

Appendix:

**Occupational and Hobby Exposures Associated with Myositis Phenotypes in a
National Myositis Patient Registry, Parks et al.:**

**Questionnaire data used in this analysis and exposure assessment methods – job/hobby
exposure questionnaire, rules-based protocol, and matrix.**

- MYOVISION patient questionnaire excerpts: data used to define myositis phenotypes, pages 2-3.
- MYOVISION patient questionnaire excerpt on jobs, hobbies and specific exposures used to generate exposure data in this study, pages 4-17.
- Rules based protocol and job/hobby exposure matrix: background and examples and references, pages 18-20.
- Table. Job/hobby-exposure matrix for evaluating questionnaire data to assess relative intensity of silica, solvents, and heavy metal exposures, by certainty level, pages 21-22.

MYOVISION patient questions used in identifying myositis phenotypes.

*Please indicate which of the following diagnoses you have. If you don't have one of these conditions, you are not eligible to participate in this survey.

- ☐ Dermatomyositis that was diagnosed when you were an adult (age 18 years or older)
- ☐ Juvenile Dermatomyositis that was diagnosed when you were a child (age 17 years or less)
- ☐ Polymyositis that was diagnosed when you were an adult (age 18 years or older)
- ☐ Juvenile Polymyositis that was diagnosed when you were a child (age 17 years or less)
- ☐ Inclusion Body Myositis
- ☐ Other form of myositis, please specify: _____
- ☐ None of the above

.....

10. Have you ever been diagnosed with another autoimmune disease?

☐ NO IF NO, SKIP TO QUESTION 11

☐ YES

☐ I don't know

10a. IF YES, please check the type of other autoimmune disease (check all that apply) and list the date diagnosed below.

☐ Rheumatoid arthritis or juvenile idiopathic arthritis

☐ Lupus (systemic lupus erythematosus)

☐ Scleroderma (systemic sclerosis)

.....

*12. Please indicate which of the following findings you had to support a diagnosis of myositis. Please check all that apply.

*Muscle weakness in the neck, shoulders, or hips	<input type="checkbox"/> No	<input type="checkbox"/> Yes	<input type="checkbox"/> I Don't Know
*Muscle weakness in the hands or feet	<input type="checkbox"/> No	<input type="checkbox"/> Yes	<input type="checkbox"/> I Don't Know
*Muscle atrophy in the thighs (the thigh muscles getting smaller)	<input type="checkbox"/> No	<input type="checkbox"/> Yes	<input type="checkbox"/> I Don't Know
*Red, raised rash over the knuckles, elbows, or knees (Gottron's papules)	<input type="checkbox"/> No	<input type="checkbox"/> Yes	<input type="checkbox"/> I Don't Know
*Purplish discoloration over the eyelids (Heliotrope rash)	<input type="checkbox"/> No	<input type="checkbox"/> Yes	<input type="checkbox"/> I Don't Know
*Blood tests (elevation of blood levels of muscle enzymes)	<input type="checkbox"/> No	<input type="checkbox"/> Yes	<input type="checkbox"/> I Don't Know
*An EMG (electromyography or needle placed into the muscle to examine the muscle electrical activity) that confirmed the diagnosis of myositis	<input type="checkbox"/> No	<input type="checkbox"/> Yes	<input type="checkbox"/> I Don't Know
*A muscle biopsy that confirmed the diagnosis of myositis	<input type="checkbox"/> No	<input type="checkbox"/> Yes	<input type="checkbox"/> I Don't Know

*Other, please specify: _____ ☐ No ☐ Yes ☐ I Don't Know

13. What have been the main problems you have experience with your myositis? Please check all that apply.

Skin rash	<input type="checkbox"/> No	<input type="checkbox"/> Yes	<input type="checkbox"/> I Don't Know
Muscle weakness	<input type="checkbox"/> No	<input type="checkbox"/> Yes	<input type="checkbox"/> I Don't Know
Joint swelling	<input type="checkbox"/> No	<input type="checkbox"/> Yes	<input type="checkbox"/> I Don't Know
Fever	<input type="checkbox"/> No	<input type="checkbox"/> Yes	<input type="checkbox"/> I Don't Know
Swallowing difficulty	<input type="checkbox"/> No	<input type="checkbox"/> Yes	<input type="checkbox"/> I Don't Know
Lung disease causing chronic coughing or shortness of breath	<input type="checkbox"/> No	<input type="checkbox"/> Yes	<input type="checkbox"/> I Don't Know

MYOVISION patient questionnaire excerpt on jobs, hobbies and specific exposures used to generate exposure data in this study.

