EQUAL OPPORTUNITY, UNEQUAL RESULTS
Determinants of Household Recycling Intensity

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ABSTRACT: This study examined the underlying factors that influence household recycling intensity when program conditions (curbside collection) are standardized. A mail-back survey was used to obtain information on public solid waste diversion behaviors, motivations, policy perceptions, and environmental attitudes of 673 households in four communities within the Greater Toronto Area (GTA). Analysis revealed several salient factors that distinguish active recyclers from those with lower levels of material recovery, including individual motivations for recycling, attitudes toward the solid waste problem and strategies to address it, the range of other waste diversion actions adopted, and certain environmental attitudes. The findings suggest potential social marketing and program changes to stimulate household recycling, improvement integral for progress toward promulgated provincial and state solid waste diversion goals.

Over the past decade, solid waste management has emerged from the periphery to become a salient environmental issue in most jurisdictions

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across North America. Americans and Canadians share the dubious distinction of being the largest per capita generators of municipal solid waste (Bartkiw, 1991).[1] The tremendous difficulties associated with acquiring adequate landfill disposal capacity in many regions of North America and a commitment to more sustainable patterns of resource consumption have resulted in a substantial shift in solid waste management policy. The "out of sight, out of mind" disposal mindset, which had become the norm in the decades following the conclusion of the World War II, has been supplanted by the re-emergence of a more traditional waste management hierarchy: reduce-reuse-recycle-energy recovery and finally land-based disposal. Research by Macdonald and Vopni (1994) indicated the majority of jurisdictions have shown a primary reliance on post-consumer recycling, relative to other policy initiatives, to achieve the promulgated waste diversion targets (25% to 50% by the year 2000 in most provinces and states).

The province of Ontario has been at the forefront of the recycling movement in North America, and in 1989 the province's residential recycling system earned a United Nations award recognizing significant multi-sector cooperation in the field of environmental protection. Since 1987, more than 3.4 million Ontario households (approximately 85% of single family dwellings) in 594 municipalities have been provided access to curbside recycling (Ontario Multi-Material Recycling Incorporated, 1995).

The ability of residential recycling programs to recover successfully all potentially recyclable materials from the waste stream is a function of the participation rate and individual household recycling intensity.[2] Despite very positive cumulative participation rates in Ontario's curbside recycling programs (85% to 90% in most communities), research has confirmed significant variations in the level of recycling among participants. Poole (1992) found that the most active 50% of curbside recyclers contributed approximately 80% of the total amount of materials recovered (by weight). The meager contribution of the least active 50% of participants illustrated the potential for increasing recycling intensity in a large proportion of households.

In order to increase overall recycling intensity, it is necessary to understand better the reasons why a high degree of variability persists in households with equal access to convenient curbside recycling. By determining variables that reliably differentiate less thorough recyclers, research could assist waste diversion planners to define important market segments in the public, tailor social marketing campaigns for maximum effectiveness, and evaluate the potential effectiveness of quantity-based pricing for garbage collection (Geller, 1989).

Although few behavioral studies have concentrated solely on the differences in household recycling intensity or even recycling frequency (Gamba &

Oskamp, 1994; and McGuire, 1984 are exceptions), it is believed the extant literature concerned with differentiating recyclers from nonrecyclers will proffer insights into the variability of household recycling intensity. The current research also differs from previous studies in that it was conducted in communities where curbside recycling had been operational for 10 years, rather than in communities with incipient programs to which segments of the public may still have been in the process of adapting. After a decade of exposure to curbside recycling, it was expected that the diffusion of recycling behavior would have reached its fullest extent, and the initial learning curve associated with adopting a new behavior pattern would have long ago concluded.

Taking into consideration the differences in the nature of the research question and the situational context in which the research was conducted, it was uncertain whether all of the variables found to be significant in previous studies would pertain to this study. It was anticipated, however, that at least some of the variables would prove significant. Thus, a review of the previous studies on the determinants of the household decision to recycle is warranted.

PREVIOUS RESEARCH ON HOUSEHOLD RECYCLING BEHAVIOR

As a consequence of the public popularity and tremendous growth of recycling in the 1980s and 1990s, researchers from a number of academic disciplines have investigated residential recycling. Pertinent to the current research, a considerable recycling behavior literature has emerged over the past decade. This literature can generally be divided into two categories. The first (interventionist) is composed of studies concerned with manipulations of specific antecedent and/or consequent conditions in an effort to further encourage recycling participation. Porter, Leeming, and Dwyer (1995) provide a thorough review of this behavior-intervention literature.

The second group of studies (correlational) has been concerned with identifying variables that differentiate those who recycle from those who do not, and examining the relationship between the decision to recycle and its determinants. This body of work suggests that the decision to recycle is influenced by a number of factors.

DEMOGRAPHICS

Results of the association between recycling behavior and various sociodemographics have been equivocal. Derksen and Gartrell (1993), Vining and

Ebreo (1990), and Lansana (1992) found a significant positive correlation between recycling participation and the age of the respondent. Other findings are more problematic. Jacobs, Bailey, and Crews (1984) observed positive relationships between recycling and both higher levels of education and family income. Derksen and Gartrell (1993) found a similar positive relationship between recycling participation and higher education levels, though they did not find any correlation with higher income levels. Conversely, Vining and Ebreo (1990) showed an association between recycling and higher income levels but argued that recyclers and nonrecyclers did not differ in terms of education, gender, or household size.

