

On the Recognition of Multiple Chemical Sensitivity in Medical Literature and Government Policy

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The history of chemical sensitivity in America is reviewed from the first description published by Edgar Allan Poe in 1839, to its first medical definition as a symptom of neurasthenia in 1869, its re-discovery as allergic toxemia in 1945, its redefinition in 1987 as multiple chemical sensitivity (MCS), and its overlap in the 1990s with chronic fatigue syndrome, fibromyalgia syndrome, and Gulf War syndrome (GWS). More than half of the over 500 peer-reviewed articles on MCS support an organic basis for MCS, whereas less than one-quarter support a psychiatric basis. The same 2:1 difference is seen in the numbers of MCS researchers writing these articles and the number of journals publishing them. A psychogenic interpretation of MCS also is specifically rejected in the latest formal position statement on the subject, a 1994 consensus of the American Lung Association, American Medical Association (AMA), U.S. Environmental Protection Agency (US EPA), and U.S. Consumer Product Safety Commission (US CPSC) (U.S. Government Printing Office 1994-523-217/81322). This and other government recognition of MCS in policy, research, and scientific conferences are summarized. Dozens of federal, state, and local authorities accept MCS as a legitimate disease and/or disability that deserves reasonable accommodation in housing, employment, and public facilities. Official recognition is expected later in 1999 when the U.S. Centers for Disease Control and Prevention (CDC) announces a formal definition of MCS and the federal Interagency Workgroup on MCS releases its long-awaited final report, 4 years in the making. Given that epidemiological data from three states puts the prevalence of chemical sensitivity at 16 to 33% of the general population, 2 to 6% of whom have already been diagnosed with MCS, this truly is a hidden epidemic that deserves the priority attention of public health researchers and policy makers. Industrial toxicologists are encouraged to work on reducing and eliminating the use of synthetic fragrances, chemical sensitizers, and other irritants in consumer products and occupational settings.

Keywords Fatigue Syndrome—Chronic, Fibromyalgia—Gulf War Syndrome, Multiple Chemical Sensitivity, Neurasthenia, Poe, Edgar Allan

Received 28 February 1999; accepted 6 July 1999.

Invited paper presented to American College of Toxicology, 10 November 1998, as part of its Great Debate on Multiple Chemical Sensitivity.

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International Journal of Toxicology, 18:383-392, 1999
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1091-5818/99 512.00 + .00

"And have I not told you that what you mistake for madness is but overacuteness of the senses?"

Edgar Allan Poe, *The Tell-Tale Heart*, 1843

HISTORICAL INTRODUCTION

The great debate over the etiology of the syndrome now known as Multiple Chemical Sensitivity (MCS) dates back at least to 1839 when Edgar Allan Poe wrote the first American description of MCS in "The Fall of House of Usher." Poe describes an unnamed disease afflicting Roderick Usher, who "suffered much from a morbid acuteness of the senses; the most insipid food was alone endurable; he could wear only garments of certain texture; the odors of all flowers were oppressive; his eyes were tortured by even a faint light; and there were but peculiar sounds, and these from stringed instruments, which did not inspire him with horror." He also hints at a possible cause: an atmosphere that hung about the mansion "which had no affinity with the air of heaven... a pestilent and mystic vapor or gas, dull, sluggish, faintly discernible, and leaden-hued." This could well be a description of the highly toxic illuminating gas that was manufactured in the early 1800s from coal and contained 4-5% carbon monoxide and lesser amounts of hydrogen sulfide, benzene, toluene, and other volatile organic compounds.

Of the 30 specific symptoms that Poe attributes either to Roderick or his narrator, an average of 27 are recognized today by people who associate the onset of their MCS with a chronic low-level exposure to carbon monoxide and/or leaking propane, whereas fewer than 2 of 30 are recognized by non-MCS controls (Donnay 1999). Although many of Poe's critics (then and now) assumed that Roderick was a madman who simply imagined all these symptoms, Poe himself—like MCS patients today—strongly resisted any psychogenic interpretation. When he describes sensory hyperesthesia again in "The Tell Tale Heart" in 1843, he pointedly reminds his readers that what they "mistake for madness is but overacuteness of the senses."

