



Survey Research Center
UNIVERSITY OF CALIFORNIA, BERKELEY

*“Setting the Standard for Data Collection
to Support Research and Evaluation”*

Survey of the Use of Ozone-generating Air Cleaners by the California Public

Chairman's Seminar, California Air Resources Board

By Robert H. Lee
Director of Survey Operations
Survey Research Center
University of California at Berkeley
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Background

- Air cleaners that emit ozone, purposely or as a by-product, are aggressively marketed.
- Ozone can cause chest pain, coughing, shortness of breath, throat irritation, and exacerbates asthma and can cause permanent lung damage.
- Vulnerable populations are most at risk from the effects of ozone.

Some Models That Emit Ozone by Design



Some New Models...



Desktop



Shoe & wardrobe



Ozone optical mouse



Used inside vehicles



Purpose of Study

- Determine the prevalence of ownership of ozone-generating air cleaners among Californians.
- Identify reasons for their purchase.
- Determine the frequency and duration of use.
- Obtain information needed to assess their impact on public health.

Methods

- A telephone survey was conducted with 2,019 households throughout California using a list-assisted Random Digit Dialing (RDD) sample.
- English-speaking adult residents with fixed-line telephones were eligible to act as the survey respondent.
- If an air cleaner was owned, a full suite of questions was asked of respondents who owned air cleaners.

Quality Assurance & Quality Control

- Pre-tested the questionnaire
- Data collection and management
 - Computer Assisted Telephone Interviewing (CATI) – program guides interviewer; reduces interviewer error by prompting, and automatic data entry; checks to assure valid codes; handles question skipping
- Extensive interviewer training
- Interviewer monitoring by supervisors
 - 10 – 20% of surveys monitored

Overview of Results

- 14% of California households own an indoor air cleaner or used one in the last 5 years.
- 8% of California households own air cleaner that may produce ozone as a by-product.
- 2% of California households own air cleaner that produces ozone intentionally (by design).
- About 282,000 California households (about 828,000 individuals) at risk of exposure to elevated ozone levels.
- 45% of households at risk have children.

Overview of Results

(continued)

- About half of owners purchased air cleaners because of allergies or asthma in the home.
- Vast majority (77%) use it year-round.
- Most use their air cleaner continuously.
- 72% of purposeful ozone-generating air cleaners are used continuously **and** every day.
- A significant minority (29%) no longer use their air cleaner.
- Both ethnicity and income were related to ownership.

Outcome of Sample

Sample Components	N	% of Total Sample	% of Eligible Numbers	% of Completed Interviews
Total Telephone Numbers	12,008	100.0%		
Ineligible Numbers	2,625	21.9%		
Eligible Households	9,383	78.1%	100%	
<i>Households confirmed, but non-response</i>	7,364	61.3%	78.5%	
<i>Households with Air Cleaners</i>	284	2.4%	3.0%	14.1%
<i>Households without Air Cleaners</i>	1,735	14.4%	18.5%	85.9%
Total households that completed interviews	2,019	16.8%	21.5%	100.0%

Prevalence of Ownership

- About one in seven (14.1%) households report ownership of a portable indoor air cleaner.
- 10% own one that may produce ozone.
 - 2% own an air cleaner that emits ozone by design (intentionally),
 - 8% own one that may emit ozone as a by-product.

Confidence of Prevalence Data

Type of Air Cleaner	Estimated Percentage	Standard Error *	95% Confidence Interval (Lower)**	95% Confidence Interval (Upper)**
Emits Ozone by Design	2.28	0.33	1.63	2.93
By-Product	7.83	0.60	6.65	9.00
Non-ozone Filter	2.53	0.35	1.84	3.21
Unclassifiable	1.44	0.26	0.92	1.96
Total with Air Cleaner	14.07	0.77	12.55	15.58
No Air Cleaner	85.93	0.77	84.42	87.45
Total %	100.0%			
Total N	2,019			

Standard error of a binomial for a simple random sample = square root ((Percent)(100-Percent) +/- (n-1))

**Confidence interval = Percent +/- 1.96 * (Standard Error)

Air Cleaner Brands Owned in California

Percent	N	Brand Name
34.1	128	Sharper Image
11.2	42	EcoQuest
9.3	35	Honeywell
4.8	18	Bonaire
4.3	16	Oreck
3.5	13	Holmes
2.4	9	Hunter
2.4	9	Kenmore
1.9	7	Alpine Air
1.9	7	Hamilton Beach
17.1	64	Others
7.1	34	Not ascertained

Number of Persons Affected

- 2.28% of California households own air cleaners that generate ozone by design.
- California Department of Finance estimates (2006) the average California household contains 2.936 persons.
- There are about 12,367,468 households in California.
- Therefore, about 282,000 California households own an ozone-generating air cleaner by design, potentially exposing about 828,000 persons to substantially elevated and harmful levels of ozone in their homes.

Number of Affected Persons Could Be Higher

- Some by-product devices can produce unhealthy levels of ozone as well.
- Households with higher incomes are more likely to own ozone-generating air cleaners, regardless of type, but are slightly under-represented in the survey sample.

