Biological and chemical risk factors associated with occupational allergies and infectious diseases in the informal sector

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ABSTRACT
Introduction: Informal workers often work under harsh conditions where occupational health and safety protection is almost non-existent.
Methodology: A literature review of scientific papers related to occupational allergies and infectious diseases among informal sector workers was conducted. The search was done using Google, as well as major peer-reviewed occupational health and social science journals and information from credible institutes and non-governmental organisations.
Results: An overview of the biological and chemical risks associated with allergies and infectious diseases for various job categories within the informal sector is presented. Inference to the formal sector is made where disease statistics in the informal sector is lacking.
Conclusion: There are numerous exposures in the informal sector including chemical and biological. A need for an occupational health system and supporting legislation in the informal sector clearly exists, as the current neglect carries a heavy burden of disease and disability.

Keywords: chemicals, hazardous biological agents, infectious diseases, informal sector, occupational allergy
INTRODUCTION

South Africa’s economy has two components, the formal economy and the informal economy (often referred to as the second economy) in which the poorest still struggle to access even the most basic services. Despite the honourable President Jacob Zuma’s declaration in his State of the Nation address in Parliament, that 2011 was going to be “the year of job creation”, the unemployment rate in the third quarter of 2011 was still 25%, no lower than previous years and 27th in the world. The ongoing worldwide economic crisis and the high incidence of debilitating diseases like HIV/AIDS and tuberculosis cause more and more young adults to fall out from the formal labour market during their most productive years. This forces them to rely on the informal sector, often working from home, for an income. This creates insecurity in the value chain, threatening the social fabric of impoverished communities where most of these individuals live and work. In addition, young children often drop out of school to pursue employment in the informal sector to provide for their families, which not only gives rise to a multitude of physical and health risks that they are usually not aware of but also robs them of an education as many leave school with little or no possibility of entering the formal labour market.

Except for the occasional article in the daily press, very little research has been published on the informal sector in South Africa. Studying the dynamics of the informal labour market not only provides valuable insight into the complex nature of unemployment in the country but also highlights the disparity of occupational health (OH) systems among the two sectors. This review article highlights some of the challenges experienced by informal sector workers; and focuses on biological and chemical risk factors associated with occupational allergies and infectious diseases in the informal sector. The list is exhaustive and many risks are still unknown due to a lack of investigation and association to disease in this sector.

Some of the more common exposures for various exposure groups from studies conducted mostly outside South Africa are listed in Table 1. Other South African studies related to the formal sector are noted as inferences can be drawn to the informal sector.

METHODOLOGY

The informal sector, is defined as “unorganised, unregulated and mostly legal but unregistered economic activities that are individually or family owned and use simple, labour intensive technology”. Studies on the informal economy in general in South Africa as well as the association of health issues in this sector both nationally and internationally were identified through a Google search. The keywords used included allergens, bacteria, chemical, contact dermatitis, exposure, fungi, hawkers, hazardous biological agents, informal sector, mould, microorganisms, occupational, skin disorder, South Africa, and street vendors. Major peer-reviewed OH and social science journals were also searched. Reports from reputable non-governmental organisations (NGOs) were also included as the majority of work done in the informal sector has been spear-headed by NGOs. Only publications (1980-2012) relating to the subject of this review were included for evaluation, as this review focuses on the influence of hazardous biological and chemical agents on occupational allergic or infectious disease.

OCCUPATIONAL ALLERGIES AND INFECTIOUS DISEASES IN THE INFORMAL SECTOR

A driver of poverty or a trigger for human development?

Informal sector workers transform backyards, refuse sites and streets into arenas of job creation and economic growth. Employment in the informal sector provides these workers

“The ongoing worldwide economic crisis and the high incidence of debilitating diseases like HIV/AIDS and tuberculosis cause more and more young adults to fall out from the formal labour market during their most productive years.”

Continued on page 7
Table 1. Biological and chemical risk factors related to occupational allergies and infectious disease in various exposure groups in the informal sector