More than 150 years later, this remains the most divisive issue in the debate over MCS: do the symptoms reflect a real physical illness caused by toxic chemical exposures or are they caused only by psychogenic factors and/or an iatrogenic belief system that misinterprets benign exposures as harmful. Fortunately, a

TABLE 2
Position statements of medical associations on clinical ecology or MCS

Medical association	Statement title and source	Statement status
American Academy of Allergy and Immunology (now the American Academy of Allergy, Asthma and Immunology)	Clinical ecology. <i>J. Allergy Clin. Immunol.</i> 78:269-271, 1986.	Adopted 1986, does not address MCS directly.
American College of Occupational and Environmental Medicine	Statement on multiple chemical hypersensitivity syndrome, multiple chemical sensitivities, environmental tobacco smoke, and indoor air quality. ACOEM Report, 2 May 1991 and addendum 27 April 1993.	Adopted 1991, revised 1993, noting that "increasingly, MCS has become a troublesome medical condition for individuals and their physicians." Addresses MCS directly but does not take a position as to psychogenic or organic basis.
American College of Physicians (ACP)	Clinical ecology. <i>Ann. Intern. Med.</i> 111:168-178, 1986.	Adopted 1986, does not address MCS directly. ACP confirmed that "it does not have a position statement on MCS" (personal correspondence from Dorothy Degler, 1996).
American Medical Association (AMA)	Clinical ecology. <i>JAMA</i> 268:3465-3467, 1992.	Adopted 1991 by the AMA's Council on Scientific Affairs, does not address MCS directly.
American Medical Association, jointly with the American Lung Association, US Consumer Product Safety Commission, and US Environmental Protection Agency	Indoor air pollution, an introduction for health professionals. Washington DC: US Government Printing Office, 1994-523-217/81322, 1994.	Adopted 1994, the only multi-agency consensus position statement. Does address MCS directly and says "complaints should not be dismissed as psychogenic."
California Medical Association	Clinical ecology—a critical appraisal. <i>West. J. Med.</i> 144:239-245, 1986.	Adopted 1986, does not address MCS directly, no longer in effect as of 1990 (personal correspondence from Astrid G. Meghrihan, 1990).

of Medicine holdings and other original sources. It does not include any articles from the *Journal of Clinical Ecology*, which was controversial and not widely recognized in its day, but it does include position statements adopted by various medical associations since 1986 on the practice of clinical ecology and/or the diagnosis of MCS (Table 2). As these positions are still cited by those who dismiss MCS as psychogenic (Barrett and Gots 1998), it is important to note how outdated most of them are: all but one are from 1992 or earlier, whereas more than half the literature on MCS has been published since.

The only multi-agency consensus position statement on MCS was adopted jointly in 1994 by the American Lung Association (ALA), American Medical Association (AMA), U.S. Environmental Protection Agency (EPA), and U.S. Consumer Product Safety Commission (CPSC). It stresses that "in cases of claimed or suspected MCS, the current consensus is that complaints should not be dismissed as psychogenic and a thorough workup is essential" (ALA 1994). Those who still dismiss MCS as psychogenic, therefore, are clearly outside this mainstream

consensus, which accurately reflects the medical literature on MCS published since 1945.

There are more than twice as many peer-reviewed articles, books, and book chapters that support an organic interpretation of MCS as compared to those supporting a psychogenic or iatrogenic view, and this gap has been consistent for decades. The same 2:1 predominance of organic over psychiatric perspectives is also seen in the number of first authors, total authors, and journals publishing these findings (Table 3). There is very little overlap among either first authors in these categories—just 9 to 11% across all columns—showing that few have modified their original views of MCS. Among journals and book publishers, the overlap is 20% overall but only 8% among the organic and psychogenic columns, indicating that, like authors, few editors ever publish opposing views of MCS.

Within this literature may be found evidence of numerous abnormal signs and diagnostic tests associated with MCS (Table 4). Although no single one of these signs or markers has been reported abnormal consistently in all MCS cases, and many such as

TABLE 3
Analysis of MCS bibliography 1945-1998^a

Category of analysis	Organic view/data	Psychogenic view/data	Mixed view/data ^b	Research design ^c
Percent of MCS articles, books or book chapters with each viewpoint, $n = 516$ (no overlap)	53%	25%	16%	6%
Percent of first authors with each viewpoint, $n = 294$, note 9% overlap ^d	53%	27%	20%	9%
Percent of all authors with each viewpoint, $n = 679$, note 11% overlap ^d	58%	25%	18%	10%
Percent of journals and publishers with each viewpoint, $n = 215$, note 20% overlap ^d	60%	29%	26%	5%

^aBibliography compiled by MCS Referral & Resources includes 516 peer-reviewed articles, books, and book chapters on or directly related to MCS published from 1945 through 1998; but it does not include letters to the editor or anything from the *Journal of Clinical Ecology*.

