle their individual effects. Several
131 approaches can be used. The “*a priori*” approach classifies DCP exposures based on hypotheses
132 regarding their potential health effects, such as respiratory effects associated with product
133 spraying²⁴ or with the use of specific irritant chemicals (e.g., bleach).²⁶ Alternatively, data-
134 driven approaches such as clustering models have been proposed to identify exposure patterns,
135 taking into account the multiplicity and correlations of exposures.^{17,27} Fitting a clustering model
136 on a large subsample of elderly women from the French E3N study (Etude Epidémiologique
137 auprès des femmes de la Mutuelle Générale de l'Education Nationale), based on 24 questions
138 on cleaning tasks and products, we recently identified seven household cleaning patterns.²⁷

139 In the current study, we aimed to investigate the association of DCP use and household
140 cleaning patterns with asthma control among elderly women from the E3N study.

141

142

143 **Material and Methods**

144

145 *Population*

146 The E3N study, initiated in 1990, is a prospective cohort among women affiliated to the
147 Mutuelle Générale de l'Education Nationale, a French national health insurance plan covering
148 mostly teachers.²⁸ A total of 98,997 women aged 40-65 years were included at baseline and
149 have been followed up approximately every 2 years since. The current analysis uses data from
150 a nested case-control study on asthma (Asthma-E3N) conducted in 2011-2013.^{23,29,30} A total of
151 7,100 women with asthma (positive answer to the question “Have you ever had an asthma
152 attack?” in at least one questionnaire since 1990) and 14,200 age-matched women without
153 asthma were invited to complete a postal questionnaire regarding respiratory health and
154 environmental exposures. Questionnaires were returned by 19,404 participants (92%). The
155 study protocol was approved by the French Institutional Ethics Committee, and all participants
156 provided their written informed consents.

157

158 *Asthma control*

159 Among women with current asthma (ever asthma, and occurrence of asthma attacks,
160 asthma treatment, or asthma symptoms in the past 12 months), asthma control was defined
161 using the Asthma Control Test (ACT). The ACT score (range 5–25) is based on five questions
162 on activity limitations, frequency of symptoms, and frequency of use of quick-relief medication
163 in the past 4 weeks.³¹ In main analyses, asthma control was classified into three categories based
164 on the ACT score (25: controlled; 20–24: partly controlled; ≤19: poorly controlled).^{18,32} We
165 conducted secondary analyses using the more common ACT two-category classification (20-
166 25; ≤19).³¹

167

168 *Use of disinfectants and cleaning products*

169 The nested case-control study included a detailed standardized questionnaire^{21,24} on the
170 frequency (never, <1 day/ week, 1-3 days/week, or 4-7 days/week) of cleaning tasks (10
171 questions), use of specific cleaning products (7 questions), and use of different types of sprays
172 (7 questions) at home.

173 Weekly use of spray was classified as none, one type of spray, or ≥ 2 types of sprays,
174 based on the seven questions regarding type of spray used (for furniture, windows/mirrors,
175 floor, degreasing/oven, air-refreshing, pesticide, and other). Similarly, weekly use of chemicals
176 was classified as none, one type of chemical, or ≥ 2 types of chemicals, based on the four
177 questions regarding type of chemical used (ammonia, acids, stain removers/solvents, bleach).
178 Weekly use of each of the seven types of spray and four chemicals was also examined
179 individually. In all analyses, we used as reference category (unexposed) participants reporting
180 no weekly use of any of the seven types of spray and four chemicals, to avoid including in the
181 reference category participants with any potentially hazardous exposure.^{18,33}

182 To identify household cleaning patterns, we used a mixture model of dependency
183 blocks, as described in detail elsewhere.²⁷ Briefly, this approach extends the standard latent
184 class model³⁴ to the case where within-class dependencies occur. Considering the within-class
185 dependency was important because of the high dependencies between the use of different DCP,
186 even within an homogenous subpopulation. The model identified seven household cleaning
187 patterns which differed on the frequency of cleaning tasks and use of specific products.

