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## Informal recycling and occupational health in Santo André, Brazil

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The collection of recyclables is a widespread activity among urban poor, particularly in countries with large socio-economic disparities. The health of recyclers is at risk because of unsafe working conditions, socio-economic exclusion, and stigmatization. Our study focuses on health problems and occupational risks of informal recyclers (in Brazil known as *catadores*). In 2005 we conducted an in-depth socio-economic survey of 48 informal waste collectors in Santo André, Brazil. Almost all workers reported body pain or soreness in the back, legs, shoulders, and arms. Injuries, particularly involving the hands, are frequent. Flu and bronchitis are common, and one recycler had contracted Hepatitis-B. Policy makers at all government levels need to address the pressing health issues affecting large numbers of informal recyclers in Brazil and abroad. Recyclers need to be involved in the design of waste management policies, and the public must be educated about the important environmental service these people provide.

**Keywords:** informal recycling; household waste; occupational health; poverty; developing world; Brazil

### Introduction: consumption, waste and environmental health

Collection and separation of recyclables creates health risks to the people involved in the activity, as described by Hamer (2003), Harpet (2003) and Kennedy et al. (2004) for North America and by Cotton et al. (1999) and Sarkar (2003) for Latin America, Africa and Asia. General risks include microbiological, chemical, physical, and ergonomic issues (Lavoie and Guertin 2001). An et al. (1999) argue that municipal waste workers are exposed to more occupational health and safety risks than workers in any other activity. This is true even in rich countries. Poulsen et al. (1995) found that in Denmark, municipal solid waste workers faced 5.6 times the risk of occupational health injuries as the average total work force, and 1.5 times the risk of occupational diseases.

This article discusses first results from a study conducted in 2005 on the occupational health risks of informal recyclers in Santo André, to contribute to the policy debate on selective waste collection. Occupational health “is a basic element [that] constitutes a social and a health dimension of the principle of sustainable development” (WHO 1995:4). Occupational health risks relate to physical, chemical, and biological factors in the environment; they may also include economic and social determinants of occupational conditions, such as job security. Environmental health is further defined as the

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“characteristics of health that result from the aggregate impact of both natural and [human]-made surroundings, including health effects of air pollution, water pollution, noise pollution, solid waste disposal, and housing; occupational disease and injuries; and those diseases related to unsanitary surroundings” (CDPH 2000: Appendix O Glossary).

In poor countries the informal sector is mainstream and determines the local economy. Approximately half of the labor force in Brazil work informally (Santana and Loomis 2004) and recycling is just one of these activities. The following section describes waste management and the deriving bottlenecks for environmental health. The empirical results are based primarily on semi-standardized interviews with recyclers and participant observation. The findings support an integrated approach toward environmental health through better formal education and policies that improve the working conditions and efficiency of the recyclers, and that educate the public to contribute with clean resource recovery.

### **Informal resource recovery in Brazil**

Recycling is not the answer to our disposable society, but it is a step to resource recovery and for environmental education of consumers. Individuals collecting recyclables in the street or at landfills and dumpsites have existed since the generation of unwanted and disposable materials, designated waste in poor and rich countries (McGurty 1998). However, the number of people depending on waste has increased significantly and everywhere (Medina 2000; Ackerman and Mirza 2001). In poor countries, selective waste collection is conducted by *catadores* (pickers), individuals who work either on an individual, informal and autonomous basis or in groups through organized recycling cooperatives or associations (Gutberlet 2005; Medina 2005). Estimates vary between at least 300,000 to 1 million informal recyclers in Brazil (Movimento Nacional 2006). Their work consists of selectively collecting recyclables from businesses, schools, apartment buildings, or out of the garbage in the streets and sometimes at landfills, and transporting them for separation at home or at recycling centres. They may walk more than 30 km a day while collecting, and usually work long hours, often 7 days a week (Cazetta 2005). Handling and processing recyclable materials exposes them on a daily basis to dangerous and unhealthy conditions (WHO 1995).

