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Workplace Safety and Health Conditions and Facilities in Small Industries in Jeddah, Saudi Arabia

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Abstract

A lot of attention has been paid to improving occupational safety and health (OSH) in small scale industries all over the globe. This study describes the outcomes of a preliminary OSH status assessment in small scale industries of motor vehicle repair workshops (MVRW) in Jeddah, Kingdom of Saudi Arabia (KSA). An inspection tool composed of 10 OSH elements and 62 items employed walk-through survey, observations and interviews. The mean positive responses for different OSH elements surveyed were as follows; personal protective equipment (PPEs) (43%), emergency preparedness (49%), fire protection (60%), facilities (80%), general workshop safety (43%), housekeeping (17%), chemical exposure (12%), services and maintenance (57%), mechanical handling (81%) and tool safety (63%). However, special concerns were found for OSH elements including; use of PPE's, emergency preparedness, general workshops safety, housekeeping and exposures to chemicals as having safety score less than 50%. OSH elements with lower positive responses at surveyed workshops would be addressed through further monitoring and training of technical and administrative staff. This preliminary survey will form the basis of a more comprehensive study for evaluation of an accurate representative OSH status in small scale industries in KSA.

Keywords: Safety and health, Occupational, Safety facilities, Safe work practices, Work environment, Jeddah

1. Introduction

Motor vehicles are essential part of today's life, their repair and maintenance has led to the emergence of a very large service sector industry also called workshops and garages. In some countries, this service sector industry is also categorized as informal, small and medium-sized enterprises (SMEs). It's a labor-intensive sector and the size of enterprise, its number of workers and their job function vary significantly [1, 2]. A small business can be defined as non-manufacturing industries employing less than 20 employees and manufacturing industries with less than 100 employees [3]. There is an increasing attention all over the globe for improving occupational safety and health (OSH) in small sized enterprises. The main characteristics of the small enterprises are that they are operated and owned independently; closely controlled by managers/owners who contribute to the operating capital predominantly and are the principal decision makers [3].

Nearly 236,000 people work in 37,600 auto collision repair businesses in the US [NAICS code 811121]. A majority of these businesses (55%) have four or less than four employees, 23% have 10 or more employees [4]. Workers encounter a wide variety of hazards, risks and exposures in this industry and the use of engineering controls and personal protective equipment (PPEs) have been well documented in this industry [4, 5] but other aspects of workplace safety including explosion and fire incidences, mechanical and electrical hazards, and the programs required to manage these hazards, are need to be explored further [4]. There is dearth of actual and reliable data available to public on number of workers in informal small repair workshops in Kingdom of Saudi Arabia (KSA). According to labor force survey 2016, total labor force work in the activity of whole sale trade, retail trade and vehicle repair

(type of economic activity) is 18.4% of the total labor force [6]. Currently most of the OSH practices are not monitored thoroughly in KSA and many accidents in self-employed and small scale informal occupations went unreported [7].

In informal, small and self-employed industries like motor vehicle repair workshops (MVRW), workers lack awareness regarding routine chemicals and other hazards. Workers at such workplaces work in unhygienic conditions, daily exposed to fuels and don't use PPEs and other protective measures that can minimize skin cancer risk and respiratory ailments [7, 8]. MVRW employ a wide age range of workers and it's a tough sector to supervise and regulate in terms of OSH. Many research studies proved that workers in such small scale repair industries are more prone to work place hazards, risks and ill health effects [9] which can be somehow attributed toward less resources, low technical capacity, lack of knowledge and awareness regarding OSH guidelines. Many severe accidents happen which left victims paralyzed, loss of body parts reproductive, musculoskeletal disorders, skin diseases, neurological, psychological, mental and respiratory diseases [9, 10].