Number of Air Cleaners Households Own

Number of Air Cleaners Owned	Any Air Cleaner	Emits Ozone By Design	Emits Ozone as By-Product
One	68%	72%	60%
Two	19%	17%	22%
Three	8%	7%	13%
More than three	4%	4%	5%
<i>Owens two or more</i>	<i>31%</i>	<i>28%</i>	<i>40%</i>
Total %	100%	100%	100%
Total N in group	284	46	158

**Percentages may not add to 100% due to rounding*

Special Features May Increase Ozone Emissions

- Added features on air cleaners may increase (or decrease) the production of ozone emissions.
- 36% of respondents with one air cleaner, and 30% of respondents who own two air cleaners, report added features.

Most Common Special Features

Special Feature	Air Cleaner 1	Air Cleaner 2
Ozone Boost	58%	56%
Ozone Filter	38%	36%
UV Light	35%	35%
Power or Fan Boost	29%	32%
Germicidal Button	23%	16%
Other Feature	18%	12%
Total N in group	80	25

** Due to multiple mentions, percentages add to more than 100%.*

Where Air Cleaners Are Used (Air Cleaner 1)

Room	Any Type	Emits Ozone by Design	Emits Ozone as By-Product
Master Bedroom	40%	20%	43%
Living Room	27%	28%	28%
Someplace Else	11%	20%	10%
Children's Room	9%	4%	8%
Family Room	6%	11%	6%
Office	4%	7%	3%
Kitchen	2%	11%	1%
Bathroom	1%	0%	2%
Total %	100%	100%	100%
Total N in group	284	46	158

**Percentages may not add to 100% due to rounding*

Air Cleaner Purchases

- At least two out of three air cleaners were purchased since 2003.
- Half (53%) of all air cleaners were purchased for \$200 or less.
- But, 73% of owners of ozone-generators spent more than \$200: 35% of these owners spent more than \$600 for their device.

Year Air Cleaner Was Purchased (Air Cleaner 1)

Year of Purchase	Any Type	Emits Ozone by Design	Emits Ozone as By-Product
1990 or earlier	3%	0%	1%
1991 – 1995	3%	0%	1%
1996 - 2000	12%	11%	11%
2001 or 2002	17%	22%	16%
2003 or 2004	39%	51%	39%
2005 – June 2006	26%	16%	32%
Total %	100%	100%	100%
Total N in group	279	45	154

** Percentages may not add to 100% due to rounding*

Purchase Price of Air Cleaners (Air Cleaner 1)

Cost of Air Cleaner	Any Type	Emits Ozone by Design	Emits Ozone as By-Product
Less than \$100	26%	14%	23%
\$100 - \$200	27%	14%	23%
\$201 - \$400	28%	22%	38%
\$401 - \$600	9%	16%	11%
Or over \$600	10%	35%	4%
Total %	100%	100%	100%
Total N in group	246	37	138

** Percentages may not add to 100% due to rounding*

Reasons for Air Cleaner Purchase (Air Cleaner 1)

Reason	Any	Emits Ozone by Design	Emits Ozone as By-Product
Allergies/Asthma	50%	50%	50%
Remove Dust	36%	41%	34%
Indoor Air Concern	36%	37%	32%
Pet Dander	17%	19%	24%
Mold/Bacteria	13%	15%	17%
Tobacco Smoke	10%	8%	4%
Chem. Contam.	10%	11%	14%
Protect Children	7%	7%	5%
Total in Group	283	203	76

** Due to multiple mentions, percentages add to more than 100%.*

Frequency and Duration of Use

- Length of exposure to ozone emissions can have an impact on health.
- Most air cleaner owners use their devices year-round, regardless of season.
- They also tend to use them every day.
- Most never turn them off.

Year-round or Seasonal Use (Air Cleaner 1)

Reason	Any Type	Emits Ozone by Design	Emits Ozone as By-Product
Use Year-round	77%	80%	80%
Use in Certain Seasons	23%	20%	20%
Total %	100%	100%	100%
Total N in Group	282	46	158

Days Per Week Used (Air Cleaner 1)

Days Per Week Used	Any Type	Emits Ozone by Design	Emits Ozone as By-Product
< 1 Day per week	4%	4%	3%
1-2 Days	6%	9%	4%
3-4 Days	8%	7%	7%
5-6 Days	4%	4%	5%
Every Day	78%	76%	82%
Total %	100%	100%	100%
Total N in group	278	46	155

Continuous and Everyday Use

- 57% of all primary air cleaners (any type) are used continuously, every day.
- Ozone-generators are used even more: 72% are used every day and continuously.
- 64% of air cleaners that may emit ozone as a by-product are used continuously every day.

Current Use Patterns

- For all air cleaners, 70% of owners currently use them, and 29% do not.
- 78% of owners of both “by design” and “by-product” air cleaners currently use their air cleaners.
- 22% of each of those groups no longer use them.