^bMixed view/data column counts articles that present findings in support of both organic and psychogenic views of MCS or which do not take a position either way.

^cResearch design papers propose methods for studying various psychogenic and organic hypotheses. These are categorized separately because the studies have not been done.

^dThe overlap is the percentage by which the row sum exceeds 100%. It shows the percent of authors and journals that have published in more than one of these categories.

TABLE 4
Multiple objective signs and test abnormalities associated with MCS

1. Cardiac: tachycardia, arrhythmia, mitral valve prolapse, abnormal echocardiogram
2. Cerebral: reduced blood flow on SPECT and slow alpha wave on qEEG
3. Circulatory: small vessel vasculitis and nontraumatic thrombophlebitis
4. Detoxification: impaired function of phase I (Cp450) and/or phase II pathway
5. Endocrine: variable hyper or hypo function in thyroid, adrenals, and HPA axis
6. Enzymes: decreased superoxide dismutase and glutathione peroxidase
7. Eyes: photophobia and dry or weeping tear glands
8. Gastrointestinal: esophagitis and 'nutcracker' esophagus
9. Immune: chronic T-cell activation, impaired NK cell function, variable autoimmunity, and reduced secretory IgA
10. Mast cells: increased number but especially also increased sensitivity, abnormal serum tryptase (high if bone marrow is positive for mast cells, low if not)
11. Minerals: numerous deficiencies, especially Zn, Mg, Se, and Cu
12. Musculoskeletal: fibromyalgia, tender points, loosely and double jointed
13. Neurocognitive: impaired memory, attention span, and reaction times
14. Nose: degraded nasal epithelium, rhinitis, and sinusitis
15. Porphyrin metabolism: multiple blood enzyme, urine, and stool deficiencies
16. Respiratory: impaired lung function, asthmatic response to challenge
17. Sensory nerves: delayed and/or decreased evoked potentials
18. Skin: loose skin, hypersensitive to chemicals, irritants, touch, vibration, and cold
19. Sleep: frequently disrupted with abnormal EEG
20. Vestibular: impaired balance
21. Vitamins: numerous deficiencies, especially in the B series

Sources: Baldwin 1998; Bell, Baldwin, and Schwartz 1998a; Bell et al. 1998; Bell et al. 1998b; Galland 1987; Heuser, Wodjani, and Heuser 1992; Heuser, Mcna, and Alamos 1994; Heuser and Kent 1996; McGovern 1983; Meggs and Cleveland 1993a; Meggs and Cleveland 1993b; Rea 1976, 1977; Schwartz et al. 1987; Ziem and McTamney 1997.

vitamin and mineral deficiencies are common to other disorders, a few are extremely rare. Two such abnormalities normally found in less than 1 in 10,000 of the general population are genetically inherited mast cell and porphyrin metabolism disorders, both of which—very much like MCS—are characterized by multisensory sensitivity and a great diversity of symptoms in response to chemical and other exposures.

The diagnostic tests for these disorders show a relatively unique pattern of abnormality in MCS cases, with results characteristically outside normal ranges but also short of the extremes typically associated with the inherited forms. Heuser and Kent (1996) has reported finding abnormal mast cell biopsies in 80% of MCS clinic patients, whereas a protocol developed with the Mayo Medical Laboratories to screen comprehensively for porphyrin disorders in blood, urine, and stool (Donnay and Ziem 1995) found multiple deficiencies in 88% of those tested (Ziem and McTamney 1997).

Such high sensitivity, especially when combined with the tests' better than 99.999% specificity in the general population and their etiological consistency with MCS, suggests porphyrin and mast cell biomarkers may be useful in screening and documenting objective abnormalities in MCS cases. Although these biomarkers have not yet been studied together in MCS patients, the most by which they can differ is only 12%, resulting in a high degree of sensitivity and specificity for those who test positive for both (based on laboratory normal reference ranges). Another less specific biomarker of mastocytosis that may be evaluated more easily is the serum tryptase level, which may be either abnormally high or low but is rarely normal (Schwartz et al. 1987).