38. Have you ever had at least one full-time or part-time paid or unpaid job that you held for at least one year, and worked at least 10 hours per week at, before the diagnosis of myositis?

☐ NO ¶ IF NO, SKIP TO QUESTION 56 ON PAGE 16

☐ YES

39. If you were working before the diagnosis of myositis, did you work ☐ full time or ☐ part time?

Are you currently working?

☐ NO

☐ YES IF YES, are you continuing to work ☐ full time or ☐ part time?

The following questions ask about work in specific industries. Please answer if you have ever worked in any of these industries for more than one year. Please include any paid or unpaid work that you did for at least 10 hours per week.

43. Did you ever work **cleaning houses or other buildings (house cleaning, janitor or maid, or other cleaning worker)** before the diagnosis of myositis?

☐ NO ¶ IF NO, SKIP TO QUESTION 44

☐ YES ¶ IF YES, when did you begin working at cleaning houses or other buildings? ____(yyyy)

Are you still working at cleaning houses or other buildings?

☐ NO ¶ IF NO, when did you stop working at cleaning houses or other buildings? ____(yyyy)

☐ YES

44. Did you ever work in the **dry-cleaning business** before the diagnosis of myositis?

☐ NO ¶ IF NO, SKIP TO QUESTION 45

☐ YES ¶ IF YES, when did you begin working in the dry-cleaning business? ____(yyyy)

Are you still working in the dry-cleaning business?

☐ NO ¶ IF NO, when did you stop working in the dry-cleaning business? _____(yyyy)

☐ YES

45. Did you ever work on a **farm or orchard** before the diagnosis of myositis?

☐ NO ¶ IF NO, SKIP TO QUESTION 46

☐ YES ☐ IF YES, when did you begin working on a farm or orchard? ____ (yyyy)

Are you still working on a farm or orchard?

☐ NO ☐ IF NO, when did you stop working on a farm or orchard? ____ (yyyy)

☐ YES

46. Did you ever work on a job involving **landscaping or gardening** before the diagnosis of myositis?

☐ NO ☐ IF NO, SKIP TO QUESTION 47

☐ YES ☐ IF YES, when did you begin working on a job involving landscaping or gardening? ____ (yyyy)

Are you still working on a job involving landscaping or gardening?

☐ NO ☐ IF NO, when did you stop working on a job involving landscaping or gardening? ____ (yyyy)

☐ YES

47. Did you ever work at a **paper or pulp mill, lumbering, or saw mill** before the diagnosis of myositis?

☐ NO ☐ IF NO, SKIP TO QUESTION 48

☐ YES ☐ IF YES, when did you begin working at a paper or pulp mill, lumbering, or saw mill?
_____ (yyyy)

Are you still working at a paper or pulp mill, lumbering, or saw mill?

☐ NO ☐ IF NO, when did you stop working at a paper or pulp mill, lumbering, or saw mill? ____ (yyyy)

☐ YES

48. Did you ever work as a **dentist, dental hygienist, dental assistant, or in a dental lab** before the diagnosis of myositis?

☐ NO ☐ IF NO, SKIP TO QUESTION 49

☐ YES ☐ IF YES, when did you begin working as a dentist, dental hygienist, dental assistant, or in a dental lab? _____ (yyyy)

Are you still working as a dentist, dental hygienist, dental assistant, or in a dental lab?

☐ NO ☐ IF NO, when did you stop working as a dentist, dental hygienist, dental assistant, or in a dental lab? _____ (yyyy)

☐ YES

49. Did you ever work **handling chemicals in a biological, medical, or chemistry laboratory** before the diagnosis of myositis?

☐ NO ¶ IF NO, SKIP TO QUESTION 50

☐ YES ¶ IF YES, when did you begin working at handling chemicals in a biological, medical, or chemistry laboratory? _____(yyyy)

Are you still working at handling chemicals in a biological, medical, or chemistry laboratory?