MOTIVATIONS

Several types of possible motivations for recycling have been examined by previous research including environmental concern, personal values of frugality, social influence, commitment to one's community, and tangible financial rewards. Both Simmons and Widmar (1990) and Vining and Ebreo (1990) concluded that recyclers and nonrecyclers differed in terms of their ratings of the most important reasons for recycling. Oskamp et al. (1991) noted that the second most important predictor of recycling behavior in their study was having friends and neighbors who recycled, suggesting that peer influence (pressure or support) is an important consideration in some people's decision to recycle. De Young (1990) found recyclers ranked conservation of natural resources far ahead of monetary rewards. Gamba and Oskamp (1994) found recyclers rated concern for the environment as a more important reason for recycling than either social pressure or financial motives. The same study also determined that infrequent recyclers rated social pressure to be more important for their participation than did frequent recyclers.

PROGRAM KNOWLEDGE

Studies by Lansana (1993), Simmons and Widmar (1990), and Vining and Ebreo (1990) found consistently that a person's knowledge of the local recycling program, particularly where to recycle and what types of materials are eligible, is an important factor influencing recycling participation.

POLICY PERCEPTIONS

Lansana (1992) showed that an individual's perception of certain waste diversion policies was an important predictor of behavior. Specifically, she

found that recyclers perceived a greater need for recycling than nonrecyclers and that they indicated a commitment to further participation if the recycling program were expanded.

ENVIRONMENTAL ATTITUDES

Reviews of the volume of work dedicated to assessing linkages between environmental attitudes and proenvironment behaviors have generally concluded that such relationships are rather tenuous (Gray, 1985; Hines, Hungerford, & Tomera, 1986). With regard to recycling specifically, Vining and Ebreo (1990), Oskamp et al. (1991), and Gamba and Oskamp (1994) found that general proenvironment attitudes failed to discriminate recyclers from nonrecyclers. Derksen and Gartrell (1993) noted that when provided access to a convenient curbside recycling program, even those with relatively low levels of environmental concern will participate.

Although proenvironment attitudes are seemingly ineffective at discriminating recyclers from nonrecyclers, Derksen and Gartrell (1993) posit that strong proenvironment attitudes do enhance a household's recycling effort: "Highly concerned individuals with access to blue boxes recycled more types of items than did other individuals" (p. 429).

RESEARCH DESIGN

RELATIONSHIPS INVESTIGATED

The results of previous related studies suggest that when program conditions are standardized there are five factors or categories of variables that potentially influence household recycling intensity. Based on a review of the extant literature and subsequent consultation with recycling planners from across the Greater Toronto Area (GTA), the following relationships were postulated.

Considering the incongruous findings related to the influence of various sociodemographics on recycling participation, it is difficult to hypothesize which demographic variables might have a significant influence on household recycling intensity. There is, however, evidence to support the idea that the age of the respondent might be positively correlated.

Motivations such as a concern for the environment or the desire to minimize the need for more landfills in the local community were hypothesized to

have a positive influence on recycling participation and intensity. Although social pressure has been shown to be a motivator in highly visible curbside recycling programs, it was hypothesized that individuals who felt obligated or coerced into recycling would not be dedicated to recycling comprehensively. Economic motivation was not expected to be positively correlated with high recycling intensity, as the financial rewards for greater participation under the current flat-fee structure are negligible on an individual household basis.

Knowledge of how to recycle properly and the types of materials eligible for recycling were anticipated to have a positive effect on the quantity of material recycled. Similarly, it was predicted that people who believe solid waste is a significant environmental issue or identify recycling as the best available waste management strategy will be more thorough recyclers. Similarly, it was hypothesized that households expressing a greater commitment to curbside recycling and who currently practice other waste diversion behaviors (composting, using hazardous waste depots, purchasing for source reduction) will be more active recyclers.

Although environmental attitudes have not been shown to be reliable predictors of participation in curbside recycling programs, it is anticipated that those who hold stronger proenvironment views and who pronounce their support for environmental protection would have higher levels of recycling intensity. Intuitively, it was expected that individuals more dedicated to the environment and proud of their environmentally responsible actions would endeavor to "practice what they preach."

SETTING

The research was conducted in four communities (Oakville, Burlington, Georgetown, and Milton) of the Regional Municipality of Halton (Ontario, Canada). Halton Region has a population of approximately 350,000 and comprises the westernmost communities of the GTA (population approximately 4.3 million). "Nowhere in the province of Ontario (and arguably in Canada) are the dimensions of the waste crisis as obvious and challenging as in the Greater Toronto Area" (Ontario Ministry of Environment and Energy, 1991, p. 2), and Halton Region is no exception. From 1975 to 1988, the region was mired in a landfill siting process that forced it to temporarily transport all solid waste to Niagara Falls, New York (1988 through 1992).