### ***Economic and social exclusion a root cause in occupational health hazards***

The Brazilian recyclers movement estimates that autonomous informal recyclers earn on average between 60 and 100 Reais\$ per month (approximately 33–55 CAD\$) (Movimento Nacional 2006). In Santo André approximately 2000 people live primarily from informal recycling. This reflects a situation similar to that in other urban centres in Brazil, where on average 0.3% of the total population is involved in this activity. Usually the collection of recyclables involves more men, and the separation more women and the number of women working in cooperatives usually exceeds the number of men.

### ***Situating the case study: Santo André***

Santo André is a city of 660,000 inhabitants in a territory of approximately 175 km<sup>2</sup> (IBGE 2004) (see Figure 1) (IPT/SEBRAE 2002). The city generates on average 0.85 kg of solid waste per person (IPT/SEBRAE 2002). Its current waste collection system includes



government and the generators of waste to maximize source separation and recovery. So far there is no specific program to include autonomous, informal recyclers (Corrêa 2005). In 1998, the existing waste collection and recycling program *Reciprocidade Agradável* was integrated into the new agency SEMASA (*Serviço Municipal de Saneamento Ambiental de Santo André*) in charge of the coordination of the city's waste management system.

During the same year, the municipal secretary for economic development and income generation (*Secretaria Municipal de Desenvolvimento Econômico e Geração de Renda*) encouraged the creation of one of the two local recycling cooperatives, *Coopcicla*, through the municipal program on work and income generation (*Programa de Geração de Trabalho e Renda*). Today, approximately 80 formerly unemployed and autonomous workers are affiliated to *Coopcicla*. The rise in household collection of recyclables by the city has led to the creation of another cooperative, *Coop Cidade Limpa*, in 1999. This group of approximately 110 recyclers also collects, separates, and commercializes recyclables from shanty towns that do not have a regular waste collection service. Officials estimate that at least 2000 of Santo André's 64,000 unemployed work in recycling (Okabayashi et al. 2004). Nevertheless, the quantity of material recovered from the waste stream remains relatively small. Only 1.9% is recovered, compared to the average 1.8% for the state of São Paulo, which includes the many cities that do not yet have a recycling program (Cazetta 2005).<sup>1</sup>

On average, only 6% of all households in Brazil are serviced by selective waste collection (see Figure 2). In the state of São Paulo, only 5.4% of the households receive this service. The official policy of Santo André is to provide every household in the future with selective collection (Cazetta 2005). Members from the cooperatives reveal that the sorting by householders is still very poor, and that at least 30% of the material collected for recycling needs to be discarded.

### **Occupational health and safety of informal recyclers in Santo André**

Despite the increasing debate on solid waste management and environmental health, surprisingly little research has been done in developing countries on human health risks associated with informal waste collection and handling. Few articles focus on the occupational health of informal recyclers in North America (Rendleman and Feldstein 1997) or in Brazil (Porto et al. 2004). Most research discusses the health situation of formal municipal refuse workers in Brazil (Pereira da Silva 1973, 1983; Ilario 1989; Robazzi et al. 1994, 1997; Velloso 1995; Fundacentro 1999; Santos 2005) and in other developing countries (Poulsen et al. 1995; Lavoie and Guertin 2001; Harpet 2003). Literature on health-related waste issues tends to provide a general overview, rather than offer quantifiable data on health impacts that can be monitored over time or provide potential innovative solutions.

Our study focuses on the recyclers' perceptions of health conditions and possible occupational risks and on the proposal for the livelihoods and health concerns of recyclers. The data collection was carried out by three graduate students (Noé Humberto Cazetta, Ivan Corrêa, and Vilson Rodrigues da Costa) who conducted an extensive survey as part of their Masters degree qualification at the *Fundação Universitária Santo André*. In addition to the information collected for their thesis we included survey questions on health and occupational safety.