☐ NO ¶ IF NO, when did you stop working at handling chemicals in a biological, medical, or chemistry laboratory? _____(yyyy)

☐ YES

50. Did you every work as a **fireman, police officer, or other first responder** before the diagnosis of myositis?

☐ NO ¶ IF NO, SKIP TO QUESTION 51

☐ YES IF YES, when did you begin working as a fireman, police officer, or other first responder? _____(yyyy)

Are you still working as a fireman, police officer, or other first responder?

☐ NO ¶ IF NO, when did you stop working as a fireman, police officer, or other first responder? _____(yyyy)

☐ YES

51. Did you ever work **painting houses or other buildings or in paint manufacturing jobs** before the diagnosis of myositis?

☐ NO ¶ IF NO, SKIP TO QUESTION 52

☐ YES ¶ IF YES, when did you begin painting houses or other buildings or working in paint manufacturing jobs? _____(yyyy)

Are you still painting houses or other buildings or working in paint manufacturing jobs?

☐ NO ¶ IF NO, when did you stop painting houses or other buildings or working in paint manufacturing jobs? _____(yyyy)

☐ YES

52. Did you ever work in **building construction or road construction** before the diagnosis of myositis?

☐ NO ¶ IF NO, SKIP TO QUESTION 53

☐ YES IF YES, when did you begin working in building construction or road construction? _____(yyyy)

Are you still working in building construction or road construction?

☐ NO ¶ IF NO, when did you stop working in building construction or road construction? _____(yyyy)

☐ YES

53. Did you ever work in a **mine or quarry, sandblasting, or as a stone mason or brick layer** before the diagnosis of myositis?

☐ NO ☐ IF NO, SKIP TO QUESTION 54

☐ YES ☐ IF YES, when did you begin working in a mine or quarry, sandblasting, or as a stone mason or brick layer? _____(yyyy)

Are you still working in a mine or quarry, sandblasting, or as a stone mason or brick layer?

☐ NO ☐ IF NO, when did you stop working in a mine or quarry, sandblasting, or as a stone mason or brick layer? _____(yyyy)

☐ YES

54. Did you ever **work in a factory** before the diagnosis of myositis?

☐ NO ☐ IF NO, SKIP TO QUESTION 55

☐ YES ☐ IF YES, were you working:

☐ Where products were being produced

☐ In an office environment

If you worked in a factory before the diagnosis of myositis, which type of factory did you work in? Check all that apply.

☐ Pottery, ceramics, or china

☐ Glass

☐ Textile, clothing, or hosiery

☐ Scouring powder or other cleansers

☐ Manufacturing plastics, petroleum products, rubber, chemicals, or dye

☐ Furniture manufacturing

☐ Manufacturing cosmetics or drugs

☐ Other, please specify the type of factory or what was made: _____

If you checked more than one, which factory did you work at longest?

☐ Pottery, ceramics, or china

☐ Glass

☐ Textile, clothing, or hosiery

☐ Scouring powder or other cleansers

☐ Manufacturing plastics, petroleum products, rubber, chemicals, or dye

- ☐ Furniture manufacturing
- ☐ Manufacturing cosmetics or drugs
- ☐ Other, please specify the type of factory or what was made: _____

If you did work in a factory, when did you begin working at the factory you worked longest at? _____ (yyyy)

Are you still working at this factory you worked longest at?

- ☐ NO ☐ IF NO, when did you stop working at this factory you worked longest at? _____ (yyyy)
- ☐ YES

55. Did you ever work in **any other job** that you think we should know about before the diagnosis of myositis?

- ☐ NO ☐ IF NO, SKIP TO QUESTION 56
- ☐ YES ☐ IF YES, please specify: _____

IF YES, when did you begin working at this job? _____ (yyyy)

Are you still working at this job?

- ☐ NO ☐ IF NO, when did you stop working at this job? _____ (yyyy)
- ☐ YES

55b. Additional data on longest held job (telephone interview)

“You worked prior to being diagnosed. Is that correct? What type of work did you do the longest?” [If they held more than 1 job- participants were asked about the job they held the longest (other than those already reported in specific questions on the main study questionnaire). “Please describe the work specifically- for example, did you work in an office?” Similar data were collected on time and duration as question 55 above.