Halton Region has established a comprehensive range of residential waste diversion programs, including curbside recycling for all single-family

dwellings, on-site depot recycling for over 90% of multi-unit dwellings, the distribution of approximately 22,500 subsidized backyard composters, seasonal curbside collection of yard wastes for centralized composting, and the operation of a household hazardous waste collection depot.

Mandatory curbside recycling has been operational in Halton Region for a decade, and to encourage participation further, a landfill ban on eligible blue box materials and a maximum household bag limit for weekly garbage pickup have been implemented. As a result, Halton has the highest cumulative recycling participation rate (approximately 90%) of all the regional municipalities in the GTA (Ontario Ministry of Environment and Energy, 1993). The current recycling recovery rate in Halton is 27%. This project represents one of the initiatives to increase recycling recovery rates and ultimately to make further progress toward the overall 50% diversion target.

THE SURVEY

Data collection was accomplished by means of a 104-item questionnaire. The initial survey instrument was developed in accordance with the design principles outlined in Dillman (1978). The survey instrument was subsequently refined following a limited pretest (N = 39) and consultations with Halton's waste diversion planners. The finalized questionnaire was presented in a booklet style with a cover letter endorsed by the Region of Halton that explained the purpose of the study and provided instructions for its completion. The instructions requested the survey to be completed by the individual primarily responsible for recycling in the household and returned in the postage-paid envelope provided.

The survey was distributed to contiguous houses in six areas of Halton Region. The six survey areas were based on recycling collection routes so that the survey data could be correlated with waste/recycling collection data. A sample of potential survey neighborhoods was chosen in conjunction with the region's planning staff in order to reflect the sociodemographic diversity of Halton. The final six survey areas were randomly selected from the list of routes with similar sociodemographic and housing characteristics. Survey distribution took place during the last week of May and the first week of June, 1996, and coincided with the day of waste/recycling collection so respondents could immediately recall their waste diversion practices. Of the 2,500 questionnaires distributed, 673 were returned complete. As no subsequent follow-up procedures were employed to increase participation,[3] a response rate of 27% for the mail-back survey was deemed acceptable.

PROFILE OF PARTICIPANTS

Overall, the sample profile reflected the population characteristics of the Region of Halton fairly well. Both genders were well represented (females = 52%, males = 48%). The average household size was 3.2, which was slightly higher than the 1991 census average for the region (2.9). The majority of respondents (75%) had lived in Halton for more than 5 years, indicating that most households had several years of experience with the local program. The average age of respondents was 47, with all age categories being well represented except for those under 29. This group was underrepresented as proportionately fewer own or rent the single-family dwellings that comprised the survey neighborhoods. Halton Region has the highest proportion of individuals (30%) employed in the finance, insurance, and real estate sectors of all the regions in the GTA, and according to the 1991 Canadian Census, the average family income in Halton was $69,668 (Canadian dollars). The majority of the survey sample (65%) also had household incomes above $60,000. The greatest difference between the sample profile and the population of Halton was the proportion that had some university education (55% and 28%, respectively).

RESULTS

RECYCLING BEHAVIORS

Respondents were asked whether they participated in curbside recycling and how consistently they recycled each of the 12 eligible materials:

- always—this material is never disposed of in the garbage;
- regularly—this material is usually recycled, but occasionally is thrown in the garbage;
- only sometimes—the recycling of this material is sporadic, but it is recycled on occasion; and
- never—this material is always disposed of in the garbage.

An overwhelming majority (99%) stated they participated in the blue box program to some extent. Slightly less than half (46%) of the respondents recycled all 12 eligible materials. As Table 1 illustrates, there was a high degree of variability in the proportion of households recycling each type of material and the consistency with which they did so. This finding is consistent with the results of Poole (1992) and Lake, Bateman, and Parfitt (1996).

TABLE 1
Participation Rate and Recovery Intensity for Eligible Blue Box Materials (*N* = 673)

Material Type	*Participation Rate (in percentages)*	*Cumulative Intensity (4 = 100%)*
Newspapers/flyers	99	3.88
Glass bottles and jars	99	3.81
Metal food and beverage containers	98	3.72
Corrugated cardboard	97	3.65
Telephone books	96	3.69
Magazines, catalogs, and books	95	3.56
Boxboard	91	3.39
PET plastic containers	90	3.49
HDP plastic bottles and containers	85	3.17
Fine paper	84	2.98
Polystyrene	63	2.39
Aluminum foil and trays	62	2.32

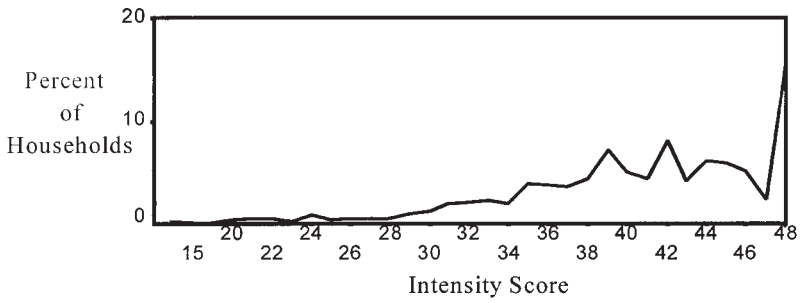

Figure 1: Household Recycling Intensity Scores

A cumulative intensity score of each household's recycling was calculated by summing responses to how consistently each of the 12 eligible materials were recycled. Respondents who indicated that they always recycled all 12 eligible materials achieved a perfect score of 48 (i.e., 12 materials × 4 "always"), while those who did not recycle any of the materials received a score of 12 (i.e., 12 materials × 1 "never"). The average recycling intensity score was 40.2, and 16% of the respondents claimed to have a perfect score (i.e., a 100% recovery rate). Figure 1 provides the distribution of scores for all respondents.