188

189 *Statistical analyses*

190 Associations between exposure to DCP and asthma control (controlled, partly
191 controlled, poorly controlled) were evaluated by multinomial logistic regression models.
192 Analyses were adjusted for age, smoking status (nonsmoker, ex-smoker, or current smoker),

193 body mass index (BMI: <20.0, 20.0-24.9, 25.0-29.9, and \geq 30.0), and education level (< high
194 school diploma, high school to 2-level university, \geq 3-level university). A two-sided $p < 0.05$
195 was considered statistically significant. Analyses were run using SAS version 9.3 (SAS
196 Institute, Cary, NC, USA).

197 As household help (positive answer to the question “does someone help you for
198 household cleaning, e.g., husband, household employee, or family members?”) has previously
199 been suggested to induce misclassification in assessment of exposure to DCP,²³ sensitivity
200 analyses restricted to women with no household help were conducted when examining specific
201 products. In another sensitivity analysis, we used multiple imputation to estimate ACT missing
202 values assuming a missing at random pattern,³⁵ as in previous analyses in Asthma-E3N³⁰ and
203 as detailed in online supplementary material, to evaluate the robustness of our results to missing
204 value issues. Finally, a sensitivity analysis with adjustment for multimorbidity-related
205 medication profiles previously identified using drug administrative databases (see Chanoine et
206 al.³⁶ and online supplementary material) was performed, as these profiles were a strong
207 determinant of poor asthma control in this population of elderly women,³⁶ and may be related
208 to use of DCP.

209

210

211 **Results**

212 Among the 7,100 women with ever asthma invited to participate, 6,274 (88%) returned
213 the questionnaire, of whom 3,023 had current asthma (Figure 1). Women with missing data for
214 all questions on household cleaning (n=18), smoking status (n=25), or asthma control (n=747)
215 were excluded. This yielded a population of 2,233 women eligible for analyses. Participants
216 were 69.7 years old on average, 46% were ex-smokers and 4% were current smokers, 13% had
217 a BMI ≥ 30 kg/m², and 37% had a high education level (\geq 3-level university). Nearly half of
218 the participants (48%) reported household help. Asthma was controlled in 29% of the
219 participants, partly controlled in 46% and poorly controlled in 25%. Women with poorly
220 controlled asthma were older and had lower education level (Table 1). They more often reported
221 household help.

222 Regarding use of specific DCP, 17% of the participants used one type of spray weekly,
223 and 9% used ≥ 2 types of spray; 35% used one type of chemical, and 15% used ≥ 2 types of
224 chemicals. The most frequently used sprays were air-refreshing sprays (weekly use: 14%) and
225 windows/mirrors sprays (8%), and the most frequently used chemicals were bleach (39%) and
226 acids (19%). The seven household cleaning patterns identified by a clustering approach are
227 described in Table 2. Household cleaning tasks, and use of sprays and chemicals according to
228 household cleaning patterns are described in online supplementary Table E1. Cleaning patterns
229 were ordered by frequency of general cleaning tasks, which did not always correspond to the
230 frequency of product use. For instance, while women in the “medium cleaning” pattern reported
231 less frequent cleaning tasks (weekly household cleaning: 29%) than women in the “frequent
232 general cleaning” pattern (85%), they reported using more sprays (weekly use of ≥ 2 types of
233 spray: 18% vs. 2%) and chemicals (weekly use of ≥ 2 types of chemicals: 19% vs. 9%)

234 In multivariable models examining specific DCP exposures (Table 3), weekly use of
235 sprays was associated with poorly controlled asthma (1 type of spray: OR: 1.31, 95%CI: 0.94-

236 1.84; ≥ 2 types of spray: 1.65, 1.07-2.53; P-trend: 0.01). Similarly, weekly use of chemicals was
237 associated with poorly controlled asthma (1 type of chemical: OR: 1.24, 95%CI: 0.94-1.64; ≥ 2
238 types of chemical: 1.47, 1.03-2.09; P-trend: 0.02). Associations were more pronounced when
239 analyses were restricted to women without household help. Results were similar when ACT
240 was studied in two categories (≤ 19 vs. 20-25, table E2). When examining specific DCP
241 individually, associations with poor asthma control were observed or suggested for several
242 products (online supplementary Table E3 & E4). Weekly use of windows/mirror sprays (1.91,
243 1.23-2.97), air-refreshing sprays (1.54, 1.07-2.22), acids (1.45, 1.04-2.02), stain removers/
244 solvents (1.89, 1.13-3.17), and bleach (1.34, 1.03-1.74) were associated with poorly controlled
245 asthma in all women. When analyses were restricted to women without household help,
246 associations of weekly use of furniture sprays (2.48, 1.22-5.06) and other sprays (5.99, 1.56-
247 23.0) and poorly controlled asthma were further observed.