The next set of questions asks about your hobbies or leisure activities before the diagnosis of myositis. These are activities done for fun or leisure; they do not include activities done while working as part of a regular job.

56. Have you ever done any hobbies or leisure activities before the diagnosis of myositis?

- ☐ NO ☐ IF NO, SKIP TO QUESTION 61 ON PAGE 19
- ☐ YES

57. Did you do **gardening** as a hobby or leisure activity before the diagnosis of myositis?

- ☐ NO ☐ IF NO, SKIP TO QUESTION 58

☐ YES ☐ IF YES, when did you begin doing gardening? ____ (yyyy)

Do you still do gardening?

☐ NO ☐ IF NO, when did you stop doing gardening? ____ (yyyy)

☐ YES

During those years before the diagnosis of myositis, on average how many hours per week did you usually do gardening?

☐ Less than 2 hours

☐ 2-4 hours

☐ 5-8 hours

☐ 9-16 hours

☐ More than 16 hours per week

On average how many months per year did you usually do gardening before the diagnosis of myositis?

☐ Less than 1 month

☐ 1-3 months

☐ 4-6 months

☐ 7-9 months

☐ 10-12 months of the year

59. Did you do **painting** as a hobby or leisure activity before the diagnosis of myositis?

☐ NO ☐ IF NO, SKIP TO QUESTION 60

☐ YES ☐ IF YES, when did you begin doing painting as a hobby or leisure activity? ____ (yyyy)

Do you still do painting as a hobby or leisure activity?

☐ NO ☐ IF NO, when did you stop doing painting as a hobby or leisure activity? _____ (yyyy)

☐ YES

During those years before the diagnosis of myositis, on average how many hours per week did you usually do painting as a hobby or leisure activity?

☐ Less than 2 hours

☐ 2-4 hours

☐ 5-8 hours

☐ 9-16 hours

☐ More than 16 hours per week

On average how many months per year did you usually do painting as a hobby before the diagnosis of myositis?

- ☐ Less than 1 month
- ☐ 1-3 months
- ☐ 4-6 months
- ☐ 7-9 months
- ☐ 10-12 months of the year

60. Did you have **any other hobby or leisure activity** before the diagnosis of myositis and spent considerable time at it that you think we should know about?

☐ NO ☐ IF NO, SKIP TO QUESTION 61

☐ YES ☐ IF YES, please specify: _____

IF YES, when did you begin this hobby or leisure activity? ____ (yyyy)

Do you still do this hobby or leisure activity?

☐ NO ☐ IF NO, when did you stop this hobby or leisure activity? ____ (yyyy)

☐ YES

During those years before the diagnosis of myositis, on average how many hours per week did you usually do this hobby or leisure activity?

- ☐ Less than 2 hours
- ☐ 2-4 hours
- ☐ 5-8 hours
- ☐ 9-16 hours
- ☐ More than 16 hours per week

On average how many months per year did you usually do this hobby or leisure activity before the diagnosis of myositis?

- ☐ Less than 1 month
- ☐ 1-3 months
- ☐ 4-6 months
- ☐ 7-9 months
- ☐ 10-12 months of the year

The following questions ask about specific chemicals and other materials you may have handled at least once a

week in any of the jobs held or during the hobbies/leisure activities pursued before the diagnosis of myositis.

61. Have you handled **gasoline, lubricating oils, or any other petroleum products** at least once a week in any job or hobby/leisure activity you have had before the diagnosis of myositis?

☐ NO ¶ IF NO, SKIP TO QUESTION 62

☐ YES IF YES, when did you begin handling gasoline, lubricating oils, or any other petroleum products?
_____ (yyyy)

Are you still handling gasoline, lubricating oils, or any other petroleum products?

☐ NO ¶ IF NO, when did you stop handling gasoline, lubricating oils, or any other petroleum products?
_____ (yyyy)

☐ YES

During those years before the diagnosis of myositis, on average how many hours per week did you usually handle gasoline, lubricating oils, or any other petroleum products?