Reasons for Little or No Use*

(for the 29% who no longer use Air Cleaner 1)

Reason	Any Type	Emits Ozone by Design	Emits Ozone as By-Product
No longer need it	58%	45%	51%
Doesn't work	20%	18%	19%
Too noisy	12%	18%	11%
Expensive	6%	18%	5%
Emits odor	5%	9%	5%
Made household members not feel well	3%	9%	3%
Total N in Group	88	11	37

** Due to multiple responses, percentages add to more than 100%.*

Household Composition

- 58% of households, with air cleaners that generate ozone by design, have two adults.
- 45% of households, with air cleaners that generate ozone by design, have children.
- 30% of households, with air cleaners that may emit ozone as a by-product, have children.

Income Distribution

Annual Income	All Respondent Households	Households with Any Air Cleaner	Emits Ozone by Design	Emits Ozone as By-product	CA Population: English Speakers, w/ Telephones*
<\$35K	29%	13%	8%	12%	30%
\$35K - \$50K	16%	16%	17%	17%	14%
\$50K - \$75K	18%	18%	11%	19%	19%
\$75K - \$100K	15%	18%	25%	14%	13%
\$100K - \$150K	12%	18%	17%	19%	13%
\$150K or More	10%	17%	22%	18%	11%
Total %	100%	100%	100%	100%	100%
Total N	1,534	223	36	126	10,484,933

* Data comes from the 2000 Census

Ethnicity

Ethnicity of Respondent	All Respondent Households	Households with Any Air Cleaner	Emits Ozone By Design	May Emit Ozone as By-Product	CA Population: English Speakers, w/ Telephones*
White	59%	74%	74%	74%	52%
Black	6%	2%	0%	2%	8%
Latino	22%	8%	9%	8%	27%
Asian, Filipino, Pacific Islander	6%	7%	77%	8%	11%
Other Mixed	7%	9%	9%	8%	2%
Total %	100%	100%	100%	100%	100%
Total in Group	1,870	266	43	152	28,763,669

* Data comes from the 2000 Census

Relationship of Race and Income to Air Cleaner Ownership

Income Group	Black or Latino N	% of These Households w/ Air Cleaner	White & Other N	% of These Households w/ Air Cleaner	Total Both Groups N	% of These Households w/ Air Cleaner
Under \$35,000	212	1%	218	11%	430	7%
\$35,000 - \$50,000	89	4%	147	20%	236	14%
\$50,000 - \$75,000	57	11%	207	16%	264	15%
\$75,000 - \$100,000	47	6%	179	21%	226	18%
\$100,000 - \$150,000	27	19%	160	21%	187	21%
\$150,000 or more	7	14%	138	24%	145	23%
Total	439	5%	1,049	18%	1,488	14%

Awareness That Their Air Cleaner Emits Ozone

- 73% of owners of air cleaners that emit ozone by design know this.
- Only 21% of owners of air cleaners that may emit ozone as a by-product have such knowledge.

Summary and Conclusions

(Methods and Purpose)

- Telephone survey
- Randomly selected representative sample of 2,019 California households
- Determine the proportion of households that own various types of air cleaners, especially purposeful ozone generators
- Determine reasons for purchase, use patterns, other information

Summary and Conclusions (Prevalence)

- 2% of California households own air cleaners that generate ozone by design.
- 8% of California households own air cleaners that can generate ozone as a by-product of their function
- 828,000 persons in 282,000 households may be exposed to elevated ozone levels (from purposeful ozone generators).
- Actual number of persons may be higher because some by-product units also emit ozone.
- 45% of homes with purposeful ozone generators have children

Summary and Conclusions

(Ownership Characteristics)

- Household income and ethnicity are significant predictors of air cleaner ownership.
- Proportionally, households with higher incomes are more likely to own an air cleaner.
- Those with the highest incomes were slightly under-represented in this study.
- Whites / Caucasians are more likely to own an air cleaner.

Summary and Conclusions

(Reasons for purchase; use patterns)

- The most commonly reported reason for air cleaner purchase is the presence of asthma or allergies in the home.
- Owners of air cleaners tend to use these devices a great deal.
- Owners of ozone-generating air cleaners by design use them even more frequently.
- Most owners run them throughout the year, regardless of season, and run them more or less continuously.

Summary and Conclusions: A Challenge

- 81% of owners ozone-generating air cleaners by design and 71% of owners of by-product air cleaners, believe indoor air quality has improved, even though they know ozone is a pollutant.
- *Challenge:* How to inform (potential) owners about health risks of ozone-generating air cleaner devices when they believe indoor air quality was improved?
- Owners need to be informed it is not the ozone that cleans the air, but it is the other features that do (e.g. particle filter, ionizer or electrostatic precipitator).

Recommendations

- After ARB adopts its future regulation for ozone emissions, further study is recommended to measure the change in ownership patterns, particularly regarding the prevalence of ozone-generators.
- Because most owners of ozone-generating air cleaners run them nearly all the time, and are at greater risk for health impacts, the ARB is encouraged more than ever to regulate ozone emissions.
- The reported high levels of usage of ozone generators should be kept in mind as ARB develops their new regulation.

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