248 In the multivariable model examining household cleaning patterns (Figure 2), the most
249 common pattern (“frequent general cleaning”) was used as reference group. Compared to this
250 pattern, associations with poorly controlled asthma were observed for the “medium cleaning”
251 pattern (Odds Ratio (OR): 1.62, 95% Confidence Interval [CI]: 1.05-2.51), and for the “very
252 frequent use of products” pattern (OR: 1.74, 95%CI: 1.13-2.70).

253 After multiple imputation, 747 additional women with missing values for ACT score
254 were included in the analyses. Association between DCP exposures and asthma control were
255 similar in the imputed dataset (online supplementary table E5). Association were also similar
256 in sensitivity analysis with adjustment for multimorbidity-related medication profiles (online
257 supplementary table E6).

258

259

260 **Discussion**

261 In this study of 2,223 elderly women with asthma, self-reported weekly use of at least 2
262 types of sprays or at least 2 types of chemicals for home cleaning was associated with poor
263 asthma control. In addition, a household cleaning pattern with very frequent use of multiple
264 disinfectants and cleaning products was associated with poor asthma control.

265 Our results are consistent and extend results from the only other study that examined
266 the association between use of cleaning sprays at home and asthma control. In this previous
267 study among 683 French women (244 with asthma) from the Epidemiological study on the
268 Genetics and Environment of Asthma (EGEA), weekly use of ≥ 2 types of sprays was associated
269 with poorly controlled asthma.²⁴ In the current study, we found that this association was not
270 restricted to cleaning sprays but was also observed for the use of chemicals. In EGEA, use of
271 bleach for home cleaning was not associated with poor asthma control²⁶. However, analyses
272 were limited by a small sample size, which also limited the investigation of exposure to multiple
273 chemicals. The current results are also in accordance with findings from a few occupational
274 studies reporting an association between occupational exposure to DCP and poor asthma
275 control.^{18,37,38}

276 We attempted to disentangle the roles of specific products using several approaches.
277 First, we compared contrasted groups of individuals based on *a priori* hypotheses regarding the
278 effect of some products (e.g., sprays vs. chemicals, individual products). However, this
279 approach has limitations as in the “real world”, products are generally not used in isolation; we
280 thus could not build fully contrasted groups defined by the use of only one product or one type
281 of products. Second, we used clustering to identify household cleaning patterns, grouping
282 participants with similar cleaning habits, and reflecting “real world” DCP use. The resulting
283 patterns were distinguished by their general frequency of cleaning tasks and product use, with
284 a gradient from very low to very high frequencies for the use of multiple products. However,

285 no profile characterized by the use of one or a few specific products emerged. This limited our
286 ability to identify specific patterns of use associated with poor asthma control, beside the use
287 of multiple products. Despite these limitations, our results, in accordance with several previous
288 studies at the workplace,¹⁶⁻¹⁸ suggest that adverse respiratory effects are not imputable to a
289 single product, but may result from the frequent use of a multitude of products. Moreover, there
290 is a biological plausibility for an effect on the airways of all the specific products investigated.
291 The active compounds of many disinfectants (e.g., bleach, acids) have been described as airway
292 irritants.^{39,40} Inhalation of irritants is thought to cause airway damage, oxidative stress and
293 neutrophilic inflammation.^{26,41,42} A direct disruptive effect of exposure to laundry detergents on
294 the epithelial barrier integrity has recently been suggested, and may be relevant for other
295 household cleaning products.^{11,43,44} DCP also commonly contain skin allergens such as
296 perfumes (e.g., terpenes).^{12,40,45} Finally, product spraying is likely to increase exposure by
297 inhalation. A recent study examining the potential for airway exposure when using cleaning
298 spray showed that the particles generated were in a size range relevant for both nasal and
299 alveolar deposition.⁴⁶ To improve knowledge regarding agents causing respiratory hazards, the
300 use of novel exposure assessment methods, such as a Smartphone application to scan the
301 barcodes of DCP and the development of databases listing all ingredients of DCP may be useful
302 in future studies.⁴⁷