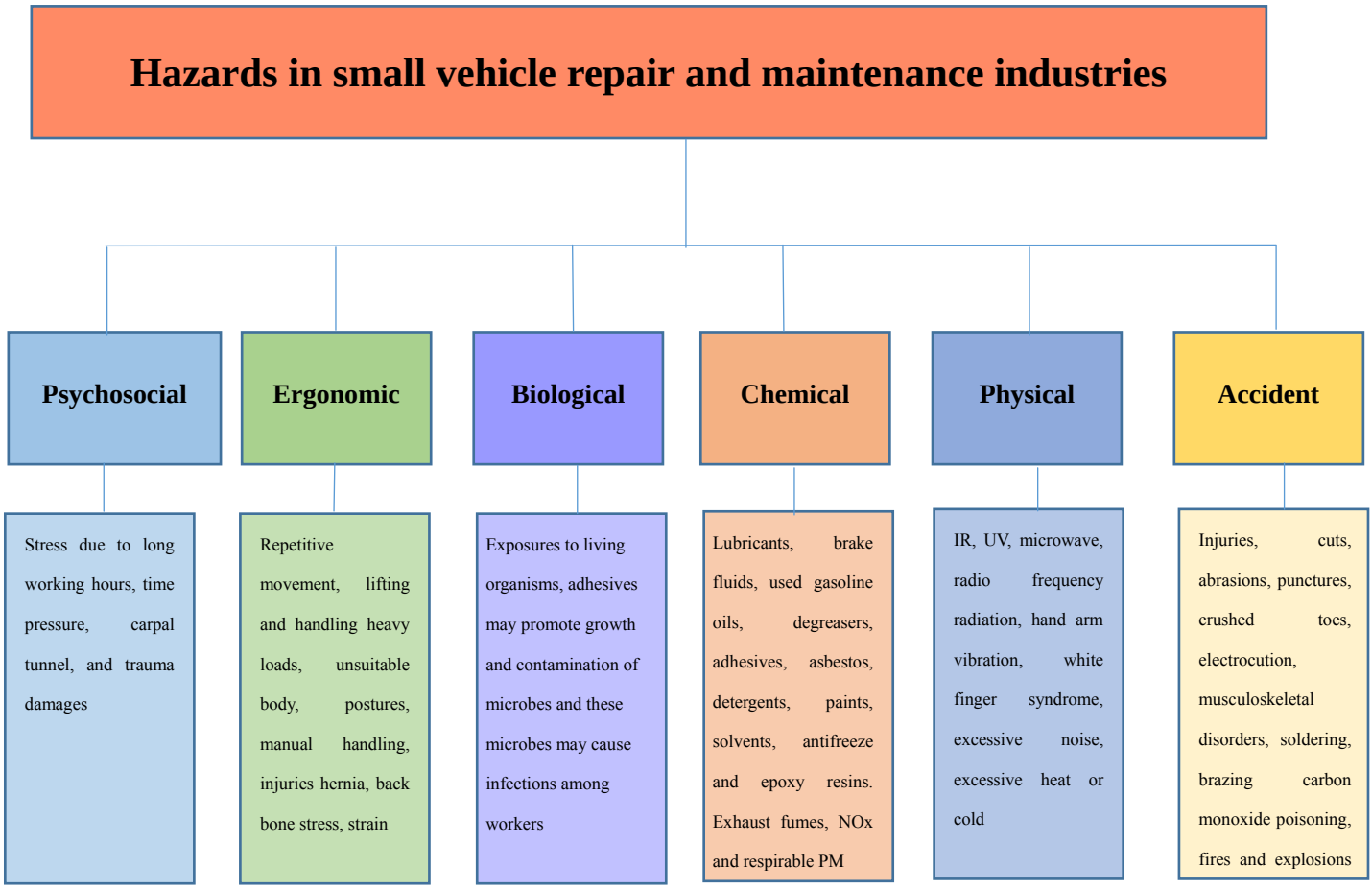

Figure 1. Flow chart for different types of hazards at small repair industries [7]

In KSA, extremely hot weather, majority of expatriate workers and their lack of OSH awareness and interest exposing them to a number of occupational hazards and risks, make

MVRW sector a more vulnerable occupational group [7]. A detailed flow chart summarizing different potential physical, chemical, biological, accidental, ergonomics and psychosocial hazards are mentioned in figure 1. At MVRW, some dangerous practices like smoking, bad housekeeping, unhygienic clothes, working beneath vehicles, manual handling, lifting heavy loads, naked eye welding, eating and drinking are a matter of daily life. These practices and such workplace hazards cause adverse health effects like respiratory ailments, acute injuries, eyes injuries, hearing loss, musculoskeletal disorders [2, 4].