A variety of theories have been proposed to explain possible mechanisms of MCS (Table 5). No well-designed human studies have been carried out to test any of the psychiatric hypotheses

(Davidoff and Fogarty 1994), but, as noted above, significant data exist to support the mast cell and porphyrin theories. The most recent hypothesis, that chronic carbon monoxide (CO) poisoning may trigger MCS (Donnay 1998a), is based on findings that CO, like nitric oxide, is a neurotransmitter (Verma et al. 1993; Ingi and Ronnett 1995). It controls sensitization and desensitization to odors, sound, and light and plays a key role in memory, blood vessel tone, gastrointestinal tone, and cardiac function—all of which have been reported abnormal in MCS cases (Bell, Baldwin, and Schwartz 1998a).

Although the medical literature is divided over these various proposed mechanisms of MCS, there is a remarkable consistency in the prevalence rates of diagnosed and undiagnosed chemical sensitivity found in epidemiological studies of randomly selected adults in New Mexico, North Carolina, and California. These range from 1.9 to 6.3% already diagnosed with MCS or suffering daily, and 15.9 to 33% reporting some degree of chemical sensitivity (Table 6).

Two studies of Gulf War era veterans by the US CDC show rates of chemical sensitivity among those who were not deployed but are still on active duty in the range of 2 (Fukuda 1998) to 2.6% (Black 1998, personal correspondence), but among those who were deployed, the MCS rates are more than twice as high: from 5 to 5.5%, respectively. Among randomly selected Gulf War era veterans who are no longer on active duty, a study by the Department of Veterans Affairs (DVA) found rates of chemical sensitivity that are almost three times higher: 14.9% in the deployed compared to 4.9% in the nondeployed (Kang et al. 1998). The highest MCS rate of all—35.9%—was found in another DVA study of veterans who signed up for the DVA's Gulf War Registry (Fiedler, Kippen, and Natelson 1998). Unfortunately, neither the Department of Defense nor the DVA has incorporated these research findings into their clinical protocols. As a result, Gulf

TABLE 5
Multiple proposed mechanisms for multiple chemical sensitivity

1. Specific adaptation syndrome	Randolph 1936
2. Limbic kindling/time-dependent sensitization	Bell 1975
3. Immune response (type 1 and/or type 3)	McGovern et al. 1983
4. Post-traumatic stress from child abuse	Staudenmayer and Selner 1987
5. Behavioral (pavlovian) conditioning	Bolla-Wilson, Wilson, and Blecker 1988
6. Neurogenic inflammation and switching	Meggs 1993
7. Psychogenic chemophobia	Lecznoff 1994
8. Environmental somatization syndrome	Gothe, Molin, and Nilsson 1994
9. Porphyrin metabolism disorder	Donnay and Ziem 1995
10. Idrogenic (physician's "belief system")	Black 1996
11. Mast cell disorder	Heuser and Kent 1996
12. Panic disorder	Binkley and Kutcher 1997
13. Toxicant-induced loss of tolerance	Miller 1997
14. Integrated defense system overlap	Rowat 1998
15. Multisensory sensitization from CO poisoning	Donnay 1998a

*Sorted chronologically by earliest known reference.

TABLE 6
Prevalence of MCS and chemical sensitivity

Principal investigator	Study population	Prevalence of symptomatic chemical sensitivity	Prevalence of diagnosed MCS or daily symptoms
Mcggs, ^a E. Carolina University School of Medicine	1027 adults in rural North Carolina, 1995; replicated 1997 second sample	33% report being sensitive to chemicals, including 16.9% with allergy and 16.1% without allergy	3.9% report daily symptoms due to chemical sensitivity (12% suffer weekly)
Kreutzer, ^b California State Department of Health Services	4000 adults in California in 1995 (statewide); replicated 1996 second sample	15.9% report being "allergic or unusually sensitive to chemicals"	6.3% report receiving diagnosis of MCS
Voorhees, ^c New Mexico Department of Health	1814 adults in New Mexico in 1997 (statewide); not replicated	17% report being "allergic or unusually sensitive to chemicals"	1.9% report receiving diagnosis of MCS

^aMcggs, W. J., K. A. Dunn, R. M. Bloch, et al. 1996. Prevalence and nature of allergy and chemical sensitivity in a general population. *Arch. Environ. Health* 51:275-282.