<table>
<thead>
<tr>
<th>Job category</th>
<th>Exposure group</th>
<th>Biological and chemical exposures</th>
<th>Symptom prevalence according to identified studies</th>
</tr>
</thead>
<tbody>
<tr>
<td>Farming</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Livestock</td>
<td></td>
<td>Dander, feeds, fur, proteins from skin, Medication, nuisance dust</td>
<td>Swine farm workers: 34% reacted to swine hair, 28% to swine confinement antigen, and 78% to animal food; they had respiratory symptoms. Contact dermatitis from ethoxyquin reported in workers handling chicken feed.</td>
</tr>
<tr>
<td>Crops/plants</td>
<td></td>
<td>Maize, mites, moulds, pollens, Pesticides, fertilisers</td>
<td>Table grape farm workers in formal farms in Hex River valley, Western Cape: 26% wheezing, 24% ocular-nasal symptoms, 15% urticaria/skin problem; 22% reacted to spider mile (T.urticae). Neurological symptoms from pesticides have been reported.</td>
</tr>
<tr>
<td>Grain workers</td>
<td></td>
<td>Microbial respiratory sensitisers (Cladosporium, Alternaria, Aspergillus spp., Penicillium spp.), storage mites (Tyrophagus, Putrescentiae, Lepidoglyphus Destructor, Gallus Domesticus, Acarus sir)</td>
<td>Prevalence of asthma-related symptoms among grain mill workers range from 7-24%.</td>
</tr>
<tr>
<td>Provision of 'street and transport services'</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gardening</td>
<td></td>
<td>Fungi, grass, insects, pollens, trees, Nuisance dust, pesticides, fertilisers</td>
<td>Pulmonary aspergillosis in a previously fit young patient without predisposing factors other than exposure to fungal spores in his occupation as a gardener.</td>
</tr>
<tr>
<td>Car wash</td>
<td></td>
<td>Soaps, polishes, waxes, water</td>
<td>Dermatitis and eye injuries from chemical splashes.</td>
</tr>
<tr>
<td>Shoemakers</td>
<td></td>
<td>Fungi</td>
<td>Contact dermatitis from epoxy resin and possibly acetone in a shoemaker.</td>
</tr>
<tr>
<td>Barbers, hairdressers</td>
<td></td>
<td>Infectious agents, Bleach (ammonium persulphate), hair dyes, perms, relaxers, rubber gloves</td>
<td>Respiratory symptoms were higher among the apprentices (10%) compared to the qualified hairdressers (7%). Hairdressing activities in Bertram, Johannesburg households increased the risk of asthma (OR: 2.89, 95% CI: 1.46-5.73).</td>
</tr>
<tr>
<td>Domestic work and cleaners</td>
<td></td>
<td>Rubber gloves, polishes, disinfectants</td>
<td>Domestic workers exposed to cleaning agents had increased risk of occupational asthma.</td>
</tr>
<tr>
<td>Car mechanics and panel beaters (includes spray painters)</td>
<td></td>
<td>Rubber, additives in fuels and fluids, turpentine, thinners, paints, isocyanates, resins, degreasers, surface preparation products, dusts from sanding, rust converters and rust removers.</td>
<td>Of the asthma cases diagnosed at the NIOH over 10-year period, 19% were spray painters. In Ibadan, Nigeria, 25% (75/300) had signs of hand dermatitis, commonest among panel beaters and welders.</td>
</tr>
<tr>
<td>Waste pickers</td>
<td></td>
<td>Bacteria, endotoxin, allergenic fungi (Aspergillus fumigatus, Aspergillus flavus, Stachybotrys atra, Fusarium spp. and Penicillium) and mycotoxins. Notoxic methane gas emitted by decomposing garbage</td>
<td>Increased risk of self reported cough (OR: 2.1, 95% CI: 1.4-3.3), phlegm (OR: 2.2, 95% CI: 1.3-3.6), wheezing (OR:1.9, 95% CI: 1.2-3.1) and chronic bronchitis (OR:2.4, 95% CI:1.1-5.1) among waste collectors.</td>
</tr>
<tr>
<td>Taxi drivers</td>
<td></td>
<td>Mycobacterium tuberculosis</td>
<td>Increased risk of having tuberculosis by a factor of 4.09.</td>
</tr>
<tr>
<td>Construction and manufacturing</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Woodworkers/ carpenters</td>
<td></td>
<td>Wood dusts, mites, reeds</td>
<td>Dar-es-Salaam workers – nasal obstruction 9.8%, nasal discharge 19.6%, sneezing 9.8%, persistent cough 20.1%, breathlessness 29.9% and other symptoms 14%.</td>
</tr>
<tr>
<td>Construction</td>
<td></td>
<td>Turpentine, thinners, paints, isocyanates, cement dusts, fibres</td>
<td>SA construction industry: dermatitis rate from 2000 to 2005 (1.5 to 1.8/100 000 workers). Respiratory (47%) and skin (17%) disease were much higher than infectious diseases (&lt;1%) among British construction workers. Dermatitis was reported as the second highest (21%) health effect among Finnish house painters &amp; carpenters.</td>
</tr>
<tr>
<td>Production activities and street vending</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Food preparation</td>
<td></td>
<td>Spices, herbs, flour allergens, microorganisms, gloves, proteins in fish Cleaning reagents, preservatives, flavours, smoke from cooking</td>
<td>Occupational asthma reported among spice mill workers. Prevalence of probable occupational asthma among super-market bakery workers – 13%. Prevalence of ocular-nasal symptoms among pilchard canning and fishmeal processing plant workers – 26%.</td>
</tr>
</tbody>
</table>
Occupational allergies in the informal sector

