

Magico-Religious Mercury Use in Caribbean and Latino Communities: Pollution, Persistence, and Politics

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Elemental mercury is put to magico-religious uses, most problematically the sprinkling of mercury on floors of homes in Caribbean and Latino communities. Indoor mercury spills are persistent and release toxic levels of mercury vapor over long periods of time. Surveys in these communities have demonstrated widespread and large-scale mercury sales for ritualistic use, elevated mercury vapor levels in public hallways, increased amounts of mercury in wastewater, and elevated urine mercury levels in Latino children. Yet no clear connection has been drawn between ritualistic mercury use and these elevated levels, nor has any pathology been associated with such use. Social, political, and economic factors have acted to preclude advocacy for these affected communities, whose members are largely unaware of their mercury exposure (frequently secondhand) and of its adverse health effects. Without the political mandate to act, environmental agencies have not allocated the resources necessary for environmental professionals to assess and respond to this latent environmental health disaster. Steps to investigate and respond to this impending public health emergency are suggested, as presently there is no coordinated plan for assessing and remediating the tens of thousands of dwellings around the country likely to be contaminated with actionable levels of mercury vapor.

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In 1989, a “learning disabled,” ethnically Puerto Rican ninth-grader in Brooklyn, New York, told his chemistry teacher that his mother sprinkled mercury on the floor of

their apartment to keep away witches. The teacher’s curiosity was aroused; he investigated, found mercury to be widely sold in the community for such uses (Wendroff, 1990), and concluded that his student exhibited symptoms of erethism arising from exposure to mercury vapor. The boy was anorexic, irritable, had short-term memory loss, and exhibited an aversion to being observed, periodically placing his head on his desk and covering it with his inverted loose-leaf notebook (Hartman, 1995). This chance observation was the starting point of much of the research described below.

Nature of the Problem

It has long been recognized that small mercury spills in homes, most commonly from broken thermometers, can produce elevated levels of mercury vapor for long periods of time (Carpi and Chen, 2001; US Environmental Protection Agency, Region 1, 2005). When such spills are reported to public health authorities, assessment and cleanup activities are regularly initiated and contaminated areas are evacuated. Such government concern about mercury toxicity is not in evidence, however, when it comes to other forms of domestic mercury contamination. In some Caribbean and Latino communities, folkloric practices and religious beliefs associated with Santeria, Espiritismo, and Voodoo attribute to mercury the power to attract good and repel evil. In these neighborhoods, elemental mercury is sold for magico-religious and ethnomedical uses by shops called *botánicas* (in the Southwest, *herboristerias* or *yerberias*) in unlabeled vials and fragile gelatin capsules containing an average weight of 10 grams of the metal. The only laws governing such sales appear to be federal and local labeling regulations, regulations that are generally flaunted, as over 90% of mercury sold by *botánicas* bears no labeling at all. Many, perhaps a majority, of ritualistic mercury users are ignorant of either the toxicity of mercury vapor, particularly to the developing brain (Goldman

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and Shannon, 2001), or of the persistent nature of mercury spills (US Environmental Protection Agency, 2002).

Even small, thermometer-sized mercury spills are extremely persistent and can generate problematic levels of mercury vapor for many years. A fever thermometer typically contains 0.7 grams of mercury. One study found residual mercury from a broken thermometer on a tiled bathroom floor continuing to emit substantial levels of mercury vapor after a period in excess of 15 years. The authors concluded that “mercury released from household devices can contaminate indoor residential environments for decades after the first release of this metal, . . . [and] this exposure route may raise significant concerns regarding mercury health effects in young children” (Carpí and Chen, 2001). The actual mercury vapor measured in a recent Agency for Toxic Substances and Disease Registry (ATSDR) investigation of a thermometer mercury spill found that this “small amount of elemental mercury can be readily volatilized by vacuuming and has the potential to pose a long-term human health exposure concern” (Nehls-Lowe and Morrison, 2004). Given the fact that mercury for magico-religious uses is typically sold in 10-gram units, it is reasonable to assume that spills resulting from such use are a great deal more problematic.