The objective of the questionnaire was to collect interview data on major health predicaments as perceived by the recyclers. We also collected demographic data and facts on other livelihood issues permitting some qualitative correlations between health and

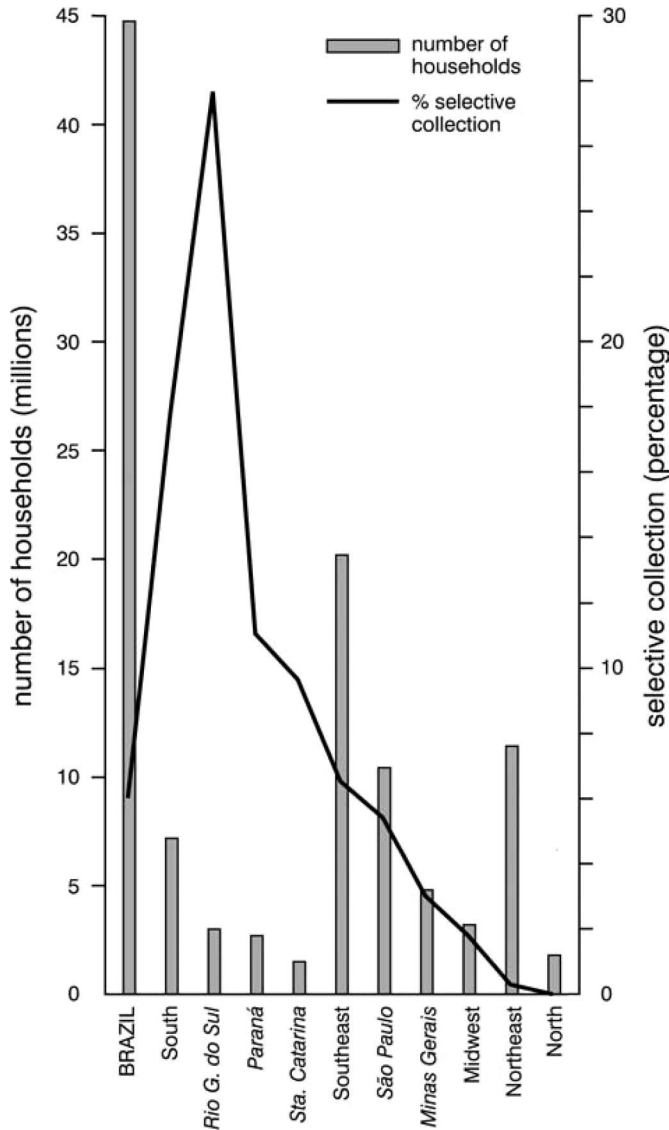


Figure 2. Percentage of households by region involved in recycling. Source: IBGE (Instituto Brasileiro de Geografia e Estatística). Ministério do Planejamento. Indicadores de desenvolvimento sustentável, 2004. [<http://www.IBGE.gov.br/>].

socio-economic indicators. The data was used for our own research and the thesis work of the students. The research was accepted for human participant research under the University of Victoria Human Research Ethics Board (approved on 31 May 2005, IRB # 05-129). Confidentiality is guaranteed by omitting the names and by considering a sample size that does not allow associations between the data and the informant. All participants and key-informants had given their consent to the study and to using the data for research purposes. The students received consent and interview training by the Brazilian author, as part of their thesis preparation.

The survey was applied to informal recyclers working near the triage centre *Estação de Coleta Seletiva Bosque*, in the city centre. The selection of the study site was based on prior contacts with informal recyclers during training activities at the centre in 2002 (Cazetta 2005). The city centre typically encloses a vital commercial area, some industrial and residential blocks and there is heavy pedestrian traffic around the train station. We limited our data collection area to 2.78 km<sup>2</sup> in the immediate vicinity of the triage centre.

Structured interviews and participant observation were used as tools for data collection (Gil 1991). We guided the graduate students towards appropriate ethical procedures. The fieldwork was divided into three phases: (i) preliminary study involving initial contacts with local *catadores*, with the research team visiting the area at different times of day in order to identify the recyclers, the type of work they do, and the specific locations and land use; (ii) mapping of the information previously observed and logistic fine-tuning of the fieldwork; and (iii) observing participants and conducting an in-depth survey applying 36 standardized questions with a total of 48 interviewees, of which four were women. One of the participants withdrew during the survey and was excluded from the data analysis. Therefore our total sample size is 47. Interviews were conducted in the street when meeting randomly with the *catadores* at work. Each interview took between 20 and 30 minutes.