The current study was conducted to assess the OSH practices, conditions, facilities and environment in the MVRW in Jeddah for the first time. An inspection tool, composed of 10 OSH elements and 62 items, was designed and employed walk-through survey, observations and interviews. OSH data was collected from 13 selected sites and individual and mean positive responses were reported for each item and element respectively. The areas of concerns were highlighted and recommendations given for further improvements. The outcome of this study will help to conduct further more comprehensive OSH studies in small scale industries in KSA.

2. Methodology

2.1 Study Area

KSA has witnessed highest urban, economic and infrastructure development in previous decades. Due to sandy deserts, background air pollution especially dust and PM level is very high throughout the year especially when wind blows from nearby sandy areas to inhabited city areas [11]. Jeddah is the second largest industrial and developed city of KSA, with an estimated population of around 4.03 million [12, 13]. Jeddah is the main gate of pilgrimage and visitors to KSA, situated at Eastern Coast of the Red Sea at Latitude 29.2º North and Longitude 39.7º East [14]. It is said to be a car dominated city, at present there are around 18 million registered vehicles in KSA [15], 70 thousand fuel stations and thousands of small industries for repairing and maintenance of motor vehicles employing thousands of workers [7].

2.2 Local Conditions

Dust storms, obstructive buildings, arid environment, exhaust emissions, extremely hot summers, energy generation from fossil fuels, construction works, humidity, wearing and tearing of tires on roads, less herbs/plantation are common features of the local environmental and atmosphere [16 - 20]. Recent studies have proved exceeding levels of PM in Jeddah than the standards of PME (KSA) and EPA (US) [21 - 23]. One special characteristics in KSA is that majority of labor force especially in informal small scale sectors here is expatriate. A previous study in small vehicle repair service industry in KSA proved that almost all the workers working in this industry are expatriates [24].

Most of the MVRW in Jeddah employ around 3-10 workers including welders, electricians, mechanics, spray painters, panel beaters etc. MVRW workers spend around 8 to 12 hours per day and the local hot weather and worker's little OSH awareness and safety precautions make them more vulnerable. In particular, exposure to exhaust fuels, dusts, particulate matters and

chemical fumes are of more health concerns as reported earlier [7].

2.3 Survey Checklist

We designed and prepared the study survey checklist items based on different workplace OSH assessment checklists, survey reports, publications, local and international regulatory rules and regulations [Civil defense, KSA, US EPA, OSHA, National Fire Prevention Code (NFPC)]. For survey tool preparation, input was also sought from academic and field OSH professionals, suppliers, workshops supervisors, mechanics and local regulators as per local conditions and applicability.

After preliminary testing in five small representative industries some items were excluded and some extra were included in the checklist. The final checklist covers assessment comprising 62 OSH questions grouped into 10 components/elements.

1. Personal protective equipment (7 items)
2. Emergency preparedness (3 items)
3. Fire protection (4 items)
4. Facilities (6 items)
5. General workshop safety (11 items)
6. Housekeeping (4 items)
7. Chemicals exposure (8 items)
8. Service and maintenance (10 items)
9. Manual handling (2 items)
10. Tool safety (7 items)

The answers for each item/question were in the form of Yes (item is present, compliance with regulation, meeting best practice), NO (if any item is incorrect, missing, deficient, against regulations, not meeting best practice) and if the question does not apply, the answer was not applicable (NA). Each "Yes" indicates best/good activity/practice/condition for workers health and safety and each "No" indicates unsafe and unhealthy activity/practice/condition. For each "No" specific recommendation for making it "Yes" was written in the comments column against that item and was briefed to supervisors as well as workers to adapt it.

2.4 Industries Inclusion Criteria

20 MVRW in Jeddah were randomly selected after visiting them. An introduction and participation invitation letter was obtained from the department of Environmental Sciences and the Faculty of Meteorology and Environment, King Abdulaziz University, Jeddah KSA and presented to the selected MVRW's representatives. 7 workshops refused to participate after learning the survey details, therefore we surveyed the remaining 13 workshops. The recruitment method included referrals from the initially agreed workshops' supervisors and some known suppliers and workers at the workshops. The method was time consuming but systematic as repeated phone calls and personal visits had to be made. The study was conducted through November to December 2015. The selected participants were briefed about aims and objectives of research and assured regarding confidentiality of their particulars.