Several articles, reports, and conferences have addressed the putative adverse health effects of elemental mercury exposure across its spectrum of ethnomedical and magico-religious uses. The ethnomedical uses include ingestion of mercury to treat abdominal complaints, and intravenous and subcutaneous injection of mercury to boost energy and to protect against infections and evil influences (Celli and Khan, 1976; Geffner and Sandler, 1980; Hryhorczuk, 2004; Prasad, 2004; Trotter, 1985). The magico-religious uses include placing mercury in perfume and candles, mopping the floor with it, and mixing it into bathwater (Greenberg, 1999; Wendroff, 1990). The most environmentally problematic uses, and apparently some of the most common, involve placing mercury in a variety of open or unsealed containers and directly sprinkling mercury on floors and furnishings and inside motor vehicles (Riley et al., 2001). In 1990, the Surgeon General of the Public Health Service wrote: “The ritual of sprinkling mercury on the floor to ward off ‘evil spirits’ is practiced by selected minority groups and may pose potential hazards to those who encounter the mercury” (Novello, 1990). Fifteen years later, these rituals involving mercury are still generally considered a “potential” (versus an actual) health threat, largely because economic and political pressures have operated to retard substantive investigation of the problem.

Scale of Ritualistic Mercury Use

Although, to date, ritualistic mercury spills have not been reported to health authorities, have not been aggressively investigated by these authorities, and have not been described in first-hand case studies in the medical literature, the belief in their occurrence appears to be well founded given the conspicuous place mercury occupies in the beliefs and practices of Hispanic communities. A 1990 survey of 100 Caribbean and Latino women at a public hospital in Brooklyn, New York, found 25% familiar with esoteric uses of mercury (US Environmental Protection Agency, 2002, p. 3). A 1993 survey of ritualistic mercury use in Hartford, Connecticut, and its environs documented substantial botánica sales and use in this largely Puerto Rican community (Hispanic Health Council, 1993; US Environmental Protection Agency, 2002, p. 2). A survey of a largely Dominican community in Massachusetts found that 38% of respondents either used mercury themselves or knew someone who had used it, with 12% of respondents reporting that mercury was sprinkled around a child’s crib or bed (Latowsky, 2003). A similar survey in New York City found that “[f]orty-four percent of the respondents from the Caribbean and 27 percent from Latin America stated that elemental mercury is used in their homes, cars or carried on their person in these cultural practices” (Johnson, 1999). A survey in Chicago found 16 out of 79 Latinos (mainly women) who had used mercury on several occasions (Chicago Department of Public Health, 1997). Given these statistics, it is virtually certain that spills from the ritualistic use of mercury occur with significant frequency, that they result in contaminating dwellings with high levels of mercury vapor (Greenberg, 1999), and that such contamination results in mercury absorption by the occupants of those dwellings “orders of magnitude greater than (methyl) mercury exposures from eating fish or from the leaching of mercury from amalgam fillings” (Wendroff, 1997). The Natural Resources Defense Council has estimated that in the Bronx, New York, ritualistic mercury use “would be likely to cause long-term contamination of more than 13,000 homes or apartment buildings each year” (Quintero-Somaini et al., 2004).

Community Response

The likelihood of contamination of large numbers of Caribbean and Latino homes with substantial amounts of elemental mercury presents a challenge to environmental professionals and a potentially enormous problem for federal agencies (among them the US Agency for Toxic Substances and Disease Registry, the Centers for Disease Control

and Prevention, and the US Environmental Protection Agency) and for state and local health departments. Unlike exposure to methylmercury in fish or to elemental mercury in amalgam dental fillings, exposures to magico-religious mercury spills (1) cannot be limited by changes in diet or dentistry, (2) are likely to entail enormous costs to government for their remediation (Malecki et al., 1995), and (3) have the potential to engender panic among families with pregnant women and small children living in communities where large numbers of dwellings have been contaminated by ritualistic mercury spills (Edelstein, 1988). In contrast to the relative ease of checking dwellings for the presence of lead, radon, and asbestos, assessment of mercury vapor cannot be performed by do-it-yourself lay occupants. Detecting low levels of mercury vapor necessitates inspection by environmental professionals employing sophisticated instrumentation. Unseen mercury droplets lurk in porous flooring, and micro-droplets formed when spills are vacuumed adhere to all interior surfaces.