One caveat about self-reported behaviors should be noted. Self-reports for socially desirable behaviors such as recycling have been found to be overstated (Barker, Fong, Grossman, Quin, & Reid, 1994). Gamba and Oskamp (1994) found the proportion of individuals who professed to recycle was overstated by only 3% when compared with observations of the same households over a 2-month period. It is assumed that a similar constant degree of overstatement will occur among the respondents of this study.

Although unobtrusive observation of actual recycling practices overcomes the bias associated with self-reported behavior, the limitations of this methodological approach are even more problematic. Observation of blue box contents can provide information on what types of materials are being recycled but it cannot estimate the relative consistency with which a household recycles each type of material because the observer cannot determine the contents of the household's garbage container. Observed set-out frequency should not be used to classify active and less active recyclers because many municipalities request residents to put out their blue box only when it is full so as to minimize the number of collection stops. Thus, a household that fills its blue box every 2 weeks and follows the correct procedure would have only half the set-out frequency as a household that generates the same volume of material but does not follow the correct procedure and puts out a half-full blue box each week. Also, the observation of set-out patterns cannot account for household size nor consumption patterns (i.e., a daily newspaper subscription or a high volume of plastic two-liter soft drink containers).

RECYCLING MOTIVATIONS

A diverse list of 10 possible motivations for recycling were provided in the survey, and respondents were asked to rate which was the most important for them. Overall, general environmental concern (conserving natural resources or minimizing the impact of extracting raw materials) was the principal motivation for 40% of the respondents. The second most prominent reason for recycling (33%) was the community-oriented motive of saving landfill space, minimizing the need to construct more landfills, and to lessen local aesthetic and pollution impacts associated with landfills. Economic considerations (reducing collection and disposal costs) and social pressure were the next most frequent responses (8% and 6%, respectively).

PROGRAM KNOWLEDGE

Program knowledge was determined by asking respondents whether they had read the region's annual Waste Management Calendar. The calendar

provides information on several waste diversion programs including what materials are currently collected in the recycling program, the proper recycling and composting techniques, and when special collections (oversize and hazardous) occur. The 75% who indicated that they had read the information contained in the calendar were generally more knowledgeable of current recycling programs than those who had not. For example, analysis indicated that those who had read the waste calendar recycled a significantly greater number of materials ($M = 10.8$, $SD = 1.72$) than those who had not ($M = 10.0$, $SD = 2.07$; $t = 3.46$, $df = 258$, $p < .01$).

ATTITUDES TOWARD SOLID WASTE MANAGEMENT ISSUES AND POLICY DIRECTIONS

Respondents' opinions on several solid waste management issues were measured on a 5-point Likert-type scale (1 = strongly agree, 5 = strongly disagree). A large majority (91%) agreed or strongly agreed that solid waste is a serious environmental issue. Only 65%, however, indicated that they thought garbage was a resource that needed to be carefully exploited (to recover valuable materials through recycling or energy through incineration) before disposal. Thus, it appeared many individuals believe solid waste is an important environmental issue because of the aesthetic and pollution problems associated with landfill operations, not because of the upstream environmental impacts associated with the concentrated material resources entombed within landfills.

When asked if it was their "right" to throw out as much garbage as they wanted, respondents for the most part (70%) disagreed or strongly disagreed. When respondents were asked whether "everyone has a social responsibility to recycle," 92% agreed or strongly agreed. Also, 92% responded positively to the question, "Do you expect your friends and neighbors to recycle?" This suggests that most of the public expects friends and neighbors to make a reasonable effort to recycle and minimize the amount of garbage they put on the curb each week.

The survey also sought opinions on solid waste management policies. Respondents were asked whether they thought Canada's goal to divert 50% of its waste from landfills by the year 2000 was an acceptable target, and a large majority (79%) agreed. Most (77%) also agreed or strongly agreed with the statement "Recycling is the most important thing we can do to reduce our garbage problems." These sentiments indicate strong public support for waste diversion as a policy strategy and perhaps an overemphasis on recycling relative to the higher order "Rs"—reduce and reuse.