The research survey was conducted at each selected MVRW site by two occupational hygienist professionals. A supervisor or manager was interviewed for safety and health documents, rules and policies, demographics of workshops and number of employees. The workplace conditions and other items (PPEs, lights, access aggress paths, fire extinguishers, physical condition of gas cylinders, tools, electrical cords, floors, exposure to chemicals, dusts, oils etc.) presence were assessed through the walk through survey, personal observations and visual inspection. Employees were interviewed about safe use of machinery equipment and use of PPEs. During survey, workers were briefed regarding observations, but the checklist was not made open and workplace interviews were made at the end.

3. Results and Discussion

The OSH practices, conditions, facilities and environment was assessed in 13 selected MVRW in Jeddah through comprehensive survey study. An inspection tool composed of 10 OSH elements and 62 items employed walk through survey, observations and interviews for the study. The first element of the survey study of PPEs availability and use showed a low average positive response of only 43% with standard deviation (SD) of 17.94. The highest positive response of 62% was reported for the provision and usage of knee and joint protection mats, whereas the lowest positive response of 23% and 15% reported for foot protection worn as required and hearing protection used when required, respectively (Table 1).

Table 1. Results summary for evaluated personal protective equipment in studied MVRW

Personal protective equipment	% Responses (N=13)		
	Yes	No	Not applicable
Safety glasses and/or goggles used as needed?	54	46	0
Hearing protection utilized when required?	15	85	0
Hand protection used/worn as required?	54	46	0
Foot protection worn as required?	23	77	0
Face masks are used/worn as needed?	54	46	0
While welding helmet, gloves, apron, and curtain used as needed?	38	46	16
Knee & Joint protecting mats are present and used?	62	38	0
Mean ± SD	43± 17.94	55±18.24	2 ± 6.00

Provision of proper PPEs is the responsibility of the employer under the Saudi labor law 2005 (Royal Decree M/51, dated 23/08/1426) as amended in 2015 by resolution 258. Workshop workers occasionally exposed to loud sounds for extended lengths of time which can effect hearings especially for older workers. The Université de Montréal study proved that mechanics are exposed to noises that are more than 90 decibels. According to another study,

at vehicle repair industry noise output of various tools i.e. air hoses, electric grinders, pneumatic grinders and chisels, and sanders all produce sounds louder than 100 decibels [25]. The low positive response of PPE element in our study was due to the unavailability of PPE in some case but mostly because of the workers unawareness of its importance or simply not used due to uncomfortable feeling. A similar type of study in the small industries in Alkhober KSA was conducted in year 2000 which revealed that only 12% of the workers used PPE's all the time, whereas 60% did not use any available PPEs at all [24].

The summary results for the safety element of emergency preparedness were found to be relatively higher as the mean positive result was 49%. It included three safety items namely emergency contact numbers displayed, cleared access and egress paths and availability of approved first aid kit (Table 2). In terms of health and safety, emergency preparedness is very important for any workplace to tackle any untoward situation. One of key concepts for effective emergency response is "preparation" [26]. The poorest response in this study was noted for the availability of first aid kit. As only 15% on average of selected small industries had appropriate first aid kit available, despite the fact that working in auto workshops is full of hazards and risks specially injuries, cuts, bruises and burns [7]. According to a previous Saudi study in small vehicle repair industries, many workplace hazards were identified, injuries and accidents were the major ones (39%) reported by workers [24].

Table 2. Results summary for evaluated emergency preparedness in studied MVRW

Emergency preparedness	% Responses (N=13)		
	Yes	No	Not applicable
Emergency contact numbers prominently displayed?	54	46	0
Access and egress paths clear?	77	23	0
Approved first aid kit available?	15	85	0
Mean ± SD	49±31.34	51±31.34	0± 0.0

Table 3. Results summary for evaluated fire protection in studied MVRW

Fire protection	% Responses (N=13)		
	Yes	No	Not applicable
Fire extinguishers and sand buckets readily available (not blocked)?	77	23	0
Workers trained in using fire extinguishers?	77	23	0
Smoking prohibited in work area	31	69	0
Rubbish and flammable substances are stored Separately?	54	46	0
Mean ± SD	60±22.02	40±22.02	0±0.0

The results of next safety element of fire protection in this study showed good positive mean response of 60% with SD of 22.02. Among the all safety items in this category, fire extinguishers and sand buckets readily available (not blocked) as well as workers trained in using fire extinguishers both items showed the highest positive response of 77% (Table 3). It can be attributed toward the vigilance of the monitoring agencies and good Saudi building code practices adherence. The lowest positive response of 31% was observed for the smoking in work area for this OSH element.