In typical “toxic disasters,” blame for widespread residential toxic exposures lies with corporate and government polluters. When such deep-pocketed polluters are identified, the wrath of the affected communities is focused on them and remediation and compensation are sought (Edelstein, 1988) and often gained. In one recent case, a corporation responsible for numerous residential mercury spills spent over 140 million dollars in cleanup costs and inspected over 200,000 homes for the presence of mercury (US Agency for Toxic Substances and Disease Registry, 2001; Williamson, 2000). This program resulted in a run on the market for portable mercury vapor analyzers, including 140 instruments leased from one manufacturer (Illinois Attorney General, 2000) and 100 purchased from another (Fenzel, 2005). A class-action lawsuit determined the defendant gas distribution company and its contractors to be liable for negligence, willful and wanton conduct, property damage, and medical expenses resulting from mercury spills from gas distribution equipment in homes (Circuit Court of Cook County, 2001).

By contrast, communities affected by ritualistic mercury contamination of dwellings cannot place the blame on corporate negligence and greed. “Any harm resulting from these practices is not only self-inflicted but also culturally sanctioned. Moreover, no readily apparent epidemic of mercury-related disease has generated the overtly ‘visible victims’ often necessary to bring about aggressive remedial action on the part of already overburdened public health officials. Attempts to call attention to the risks involved have regularly met [with]

indifference and sometimes even outright hostility” on the part of those charged with safeguarding the public health (Foreman, 1998).

Community-based environmental justice organizations have, for the most part, not yet engaged in the issue of ritualistic mercury contamination of dwellings. Despite their acknowledgment that “community members were the only experts who could gather information on such things as angler practices [contributing to methylmercury exposure] and the home remedies used by Latinos . . .” (Corburn, 2002) and their awareness of ritualistic mercury sales by botánicas in their neighborhoods, many have refrained from addressing this issue.

As a result of this indifference, in the 15 years since the health threat posed by ritualistic mercury use has been described in both the medical literature (Greenberg, 1999; Prasad, 2004; Riley et al., 2001; Wendroff, 1990, 1991) and the mass media (Castillo, 2004; Ojito, 1997; Rauch, 1991; Vinicio, 2001), there has been essentially no advocacy on this issue from Caribbean or Latino community organizations, medical professionals, or political representatives. Packard et al. (2004) recently made the statement that “illnesses ‘emerge’ from the suffering of individual patients to become medically recognized problems and public health issues.” As no one appears to be suffering from mercury poisoning, no one is advocating for government to substantively address the issue, aside from a few nominal and inconclusive pilot studies. The relatively straightforward research needed to demonstrate mercury contamination of dwellings and to correlate it with biomarkers of mercury absorption has not been conducted. Government knows what to do, but evidently feels that an actual demonstration of ritualistic mercury contamination, especially with attendant clinical involvement, would open a Pandora’s box that it would rather leave undisturbed.

The following example illustrates governmental ambivalence on this issue. The US Agency for Toxic Substances and Disease Registry (1999) has stated, “There is an urgent need to obtain information on the levels of exposure from these [ritualistic] practices to determine if children or adults are at risk. Mercury vapor concentrations may be much higher after use during the winter months when the heat is turned on and the windows are closed, so data that reflect a variety of exposure scenarios are also needed.” Yet despite this declared “urgent need,” the agency in question has of yet funded no research to meet it.