☐ Less than 2 hours

☐ 2-4 hours

☐ 5-8 hours

☐ 9-16 hours

☐ More than 16 hours per week

On average how many months per year did you usually handle gasoline, lubricating oils, or any other petroleum products before the diagnosis of myositis?

☐ Less than 1 month

☐ 1-3 months

☐ 4-6 months

☐ 7-9 months

☐ 10-12 months of the year

62. Have you handled any **solvents, such as benzene, toluene, xylene, naphthalene, trichloroethylene (TCE), tetrachloroethene (PERC), or Solvane** and so forth at least once a week in any job or hobby/leisure activity you have had before the diagnosis of myositis?

☐ NO ¶ IF NO, SKIP TO QUESTION 63

☐ YES ¶ IF YES, when did you begin handling such solvents? _____ (yyyy)

Are you still handling any solvents, such as benzene, toluene, xylene, naphthalene, trichloroethylene (TCE), tetrachloroethene (PERC), or Solvane, and so forth?

☐ NO ¶ IF NO, when did you stop handling such solvents? _____ (yyyy)

☐ YES

During those years before the diagnosis of myositis, on average how many hours per week did you usually handle such solvents?

☐ Less than 2 hours

☐ 2-4 hours

☐ 5-8 hours

☐ 9-16 hours

☐ More than 16 hours per week

On average how many months per year did you usually handle such solvents before the diagnosis of myositis?

☐ Less than 1 month

☐ 1-3 months

☐ 4-6 months

☐ 7-9 months

☐ 10-12 months of the year

63. Have you handled any **dyes or inks** at least once a week in any job or hobby/leisure activity you have had before the diagnosis of myositis?

☐ NO ☐ IF NO, SKIP TO QUESTION 64

☐ YES ☐ IF YES, when did you begin handling any dyes or inks? ____ (yyyy)

Are you still handling any dyes or inks?

☐ NO ☐ IF NO, when did you stop handling any dyes or inks? ____ (yyyy)

☐ YES

During those years before the diagnosis of myositis, on average how many hours per week did you usually handle any dyes or inks?

☐ Less than 2 hours

☐ 2-4 hours

☐ 5-8 hours

☐ 9-16 hours

☐ More than 16 hours per week

On average how many months per year did you usually handle any dyes or inks before the diagnosis of myositis?

☐ Less than 1 month

☐ 1-3 months

- ☐ 4-6 months
- ☐ 7-9 months
- ☐ 10-12 months of the year

64. Have you handled any **paints, paint thinners, or removers** at least once a week in any job or hobby/leisure activity you have had before the diagnosis of myositis?

- ☐ NO ¶ IF NO, SKIP TO QUESTION 65
- ☐ YES ¶ IF YES, when did you begin handling any paints, paint thinners, or removers? ____ (yyyy)

Are you still handling any paints, paint thinners, or removers?

- ☐ NO ¶ IF NO, when did you stop handling any paints, paint thinners, or removers? ____ (yyyy)
- ☐ YES

During those years before the diagnosis of myositis, on average how many hours per week did you usually handle any paints, paint thinners, or removers?

- ☐ Less than 2 hours
- ☐ 2-4 hours
- ☐ 5-8 hours
- ☐ 9-16 hours
- ☐ More than 16 hours per week

On average how many months per year did you usually handle any paints, paint thinners, or removers before the diagnosis of myositis?

- ☐ Less than 1 month
- ☐ 1-3 months
- ☐ 4-6 months
- ☐ 7-9 months
- ☐ 10-12 months of the year

65. Have you handled any **stains, varnishes, or other wood finishes** at least once a week in any job or hobby/leisure activity you have had before the diagnosis of myositis?

- ☐ NO ¶ IF NO, SKIP TO QUESTION 66
- ☐ YES ¶ IF YES, when did you begin handling any stains, varnishes, or other wood finishes?
_____ (yyyy)

Are you still handling any stains, varnishes, or other wood finishes?

- ☐ NO ¶ IF NO, when did you stop handling any stains, varnishes, or other wood finishes?
_____ (yyyy)

☐ YES

During those years before the diagnosis of myositis, on average how many hours per week did you usually handle any stains, varnishes, or other wood finishes?