The provision of facilities element received one of the highest mean positive response of 80% with SD 11.51 in this study. The drinking water facility item, water coolers were available at the studied sites for workers, was ranked the highest with 92% in this element, attributed to generosity of the local people. Moreover, the facilities items of toilets, shadow and proper exhaust and ventilation systems also scored very high positive response of 85% (Table 4). Even the lowest positive response of 62% in this category for availability of air conditioners is good enough. The provision of all such facilities is also mandatory under Saudi labor law 2005.

Table 4. Results summary for evaluated facilities in the studied MVRW

Facilities	% Responses (N=13)		
	Yes	No	Not applicable
Rest areas provided?	69	31	0
Toilets and accessible?	85	15	0
Drinking water facility accessible?	92	8	0
In case open work amid hot weather, shadow provided?	85	15	0
Air conditioner available	62	38	0
Proper exhaust and ventilation system (toxic vapors such as carbon monoxide and other solvents) exist?	85	15	0
Mean ± SD	80±11.51	20±11.51	0±00

The mean positive results for general workshop safety element was found to be low i.e. 43% (Table 5). This indicates that only 43% of vehicle repair industries studied followed safe practices and procedures according to the general workshop safety guidelines. The general observations amongst most workshops studied were that floors were uneven, cluttered with oily rags, work benches were not properly cleaned and most of the working area had fuel and other chemical odors etc., thus scored below 30% for these items. The safety guidelines for no food and drinks in the working area was not followed at all in all studied sites. Moreover, other crucial OSH visual aids, signs, symbols, slogans present also scored only 23% positive response. This clearly indicates the need of more similar studies across different industry

sectors in KSA. In addition, workers training in OSH as well as strict protocols to ensure the implementation of these crucial OSH guidelines for the safety of the workers is needed. Many researches endorsed that providers recognize the extraordinary need for preparing and delivering OSH information. According to an Australian study in small metal industry, exposure to hazards were found above permissible values and access to OHS information was poor by immigrant and low level literate workers [3].

Table 5. Results summary for evaluated general workshop safety in studied MVRW

General workshop safety	% Responses (N=13)		
	Yes	No	Not applicable
Workshop floors in good condition, smooth and are free from obstacles?	8	92	0
All areas have adequate illumination?	100	0	0
Appropriate cans/bins/container available for disposing off oily rags, metal rubbish and flammable liquids?	31	69	0
Work benches are neat and clean?	15	85	0
Heavy goods, materials stored in appropriate racks/shelves designed for load bearing purposes?	38	62	0
Temperature in working area is comfortable?	100	0	0
Working area is free from odor?	23	77	0
Food/ drinks are not allowed in the work area?	0	100	0
Are vehicles always braked and chocked?	100	0	0
No pedestrians are passing front/back of vehicles	38	62	0
OSH visual aids, signs, symbols, slogans present	23	77	0
Mean ± SD	43±38.20	57±38.20	0.00

The performance of selected sites in terms of housekeeping element was also found to be very low. On average only 17% of studied workshops had good housekeeping in terms of spill free, smooth neat and cleaned floors and immediate cleanup for spillages. The worst results found for the safety item of chemical spills containment facility provide, where none of the studies sites had proper containment facility for chemical spillage (Table 6). Again, the poor results of housekeeping element indicates the need of awareness and training of all staff, especially the technical workers to not only understand the OSH guidelines and protocols but give importance in their implementation.

