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## An ergonomic assessment of musculoskeletal disorders among airport bag handlers: A case study in Malaysia

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### ABSTRACT

Flight baggage handlers are highly exposed to risk factors associated with musculoskeletal disorders. It is a grave issue that needs to be highlighted since the aviation industry in Malaysia is continuously growing to support ongoing demand. Hence it is imperative to have an efficient working practice to smooth the entire airline operation. This study aimed to i) identify an association between heavy lifting with musculoskeletal disorders among flight baggage handlers; and ii) determine the association between age with lower back pain prevalence among flight baggage handlers. The data were collected using the Nordic Musculoskeletal Questionnaire (NMQ), daily observation and informal interviews. Findings of this study demonstrated that the majority of bag handlers in the study area suffer from musculoskeletal disorder (MSD) problem caused by their daily routine work. The most affected body parts of these workers are lower back, upper arm and shoulder whereby more than 60% of the workers have reported suffering from MSD symptoms in these body parts. It is evident from this study that the prevalence of MSDs among airport baggage handlers is high. Thus an effective MSD prevention is highly essential. Prevention of MSD in the workplace requires a strong commitment between the employer and employees within an organisation. The employer is fully responsible in providing a safe workplace, a sound ergonomic principle and proper training on health and safety for all employees.



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### INTRODUCTION

Flight baggage handlers are exposed to many safety and health hazards that could potentially lead to serious injury. The main tasks of a flight baggage handler include transferring baggage between carts and aircraft, and pushing and pulling heavy baggage often in standing, kneeling, bending, squatting and stretching postures mostly in the tarmac area of the airport and within the confined space of the narrow-bodied aircraft. As a consequence, these strenuous activities could potentially lead to musculoskeletal disorders (MSDs), ei-

ther temporarily or permanently, among the baggage handlers (Saudi *et al.*, 2017). It is vital for the aviation industry to commence a sound strategy to overcome these problems.

Aviation industry plays an important role in developing the Malaysian economy and helps to boost the growth of other economic sectors such as tourism, hospitality, education, and global trade. The dynamicity of the Malaysian aviation industry showed rapid growth in the passenger traffic for both domestic and international travelling. In consequence, Malaysia is currently the 18<sup>th</sup> largest civil aviation market in the world in terms of air passenger traffic; in 2014, Malaysia contributed to 1.5% of the world's passenger traffic. During the last decade (2005 to 2015), the volume of passenger traffic at all Malaysian airports grew from 7.2% and exceeded 83 million passenger flow by the end of 2015 (CAPA, 2017). The increment in passenger volume is due to the growing popularity of Malaysia as an Asian travel hub and the rising of Kuala Lumpur as one of the international financial centres (De Beck and Herman, 2000).

In the aviation industry, aircraft ground handling is a must-have service required by all aircraft following their arrival at the terminal gate. One of the services offered through ground handling is baggage handling operation. A baggage handler is responsible for loading and unloading passenger baggage, parcels, as well as commercial postal freight materials for both inbound and outbound flights (Dawson *et al.*, 2009).

The nature of baggage handling activity exposes workers to various health and safety hazards, potentially leading to work-related MSDs. Furthermore, baggage handlers are also subjected to various job hazards, including difficult weather conditions, as they are required to cover all working ground in the airport as well as inside the aircraft. A summary of the manual handling activities in the airport is listed in Table 1.

Due to the gravity of this problem, the study was aimed to i) identify if heavy lifting is associated with MSD among baggage handlers; and ii) determine whether age is a factor for the prevalence of lower back pain among baggage handlers.

## MATERIALS AND METHODS

### Data Collection

50 respondents out of 138 ramp employees who are baggage handlers at one of the aviation companies in Malaysia were recruited in this study. The baggage handlers were predominantly male, with a ratio of 90:10 (male=124: female=14) and were directly involved in the handling of passenger baggage and cargo items at the tarmac area. These

ramp employees work on shifts of about eight hours per shift. Baggage handlers, however, are often required to work overtime, particularly during peak seasons.