☐ Less than 2 hours

☐ 2-4 hours

☐ 5-8 hours

☐ 9-16 hours

☐ More than 16 hours per week

On average how many months per year did you usually handle any stains, varnishes, or other wood finishes before the diagnosis of myositis?

☐ Less than 1 month

☐ 1-3 months

☐ 4-6 months

☐ 7-9 months

☐ 10-12 months of the year

67. Have you handled any **glues or adhesives** at least once a week in any job or hobby/leisure activity you have had before the diagnosis of myositis?

☐ NO ☐ IF NO, SKIP TO QUESTION 68

☐ YES ☐ IF YES, when did you begin handling any glues or adhesives? ____ (yyyy)

Are you still handling any glues or adhesives?

☐ NO ☐ IF NO, when did you stop handling any glues or adhesives? ____ (yyyy)

☐ YES

During those years before the diagnosis of myositis, on average how many hours per week did you usually handle any glues or adhesives?

☐ Less than 2 hours

☐ 2-4 hours

☐ 5-8 hours

☐ 9-16 hours

☐ More than 16 hours per week

On average how many months per year did you usually handle any glues or adhesives before the diagnosis of myositis?

- ☐ Less than 1 month
- ☐ 1-3 months
- ☐ 4-6 months
- ☐ 7-9 months
- ☐ 10-12 months of the year

68. Have you handled any **mercury, cadmium, or other metals** at least once a week in any job or hobby/leisure activity you have had before the diagnosis of myositis?

- ☐ NO ¶ IF NO, SKIP TO QUESTION 69
- ☐ YES ¶ IF YES, when did you begin handling any mercury, cadmium, or other metals? ____ (yyyy)

Are you still handling any mercury, cadmium, or other metals?

- ☐ NO ¶ IF NO, when did you stop handling any mercury, cadmium, or other metals? ____ (yyyy)
- ☐ YES

During those years before the diagnosis of myositis, on average how many hours per week did you usually handle any mercury, cadmium, or other metals?

- ☐ Less than 2 hours
- ☐ 2-4 hours
- ☐ 5-8 hours
- ☐ 9-16 hours
- ☐ More than 16 hours per week

On average how many months per year did you usually handle any mercury, cadmium, or other metals before the diagnosis of myositis?

- ☐ Less than 1 month
- ☐ 1-3 months
- ☐ 4-6 months
- ☐ 7-9 months
- ☐ 10-12 months of the year

69. Have you handled **dust from sand, rock, clay, tile, or brick** at least once a week in any job or hobby/leisure activity you have had before the diagnosis of myositis?

- ☐ NO ¶ IF NO, SKIP TO QUESTION 70

☐ YES ☐ IF YES, when did you begin handling dust from sand, rock, clay, tile, or brick? _____(yyyy)

Are you still handling dust from sand, rock, clay, tile, or brick?

☐ NO ☐ IF NO, when did you stop handling dust from sand, rock, clay, tile, or brick? ____ (yyyy)

☐ YES

During those years before the diagnosis of myositis, on average how many hours per week did you usually handle dust from sand, rock, clay, tile, or brick?

☐ Less than 2 hours

☐ 2-4 hours

☐ 5-8 hours

☐ 9-16 hours

☐ More than 16 hours per week

On average how many months per year did you usually handle dust from sand, rock, clay, tile, or brick before the diagnosis of myositis?

☐ Less than 1 month

☐ 1-3 months

☐ 4-6 months

☐ 7-9 months

☐ 10-12 months of the year

70. Have you handled **animal parts, carcasses, blood, or raw meat** at least once a week in any job or hobby/leisure activity you have had before the diagnosis of myositis?

☐ NO ☐ IF NO, SKIP TO QUESTION 71

☐ YES ☐ IF YES, when did you begin handling animal parts, carcasses, blood, or raw meat? _____(yyyy)

Are you still handling animal parts, carcasses, blood, or raw meat?

☐ NO ☐ IF NO, when did you stop handling animal parts, carcasses, blood, or raw meat?
_____ (yyyy)

☐ YES

During those years before the diagnosis of myositis, on average how many hours per week did you usually handle animal parts, carcasses, blood, or raw meat?

☐ Less than 2 hours

☐ 2-4 hours

- ☐ 5-8 hours
- ☐ 9-16 hours
- ☐ More than 16 hours per week

Rules based protocol and job/hobby exposure matrix: background and examples.