Table 6. Results summary for evaluated housekeeping in studied MVRW

Housekeeping	% Responses (N=13)		
	Yes	No	Not applicable
Floors are free from oil, grease/ water spillage?	15	85	0
General housekeeping is neat and orderly?	31	69	0
Fluid and water spillages cleaned up immediately?	23	77	0
Chemical spills containment facility provided?	0	100	0
Mean ± SD	17±39.50	83±39.50	0±00

The mean positive response for the safety element of chemical exposure was found to be the poorest among all safety elements in this study, only 12% mean positive response was reported at all studied sites. Unsafe practices and conditions like exposure to paint, diesel, gasoline and used gasoline engine oil (UGEO) fumes was observed at all surveyed workshops (Table 7). These unsafe acts, practices and unhealthy working environment is very dangerous for occupational health of the studied population. Many epidemiology studies proved that inhalation and ingestion of gasoline among mechanics causes lead poisoning and even death [27]. Hands and forearms exposure to mineral oil and hydraulic fluids can develop weakness in them [28]. Direct contact with fuels and lubricants causes acne, dermatitis, skin sensitization and eczema [29]. The freely use of gasoline among workshop workers is due to some misconceptions, as according to a research in Ilorin, workers believed that such fuels are not harmful when taken in small doses instead these can actually act as a cleansing [30].

Table 7. Results summary for evaluated chemicals exposure in studied MVRW

Chemicals exposure	% Responses (N=13)		
	Yes	No	Not applicable
Workers don't expose to chemicals while painting vehicle?	0	46	54
Workers not expose to diesel, gasoline fumes while degreasing, repairing engine or parts?	0	61	39
Workers not expose to UGEO?	15	46	39
Batteries (lead acid, Ni-cad, silver, etc.) managed for recycling?	0	39	61
Waste oils stored and disposed of ppropriately?	46	54	0
All chemical containers labeled appropriately?	23	77	0
Gasoline is not used to clean parts?	0	100	0
Workers know chemical safety of chemicals?	15	85	0
Mean ± SD	12±16.34	64±21.66	24±26.78

The mean positive response for another important safety element of service and maintenance was found to be of satisfactory level of 57%. These surveyed sites had safe and healthy working environment and conditions and were following good OSH practices in this regard (Table 8). The maximum positive results of 85% were observed for three safety and health items; compressors guarding in place and serviced regularly, air pressure used for cleaning is discharged at no more than 30 psi, and bench grinder wheel is guarded & securely fastened. The lowest positive response of 15% and 22% were reported for OSH item of acid carboys are available and OSH items of gas cylinders lacking obvious defects, leaks and damage as well as gas cylinders stored in a safe, well ventilated place, respectively.

Table 8. Results summary for evaluated Service and maintenance in studied MVRW

Service and maintenance	% Responses (N=13)		
	Yes	No	Not applicable
Gas cylinders, valves, couplings, regulators kept free of oil and grease?	38	38	24
Gas cylinders lacking obvious defects, leaks and damage?	22	54	24
Gas cylinders stored in a safe, well-ventilated place?	22	54	24
Compressors guarding in place and serviced regularly?	85	15	0
Air pressure used for cleaning is discharged at no more than 30 psi?	85	15	0
Spark plug cleaner is in good condition	69	31	0
Parts are cleaned in dip tank?	77	23	0
Bench Grinder wheel is guarded & securely fastened?	85	0	15
All lifting equipment (chains, slings, jacks) serviced, maintained and in good condition?	69	31	0
Acid carboys are available?	15	85	0
Mean ± SD	57±29.08	35±24.56	8±11.52

The results for the safety element of manual handling were good, the mean positive response was found to be 81% with SD of only 5.65 (Table 9). It comprised of investigating that either mechanical aids for lifting and carrying heavy and bulky items i.e. tires, engine parts, gas cylinders etc. were provided, assistance for moving, pushing, pulling heavy and bulky items was available. During the work at workshops, employees are around tools and bulky equipment, often lifting items which can cause musculoskeletal problems. Furthermore, they spend long time in working in bent position, lying on their back and such other awkward postures. The workers at workshop especially mechanics often work with various tools, so the appropriate and safe tools can play an important role in the OSH of the workers. The

mean positive response of our inspection study for the safety element of tool safety was found to be 63% with SD of 18.55 (Table 10). The maximum safe act of 85% was found for the use of safety jacks while working under vehicle, whereas the lowest positive response of 31% was found for safety item of presence of warning labels on tools, equipment/ appliances.