Real Estate Industry Response

Although the real estate industry has moved to protect tenants from residential toxic exposures, most notably from lead in paint, landlords tend to act only when litigation-driven regulations are enacted (Cahn and Thompson, 2003). Economic constraints make it difficult for landlords, and on occasion for government agencies as well, to apply the Precautionary Principle, which states that if reasonable evidence of toxic exposures exists, then efforts to reduce or eliminate such exposures should be implemented “even in the absence of clear, scientific evidence of harm” (Raffensperger and Tickner, 1999) and that “to wait for scientific certainty (or near certainty) is to court disaster” (Wyman and Stevenson, 2001). In strictly economic terms, then, it is understandable that the applicability of the Precautionary Principle to ritualistic mercury exposure has essentially been ignored by the real estate industry, by government, and by the environmental medical profession, though it is nonetheless deplorable. This is of course hardly the first instance in which, in the collision of economic interest with the Precautionary Principle, the Precautionary Principle has had to give way.

An instance of such a failure to act prior to “scientific certainty” began with an editorial preface to an article on ritualistic mercury contamination of homes, appearing in an environmental publication serving the real estate industry. The editors wrote, “Phase I Environmental Site Inspectors should be sure to notify their lender clients about the risk of mercury contamination in certain residential neighborhoods. Frequently, lenders are unaware of the variety of risks endangering the value of their residential real estate owned. The following is just one of the many ways lenders’ collateral can be jeopardized” (Wendroff and Jetter, 1999). Yet despite such editorial admonition and the wealth of circumstantial evidence of serious and widespread ritualistic mercury contamination presented in the article itself and in several subsequent studies (Garetano, 2004; Latowsky, 2003), to date there has been no apparent interest on the part of the real estate industry, or the environmental assessment profession serving it, in assessing and addressing the widespread contamination of homes with ritualistic mercury.

It seems likely that when the extent and impact of this environmental health threat are ultimately demonstrated, testing of housing stock for mercury vapor at the time of transfer will be mandated, as is currently the case with lead, radon, and asbestos. The political constraints retarding the implementation of such a program will no doubt

be very great. The New York City Housing Authority (NYCHA), possibly somewhat more of an advocate for tenant protection than the private housing sector, has failed to assess its own heavily Caribbean and Latino housing developments and has declined an offer from outside to provide free surveillance of mercury vapor levels in public housing hallways, this despite its own assurance that “NYCHA is giving serious consideration to the mercury issue” (Clarke, 2002). This same communication stated that the New York City Department of Health recommended that NYCHA await the results of an investigation by the New Jersey Department of Environmental Protection. When that study demonstrated that there were elevated mercury vapor levels in Latino housing (Stern et al., 2003), NYCHA still did not assess its own buildings for elevated levels of mercury vapor. The US Department of Housing and Urban Development (HUD) has displayed the same apparent indifference to addressing this issue. A HUD official wrote to acknowledge “a potential environmental health threat caused by contamination of homes, including HUD properties, through ritualistic uses of mercury,” and went on to state that HUD was awaiting results of studies from the Centers for Disease Control and the US Environmental Protection Agency (USEPA) before being able to “justify in-depth environmental assessments” (Teninga, 2002).

Government Agency Response

The Agency for Toxic Substances and Disease Registry’s chronic minimal risk level for domestic mercury vapor exposure is $0.2 \mu\text{g}/\text{m}^3$, and USEPA’s domestic mercury vapor evacuation was recently lowered to $1 \mu\text{g}/\text{m}^3$ by joint ATSDR, USEPA, and Washington, DC, Department of Health consultation over a mercury spill incident so as to be more protective in cases of fetal exposure (Blum and Fernandez, 2003; US Agency for Toxic Substances and Disease Registry, 2003). Government has no direct mandate to lower the body mercury burden of individuals with clinically elevated mercury levels resulting from fish consumption or amalgam dental fillings; however, when mercury contamination of a dwelling is suspected, government has often assumed responsibility for assessment and frequently for decontamination (Baker et al., 2005; Malecki et al., 1995). The same will likely be the case in ritualistic mercury spills, when it generally will be impossible to determine who is legally responsible for the spills and when occupants and frequently landlords will be unable to pay the cleanup costs. As experience with the assessment and cleanup of ritualistic mercury spills mounts, growing familiarity with the pattern and intensity of mercury distribution will make

the identification of ritualistic mercury contamination more assured.