The results confirm a strong gendered labor division, with men more likely to work in the collection and women in the separation of the recyclables. The youngest participant was 14 years old, and the oldest was 64. Most of the participants were between 21 and 60, and among these the age groups were evenly distributed. The survey covered several livelihood aspects such as demography, housing, work and income situation, education, transportation, health, accidents, and perception of major risks.

### *Specific health and risks of informal recyclers*

When asked about their general state of health since becoming informal recyclers, most of the participants did not perceive any change. Eight mentioned that they were now less sick than before, whereas six had become sick more frequently since working in this business. Fifteen of the interviewees referred to a specific health problem that had occurred after they initiated their activity as informal recyclers. Eleven interviewees reported that these health problems persisted at the time of the interview. Figure 3 shows the distribution of the most prevalent health issues.

The recyclers mentioned the common cold as the most frequent illness. Recurring problems with ulcers and high blood pressure, typical indicators for stress, were also reported. Work accidents occur, often involving the hands. Two of the interviewees had already injured their hands (one had lost two fingers) before entering this type of activity, and two others had cut their hands while working with recyclables. More than half of the interviewees who continued having health problems after they had started in the recycling business live either in the street or in very precarious housing conditions (e.g. squatter settlements).

More than half of the respondents (27) confirmed that they experienced frequent pain. The most common kinds of pain were back pain (14), pain in the legs (nine), pain in the arms (four), and general pain in the body (four). Waste collectors and recyclers are involved in heavy lifting, as well as pulling and pushing containers and carts on a daily basis. All of these activities present obvious risk factors for lower back pain. Musculoskeletal injuries are often the result of continuously carrying heavy loads (An