RECYCLING COMMITMENT

Commitment to recycling was measured by three items. The first question asked respondents if they thought "blue box recycling costs taxpayers too much and should be canceled." The curbside blue box program is highly popular, and 81% disagreed or strongly disagreed that it should be cut by government. The second question inquired whether respondents would like to see the blue box program expanded to include additional materials: A strong majority (76%) supported expansion. The final item examined the behavioral intentions of the respondents if the curbside recycling program were to be canceled and replaced by a system of neighborhood drop-off depots. Almost one half (48%) of the respondents stated they would recycle less if such a program change took place. This finding reinforces the conclusion of Vining, Linn, and Burdge (1992), Derksen and Gartrell (1993), and Guagnano, Stern, and Dietz (1995) that the situational context (essentially the convenience of the program) is critical for recycling participation. Those who stated they would maintain their present level of recycling were also significantly more supportive of expanding the number of materials to the existing curbside program (82% versus 68%, $\chi^2 = 12.14$, $df = 1$, $p < .001$).

OTHER WASTE DIVERSION BEHAVIORS

In addition to each household's recycling habits, respondents were asked about their other waste diversion practices. The level of participation in all but one of the other diversion behaviors was substantially lower than in the curbside recycling program. Donating used clothing, furnishings, and toys to charities was the most widely practiced other waste diversion behavior (97%) and the only other behavior with participation levels close to that of curbside recycling. The second most common (78%) waste diversion practice was *grass-cycling* or mulching grass cuttings to decompose on the lawn rather than collecting and bagging them for landfill disposal. The region's household hazardous waste depot had been used at least once (but not necessarily regularly) by 69% of the respondents.

The majority of respondents also stated they were making a conscious effort to purchase fewer disposable products and avoiding excess packaging (66% and 60% respectively). A similar proportion (61%) of the respondents stated they maintained a backyard compost pile for their biodegradable kitchen and yard wastes. Only 8% of the respondents had posted a "no flyers" or "no junk-mail" notice near their mailbox or front door. Comments made by respondents suggest that this low participation rate can be attributed in part to the confusion that exists about the homeowner's right to refuse such

advertising and the frustration of many who had posted such a notice only to have it repeatedly ignored.

The seven waste diversion actions were combined into a single waste diversion behavior scale for subsequent analysis. Each respondent received a score ranging from 0 to 7, depending on the number of additional waste diversion actions they practiced.

GENERAL ENVIRONMENTAL ATTITUDES

Several earlier investigations of recycling behaviors used only a single item to measure an individual's environmental attitude. The current research combined attitudinal items from several widely cited scales used previously to examine public attitudes toward natural resources and the environment, including (a) the Dominant Social Paradigm (Dunlap & Van Liere, 1984), (b) the New Environmental Paradigm (Dunlap & Van Liere, 1978; Milbrath, 1984), (c) the Alternative Environmental Paradigm (Cotgrove, 1982).

This strategy of combining scale items was previously employed by Blaikie (1992) to compose what he termed an *Ecological Worldview* scale. The items derived from the aforementioned studies examine public perspectives on technology, unlimited economic growth, political ideology, inter- and intra-generational equity, the relationship of humanity to other species, and general valuations of natural resources and the environment. This composite scale provided a more detailed and reliable measure of each respondent's general environmental attitude and their perception of the necessity for societal change commensurate with the concept of sustainable development.[4]

Responses to each of the statements were measured on a 5-point Likert-type scale (1 = *strongly agree*, 5 = *strongly disagree*). The results of principal components factor analysis (varimax rotation) produced three dimensions with eigenvalues of greater than 1.0. These three dimensions accounted for 49% of the variance (see Table 2). The three factors that emerged were composed of 11 items with factor loadings of at least .40 and each exclusively contained items that either supported what is considered the dominant social paradigm in capitalist industrial nations (DSP—as defined by Dunlap & Van Liere, 1984) or the position represented by the concept of sustainable development.

The components of the DSP separated into two factors. The first (DSP-1) was composed of support for individual private property rights at the expense of future generations, support for the use of natural resources for the primary benefit of present generations, and the domination of nature by humans. The second (DSP-2) was composed of what might be considered more commonly held components of the DSP: support for laissez-faire government, faith in

TABLE 2
Factor Loadings of Environmental Attitudes

Item	*Factor I* *SSD*	*Factor II* *DSP-1*	*Factor III* *DSP-2*
Want to have more say in government decision making	.684		
Cannot rely on science and technology to solve society's problems	.683		
Conservation needs to become more important to Canadian culture	.655		
Solving environmental problems will require significant lifestyle change	.618		
Property owners have the right to use their land as they see fit, even if it becomes unfit for use by future generations		.721	
There is no need to conserve natural resources because they will not be exhausted in my lifetime		.645	
Plants and animals exist primarily for human use		.644	
Economic growth improves the quality of life for all Canadians			.761
Technology will solve our environmental problems in the next 25 years			.695
Economic growth is more important than protecting the environment			.533
Government regulation of business does more harm than good			.425
Eigenvalues	3.27	1.32	1.07
Percentage of variance (total = 49.2%)	27.2	12.0	10.0
Cronbach's alpha	.61	.63	.53

economic growth and its priority over environmental protection, and faith in science and technology to solve society's problems.

The remainder of the items (the desire to have more say in government decision making on the environment, a questioning of science and technology, support for greater resource conservation, and the belief that less resource-intensive lifestyles are needed if environmental problems are to be solved) loaded on a single dimension labeled SSD (Strong Sustainable Development). Cronbach's alpha for the three factors ranged from .63 to .53, indicating a reasonable degree of internal consistency within each of the three factors.