Mounting evidence suggests that large numbers of homes in Caribbean and Latino communities are contaminated with actionable levels of mercury vapor. Much of this mercury contamination was likely caused by prior mercury-using occupants. This residential contamination is believed to result in significant second hand exposure (Greenberg, 1999; Johnson, 1999). Occupational exposures are likely to occur in shops that sell mercury. The New York City Department of Health inspected 20-odd botánicas, many of them known to have sold the metal. Several had elevated mercury vapor levels, and one had from 13 to 17 $\mu\text{g}/\text{m}^3$ in the store itself and from 4 to 7 $\mu\text{g}/\text{m}^3$ in stairwells and hallways leading to the three floors of apartments above (New York City Department of Health and Mental Hygiene, 2000). The New Jersey Department of Environmental Protection found substantially elevated indoor air mercury vapor levels in public vestibules and hallways of heavily Hispanic multifamily housing. It reported that although “most indoor samples were low . . . about 17% of buildings had average air levels above 20 ng/m^3 , with one building average at 299 and a maximum internal reading of 2000 ng/m^3 [2.0 $\mu\text{g}/\text{m}^3$, or twice the recommended evacuation level]” (Stern et al., 2003). A recent survey found that of four apartments actually entered, the mercury levels inside were on an average 5.5 times (ranging from 3.8 to 8.8 times) higher than those detected at the doorjamb in the hallway (Puchalik, 2005). One investigator stated, “The cultural use of mercury has been identified as a potential source of mercury vapor exposure in [these] New Jersey residential settings. In this instance, elemental mercury may be intentionally dispersed within a residence. . . . We conclude that indoor mercury vapor concentrations are substantially elevated over outdoor concentration in many instances. The concentrations in some buildings approach levels of public health concern” (Garetano, 2004).

In late 2001, the US Environmental Protection Agency began a simulation to measure mercury vapor levels from ritualistic spills in a home. Mercury was sprinkled on carpeting inside a house trailer and vapor levels were monitored. A final report has yet to be released, owing to the fact that external reviewers found flaws in the simulation design, which tested only a single type of flooring and simulated neither the effects of walking on it nor of vacuuming it. More problematic still was the incongruity of the experimental results with real-world experience of domestic mercury spills requiring lengthy decontamination to reduce

mercury vapor to a reoccupation level below 1 $\mu\text{g}/\text{m}^3$. The authors concluded, “Intentional ritual sprinkling of metallic mercury. . . may initially produce indoor air mercury vapor levels above the ATSDR suggested residential occupancy level, and in some cases, above the action level, but the concentration decreases over time and generally falls below the residential occupancy level” (Singhvi et al., 2004). The authors go on to state that “ATSDR has proposed a residential occupancy level of 1.0 microgram per cubic meter of air (1 $\mu\text{g}/\text{m}^3$) as the mercury level considered ‘safe and acceptable’ for occupancy of any structure after a spill, provided that no mercury is present” (US Agency for Toxic Substances and Disease Registry, 2001).

Contrast these simulation findings with the actual case of a thermometer containing approximately 0.7 grams of mercury that was broken on the dresser and hardwood floor of a bedroom occupied by a pregnant woman. The occupants cleaned up the visible droplets and then vacuumed the floor. Five days later, mercury vapor levels in the bedroom were over 14 $\mu\text{g}/\text{m}^3$, and the occupants were advised to evacuate the bedroom and ventilate it. Seven days after the initial spill, the bedroom had levels of 2 to 3 $\mu\text{g}/\text{m}^3$, or twice the current recommended evacuation level (Nehls-Lowe and Morrison, 2004). This scenario, involving a minute amount of mercury—probably well under 0.5 gram—should be compared with the situation in which the average 10-gram quantity of ritualistic mercury is spilled in the home, no attempt is made promptly to clean it up, it is tracked about to other rooms and to adjacent hallways and apartments, and in many cases the floors are routinely vacuumed.