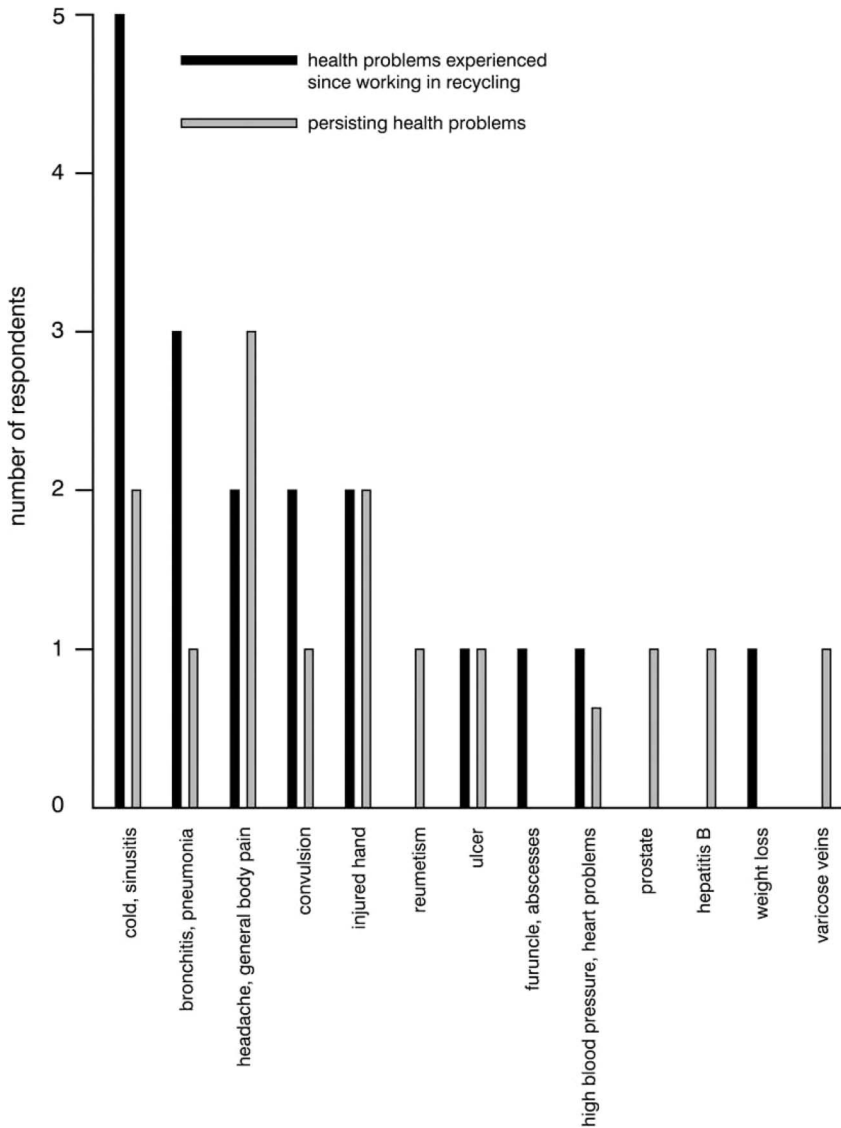


Figure 3. Persisting health problems since working in informal recycling.

et al. 1999). Disorders involving the neck, shoulders, and arms were reported in different studies in the US and in Denmark, as discussed in Poulsen et al. (1995).

Another survey conducted in Florida found evidence of elevated rates of injuries such as lacerations, contusions, strains/sprains, and illness among waste collectors (Smith and Linton 2001). Of the municipal collectors interviewed, 75% reported having been injured in a 12-month period (Smith and Linton 2001). The authors further mention that health incidents and accidents for this category are usually underestimated, because often the person who is injured or ill leaves the workforce and is therefore not captured in the assessment.



With the following three health-related questions, we were able to cross-check the most relevant information:

- (1) Which health problems have you experienced after having started with the recycling activity?
- (2) What are the persisting health problems?
- (3) Where do you feel frequent pain?

Eighteen interviewees responded that they hurt themselves “quite often” at work and nine mentioned that they had already experienced at least one accident while collecting recyclable material in the street. In most cases, they were hit or run over by a car. Furthermore, seven respondents agreed with the statement that “they had already experienced a problem with a driver, a pedestrian, or the police”.

Accidents among refuse workers are frequent. Poulsen et al. (1995) indicates a significantly higher level of occupational accidents among Danish refuse workers (95 per 1000 employees) than among the total work force (17 per 1000 employees) (1995:5). In Brazil, Robazzi et al. (1997) recorded an extremely high frequency of accidents. This study reveals that the major cause of accidents among municipal refuse workers was related to improper garbage wrapping. The body parts most affected were the legs, followed by the arms. The most frequent medical diagnoses made were wounds, cutting-contusion injuries, cutting injuries, and excoriations.

A study conducted among municipal workers in Rio de Janeiro highlights the fact that 80% of all workers had suffered an accident during their employment in waste collection; of these, 58% had to be suspended from work for some time (Vellos et al. 1997). Recyclers who work at dumpsites are exposed to extreme conditions and suffer most from accidents. Porto et al. (2004) conducted a study on health conditions of waste pickers at the largest landfill in Rio de Janeiro. The nature of the working environment generates specific kinds of risks and accidents. The majority (71.7%) of the waste pickers at this site had already suffered an accident. Of the 267 accidents referred to in the study, the majority were related to cuts from glass (37%), followed by perforations due to other materials (19%), and falls (15%). In addition, accidents involving informal recyclers and the landfill operator’s machinery are frequent (Porto et al. 2004).

Collecting and transporting recyclables demands a lot of energy, as most of the respondents push their carts manually. In order to make a living, recyclers have to work long hours. The typical work day of 31 respondents was 8 hours or longer. Most of these respondents work on average 6 or 7 days per week. The self-made carts have various carrying capacities. Eighteen of the respondents generally do one round trip per day, 20 of them do two trips a day, and the rest do up to 5 trips. The amount carried per day can vary from 30 to 1000 kg, depending on the specific material the recycler is interested in. Twenty-one of the interviewees transport up to 150 kg/day, 19 transport between 200 and 500 kg/day, and 4 more than 500 kg/day. More than half of the interviewees also collect and carry construction waste such as wood, bricks, and metal. Almost all of them confirmed that besides the collection they also do the separation of the material.