There is a lack of information in the scientific literature on both occupational respiratory and skin allergies among informal workers in South Africa. These conditions often co-exist in sensitised individuals and are well documented in the formal sector, particularly in the formal agriculture industry. A high proportion of people work in the informal agricultural setting, particularly, in rural areas. A high prevalence of occupational symptoms, wheezing, as well as skin problems have been reported in the agriculture industry. The risks would be similar or even higher among informal agricultural settings, particularly in rural areas.

Another group of hawkers at risk of allergen and irritant exposure are the spice traders prominent in Durban, KwaZulu-Natal and to a lesser extent in Johannesburg, Gauteng and other provinces. Allergies in spices have been reported in many international studies and one South African study, although the latter has been done in the formal industry. The grinding process of spices resulting in high exposure is also synonymous with the grinding of herbs/plants typical of the traditional medicine trade. The selling of traditional herbal medication is evident in most provinces. There is a paucity of information on allergies from South African herbal medicine due to a lack of knowledge about the plants from which these herbs are extracted. The research done by Goring also supports the occupational risk to spice

Biological and chemical exposure in the informal sector

Considering the heterogeneous nature of informal work, these workers are exposed to elevated occupational health and safety (OH&S) risks. They work under unfavourable conditions such as cramped and poorly ventilated spaces impacting on indoor air quality, or extreme weather conditions when working outdoors. In most instances there is a lack of access to potable water and ablution facilities leading to urinary tract infections, typhoid and hepatitis. Poor nutrition adds to their increased risk of illness. A health hazard evaluation of the informal sector, possibly the only one done in South Africa to our knowledge demonstrated a lack of awareness of hazards and risk in their work environment. While this study provided useful information of exposures (dust, welding fumes, noise, illumination, thermal stress) in some business operations (coal loaders, hairdressing, motor repair, panel beating, sewing, welding) it lacked in other operations. For example thermal stress was measured in hairdressing salons; however major risk factors in salons are chemical and water exposures which were not addressed. Biological and chemical risk factors related to occupational allergies and infectious diseases are numerous in various exposure groups in the informal sector; however, a list of the more common risk factors is highlighted in Table 1.

Continued from page 5
allergens in a medium sized company situated in the East Rand, Gauteng.44

Skin disease estimates from the World Health Organization and Women in Informal Employment: Globalisation and Organising (WHO/WIEGO) based on different regions of the world showed a high prevalence. In Sub-Saharan Africa and Latin America, two regions with very large informal sectors, skin disease estimates were 210 500/155x10^6 and 186 000/179 x10^6, respectively.45 Skin disorders are evident across various exposure groups of the informal economy including construction, hairdressing, welders, painters, woodworkers, metal workers and car mechanics. Some examples are shown in Table 1. Skin irritation in small-scale industries (SSI) of Dar-es-Salaam varied by job type with a higher prevalence among metal workers (75.4%) than among welders (29.7%), painters (25.6%) and woodworkers (29.0%) where prevalences were relatively similar. Interestingly, chest and throat pains were reported among welders (71.3%) and painters (60.4%) but not woodworkers or metalworkers.46 Spray painters/panel beaters are also exposed to isocyanates from spray mist and vapours which may cause or worsen existing asthma or dermatitis or cause long-term and at times life-threatening illness. Frequent and prolonged contact with used engine oil may also cause dermatitis.47

Both respiratory and skin diseases are also common among hairdressers or barbers, as a result of the harsh chemicals used as well as prolonged exposure to water from washing hair. Numerous make-shift ‘boutiques’ advertising haircuts, braiding, tints, etc. are evident when one drives through busy urban streets. Although these informal workers can be commended for their entrepreneurship skills, they have little or no health supervision in the workplace. Staff in 58% of SME hairdressing salons in the greater London area had dermatitis.48 They are also subject to cuts and bruises from the shaving instruments used,27 which could result in infections.