Data on botánica mercury sales in the heavily Hispanic Bronx, New York, indicated a range of 25,000 to 155,000 9-gram mean-weight-units of mercury sold in one year (1995), with some 30% of those units likely to be sprinkled on floors (Zayas and Ozuah, 1996). The enormous sales and ritualistic use of elemental mercury in New York City and its environs, estimated at between 500 and 3,000 pounds per year in the Bronx alone (Baard, 2001; Zayas and Ozuah, 1996), has a significant but little appreciated environmental impact. Ritualistic mercury is placed in bathwater and in water for mopping floors, and unused mercury is dumped down drains (Johnson, 1999). Ingested and inhaled mercury is also excreted in feces and urine and, along with discarded mercury, may substantially add to the mercury burden of wastewater (New York City Department of Environmental Protection, 2004). These uses and excretory and disposal pathways allow mercury to enter the aquatic

environment. In the New York/New Jersey harbor, the median source of mercury influx has been found to be divided equally between emissions from electric power plants and emissions resulting from the religious and cultural uses of mercury, each estimated at from 200 to 600 kilograms per year (de Cerreno, Panero, and Boehme, 2002). Several analyses for metals influent to New York City's wastewater treatment plants have found excesses of mercury apparently associated with ritualistic mercury use. The New York City Department of Environmental Protection therefore sampled a small, overwhelmingly Dominican residential area and found major excesses of mercury, 10 to 100 times above the norm (albeit associated with copper, lead, and zinc). The source of this mercury seems likely to be from the contamination of drain traps when ritualistic mercury is disposed (New York City Department of Environmental Protection, 2004).

Biomarker Studies

A pilot study of pediatric urine mercury levels of Hispanic children in the Bronx found 5% with what were deemed to be clinically elevated levels of 5 to 11 $\mu\text{g}/\text{L}$ (Ozuah et al., 2003). A recent Centers for Disease Control/New York City Department of Health study of urine mercury levels of over 400 Caribbean and Latino children in New York City found one with a notifiable level of 24 $\mu\text{g}/\text{L}$ (Jeffery, 2004). The notifiable urine mercury level in New York State is 20 $\mu\text{g}/\text{L}$. Another mercury biomarker study is under way in New York City as part of a citywide health and nutrition examination survey. A study in Chicago found none of the 400 Latino children tested had elevated urine mercury levels (Rogers, Caldwell, and McCullough, 2004). Both blood and urine mercury levels are being measured in a representative sample of 2,000 adults in New York City, the urine mercury levels being measured because of concern over ritualistic mercury exposure (New York City Department of Health and Mental Hygiene, 2004). Unfortunately, these several urine mercury level investigations were designed without reference to recent findings that urine mercury levels resulting from exposure to low levels of mercury vapor, i.e., "below 10 $\mu\text{g}/\text{m}^3$ " are "likely to be indistinguishable from background urinary mercury levels" (Tsuji et al., 2003), so their conclusions are essentially invalid. Scientists from the Centers for Disease Control and Prevention and the New York City Department of Health and Mental Hygiene have stated that their results have been released in a public forum, although no manuscripts have been published as yet (Jeffery, 2005; Rubin, 2005).

Discussion

Fear of the prospect of having to evacuate and decontaminate many thousands of homes in Caribbean and Latino communities around the country has undoubtedly acted to retard substantive environmental and clinical assessment of the ritualistic mercury problem. At the August 2004 conference of the International Society for Environmental Epidemiology, the oral session on "Urban/Ritualistic Mercury Exposure: Assessment to Intervention" demonstrated government ambivalence toward addressing the problem by its failure to mention any substantive governmental "assessment" or "intervention." The tenor of the session illustrated the issues addressed by J. H. Perkins's editorial, "Mercury: Persistence, Pollution, and Politics," which examined economic and political pressures faced by environmental scientists attempting to assess and minimize mercury emissions from coal-fired power plants (Perkins, 2004). Although smokestack emissions far exceed ritualistic mercury releases, they pose only an indirect threat to human health via bioaccumulation in the aquatic food chain, whereas if elemental mercury is sprinkled on the floors of a home, "the apartment or dwelling certainly will become contaminated with mercury [and] subsequent inhabitants will never know they are facing the potential for continuing, potentially serious exposure to mercury" (Greenberg, 1999).