### ***Livelihood issues and wider health impacts***

In addition, we also collected demographic data and information on formal education, average earnings, quality of housing and access to food. Health is also influenced by

the work environment and housing conditions, where access to public infrastructure and services for example also play a crucial role. Adequate housing for the poor is one of the largest bottlenecks in most large cities in Brazil. In the MRSP, the deficit in low-income housing is visible, and irregular squatting has become a necessity for many. As a result, extensive areas have no access to clean water and sewage collection. In Santo André, the situation is particularly serious due to recent de-industrialization and out-migration of industrial establishments causing an increase in unemployment. In 2000, approximately 64,000 people or 20.4% of the economic active population was unemployed; for women the rate was 24.7%, and for men 17.2% (Okabayashi et al. 2004).

More than 15% of the population of Santo André, or approximately 97,000 people, currently live in substandard housing conditions (Carneiro 2001). There are a total of 132 squatter settlements in Santo André, of which only 13 have been upgraded with basic infrastructure, amenities, and services; 37 have received partial improvements; and 82 remain problematic. When low- or no-income groups do not own property and cannot afford to rent, they have no other choice than to squat, to live in shared accommodation and homeless asylums, or to live in the street (Carneiro 2001).

Our survey reveals that many interviewees were living under precarious housing conditions. The low and irregular income from informal recycling is usually insufficient to pay for housing and therefore squatting is one of the few options. A permanent threat of removal adds another stress factor to the already insecure livelihood of these individuals and makes them more vulnerable.

The majority of the recyclers (41) get involved in the collection and separation of the materials; only four answered that they do the collection only. Eleven of the interviewees separate the material at home, which means bringing home disease vectors and risks and exposing other family members as well. Most of them separate the material in the street (21), and others (8) separate at the landfill site or at the middlemen's premises. The recyclable material is usually not clean and attracts insects, rodents, fungi, bacteria, and other transmitters of disease.

Workers handling mixed waste, compost, and recycling products face a number of health problems (Poulsen et al. 1995). Several authors highlight the elevated risks of respiratory, dermal, and gastrointestinal problems among municipal waste workers, due to exposure to dust, micro-organisms, and microbial toxins at their workplace (Poulsen et al. 1995; An et al. 1999; Rogers et al. 2003). Molds and fungus spores, abundant on discarded food packaging, are recognized biological sources for respiratory diseases, mucous membrane irritation, and allergies in general (Poulsen et al. 1995). Dust and mold spores have the capacity to increase already existing allergic reactions. Waste exudates also contain Gram Negative bacteria and endotoxins. Endotoxins, which are confined inside the microorganisms and are released when the microorganisms are broken down or die, cause mucous membrane irritation. Often the workers are also exposed to chemical pollution from containers contaminated with chemical substances, particularly when recyclers collect materials at industries (Vellos et al. 1997).

Lavoie and Guertin (2001) found *organic dust toxic syndrome* to be a frequent health complaint at recycling plants, which are often contaminated with bioaerosols. These are extremely small living organisms or fragments of living things suspended in the air. Dust mites, molds, fungi, spores, pollen, bacteria, viruses, amoebas, and fragments of plant materials are some examples. Similarly, An et al. (1999) mention particular health problems that arise from the exposure of waste collectors to Gram Negative bacteria and fungal spores.

Storage and handling of recyclables are the major sources of bacteria in the atmosphere. The concentration of micro-organisms seems to fluctuate with the season, being greater during higher temperature and humidity levels in the summer. In addition, working in the street exposes waste collectors, often continuously, to automobile and truck exhaust gases that can also cause respiratory disease (Poulsen et al. 1995).

The survey also questioned the availability of regular meals while performing the job. All respondents indicated having access to at least one meal per day, with the exception of two recyclers who declined to answer this set of questions. Both of them were homeless and lived in the street. Three respondents, who also lived either in the street or in a squatter settlement, have only one meal per day. One of them has only breakfast guaranteed, whereas the other two have only lunch. Most of the respondents (26), however, had lunch and dinner, and 17 had breakfast and one hot meal during the day.