Opinions on the three factors differed substantially. The cumulative mean for the SSD factor was positive (2.62—where 1 = *strongly agree*, 5 = *strongly*

TABLE 3
Inter-Correlation of Environmental Attitude Factors and the Belief That Pollution Levels Are Exaggerated

Variable	*Factor I SSD*	*Factor II DSP-1*	*Factor III DSP-2*	*Pollution Levels Are Exaggerated*
SSD	—	–.39	–.33	–.40
DSP-1		—	.49	.68
DSP-2			—	.45
Pollution levels are exaggerated				—

$p < .001$

disagree), whereas the mean for both DSP factors was negative (DSP-1 = 4.41, DSP-2 = 3.23). This would suggest overall support for the SSD dimension, a slight general disagreement with the DSP-1 dimension and strong public disagreement with the beliefs contained within DSP-2.

To further test the strength of the relationship between the three factors and environmental concern, all were subsequently examined for correlation with the statement: "The true amount of pollution is exaggerated by environmentalists" (1 = *strongly agree*, 5 = *strongly disagree*). All 11 of the items that make up the three factors were significantly correlated with this statement (strength ranged from –.23 to .36, all $p < .001$). Correlation between the belief that the levels of pollution and environmental degradation are exaggerated and the three factors were divided exactly as expected (see Table 3). The two DSP dimensions were positively correlated (DSP-1 = .68; DSP-2 = .45) with this belief, whereas the SSD dimension was negatively correlated (–.40).

REGRESSION ANALYSIS

As Boldero (1995) pointed out, one of the shortcomings of some previous studies of recycling behavior has been the exclusive use of bivariate correlation statistics to examine relationships between recycling behavior and independent variables. These techniques do not allow the researcher to establish which of the covarying factors are the most reliable predictors of the dependent variable. In order to do so requires the use of multivariate regression techniques (Norusis, 1990). A stepwise multiple regression procedure was used to assess the extent to which the variation in recycling intensity can be explained by an array of independent predictor variables. The beta values of the significant predictor variables have been included in Table 4. Together the six variables were able to account for 26% of the variance in household recycling intensity.

TABLE 4
Multiple Regression Analysis of Recycling Intensity

Predictor Variables	*Beta Values*
Demographics	
Age	.143*
Household size	—
Children (1 = yes)	—
Education (1 to 6)	—
Income (1 to 6)	—
Tenure (1 = ownership)	—
Primary motivation	
Environmental (1 = yes)	—
Community-oriented (reduce the need for landfills) (1 = yes)	—
Social pressure/obligation (1 = yes)	– .227 ***
Economic (1 = yes)	—
Program knowledge	
Use waste calendar (1 = yes)	—
Commitment to recycling	
The blue box costs too much and should be canceled (1 to 5)	—
Like to see more materials added to the blue box program (1 = yes)	—
Will recycle if curbside recycling is replaced by depots (1 = yes)	—
Attitudes toward waste management issues	
Solid waste is serious environmental issue (1 to 5)	—
Garbage is a resource that should be exploited (1 to 5)	—
Recycling is the best strategy to solve the waste problem (1 to 5)	—
Incineration to generate power is better than landfilling (1 to 5)	—
Everyone has a right to throw out as much garbage as they want (1 to 5)	.128*
Everyone has a social responsibility to recycle (1 to 5)	—
Those who generate more garbage should pay more (1 to 5)	—
Canada's goal of 50% diversion by 2000 (1 = too high, 3 = too low)	—
Other waste diversion practices	
Diversion score (0 to 7)	.194**
Proud of my environmentally responsible actions (1 to 5)	– .121*
Environmental attitudes	
SSD (factor score—4 to 20)	—
DSP-1 (factor score—3 to 15)	.178**
DSP-2 (factor score—4 to 20)	—
Multiple R = .51	
R^2 = .26	

NOTE: All items measured with a 1 to 5 Likert-type scale (1 = *strongly agree*, 5 = *strongly disagree*).
*$p < .05$. **$p < .01$. ***$p < .001$.

Age was the only demographic variable that significantly predicted recycling intensity. The hypothesized finding that older respondents were generally more active recyclers was consistent with previous studies. Two

plausible explanations include the greater availability of time to recycle when children are older and the influence of the Depression and wartime material conservation on older generations. For example, Respondent 438 disclosed that his conservation-related values and behaviors were conditioned by his early life experience: "All our conservation habits were inculcated during WW II in England." It was noted that the recycling intensity among those older than 70 years did drop slightly. This can be partially attributed to the physical difficulties that some seniors encountered: "I have arthritis in my hands and arms—I am not going to injure myself for the sake of garbage" (Respondent 633).

Contrary to the stated hypothesis, neither an environmental motivation nor the desire to minimize the need for additional local landfills and attendant impacts were significant positive predictors of recycling intensity. The only motivation to emerge as a significant predictor was social pressure, which as hypothesized, was negatively correlated with household recycling intensity. Social pressure manifests itself in several ways. Although the region's mandatory recycling by-law cannot be enforced in any meaningful way for logistical reasons, several individuals stated they recycled because

- the government demands you do it (Respondent 86),
- because we have been *told* to do it (their emphasis—Respondent 598), and
- it is forced down your throat "do it or else!"! (Respondent 558).