^bKreutzer, R., R. Neutra, and N. Lashuay. 1999. Prevalence of people reporting sensitivities to chemicals in a population-based survey. *Am. J. Epidemiol.* 150: 1-12.

^cVoorhees, R. E. 1998. Memorandum from New Mexico Deputy State Epidemiologist to Joc Thompson, Special Counsel, Office of the Governor, 13 March 1998.

War era veterans are still not being routinely screened, diagnosed, compensated, or treated for MCS.

Even higher prevalence rates have been reported in civilian studies of chronic fatigue syndrome (CFS) clinic patients—67% of whom had MCS (Buchwald and Garrity 1994)—and fibromyalgia (FM) clinic patients—56% of whom did so (Slotkoff, Radulovic, and Clauw 1997). The only study of these overlaps among MCS clinic patients found 47% with all three, 41% with only MCS and CFS, 10% with MCS alone, and just 2% with MCS and FM (Donnay and Ziem 1999b).

A 1999 Consensus on MCS, signed by over 30 physicians and researchers, attempts for the first time to establish a formal definition of MCS for use in clinical practice (Bartha et al. 1999). It requires all six of the following:

1. The symptoms are reproducible with repeated chemical exposure.
2. The condition is chronic.
3. Low levels of exposure [lower than previously or commonly tolerated] result in manifestations of the syndrome.
4. The symptoms improve or resolve when the incitants are removed.
5. Responses occur to multiple chemically unrelated substances.
6. Symptoms involve multiple organ systems.

RECOGNITION OF MCS IN GOVERNMENT POLICY

The United States federal government first began funding MCS-related "chemosensory" research into smell and taste disorders in 1968, through the National Institute of Health (NIH) National Institute on Neurological Disorders and Stroke. In 1987, this research funding—provided mostly to scientists working closely with fragrance and flavor industries—was spun off into a new agency, the NIH's National Institute on Deafness and Other Communication Disorders (NIDCD). In fiscal year 1997 alone, NIDCD's Chemical Senses Branch spent \$28.6 million dollars on chemosensory research, which is more than the MCS spending of all other federal agencies combined (personal communication with Rochelle Small 1998).

Although most of these funds go for research into disorders involving the loss of smell and/or taste, rather than the hypersensitivity seen in MCS, NIDCD has made important contributions to basic research into the neurophysiology and genetics of olfaction. It funded the Johns Hopkins University study, for example, that first reported CO was a neurotransmitter of olfaction (Verma et al. 1993), a clearly relevant finding that is still not widely known to either toxicologists or MCS specialists.

Government interest in MCS as an indoor air quality issue grew out of US EPA's own experience with an epidemic of Sick Building Syndrome (SBS) and MCS, that began in 1987

TABLE 7
U.S. government sponsors of MCS-related research and conferences^a

1. Agency for Toxic Substances and Disease Registry^a—1991, 1993, 1994, 1995,^b 1999^c
2. Centers for Disease Control and Prevention—1999^c via its National Center for Environmental Health^d
3. Department of Defense^a—1995^b via its Tri-Service Toxicology and 1997 via the Institute of Medicine
4. Department of Energy^a—1994^d via its Oak Ridge National Laboratory
5. Environmental Protection Agency, Office of Research and Development^a—1991 via the National Research Council, then two in 1994,^d two in 1995^b
6. National Institute on Deafness and Other Communication Disorders
7. National Institute of Environmental Health Sciences^a—1993 and 1995
8. National Institutes of Health, Office of Public Health and Science—1999^c
9. National Institute for Occupational Safety and Health^a—1995
10. Veterans Administration^d

^aSorted alphabetically; years refer to dates of conferences sponsored, if any.

^bDepartments and agencies represented on the federal interagency Workgroup on MCS, which was cochaired by ATSDR and NIEHS.

^cDOE is the primary sponsor of this conference.

^dCDC is the primary sponsor of this conference.

^eDOE is the primary sponsor of this conference.

Source: Donnay, A. 1998. *Recognition of MCS*. Baltimore MD; MCS Referral & Resources.

with the remodeling of its Washington DC headquarters known as Waterside Mall. Hundreds of employees were affected by the end of 1988 and dozens can no longer work in the building, but only a few are being accommodated with alternative work assignments and/or telecommuting arrangements (Zicm and McTamney 1997).