The failure of government to act on this issue is traceable in part to racial, ethnic, and religious factors inherent in ritualistic mercury use and to the absence of community advocacy. Embarrassment over the self-inflicted nature of the mercury contamination accounts in some measure for such absence. This combination of fear, embarrassment, and lack of community advocacy is well illustrated in Paul's article, "Mercury Rising" (2003), which additionally shows how anthropologists, environmental scientists, and physicians have allowed political pressures to influence their professional judgment. One anthropologist interviewed suggests that because remediation of mercury-contaminated dwellings is expensive, will lead to evacuations, and so will anger both the evacuated tenants and their landlords, "you have eventually solved nothing"; further, it intimates that the status quo of domestic mercury exposure be allowed to continue. A physician quoted as stating, "We may be dealing with tons of mercury going into the air, and here we are talking about ounces going into the environment through ritualistic use," ignores the fact that a small amount of mercury in a dwelling can result in dangerously high vapor concentrations. The same erroneous correlation of gross environmental pollution with individual health threat is to

be seen in the suggestion by an environmental health advocate that “a focus on ritualistic [mercury] use is a diversion from much larger sources of contamination . . . [such as from] coal-burning power plants and medical incinerators” (Paul, 2003).

A good example of how academics and medical professionals have elided and glossed over this issue can be seen in a major edited work on Latino health. Although the editors (Aguirre-Molina, Molina, and Zambrana, 2001) and chapter authors (e.g., Zambrana and Flores, 2001) were well aware of the magico-religious uses of mercury and had been provided with extensive documentation on the subject, their section on environmental health entirely omitted mention of the contamination of dwellings from ritualistic mercury use. Their sole reference to mercury exposure in the Latino community was that “[s]hops called *botánicas* . . . sell metallic mercury (*azogue*) as an ethno medical remedy” (Wendroff, 1990), this despite the facts that the reference they cited (1) bore the title “Domestic Mercury Pollution,” (2) made no mention whatsoever of mercury as an “ethno-medical remedy,” (3) repeatedly emphasized the hazards of maternal-fetal and pediatric mercury vapor exposure, and (4) ended with a suggestion that clinical, environmental, and sociological research into these exposures was “required to develop an effective health-education programme for *botánica* owners and their clients” (Wendroff, 1990).

The president of the Latin American Foundation for Environmental Protection in Miramar, Florida, stated that he “tried to reach the politicians to get a better grant for research, [as] its [ritual mercury contamination] a very serious issue. The reason I believe politicians don’t want to do anything about it is because the religious beliefs are too strong for politicians to get involved. My personal opinion is that they don’t want to touch that issue” (LaPeter and De La Garza, 2004). A spokeswoman for the Miami-Dade County Health Department echoed these sentiments: “We can talk about the health issues of mercury in general. . . . But when it’s something related to religion in rituals, it’s not something we deal with” (Fleshler, 2004). In 1993, 31 of 78 *botánicas* surveyed in Puerto Rico were found to be selling mercury (Nunez-Molina, 1993). The USEPA Region 2 and the Puerto Rican Ministry of Health have repeatedly been requested to investigate the environmental health impact of ritualistic mercury use in Puerto Rico, but they have failed to do so. A government-sponsored study in French Guiana found high hair mercury levels in ethnically Haitian women and children, “likely resulting from the use of mercury for religious rituals” (Cordier et al.,

1998), but no follow-up research was conducted to prove or disprove this hypothesis.