In his work on waste management, particularly in Mexico, Medina does not specifically focus on occupational health hazards (Medina 1998, 2000, 2001, 2005) but he underlines the necessity of carefully studying health effects on informal recyclers involved in the collection and separation of recyclables (2001). Constant heavy work is one of the factors contributing to the widespread spine and back problems of recyclers, as well as general pain in the body. Better collection and separation methods and infrastructure could alleviate some of the current ergonomic problems. Appropriate technology could be used to develop more efficient vehicles for material collection. Innumerable conversations with informal recyclers in Brazil confirm the fact that most recyclers do not object to using a pushcart, which allows access to places where cars and trucks cannot go, and they understand that owning the means of production provides autonomy. The existing carts can be improved to make the work safer and less effort intensive.

Contracting infectious diseases are a real threat to refuse workers and particularly to informal recyclers. Rendleman and Feldstein (1997) underline the risk of contracting Hepatitis B among solid waste workers in North America. This fact is confirmed in our study with one of the respondents who had contracted Hepatitis B. Another widespread risk is the contraction of *Leptospirosis*, a bacterial disease transmitted through the urine of infected rodents. Recyclers who handle waste, which frequently is the niche of rats infected by bacteria of the genus *Leptospira*, face this additional threat. The situation described for Accra, Ghana, reveals a variety of health-related symptoms associated with waste storage in households and with waste burning, as well as environmental pollution and the spread of infectious diseases due to littering (Boadi and Kuitunen 2005).

### Conclusions and recommendations

This survey of informal recyclers in Santo André reveals the first insights into the occupational risks these workers face in terms of injury and disease. Although the symptom levels seem worrisome it is difficult to conclude about the degree of concern, since we did not have population comparison data on the general health in Santo André. Most academic literature discusses only the health predicaments of formalized employees at landfills and recycling depots, and little has been documented about the health situation of the many informal recyclers in developing countries. The health implications, as described in the literature, provide a baseline on typical occupational risks and injuries within this activity sector.

Occupational health risks are usually classified into these categories: (i) *mechanical* (cuts, blunt trauma, fractures, lacerations, traffic accidents); (ii) *ergonomic* (musculo-skeletal illness resulting from moving heavy weights); (iii) *chemical* (dermatitis and

respiratory disease due to exposure to toxic chemical substances); (iv) *biological* (infections due to contact with biological pathogens); and (v) *social* (malnourishment, under-nourishment, and lack of training).

Our results are consistent with the findings of the wider literature on specific types and the frequency of injuries and disease that affect refuse collectors and formal recyclers elsewhere, particularly with the studies conducted in developing countries. Cuts and fractures as a result of working with recyclables were very common and are most probably related to unsafe disposal of the recyclable material, which affects the recyclers during collection and separation. Source separation needs to be more effective providing clean and safe materials, which translates into extensive and repetitive environmental education campaigns at the household level. Within the category *mechanical health risks*, traffic accidents are notable. Nine of the surveyed recyclers had already suffered an accident in the street while collecting or transporting materials. Traffic congestions, dangerous conditions due to road obstructions, and on-road barriers add to the risks all participants face in the street. Recyclers with carts are among the most vulnerable participants in traffic. Visible clothing and reflectors on the cart can easily contribute to more safety. Recyclers often hurt themselves during their work.

The most frequent *ergonomic* health implication found was body pain (in particular back pain), resulting from carrying heavy loads, constant bending, long working days and inadequate working conditions at the sites where separation takes place. More than 70% of the interviewees reported to work more than 8 hours a day, often 6 or even 7 days a week. Ergonomic issues can be addressed. For example, the provision of battery-driven handcarts could reduce the weight to be carried and prevent body pain and strains. Adequate sorting infrastructure is crucial, as recyclers often spend many hours separating the materials. The setting needs to take into consideration specific gender-related needs. It is mostly women who are involved in the separation. Access to sanitation facilities makes a difference to the quality of life of the workers. Access to public healthcare and provision of social benefits are also important needs and would help improve the health of informal recyclers. Furthermore, formalized groups, cooperatives and associations can offer regulated working hours and diminish the risks from overwork.