The questionnaire survey was carried out on the following scheduled dates to get as many respondents as possible to participate in this survey:

25/5/2017 (Thursday): 1<sup>st</sup> shift, 2<sup>nd</sup> shift and 3<sup>rd</sup> shift

26/5/2017 (Friday): 4<sup>th</sup> shift, 5<sup>th</sup> shift and 6<sup>th</sup> shift

27/5/2017 (Saturday): 2<sup>nd</sup> shift, 4<sup>th</sup> shift and 6<sup>th</sup> shift

### Structured Questionnaire

The questionnaire was divided into three sections as follows:

- Section A: General questions
- Section B: Locations and tasks that are most likely to cause injury
- Section C: Musculoskeletal discomfort based on Nordic Musculoskeletal questionnaire to assess musculoskeletal symptoms.

## RESULTS AND DISCUSSION

### Heavy lifting is associated with musculoskeletal disorders among baggage handlers

26% of respondents failed to perform any stretching exercises prior to working as the activity was not made compulsory by their supervisors (Table 3). When further questioned about the state of their health, 76% of respondents have experienced any kind of health problems resulting from their daily task as a baggage handler and 66% respondents reported having injuries that reduced their ability to handle baggage. The most common injury area was the shoulder (74%), followed by the back (66%), upper arms (54%), neck (40%), and the hip (26%). These findings confirm that heavy lifting is associated with musculoskeletal disorder consistent with previous studies (Dell, 1997; Dell 1998; Gangopadhyay and Dev, 2014; Gasibat *et al.*, 2017).

### Manual work location and tasks likely to cause injuries

In Section B of the questionnaire, respondents were asked to rank locations and nature of their tasks according to the safety, from the highest to the lowest risk. The four locations identified (Table 4) were: i) tarmac area outside the aircraft; ii) baggage room; iii) inside the compartment of narrow-bodied aircraft, and iv) inside wide-body aircraft bulk hold.

46% of respondents experienced an injury while working inside the compartment of the narrow-

**Table 1: The manual handling activities at the airport**

Type	Activities
Inbound	<ul style="list-style-type: none"> <li>• Baggage handling on the ramp</li> <li>• Baggage handling in the luggage hall</li> <li>• Baggage handling in the reclaim area</li> </ul>
Outbound	<ul style="list-style-type: none"> <li>• Baggage check-in process</li> <li>• Baggage handling in the baggage hall</li> <li>• Baggage handling on the ramp</li> <li>• Baggage stacking in the aircraft hold</li> </ul>
Persons with disabilities/mobility	<ul style="list-style-type: none"> <li>• Passenger check-in process</li> <li>• Assistance with boarding</li> <li>• Wheelchair services</li> <li>• Lift on/off aircraft</li> </ul>

**Table 2: Frequency of respondents involved in the study**

Variable	Frequency
Gender	Male: 44 (88%) Female: 6 (12%)
Age Range:	18-24 years old: Male: 26 (52%), Female: 4(8%) 25-30 years old: Male: 13 (26%), Female: 2 (4%) ≥31 years old: Male: 5 (10%), Female: 0 (0%)
Length of employment	<3 years: 18 (36%) 3-5 years: 12 (24%) >5 years: 20 (40%)
Number of shifts per week	1: 0 (0%) 2: 19 (38%) 3: 31 (62%)

**Table 3: General question responses by bag handler respondents**

Questions	Yes	No			
Do you do warm-up exercises (stretching) before and after lifting baggage?	37 (74%)	13 (26%)			
Are this stretching exercises enforced by your supervisor before and after lifting baggage?	16 (32%)	34 (68%)			
Do you have any health problems resulting from your daily task as a baggage handler?	38 (76%)	12 (24%)			
Has this injury reduced your ability to handle baggage?	33 (66%)	17 (34%)			
Question	Back	Shoulder	Neck	Upper Arm	Hips
Please indicate the body parts most affected by your daily tasks	33 (66%)	37 (74%)	20 (40%)	27 (54%)	13 (26%)

**Table 4: Manual handling location most likely to cause injury**

Location	Frequency (Percentage) n=50
Working inside compartment of narrow-body aircraft	23 (46%)
On the tarmac outside aircraft	17 (34%)
Lifting in the baggage room	9 (18%)
Working inside wide-body aircraft bulk hold	1 (2%)

bodied aircraft while 34% of respondents experienced an injury while working in the tarmac area. Another 18% experienced an injury while lifting in the baggage area while the least injury location was inside the wide-body aircraft bulk hold (2%).