Some felt pressured to conform to the community norm.

- [Recycling] seems the in-thing to do right now (Respondent 292),
- [People] feel they have to because their neighbors put out a blue box (Respondent 463).

Certain individuals were hostile toward the pressure they felt to recycle, arguing that the extent of public recycling today is the result of "environmentalists hav(ing) become too influential" (Respondent 172) and "Brainwashing" (Respondent 599).

Although program knowledge was positively correlated with the number of materials recycled, it did not positively predict recycling intensity as hypothesized. Similarly, only one of the items measuring waste management attitudes was significant in the multivariate regression. Those who did not believe unlimited garbage collection was their right had higher recycling intensity scores.

As hypothesized, the extent to which a household had adopted other waste diversion practices was a positive predictor of a household's recycling intensity. Likewise, how proud an individual was of their environmentally-responsible actions was found to have a significant positive correlation with higher recycling intensity. Contrary to those who recycle as a consequence of social pressure, some individuals attached a more symbolic meaning to their recycling behavior.

> Whether it's the destruction of the rain forest or the dumping of toxic waste in third world countries, we have become aware that our. . . practices are not enhancing our lifestyle. In my own small way, on an individual basis, recycling is my contribution to improving the environment. (Respondent 470)

> It's a very emotional subject in some strange sort of way . . . I would think that unconscionable on our part, to [cancel the recycling program]. It would make me sick to throw it all out again. (Respondent 498)

It would seem that those who invest symbolic meaning in their behaviors and derive greater intrinsic satisfaction perform at a consistently higher level.

Finally, of the three environmental attitude factors, only DSP-1 was a reliable predictor of recycling intensity levels. As hypothesized, those who agreed with the positions represented in DSP-1 reported consistently less recycling. The fact that SSD was not significantly correlated with higher recycling suggests individuals with stronger proenvironment attitudes are not necessarily the best recyclers. A partial explanation might be that older generations, whose conservation attitudes and behaviors were shaped by scarcity early in their lifetime, embrace the return of recycling as common sense, yet are also more likely to subscribe to the beliefs contained within the DSP. In short, the findings support the supposition that individuals with a wide range of attitudinal positions on the environment will recycle, but like Derksen and Gartrell (1993), qualify this argument by noting that the recycling intensity of those with the least concern for the environment are generally lower.

DISCUSSION

The main objective of this analysis was to identify factors that influence household recycling intensity. The findings identified a substantial range in the recycling intensity of participating households and illustrated the sizable

opportunity to increase recovery rates. It should be noted that increasing the intensity of less active recyclers also has the affect of decreasing program costs, a vital consideration for program administrators. Low-intensity recyclers drive up collection costs by increasing the number of stops (thus decreasing collection efficiency) while contributing relatively little material for resale. Two important strategies for improving the recycling intensity of all recycling households include social marketing campaigns and the implementation of quantity-based garbage collection fees.

Based on the results of this study, several potential strategies for social marketing have been identified. There should be a continuous effort on the part of recycling planners to provide up-to-date program information, particularly eligible materials, proper set-out techniques, and schedules for special collections. The importance of making this type of information an ongoing initiative is illustrated by the statements below.

> I still sometimes wonder what I can and cannot recycle. . . sometimes I don't think I can so it goes in the garbage. I think more needs to be done to make everybody aware of what can and can't [be recycled] then maybe there would be more participation from more people. (Respondent 21)

> If I'm not sure, I think, "Oh heck, put it in anyway and see if they'll take it." If in doubt, I put it in. (Respondent 437)

The importance of not knowing what can be recycled should not be underestimated. Not only does this result in lower recycling intensities (thus lower diversion rates) and collection efficiencies, but the trial-and-error approach increases contamination levels. The good intentions of an uncertain public can unknowingly reduce the resale value of recovered materials or if serious enough, cause manufacturers to reject certain loads of recovered material (which are then often disposed of in landfills).

Another of the most frequent comments made by respondents was that they felt in the dark about what happens to the materials they collect and what benefits the community and the environment realize from their actions.

> I'd like to know that it [collected recyclables] is not just sitting in a big warehouse just being junk. . . we need more feedback on what we're doing and if it is making a difference. (Respondent 21)

> There is a need to publicize the results of blue box collection. . . and the net diversion from landfill. I suspect that significant quantities of unsaleable materials are sent to landfill anyway. (Respondent 155)

Recycling planners should reciprocate by providing information on the effectiveness of public actions to recover materials and what is done with the various recovered materials once they are sold (i.e., how the recycling loop is closed). In this way, any misinformation that might be adversely influencing public participation could be countered.

The community and environmental benefits accrued by the public's efforts (e.g., the number of trees or the amount of energy the community saved annually, how long the lifetime of local landfills have been extended), as well as any cost savings associated with waste diversion need to be demonstrated to the public. By helping the public make the connection between their contributions at the curb and both community and environmental improvement, social marketing can build on existing motivations to enhance overall waste diversion efforts. In addition to reinforcing the dedication of those who recycle for environmental or community reasons, social marketing, by illustrating any economic benefits from waste diversion, can appeal to individuals whose sole motivation for recycling is cost savings or social pressure.