A further example of governmental ambivalence on this issue is the statement by the US Agency for Toxic Substances and Disease Registry (cited earlier) proclaiming “an urgent need” to determine levels of adult and child exposure to ritualistic mercury and recognizing that research on “a variety of exposure scenarios” is needed. Yet despite the proclaimed urgency of need, to date there has been no serious government-sponsored research to measure air mercury vapor levels inside living quarters in communities likely to be contaminated by ritualistic mercury use. At the recent USEPA-sponsored symposium, “Mercury: Medical and Public Health Issues,” a senior ATSDR science advisor only briefly discussed “ethnic and folk uses of mercury” (Risher and Amler, 2004). Over the past 15 years, many government environmental health professionals have privately expressed their reservations about government’s ability to substantively address this racially divisive, politically and fiscally explosive issue until there is significant demand for such intervention from the Caribbean and Latino communities themselves.

Recommendations

Sooner or later, government agencies and the environmental profession will have to respond forcefully to this looming environmental health disaster. At present, their denial that there is a serious problem has resulted in a lack of both conceptual and logistical infrastructure to deal with the need to assess very large numbers of homes for mercury contamination and even larger numbers of individuals for mercury exposure and absorption.

For the problem of ritualistic mercury contamination to be taken seriously by both the public health and the environmental health communities, *botánica* mercury sales must be correlated with domestic mercury contamination, with elevated body-mercury burden, and, ultimately, with pathology. There should be little technical difficulty in carrying out such research, but it is clear that without advocacy on the part of the affected communities, government will not allocate resources to gather the necessary data. Therefore, advocacy is the first requirement for conducting the necessary research. Advocacy will, in turn, come about only when the members of the Caribbean and Latino communities, especially community leaders, are, by a program of education, made fully aware of the health threat posed

to their infants, their children, and themselves by the use of ritualistic mercury in their homes.

To date, the standard biomarker of elemental mercury exposure has been the urine mercury level (Goldman and Shannon, 2001). As already noted, however, the validity of this measure for the low levels of mercury vapor likely to be the norm in contaminated dwellings ($<10 \mu\text{g}/\text{m}^3$) has recently been called into doubt (Tsuji et al., 2003). One possible response to this is to separate screening for mercury exposure from screening for mercury absorption. Total mercury levels in unwashed hair include mercury absorbed into the blood and incorporated into the hair structure and adsorbed mercury on the surface of the hair, which is indicative of ambient mercury exposure. Automated instrumentation, requiring no wet chemistry, can analyze hair samples for mercury content accurately, rapidly, and economically (Cizdziel, Hinnners, and Heithmar, 2002). Individuals with elevated hair mercury levels would then be further examined for signs and symptoms of mercury absorption and their dwellings screened for elevated levels of mercury vapor.

It is likely that a convincing demonstration that ritualistic mercury use has contaminated large numbers of homes will precipitate a demand for assessment and remediation that can only be met by government action. Accurate real-time assessment of mercury vapor levels below the $1 \mu\text{g}/\text{m}^3$ range will require large numbers of portable atomic absorption spectrometers (Garetano, 2004). Large numbers of such instruments will be needed in a mercury emergency, along with trained operators (Illinois Attorney General, 2000). Their lack is certain to be a major constraint in both assessment and remediation efforts. Public health and environmental health agencies should be acquiring them now.

When, under a functioning government program of assessment and remediation, dwellings are found to be contaminated with mercury vapor levels above $1 \mu\text{g}/\text{m}^3$, until remediation can be initiated it should be possible to postpone evacuation of occupants by the provision of some form of mercury-vapor filtration system. At least one manufacturer has developed such a filter for domestic use, which it claims is able to “remove mercury vapor from a 10ft² room, with carpeting in approximately 4 hours” (Siperstein, 2004). Such filters need to be further developed, tested, certified, and stockpiled. Their availability would greatly reduce the need for the evacuation of large numbers of dwellings, which in any event would likely prove impracticable, given the numbers of people involved and

the difficulty bound to be encountered in finding alternative accommodations for them.

The unhappy public health consequences of past violations of the Precautionary Principle should alone be sufficient to induce government to delay no longer in confronting the substantial threat to health posed by the ritualistic use of mercury in the home. Common prudence requires that, in concert with the public health and the environmental health communities, it act now.

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