In response, US EPA researchers conducted the largest occupational study ever done of SBS and MCS, surveying nearly 4000 employees in this and two other smaller EPA buildings and 3000 controls working in the Madison building of the Library of Congress. They found approximately one-third (29 to 33%) of the occupants in each building, including the controls, complained of being "especially sensitivity to chemical fumes" and that this was "significantly related to health factors more often than any other [of 48] variables" (Wallace et al. 1993), although those working in the Library of Congress appeared to have been sensitized by mold from books rather than by any type of remodeling exposures such as the new carpet installation that first triggered symptoms at Waterside Mall.

US EPA also commissioned the National Research Council to convene a scientific conference on MCS in 1991, which was just the first of a dozen on MCS cosponsored by eight federal agencies over the next 8 years (Table 7). Unfortunately, few of their many policy or research recommendations have been adopted. The latest "research planning conference"—this one on the health impact of chemical exposures during the Gulf War—was held February 28 to March 2, 1999. The cosponsors, the US NIH, CDC, and the Agency for Toxic Substances and Disease Registry (ATSDR), specifically promised Congress in 1998 that the one goal of this conference would be to develop a formal definition MCS to standardize future research (Eisenberg 1998). A consensus definition was proposed at the

conference and published independently by 34 MCS physicians and researchers (Bartha 1999).

Also expected later in 1999 is the final MCS report of the federal government's Interagency Workgroup on MCS. This 4-year effort was initiated by US EPA and cochaired by ATSDR, the government's lead agency on MCS policy up to now, and the CDC's National Center for Environmental Health, which at the time had no experience with MCS but which has since been involved in two studies of Gulf War Veterans as discussed above. Other agencies included in the eight-member workgroup are the Departments of Defense, Energy, and Veterans' Affairs, the National Institute for Occupational Health and Safety, and the National Institute for Environmental Health Sciences, the largest funder of MCS-related research in the 1990s aside from the US NIDCD, which was not included (see Table 7, footnote "a").

Unfortunately, the Workgroup's efforts were undermined by numerous procedural problems (Donnay 1998b):

1. All its meetings were conducted in secret, few minutes were kept, and no input was solicited along the way from patients, doctors, or the many other federal, state and local government authorities that also support MCS research and/or have adopted MCS policies (Table 8);
2. Dr. Frank Mitchell, a recently retired ATSDR medical officer who was hired back in 1995 as a 'consultant' to draft and edit the Workgroup's report, never signed a written contract or conflict of interest disclosure statement as required. He was discovered in 1996 by MCS Referral and Resources to be on the board of directors of the Environmental Sensitivities Research Institute (ESRI). This organization was founded by an industry consultant, Dr. Ronald Gots, and is funded exclusively by chemical manufacturers, their associations,

TABLE 8
Summary of MCS recognition by government authorities

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- 25 U.S. Federal government authorities, including (in addition to the 10 in Table 7):
1. Congress, since 1992
 2. Consumer Product Safety Commission, since 1994
 3. Department of Education, since 1990
 4. Department of Health and Human Services, Agency for Health Care Policy and Research, since 1998
 5. Department of Health and Human Services, Office for Civil Rights, since 1996
 6. Department of Health and Human Services, Social Security Admin, since 1988
 7. Department of Housing and Urban Development, since 1990
 8. Department of the Interior, National Park Service, since 1996
 9. Department of Justice, since 1991
 10. Environmental Protection Agency, Office of Radiation and Indoor Air, since 1989
 11. Equal Employment Opportunity Commission, since 1991
 12. Federal Coordinating Council for Science, Engineering, and Technology, since 1994
 13. National Council on Disability, since 1993
 14. National Library of Medicine, since 1994
 15. President's Committee on Employment of People with Disabilities, since 1994
- 28 State government authorities, including agencies and/or legislatures in:
Arizona, California, Florida, Connecticut, Maryland, Massachusetts, Missouri,
North Carolina, New Jersey, New Mexico, New York, Pennsylvania, Washington
- 14 Local government authorities, including agencies and/or legislatures in:
Berkeley (CA), Chicago (IL), Contra Costa (CA), Fairfax County (VA), Jefferson
County (MO), Minneapolis (MN), Northwest Air Pollution Authority (WA), Oakland (CA),
Santa Fe (NM), San Francisco (CA), Santa Clara (CA), Santa Cruz (CA)
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Source: Donnay A. 1998. *Recognition of MCS*. Baltimore MD: MCS Referral & Resources.

attorneys, and insurers to oppose recognition of MCS. Although the Workgroup supposedly terminated Mitchell's involvement shortly after this conflict was brought to its attention, the Workgroup also decided against disclosing either Mitchell's ESRI affiliation or his key role as first author in their final draft, which lists him only as a "consultant."