A second strategy that is increasingly being considered to improve overall levels of recycling intensity is the implementation of various types of quantity-based garbage collection fee structures.[5] Studies have found that the introduction of quantity-based garbage collection has successfully increased recovery rates of recyclable material in 23 smaller (<50,000) communities in Ontario (Recycling Council of Ontario, 1994). When the respondents of this study were asked if "garbage collection is like any other municipal utility (gas, electricity, water) and those who use the service more should pay more," 44% were in agreement, 39% were opposed, and 19% were undecided.

The concept of introducing quantity-based garbage collection was a highly contentious issue, generating a large number of comments by participants. Interestingly, although 44% of the respondents stated they were in favor of a variable fee structure, only 20% indicated they would increase their recycling efforts if such a system were implemented. There were three explanations for the low proportion who would change their recycling patterns as a result of the introduction of an economic incentive. First, large proportions of households were already recycling at actual or perceived maximum levels for reasons other than economic incentives. Second, some respondents indicated that unless the amount charged per bag was higher than the usual one or two dollars per bag, it would not be enough to initiate any change in their current behavior. This finding raises an important question about the income sensitivity of behavior change as higher income families will be less likely to be

influenced by the introduction of a quantity-based fee structure. Third, some respondents desired a quantity-based fee structure not as a reward for their efforts, but in order to inspire their neighbors to do their part. Perhaps the most important finding regarding the introduction of a quantity-based fee structure was that they would have a greater behavioral impact on an important target group: households with lower recycling intensity scores (25% would increase recycling levels).

The research also suggested some possibly rewarding directions for future inquiry. Based on the findings of Howenstine (1993) and discussions with recycling planners from across Toronto, it would appear that further research is needed to examine the different waste diversion habits and waste-related attitudes of various ethnic groups within ethnically diverse metropolitan centers. Second, research might further examine the relationship between recycling and other household conservation behaviors. Are blue box proponents correct when they suggest recycling will act as a "foot in the door" for environmental behaviors, stimulating the adoption of additional waste diversion and conservation behaviors? Conversely, is there evidence to support the contention of those critical of the current emphasis on recycling that it reaffirms the tenets of consumption rather than conservation and actually impedes progress toward waste reduction (both pre- and post-consumer)?

A final potential area of inquiry that emerged during the course of this investigation was the need to understand better the nature of individual commitment to recycling. Does recycling merely represent a change in routine, a different colored receptacle for waste and no more, or do people frame recycling as a necessary lifestyle change?

If the majority of individuals do not equate recycling with a needed lifestyle change, it is conceivable that they may eventually tire of recycling, leading to an erosion of recycling intensity or perhaps the abandonment of recycling altogether. Such tentative commitment would not bode well for the long-term viability of recycling in communities where participation levels remain low. More important, from the standpoint of progress toward the project of sustainability, it would almost certainly rule out the prospect for more profound changes associated with waste reduction. Exploratory, in-depth examinations of how the public frames the garbage issue and the meanings they ascribe to their behavior would provide additional insight into the contemporary recycling ethos. The less quantifiable, more elusive nature of these questions mean qualitative methods may prove especially profitable in this regard.

NOTES

1. Studies of contemporary per capita waste generation have produced inconsistent results with estimates for the United States ranging from 1.8 (Keolian & Menery, 1992) to 3.0 kilograms/day/person (Hirschhorn & Oldenburg, 1991) and similar per capita, per day estimates for Canada ranging from 2.5 kilograms (Statistics Canada, 1993) to 2.7 kilograms (Environment Council of Alberta, 1994). Each of the preceding estimates far exceed the per capita generation rates in developing countries (see Hershkowitz, 1987) and more tellingly are higher than all developed countries (see Bartkiw, 1991), which have comparable standards of living.

2. For the purpose of this study, *recycling intensity* was defined as a measure of the number of eligible materials a household collects for recycling and how consistent each type of material is diverted from the waste stream.

3. The decision not to employ follow-up procedures was that of the municipal sponsor of the survey and was based on the availability of resources and the consideration that the survey was only one phase of a larger program evaluation (the other phases of the project included in-depth qualitative interviews and waste/recycling collection data).

4. Although many conceptualizations of sustainable development have been proffered since the term was popularized by the Brundtland Commission, that adopted by the author resembles the interpretation articulated by Milbrath (1989) and Daly's (1991) *strong* sustainability (recently defended by Skolimowski, 1995; Daly, 1995; Jacobs, 1995).

5. The various types of quantity-based garbage collection fee structures (or *variable rates*, *user-pay*, *incentive rates*, *pay-as-you-throw* as they are sometimes labeled) have one common characteristic, households that generate more garbage pay more for the service of garbage collection and disposal. This concept is obviously not new and is applied to other public utilities such as water, electricity, gas, and telephone service. The rationale for a quantity-based fee structure is to introduce an ongoing economic incentive to the household to reduce its garbage bill by practicing recycling and source reduction.

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