303 Major strengths of our study include the large population size, the high response rate
304 and the use of standardized and validated definitions to evaluate asthma and asthma control.
305 Our population only included elderly women with relatively high education levels and may not
306 be generalizable to different populations. However, similar results have been observed in a
307 cohort of middle-aged women,²⁴ Although no study has specifically examined the impact of
308 DCP exposures on asthma control in men, associations between DCP and asthma have been
309 reported in populations of both men and women.^{21,22}

310 We used a standardized questionnaire to evaluate DCP exposures, as in previous
311 studies.^{21,22,24} Use of DCP was self-reported, which may raise concerns regarding a potential
312 differential misclassification bias (recall bias). Such a bias would occur if women with poor
313 asthma control tended either to overestimate or to recall more precisely their use of DCP
314 compared to women with controlled asthma. However, we assume that this bias is less
315 pronounced than when comparing asthmatics to non-asthmatics. Another potential bias would
316 be reverse causation, which would occur if women with poor asthma control were seeking to
317 live in a cleaner environment (e.g., to avoid dust or mold exposures), which would involve more
318 frequent cleaning tasks. Although these biases cannot be completely ruled out, they are unlikely
319 for several reasons. First, when examining household cleaning patterns, two patterns could
320 either result from a recall bias or reflect a behavior of seeking a clean environment: “very
321 frequent use of products” which involved very frequent use of chemicals and cleaning sprays,
322 and “very frequent general cleaning” which involved very frequent general cleaning tasks (e.g.,
323 dusting/hovering) but with moderate use of products. However, only the pattern “very frequent
324 use of products” was associated with poor asthma control. Second, our results are consistent
325 with studies on occupational exposure, in which exposures were evaluated by job- or job-task-
326 exposure matrices,^{18,37} less prone to recall bias, and where the frequency of cleaning tasks is
327 driven by workplace requirements rather than by individual behaviors.

328 In analyses of household cleaning patterns, poor asthma control was associated not only
329 with the “very frequent use of cleaning products” pattern, but also with a pattern of infrequent
330 cleaning tasks and intermediate use of products. We also observed that women with poor
331 asthma control more frequently had household help. These results may reflect a “healthy home
332 cleaning effect”, as suggested in previous studies.^{22,24} Such effect may occur if women with
333 respiratory symptoms or poor asthma control avoid or reduce their use of DCP.^{22,24} Similarly
334 to the healthy worker effect in occupational studies, this bias is difficult to control in cross-

335 sectional studies.⁴⁸ No question on avoidance of use of DCP was available in the current study.
336 The result of such as bias would be a general underestimation of the associations observed in
337 our study. Despite this potential underestimation, we observed relatively elevated ORs (range
338 1.3-2.0) for the association between weekly use of several specific DCP and poorly controlled
339 asthma.

340 In conclusion, we found that the weekly use of several types of DCP for home cleaning
341 was associated with poor asthma control in elderly women. While more research is needed to
342 precisely identify causative agents and mechanisms, reduction in exposure and development of
343 safer methods/products for home cleaning is recommended. Clinicians should be aware of this
344 environmental risk factor for poor asthma control and integrate it in asthma management
345 strategies.⁸ Given the ubiquitous use of disinfectants and cleaning products, our results may
346 have important impact in improving asthma control in adult patients.

347

348

349

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357

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E3N: prospective study among women members of a French health insurance plan