In addition, respondents were also requested to rank in order the nature of manual baggage handling tasks from least likely to most likely to cause injury onto baggage handlers. The four main tasks identified were: i) lifting baggage handling off from conveyor belts into baggage trucks; ii) lifting baggage from baggage trucks directly into aircraft; iii)

**Table 5: Manual handling tasks ranked most likely to cause injury**

Activities	Frequency (Percentage)
Stacking baggage inside the baggage compartment of narrow-bodied aircraft	19 (38%)
Lifting baggage from baggage trucks directly into aircraft	17 (34%)
Lifting baggage off from conveyor belts into baggage trucks	9 (18%)
Pushing and pulling loaded baggage carts	5 (10%)

**Table 6: Frequency table of respondents' self-reported pain by body parts**

Body Parts (n=50)	Have you in the last 12 months been affected by pain, discomfort or numbness in this part		During the last 12 months have you been prevented from doing your normal work because of the pain		During the past 7 days have you been troubled by pain associated with this part	
	Yes	No	Yes	No	Yes	No
Neck	15 (30%)	35 (70%)	13 (26%)	37 (74%)	5 (10%)	45 (90%)
Shoulders	38 (76%)	12 (24%)	36 (72%)	14 (28%)	33 (66%)	17 (34%)
Elbows	28 (56%)	22 (44%)	21 (42%)	25 (50%)	8 (16%)	42 (84%)
Wrists/Hands	31 (62%)	15 (30%)	27 (54%)	23 (46%)	11 (22%)	39 (78%)
Upper Back	14 (28%)	36 (72%)	9 (18%)	41 (82%)	3 (6%)	47 (94%)
Lower Back	44 (88%)	6 (12%)	39 (78%)	11 (22%)	28 (56%)	22 (44%)
Hips/Thighs	21 (42%)	29 (58%)	18 (36%)	32 (64%)	18 (36%)	32 (64%)
Knees	41 (82%)	9 (18%)	37 (74%)	13 (26%)	31 (62%)	19 (38%)
Ankles/Feet	12 (24%)	38 (76%)	10 (20%)	40 (80%)	4 (8%)	46 (92%)

**Table 7: Frequency table for the most frequently affected body parts (Comparison between past 12 months and last 7 days)**

Parts	Prevented from doing work for last 12 months (n=50)	Had trouble during the last 7 days (n=50)
Shoulder	38 (76%)	33 (66%)
Lower Back	44 (88%)	28 (56%)
Upper arms	41 (82%)	31 (62%)

pushing and pulling loaded baggage carts, and iv) stacking baggage inside the baggage compartment in the narrow-bodied aircraft (Table 5).

As listed in Table 5, the majority of respondents (38%) reported that stacking baggage inside the baggage compartment of narrow-bodied aircraft was the most likely task to cause injury followed by 34% respondents who felt lifting baggage from baggage trucks directly into aircraft can cause them injuries, while 18% reported experiencing pain while lifting baggage off from conveyor belts into baggage trucks. The handling task that was thought to least likely to cause injury is the pushing and pulling loaded baggage carts. All the injuries may occur because baggage handlers must adopt harmful postures when lifting, stacking and unloading heavy baggage (Thomas *et al.*, 1995; Tapley and Ripley, 2005).

### Factors and Prevalence of Musculoskeletal Symptoms

All respondents, aged 18 to 31 years, reported experiencing pain in certain body parts which suggests that age is not a factor for the prevalence of MSD. Factors that could contribute to the progression of MSDs include physical and psychosocial

conditions experienced by individuals (Benjamin and Wilson, 2005). Our results showed that heavy lifting inflicted several physical symptoms to the participants (Table 6). The three highest affected body parts in the last twelve months are causing pain, discomfort or numbness are the lower back region with the highest score of 88%, followed by the knees (82%) and shoulders (76%). 78% of respondents were affected by pain in their lower back, 74% were affected by pain in their knees and another 72% experienced pain in their shoulders which prevented them from performing their normal work. When asked which body parts are most associated with pain for the last seven days, 66% experienced pain in the shoulders, 62% in the knees and 56% in the lower back.