Infectious diseases in the informal sector
Exposure to biological agents (e.g. bacteria, moulds, viruses, endotoxins, β-glucans) occurs in many occupational environments, including informal sectors or small scale industry. Infectious diseases are common in the informal sector especially among waste pickers. Nearly 15 million waste pickers across the globe collect, sort, recycle and sell materials of a potentially hazardous nature exposing them to hazardous substances of unspecified origin as expected, be it on a landfill site or door-to-door picking.49 Non-compliance with methods of safe medical waste disposal renders them vulnerable to various infections from biological waste including
contaminated sharps and soiled sanitary pads.\textsuperscript{53} Waste pickers, particularly, door-to-door pickers, are also at risk of acquiring rabies from stray dogs. Raw waste contaminated with microbes such as \textit{E. coli} of faecal origin (e.g. soiled diapers) could result in gastrointestinal tract infection as many poverty-stricken workers may consume or provide for their families what they deem to be edible.\textsuperscript{51} In addition, methane and other gases can be emitted from decomposition of waste products or chemical bottles, which apart from the risk of explosion, may lead to respiratory symptoms and asthma.\textsuperscript{50} In developing countries, a significant proportion of waste pickers are women and children who are particularly vulnerable to noxious agents and toxins. Children are vulnerable as their immune systems are not fully developed yet. The risks to women during their reproductive years are also concerning.\textsuperscript{12, 52-53} In addition to this, children lack judgement, experience and knowledge when compared to adults thereby putting them at a higher risk.\textsuperscript{12, 54} A study among waste picking child labourers in Nicaragua demonstrated 13% decreased lung function in waste picking children with wheeze compared with non-waste picking children with wheeze. Exposure to small particles among the waste picking children was unacceptably high.\textsuperscript{55} Communal ablution facilities add to the risk of infectious disease among informal workers.\textsuperscript{56-57}

Workers involved in traditional communal farming are also at risk of contracting zoonotic diseases as a result of poor healthcare of livestock. Rivers and streams may become contaminated from faecal waste or improper disposal of carcasses and hence pose a risk to nearby communities dependant on this water for drinking and domestic activities.\textsuperscript{58} Research conducted at the South African NIOH, assessing the quality of storage water in farm workers' houses in the Heidelberg area, demonstrated that borehole water collected and stored in containers before use contain a high number of potentially pathogenic microorganisms.\textsuperscript{59} This not only puts the workers themselves at risk of waterborne infections, but also their families. In the Phillipines, 19% of working children (3.6 million) particularly in the farming and retail categories felt they were exposed to biological hazards (especially bacteria and fungus).\textsuperscript{60}

Another study led by the Medical Research Council, investigating the water quality of houses in five residential areas (Hillbrow, Braamfisheville, Bertrams, Hospital Hill, Riverlea) in inner Johannesburg, demonstrated that households with mould or fungus problems on the inside walls had a 60% increased risk of reporting tuberculosis.\textsuperscript{28} This study stressed that the use of the home as a workplace may predispose occupants to exposure to hazardous chemical substances and infectious diseases. For example, in 2006 28% and 19% of the households in Hospital Hill and Bertrams respectively reported diarrhoea and vomiting in a two-week recall period (The Health, Environment & Development Study (HEAD) study annual report 2009). Although these figures appear to be decreasing, the report stresses the need for personal, domestic and food hygiene awareness campaigns to reduce the incidence of diarrhoeas and vomiting further. The transmission of tuberculosis (TB) in congregate settings like homeless shelters has also been reported.\textsuperscript{61-62}

**Tuberculosis in motion driving a different agenda**

Studies have shown that over-crowded public transport increased the risk of having pulmonary TB by a factor of 4.09 compared to individuals using private transport.\textsuperscript{35} The risk was also increased by a factor of 2.07 if the commuting time was ≥1 hour. Infected persons have more productive coughs in the morning (when more bacilli are released because of their accumulation at night), increasing the risk to passengers,\textsuperscript{35} possibly on route to work. However, in another study TB transmission on a train was demonstrated for an exposure time below 1 hour.\textsuperscript{63} These studies suggest that we need to be alert to transmission of TB in the public transportation industry, where drivers are at continuous risk of exposure from infectious passengers. In addition, TB transmission risk for passengers may be escalated by infected drivers. With the majority of South Africans living in decentralised areas which are a distance from work, the taxi industry carries over 60% of South Africa’s commuters.\textsuperscript{64} The average time spent in a South African taxi by a passenger is 65 minutes and the average number of trips per day is
2.3. It is therefore not unlikely that the transmission of TB in the taxi industry might be considerably higher based on the high burden of active TB in South Africa. The City of Tshwane has formed a partnership with the taxi associations to put stickers on their taxis educating the transport industry and the public about airborne TB and the prevention of infection.