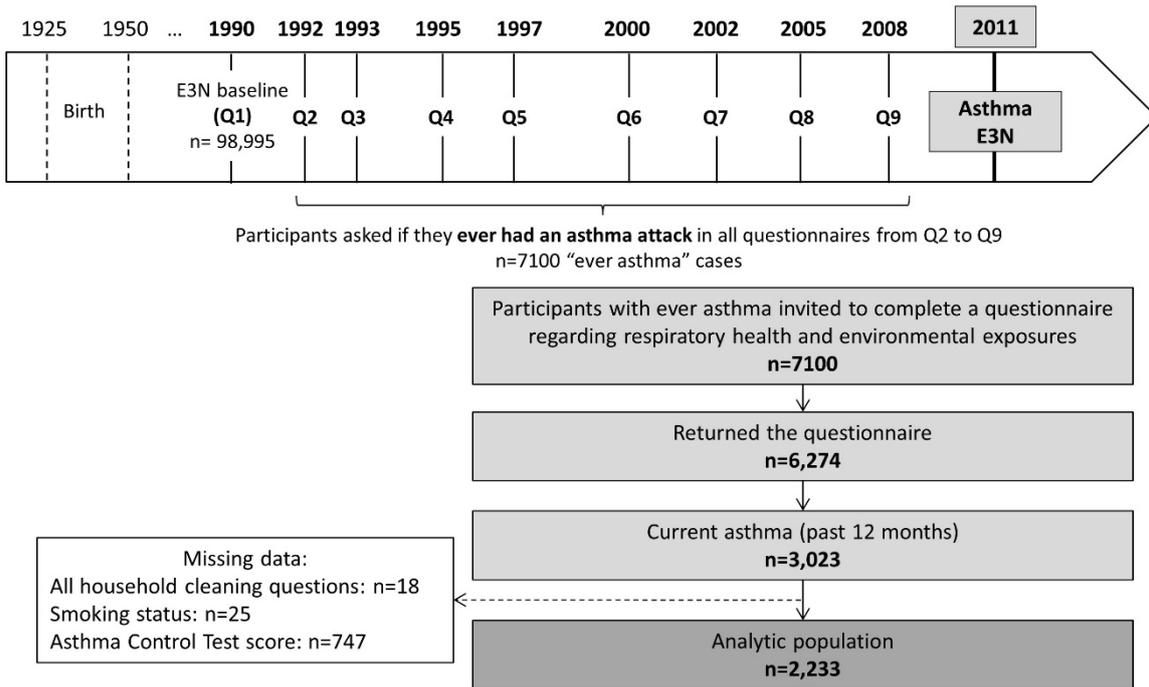


Figure 1. Flow chart of the study population

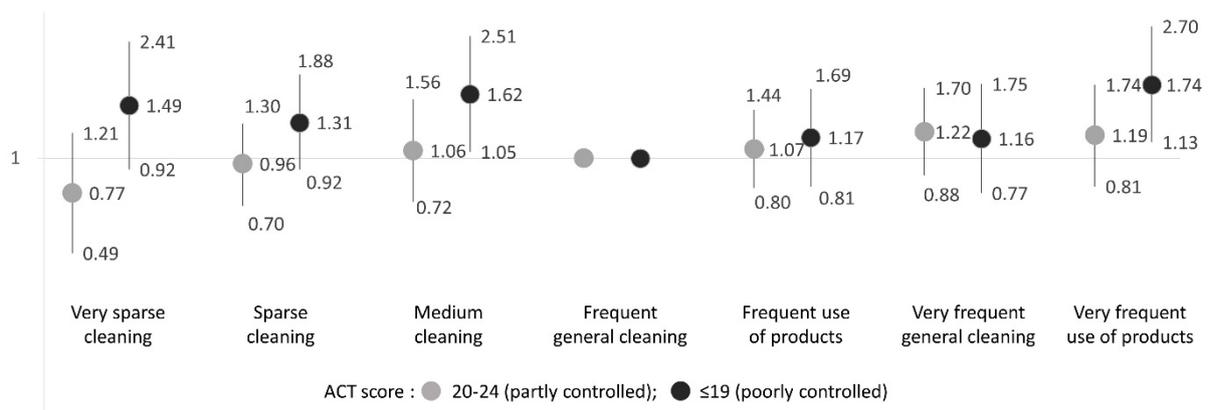


Figure 2. Associations between household cleaning patterns and asthma control. Results are presented as odds ratios and 95% confidence intervals for a decrease in Asthma Control Test (ACT) score category (25: controlled [ref.]; 20–24: partly controlled; <19: poorly controlled) adjusted for age, smoking status, body mass index, and education level. The most common pattern (“frequent general cleaning”) was used as reference category.