In terms of frequency, the most often affected body parts in the last twelve months is the lower back (88%) followed by upper arms (82%) and shoulder (76%), as summarized in Table 7. While in the short term, the body part most affected in the last seven days was the shoulder (66%), followed by upper arms 62% and the lower back 56%. Our findings suggest that the prevalence of musculoskeletal symptoms when handling heavy baggage among airport workers are prominently evident.

MSDs can cause a significant level of interference with work routine; thus, our findings are alarming and shall be further investigated for intervention to take place and prevent further damages (Bernard, 1997; Rosskam, 2003). The prevention of MSD requires good synergy between employer and employees. The employer is responsible for providing a safe workplace, proper training, and a sound ergonomic principle for all employees. The aviation industry and Occupational Safety and Health (OSH) regulators worldwide must provide an initiative in setting realistic standards across the industry to address the safety hazards exposed to baggage handlers.

## CONCLUSION

The prevalence of MSDs among airport baggage handlers have been positively documented in this study. Thus, an effective intervention programme is highly recommended to ensure the safety and wellbeing of workers are taken care of. All the aviation stakeholders must partake an active role in strategizing solutions to this issue as providing a safe working environment relies on the cooperation of all parties concerned, namely the airport operators, owners of airlines, aircraft manufacturers and also the baggage handlers.

## REFERENCES

- Benjamin, K. and Wilson, S. 2005. Facts and misconceptions about age, health status and employability. *Health and Safety Laboratory, Buxton Report*, Report HSL/2005/20.
- Bernard, B. P. 1997. *Musculoskeletal disorders and workplace factors. A critical review of epidemiologic evidence for work-related musculoskeletal disorders of the neck, upper extremity, and low back.* (2<sup>nd</sup> Ed.) National Institute for Occupational Safety and Health, Cincinnati.
- Centre for Aviation (CAPA). 2017. Malaysian 2017 aviation outlook: passenger growth may reach 15% as Air Asia, Malindo and MAS expand. *Airline Leader*, 39.
- Dawson, A. P., Steele, E. J., Hodges, P. W., and Stewart, S. 2009. Development and test-retest reliability of an extended version of the Nordic Musculoskeletal Questionnaire (NMQ-E): a screening instrument for musculoskeletal pain. *Journal of Pain*, 10, 517-526.
- De Beck, O. and Herman, V. 2000. *Research on work-related low back disorders.* Bulbar: European Agency for Safety and Health at work.
- Dell, G. 1997. The causes and prevention of baggage handler back injuries: A survey of airline safety professionals. *Safety Science Monitor*, 3(3),87-96.
- Dell, G. 1998. Airline baggage handlers back injuries: A survey of baggage handler opinion on causes and prevention. *Safety Science Monitor*, 2(2), 6.
- Gangopadhyay, S. and Dev, S. 2014. Design and evaluation of ergonomic interventions for the prevention of musculoskeletal disorders in India. *Annals of Occupation and Environmental Medicine*, 26(18), 1-6.
- Gasibat, Q., Simbak, N. and Aziz, A. A. 2017. Stretching Exercises to Prevent Work-related Musculoskeletal Disorders - A Review Article. *American Journal of Sports Science and Medicine*, 5(2), 27-37.
- Rosskam, E. 2003. Airport check-in work: Consequences for worker health and management practices. *Ergonomic Society*, 5, 263-266.
- Saudi, A. S. M., Rahman, R. A., Mahmud, M., Ishak, R., Ridzuan, I. S. D., Azid, A., Juahir, H. and Saudi, M. H. M. 2017. The Effectiveness of Ergonomic Practice in Preventing Musculoskeletal Disorder Among Asian Construction Workers: Case Study in Kuala Lumpur, Malaysia. *Advanced Science Letters*, 23, 11391-11394.
- Tapley, S. and Ripley, D. 2005. Baggage handling in narrow-bodied aircraft: Identification of assessment of musculoskeletal injury risk factors. *Health and Safety Executive Report*.
- Thomas, R. G., Van Baar, C. E. and Van Der Stee, M. J. 1995. Baggage handling postures and the design of conveyors. *Journal of Applied Ergonomics*, 26(2), 123-127.