**Occupational health systems**

Occupational hazards and inadequate OH&S standards are particularly evident in the informal sector. Some are not even interested in learning about OH&S. Department of Labour inspections revealed that a high proportion of small employers do not have the capacity to take preventive measures to prevent injury and particularly occupational disease, even more so for the informal sector. Therefore, innovative means are needed to increase the importance of OHS agencies servicing the informal sector, especially the special needs of women and child labourers. Labour laws which are supposed to protect the plight of workers in the lower income groups, do nothing for their working conditions. One worker was sent to India to learn from the Indian waste pickers, clearly demonstrating their ability to empower themselves.

“In developing countries, a significant proportion of waste pickers are women and children who are particularly vulnerable to noxious agents and toxins.”

Legal framework

Workers in the formal sector are protected by laws that provide OH&S standards. However, these standards lack substantive measures to address the concerns of workers in the informal sector, especially the special needs of women and child labourers. Labour laws which are supposed to protect the plight of workers in the lower income groups, do nothing for their working conditions. A number of more recent changes in employment patterns (e.g. growth of SMEs) increase the importance of OHS agencies servicing the informal sector and protecting these workers. In many countries in southern Africa, small-scale (informal-sector) production is not covered even by the most comprehensive notification systems, despite the fact that informal-sector production is growing more rapidly than that in the formal sector. Surveys of informal-sector workers in Zimbabwe reported rates of 131 injuries/1000 workers and 116 illnesses/1000 workers which exceeded the formal-sector rates tenfold and a hundredfold, respectively. Working with hazardous substances in the informal sector has significant public health and safety consequences – for instance, children may be exposed to hazardous biological agents from illegal medical waste removal practices.

In addition, certain formal businesses lay permanent workers off to stay smaller than the minimum size prescribed by the current labour legislation in terms of minimum wages and other conditions of employment. The business then hires the same workers as casual staff, in this way avoiding the institutional cost involved in adhering to all the prescriptions of the relevant labour legislation. Policies, addressing structural unemployment, like training and skills development have to be directed to this industry as well.

**RECOMMENDATIONS AND EMERGING ISSUES**

- The informal sector is growing at a phenomenal rate therefore an occupational health service at public (district) primary level as part of the National Health Insurance (NHI) should be easily accessible by these workers.
- Work with the various NGOs in the informal sector (e.g. The South African Traders Association, WIEGO, International Domestic Workers Network, Tshwane Waste Pickers Network, Groundwork) to promote OH systems starting with basic issues such as: the provision of clean drinking water, ablution facilities and appropriate personal protective equipment; restricted control to certain work sites (e.g. landfill sites); and the encouragement of participation in health examination programmes. The independent organising of waste pickers in the Tshwane metropolitan area is a good example. They have a committee (Rekopane Recycling Revolution) which holds monthly meetings to improve working conditions. One worker was sent to India to learn from the Indian waste pickers, clearly demonstrating their ability to empower themselves.
- Engage with the media to promote awareness and sensitise workers on the risks of their work environment adapted for literacy levels as has been done in Ghana.
- Invite informal workers to attend workshops to understand their attitudes and concerns, which may also generate ideas on methods to address lack of interest pertaining to OH&S issues. For example concerns amongst waste pickers in India about the risk of biological exposure from soiled sanitary pads may be addressed at such forums. These gatherings may foster discussions to reduce exposure and waste pickers educated on how to avoid exposure.

**CONCLUSION**

In spite of their plight these workers contribute to economic development, manage natural resources, alleviate poverty,
strengthen communities, support families and the desti-
tute. The temporary nature of employment in the informal
sector complicates the implementation and functioning of
OH&S systems; however, that should not deter from the
need to introduce and develop this. Further research into
the health of South African informal workers, particularly
on occupational allergies and infectious disease, which ranks
among the OH problems reported in international studies
in this sector, is warranted. This will also give guidance on
the priority issues required for OH&S interventions in this
sector. Epidemiological studies allow for trend analyses to
be conducted which will assist in monitoring the effects of
interventions once implemented.

CONFLICT OF INTEREST

The authors declare no conflict of interest.

LESSONS LEARNED

• Informal workers are exposed to numerous occupa-
tional health and safety risks.
• Occupational allergies and infectious diseases should
be considered when individuals from the informal
sector present at health facilities.
• The linked between workplace biological and chemi-
cal exposures should be explored in informal workers
suffering from allergies or infectious diseases.
• Occupational allergies and infectious disease rates
are high among informal workers.
• Efforts should be made to educate informal workers
of the hazards and health effects present in their work
environments.

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