Table 9. Results summary for evaluated manual handling in studied MVRW

Manual handling	% Responses (N=13)		
	Yes	No	Not applicable
Mechanical aids provided/used for lifting, carrying heavy/ bulky items; tires, batteries, gas cylinders, engine blocks?	85	15	0
Is assistance for moving, pushing, pulling heavy or bulky items available when required	77	23	0
Mean ± SD	81±5.65	19±5.65	0±0.0

Table 10. Results summary for evaluated tool safety in studied MVRW

Tool safety	% Responses (N=13)		
	Yes	No	Not applicable
Safety jacks used while working under vehicles?	85	15	0
Portable power tools provided with guarding?	69	31	0
Double insulated or grounded power tools used?	62	38	0
Hand tools are in good condition, (hammers, wrenches, striking tools, etc.)	77	23	0
Impact air tools have safety clips or retainers on them?	46	23	31
Stepladder or stepstool used for high access?	69	31	0
Warning labels/instructions on equipment's, tools/appliances present?	31	69	0
Mean ± SD	63 ±18.55	33±17.57	4±11.71

Lot of attention has been paid for improving occupational safety and health in small scale industries all over the globe. This study for the first time, showed outcomes of a preliminary OSH status assessment in small scale industries of MVRW in Jeddah, KSA. Many similar studies reported that most small scale industries' managers, employees have little knowledge and awareness of OSH and give low priority to it. The lack of awareness for multiple hazards in such working conditions and low importance to implement OSH practices can potentially

cause serious health problems to workers [30]. For example, eating and drinking habits were found in almost all of the studied sites. Similar findings have been reported by a Nigerian study, where eating and drinking was reported as very common habit among auto mechanics and they rarely wash their hands properly before eating. This unhygienic habit expose the workers to auxiliary risks [31].

Many studies suggested that the OSH unsatisfactory outcomes in small scale industries might be due to a commonly held perspective among owners that OSH relies mostly on employee actions. Interestingly managers and owners agreed that they had an obligation for providing a healthy and safe work conditions and PPE's, but they also believe that most of the responsibility for safety resides with workers [4]. To minimize exposure to noxious workplace agents like loud noises, dust, smoke, fumes, and poor working postures low cost approaches should be formulated i.e. implementing engineering controls (e.g., proper ventilation), encouraging the use of personal protective equipment's.

This study was a preliminary assessment of OSH status in 13 selected MWRV in Jeddah and may not represent the true OSH status in this industry. There are certain limitations in this study that need further investigation and analysis. It is possible that selected workshops may have higher than average levels of interest and practices in OSH. At the same time, it is also possible that workers at some sites may have had cleaned up operation before assessment as the visits were scheduled, which would effect on the accuracy of the results. Nonetheless, unscheduled visits are generally not an acceptable approach in the local cultural as well as governmental and managerial rules and practices. Furthermore, seasonal variation can also effect survey results in terms of the provision and need for facilities to employees which vary significantly in summer and winter in KSA. A more detailed survey study is under progress by authors and will be published in another article after completion. More comprehensive similar studies are needed in MVRW and other small industries in order to understand the situations and gaps for improvement of OSH in such industries in KSA.

4. Conclusion

This study describes the outcomes of a preliminary OSH status assessment in small scale industries of 13 selected MVRW in Jeddah, KSA. The designed survey was based on 10 OSH elements and 62 items employed walk-through survey, observations and interviews. 5 OSH elements received good mean positive responses including; fire protection (60%), facilities (80%), services and maintenance (57%), mechanical handling (81%) and tool safety (63%). However, 3 OSH elements showed below average positive responses in between 40-50% including; PPEs (43%), emergency preparedness (49%), general workshop safety (43%). The 2 most concerning OSH elements were found to be the housekeeping and chemical exposure, which scored only 17% and 12%, respectively. OSH elements with lower positive responses at surveyed workshops would be addressed through further monitoring and training of technical and administrative staff. There is a requirement for a conceptual framework for interventions in this industry sector. Our preliminary results suggest that such small scale industries could benefit from training, consultation assistance, intervention programs and awareness workshops.

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