Table 1. Characteristics of the participants according to asthma control, among 2,233 women with current asthma

	Asthma Control Test score			P
	25 (controlled)	20-24 (partly controlled)	≤19 (poorly controlled)	
n (%)	650 (29)	1,024 (46)	559 (25)	
Age, m (sd)	68.6 (5.7)	69.4 (5.8)	71.4 (6.3)	< 0.001
Smoking status*, %				
Never smoker	49	49	53	0.38
Ex-smoker	47	47	43	
Current smoker	4	4	4	
BMI (kg/m ²), %				
<20	11	9	10	0.04
20-24.9	49	49	44	
25-29.9	28	31	29	
≥ 30	12	11	17	
Education level, %				
< high school diploma	8	9	15	< 0.001
High school to 2-level university	48	49	50	
≥ 3-level university	40	39	30	
Missing	4	3	5	
Household help, %	47	46	54	0.01

BMI – Body Mass Index.

Table 2. Description of the seven household cleaning patterns identified by a clustering approach, among 2,233 women with asthma

Name	Description	n (%)
Very sparse cleaning	Very infrequent cleaning tasks and use of DCP	155 (7)
Sparse cleaning	Infrequent cleaning tasks and very infrequent use of DCP	376 (17)
Medium cleaning	Infrequent cleaning tasks and intermediate use of DCP	211 (9)
Frequent general cleaning (reference)	High frequency of general cleaning tasks (general cleaning, dusting/sweeping/hovering, humid cleaning), moderate use of general-purpose cleaning products (e.g., general purpose products, bleach, window/mirror), and low use of chemicals and sprays	602 (27)
Frequent use of products	High frequency of cleaning tasks (general cleaning, dusting/ sweeping/hovering, humid cleaning) and use of DCP (bleach, polishing/waxing, windows/mirrors, chemicals, sprays)	389 (17)
Very frequent general cleaning	Very high frequency of cleaning tasks (general cleaning, dusting/sweeping/hovering, humid cleaning), moderate to high use of general cleaning products, medium use of chemicals and low use of sprays	285 (13)
Very frequent use of products	Very high frequency of cleaning tasks and use of DCP, especially bleach, chemicals, and sprays.	215 (10)

Table 3. Associations between types of DCP and asthma control

	Asthma Control Test score						
	25 (ref.; controlled)		20-24 (partly controlled)		≤19 (poorly controlled)		
	n	%	OR*	%	OR* (95% CI)	%	OR* (95% CI)
Weekly use of sprays							
In all participants							
No (ref.)†	863	32	1	46	1	22	1
1 type	372	29	1	44	1.05 (0.78-1.40)	27	1.31 (0.94-1.84)
≥ 2 types	202	24	1	45	1.29 (0.88-1.89)	31	1.65 (1.07-2.53)
<i>P-trend</i>					<i>0.24</i>		<i>0.01</i>
In participants without household help							
No (ref.)†	465	34	1	48	1	18	1
1 type	228	30	1	45	1.03 (0.70-1.50)	25	1.47 (0.93-2.32)
≥ 2 types	108	22	1	48	1.46 (0.85-2.49)	30	2.05 (1.11-3.80)
<i>P-trend</i>					<i>0.24</i>		<i>0.01</i>
Weekly use of chemicals							
In all participants							
No (ref.)†	863	32	1	46	1	22	1
1 type	733	28	1	47	1.15 (0.91-1.45)	25	1.24 (0.94-1.64)
≥ 2 types	316	28	1	42	1.06 (0.78-1.45)	30	1.47 (1.03-2.09)‡
<i>P-trend</i>					<i>0.48</i>		<i>0.02</i>
In participants without household help							
No (ref.)†	465	34	1	48	1	18	1
1 type	413	29	1	48	1.14 (0.83-1.55)	23	1.39 (0.95-2.04)
≥ 2 types	189	30	1	42	0.97 (0.65-1.45)	28	1.59 (1.00-2.54)‡
<i>P-trend</i>					<i>0.89</i>		<i>0.03</i>

* OR from multinomial logistic regressions, adjusted for age, smoking status, body mass index, and education level. OR – odds ratio; CI – confidence interval. †Reference group in all analyses: No weekly use of sprays or chemicals. Results in bold face are statistically significant (comparison with reference group “controlled”). ‡ Statistically significant difference when comparing “poorly controlled” to “partly controlled”.