Here we describe the background, process, and examples of the rules-based protocol and expert assessment used to characterize silica, solvents, and metals exposure in this study. A custom job exposure matrix (JEM) for each exposure was developed to guide the systematic assignment of the highest relative intensity of exposure an individual experienced before their myositis diagnosis (see Table, page 20). Write-in data on specific jobs, factories, and hobbies were assessed by experts, without regard to clinical characteristics, demographics, or data from other exposure questions; three independent reviews and assessments were conducted separately, and then compared, with resolution of any differences through an iterative process of discussion and seeking additional evidence on exposures as needed to achieve consensus. These ratings were subsequently evaluated together with the self-reported data on specific jobs and tasks as indicated in the JEMs below.

In developing our JEMs, we adapted information from existing population based JEMs (1-5), adding data on specific jobs and tasks to improve the accuracy of assessment. Responses to questions on hours per week of self-reported exposures (see questionnaire above) were also integrated in the matrix, such that more time reported per week could contribute to a higher relative exposure rating. Ratings assumed that exposure intensity was the most relevant construct for triggering autoimmunity, and subsequent immune dysregulation and inflammation, for example in the case of silica (6). Jobs with more intense exposure opportunities are also likely to impart greater cumulative exposure at lower levels. However, we did not attempt to develop a cumulative exposure score, also due to overlapping jobs and a lack of data on the frequency of tasks over the total weeks and years of employment.

Our approach differs from traditional population based JEMs, which are typically limited to reported job and industry, lacking additional data on tasks or exposure. These may be useful in very large association studies, or from a public health or occupational medicine point of view (7, 8). Our JEMs also differ from industry specific JEMs, which may be validated against exposure measurement data. While these are not directly applicable in a population-based assessment, they provide important information that may help to inform questionnaire-based assessment. In our matrix, a certainty level was also assigned, based on the level of available data provided through the questionnaire and evidence found in the literature regarding potential exposures, especially regarding measurement data (or lack thereof) in occupational or population-based studies.

While we cannot provide comprehensive documentation for each exposure scenario, we highlight a few examples here. Some exposures, such as silica, have well-established body of supporting research on high or very high-level exposures in the “dusty trades” industries (9), while others are less well established. Agricultural exposure to silica in soil dust, for example, has been less frequently studied, but is supported by evidence suggesting moderately elevated exposures (10). Work as a dentist, hygienist, assistant, or in a dental lab was rated as potentially high silica

exposure, based on inclusion by NIOSH in a list of at risk occupations (<https://www.cdc.gov/niosh/topics/silica/default.html>), as well as case reports of silicosis or idiopathic pulmonary fibrosis among workers in the profession, but with low certainty given limited surveillance and measurement data and a lack of detail in our questionnaire regarding specific tasks (11-13). By contrast, assessment of dental work and metals (e.g., mercury vapors) exposures were based on more abundant measurement data, resulting in a low exposure rating with a higher certainty assessment (14). Confirmatory data from reported exposures, together with time frame and hours reported, were evaluated when available, for example if someone reported work in a dental lab and sandblasting or exposure to metals.

Most JEMS do not consider hobbies, while ours included unpaid work and hobbies, which were included among the specific questions about jobs and tasks. We could not always determine which of these were paid versus unpaid work but were guided by write-in information on hobbies. For example, the most common examples of silica exposure from reported hobbies included pottery (e.g., “high” if they reported exposure to dust from sand, rock, clay, tile, or brick was >8 hours per week, over the same period) and automotive restoration (also considering the response to the question on sandblasting). Less certain assessments included the contribution of pesticides and fertilizers (not assessed) to heavy metals contamination in agriculture and hobby exposures during gardening (15-17), including residential fungicides containing copper and other metals.

References

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Table. Job/hobby-exposure matrix for evaluating questionnaire data to assess relative intensity of silica, solvents, and heavy metal exposures, by certainty level.