Working in the streets and dealing with often highly contaminated materials make informal recyclers particularly at risk to *chemical* contamination and *biological* infection. Kennedy et al. (2004) highlight the unsafe and unhealthy working conditions of refuse workers at recycling centres. Refuse collectors are often exposed to extreme weather patterns (cold, hot, dry, or wet), a contributing factor for colds and, in some cases, virus infections, sinusitis, or pneumonia. High levels of air pollutants cause additional health impacts, often exacerbating respiratory diseases, allergies, and skin problems. These circumstances are reflected in our findings. Actions that contribute to improved occupational health include training and educational activities on recycling-related issues; strengthening of the organizational structure of recyclers (cooperatives, associations, etc.); and building awareness among the general public on consumption and waste issues (Lavoie and Guertin 2001). Kennedy et al. (2004) offer a number of suggestions for reducing health impacts, namely having consumers wash bottles prior to returning them to remove fungal contamination, and more stringent regulations and control for the breaking of glass that has mold content.

Sanitary and ergonomic conditions are controllable at recycling centres, and precautionary and protective measures can be implemented. It has been shown that specific preventive training and stronger local government support diminish the risk of

accidents (Robazzi et al. 1997). Finally, in order to guarantee minimum health standards, national safety codes for municipal waste workers need to be in place (Poulsen et al. 1995).

Attention needs to be given to the *social* health implications. Powerlessness, vulnerability and low self-esteem are often the experience of informal recyclers. They are frequently bullied or treated with prejudice by the public. They are often stigmatized and excluded by the rest of society. Sarkar's (2003) vulnerability study of rag pickers in Delhi, India, focused on the socio-economic and occupational health of these workers and highlighted their catastrophic health conditions due to poverty and low social status. In our study one of the interviewed recyclers reported: "more respect would be the most needed change to improve work".

Health concerns of informal recyclers hardly receive media or public attention, and seldom are the needs and health matters of informal recyclers taken into consideration in waste management policies. This sector does not have a lobby or pressure group to demand investigation into their specific health issues, and their cases remain unvoiced. Informal recyclers themselves often are powerless and cannot afford to seek improved and healthier working conditions. There are too many pressing problems to secure survival in their daily life, and the recyclers' attention is usually concentrated on collecting as many materials as possible to make it through the day.

One immediate solution would be to recognize the important role selective waste collection plays in improving environmental health, and to pay for the service. Sustainable waste management strategies are urgently needed in order to change the prevailing paradigm of resources depletion, ultimately adding to climate change. Including the informal recycling sector as partners in waste management is a sensible solution. Formalizing their activity provides opportunities to tackle their serious health issues. Providing training, better working environments and improved source separation are key within this proposal.

Recyclers are also environmental agents when collecting door-to-door, communicating with the local community. In order to be recognized as such they need to be trained and made visible, by wearing uniforms and carrying ID cards. Formalizing the appearance of the worker contributes to a better relationship with the community, and builds the self-esteem of the workers, who now feel that they belong to a public service. Further research is needed to confirm how formalizing the activity, e.g. through recycling co-ops or government program improves occupational health and diminishes risks. Finally, providing opportunities for equitable and fair pay will help to reduce social exclusion, malnourishment, inadequate housing, and ultimately also crime.

Resource recovery is also a form of combating climate change by reducing the emission of greenhouse gases. It is a way of recovering material that would otherwise be dumped, landfilled, or incinerated, contributing to the generation of CO<sub>2</sub>. Waste diversion also prevents the extraction of virgin resources and thus indirectly contributes to resource and energy conservation. With increasing costs of conventional waste treatment most governments are now in favor of recycling; however, seldom do they consider the informal recycling sector. The city of Santo André has been a showcase for innovative governance, with community participation in budgeting decisions as well as other innovative practices and programs in the areas of income generation, housing, and education. However, the necessary strong commitment to include the informal recycling sector alongside the already existing organized recycling cooperatives remains to be seen. More research is needed to better understand the needs of this population in terms of health and safety in order to influence legislation and public policies for better safety regulations.

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## Note

1. Official selective collection is more widespread in the south, where 8.4% of the total amount of household waste generated in tonnes/day is diverted into recycling. In the state of Paraná selective household waste collection is highest, with 12.2% out of the total amount generated in tonnes/day, compared to the northeast with 0.5%. Furthermore, 23.6% of the cities in the south have formal selective collection, compared to only 0.2% of the municipalities in the north. Rio Grande do Sul is the state where official selective collection is most widespread (Cazetta 2005).

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