3. although the Workgroup later solicited comments from its member agencies and a dozen outside experts, there is no written record—as is usually required—documenting how these comments were addressed and most, in fact, appear to have been ignored.

The most recent draft released for public comment in August 1998 reflects these problems and is more notable for all it omits than the sparse and misleading information it contains. As documented in the comments filed by MCS Referral & Resources (Donnay 1998b): less than one-third of the MCS literature published since 1945 is reviewed, including less than half that published in just the last 5 years; although all eight agencies have been involved in MCS research (this supposedly is why they were invited to join the Workgroup), only ATSDR reveals any information about either the funding or results of any of its MCS research, but even these data are incomplete; and no information is provided on the MCS research funding, findings, or policies of at least 14 other federal government authorities that were not included, such as the legal memorandum issued by the Social

Security Administration stipulating "that it recognizes multiple chemical sensitivity as a medically determinable impairment" (Stern and Goodwin 1997).

In response to a request from MCS Referral and Resources, the Governing Council of the American Public Health Association unanimously adopted a "late breaking" resolution (98-LB-5) at its annual meeting in November 1998 calling on the Inter-agency Workgroup to provide all this missing information in its final report so that—as originally intended—it may serve as a useful guide to public health policy making and research planning.

SUMMARY

The chronic disorder now known as MCS—characterized by multiple symptoms in multiple organs in response to multiple previously tolerated chemical exposures—has been recognized in medical literature by one name or another for 130 years. More than half of the over 500 peer-reviewed articles published since 1945 support an organic interpretation, whereas less than one-quarter support a psychiatric view. A psychogenic etiology is specifically rejected in the 1994 consensus statement of the ALA, AMA, US EPA, and US CPSC.

The 2 to 6% prevalence of diagnosed MCS found in the general population of New Mexico and California ranks the disorder among the top 10 to 20 most common chronic illnesses

in the United States. MCS clearly is already widely recognized by physicians in clinical practice, but the finding that so many more who complain of symptoms remain undiagnosed—10% in California and 15% in New Mexico—shows that much more professional outreach and education of physicians needs to be done. This is a role the US NIH should take on, just as it has begun to educate physicians about chronic fatigue syndrome and fibromyalgia, two equally variable disorders with which MCS has been reported to overlap by as much as 88% and 49%, respectively (Donnay and Ziem 1999). US Department of Defense and Veterans' Affairs physicians also need to be taught how to diagnose and treat MCS, as the disorder is truly epidemic among Gulf War veterans, whose relative risk of developing the disorder is two to three times that of their nondeployed brethren.

Since the late 1980s, dozens of federal and state government agencies have recognized MCS in one fashion or another and adopted policies to accommodate their own employees and/or others with MCS. Nine federal agencies and three states have together spent millions on MCS research and sponsored 13 MCS conferences. A consensus definition of MCS finally emerged from the last in March 1999, signed by 34 physicians and researchers.

Although many sectors of the chemical industry still oppose recognition of MCS in medicine, law, and government policy for liability reasons, some consumer product manufacturers are simultaneously seeking to profit from MCS by promoting less toxic, unscented, and undyed products for this growing sector of the consumer market.

Industrial toxicologists can make an important contribution by screening new chemicals, drugs, and other products carefully to identify and eliminate, or at least minimize, the use of sensitizers and irritants that provoke symptoms in MCS and the many disorders with which it overlaps: from extremely rare mastocytosis and porphyria to common migraine, allergy, and asthma. More research is also needed on the effects of chronic carbon monoxide poisoning—especially from dichloromethane exposures—on the senses, especially hearing, olfaction and vision, whose habituation is controlled by carbon monoxide and abnormally hypersensitive in most MCS cases.

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