Exposure type/ Relative intensity	High Certainty [†]	Low Certainty [†]
Silica*		
None	<ul style="list-style-type: none"> • Dry-cleaning 	<ul style="list-style-type: none"> • Factory (Furniture) • Factory (Textile)
Low	<ul style="list-style-type: none"> • <i>Silica dust (<2 hrs/week)</i> 	<ul style="list-style-type: none"> • Handling lab chemicals • Fire and Police • Gardening • Painting hobby
Moderate	<ul style="list-style-type: none"> • <i>Silica dust (2-8 hrs/week)</i> • Farm/orchard • Landscaping 	<ul style="list-style-type: none"> • Housecleaning • Paper/Pulp/Sawmill • Factory (Cosmetics)
High	<ul style="list-style-type: none"> • <i>Silica dust (>8 hrs/week)</i> • Road/building construction • Mining/quarry • Factory (Pottery, ceramics, glass, scouring powder) 	<ul style="list-style-type: none"> • Dentist/hygienist/dental lab • Painting houses • Factory (Plastics)
Solvents*		
None	<ul style="list-style-type: none"> • Mining/quarry • Factory (Pottery, ceramics) 	<ul style="list-style-type: none"> • Factory (Textile, cosmetics) • Gardening
Low	<ul style="list-style-type: none"> • <i>Solvents (<2hrs/week)</i> • Dentist/hygienist/dental lab • Factory (Furniture) 	<ul style="list-style-type: none"> • Road/building construction • Landscaping • Fire and Police
Moderate	<ul style="list-style-type: none"> • <i>Solvents (2-8 hrs/week)</i> • Handling lab chemicals • Factory (Plastics) 	<ul style="list-style-type: none"> • Housecleaning • Farm/orchard • Paper/Pulp/Sawmill • Factory (Glass) • Painting (hobby; ≤4hrs/week)
High	<ul style="list-style-type: none"> • <i>Solvents (>8hrs/week)</i> • Painting houses 	<ul style="list-style-type: none"> • Dry-cleaning • Painting (hobby; >4hrs/week)
Heavy Metals*		
None	<ul style="list-style-type: none"> • Dry-cleaning 	<ul style="list-style-type: none"> • Factory (textile, furniture,

	<ul style="list-style-type: none"> • Painting houses (after 1980) • Painting hobby (after 1980) 	cosmetics, scouring powder)
Low	<ul style="list-style-type: none"> • <i>Mercury, cadmium, or other metals (<2hrs/week)</i> • Dentist/hygienist/dental lab • Fire and Police 	<ul style="list-style-type: none"> • <i>Gasoline exposure (<2 hrs/week prior to 1980)</i> • Housecleaning • Paper/Pulp/Sawmill • Handling lab chemicals • Gardening (if used pesticides >1hr/week) • Painting (hobby, prior to 1980)
Moderate	<ul style="list-style-type: none"> • <i>Mercury, cadmium, or other metals (2-8hrs/week)</i> 	<ul style="list-style-type: none"> • <i>Gasoline exposure (2-8 hrs/week prior to 1980)</i> • Farm/orchard • Landscaping • Painting houses (before 1980) • Road/building construction
High	<ul style="list-style-type: none"> • <i>Mercury, cadmium, or other metals (>8hrs/week)</i> 	<ul style="list-style-type: none"> • <i>Gasoline exposure (>8 hrs/week prior to 1980)</i> • Mining/quarry • Factory (Pottery, ceramics, glass. plastics)

*Sources of exposure considered, based on specific jobs/tasks and exposures in italics. Silica dust specified as dust from sand, rock, clay, tile, or brick. Solvents specified were benzene, toluene, xylene, naphthalene, trichloroethylene (TCE), tetrachloroethylene (PERC), and Solvane. Heavy metals specified included mercury and cadmium, while the intensity of lead (Pb) exposure was assessed for painting and gasoline exposure using a threshold of 1980, 2 years after when the U.S. Consumer Product Safety Division banned Pb from paints intended for consumer use, and when Pb in U.S. gasoline dropped from 2 to 1 gram per gallon and about 50% of gas sold in US was unleaded, such variability contributing to a low certainty level.

†Write-in information on other jobs, factories, or hobby were evaluated individually and assigned intensity and certainty rating by expert assessment. Other data sources (specific exposures, jobs, and tasks) could be compared and used as confirmatory only after independent expert assessment ratings were completed.