

Study on Effectiveness of Social Distancing Equipment at Construction Sites

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ABSTRACT

Current methods for control social distance at worksites is using marker, tape, or barrier to label the distance of 2 m. However, at the practical worksite, due to the complexity and the nature of the tasks, it was difficult for the construction workers themselves who need to move constantly while completing their tasks to maintain the social distance. Furthermore, the variation in contacting time between workers within 2 m is still unknown and the importance for using monitoring devices to provide additional awareness need to be addressed. The purpose of this study is to investigate the effectiveness of the hand wear device with the Social Distancing function in maintaining the 2m distance and monitoring the contacting time (times for workers within 2m distance). The results also suggested that the total contacting time and average contacting time per worker with Social Distancing Equipment is decreased when compared with traditional social distancing control methods. The hand wear monitoring devices could be used as an effectiveness preventive measure against infectious diseases of workers at worksites.

KEYWORDS

Construction, Social Distancing, Prevention Measures, Hand-Arm Vibration, New Normal

Introduction

Currently, the spread of Corona Virus Disease 2019 (COVID-19) is a problem all over the world. Under such circumstances, due to the need for economic reconstruction, the resumption of business activities after taking measures to prevent infectious diseases is paramount. Avoiding congestion, ventilation in crowded environments, and contact tracing between people in such places has been considered as infectious disease prevention measures in World Health Organization (WHO) to prevent COVID-19 transmission from person to person.

In the UK, mitigation measures after the release of Lockdown have been announced. From May 11th (Monday), people in occupations (construction industry, manufacturing industry, etc.) who cannot work from home will be encouraged to go to work. However, it is said that the rules of Social Distancing must be obeyed at worksites. Following this, work at construction site has become possible due to the relaxation, however, clear statements were made to emphasise the importance of maintaining social distancing while workers conducting their tasks. Many construction companies were proactively drafted new risk assessment with additional safety measures to introducing social distancing using markers, signs and barriers. Figure 1 shows the

instructed social distancing sign and the barrier at the construction site for keeping the social distance between workers.



Figure 1. Example of the Social Distancing Sign and Barrier at Construction site.

The main concern that has been raised from the construction sector is that due to the complexity of tasks, it was difficult for the workers to maintain the 2m social distance at workplaces. Following difficulties have been observed, the marker, signs and barriers work well if workers only involves with tasks that can be completed at one or two locations. When the tasks require workers moving with multiple locations and conducting collaborative jobs, the current social distancing methods cannot provide accurate tracing of their moving paths or active warning to workers if they get closed with each other while they had a social talking or taken a task together. There is a need to develop an effective method to control the risk and promote awareness among workers. A hand wear device has been developed in Edinburgh, which originally designed to monitor the hand-transmitted vibration level for construction workers (Maeda et al, 2019) but now with the added feature to notify workers that they have approached each other within 2m and record the contacting time while workers get in touch withing 2m distance.

Therefore, the purpose of this study is to compare the contacting time between workers using the hand wear Social Distancing detection equipment and using the traditional social distancing control methods, using marker, tape and barrier to label the 2m distance. It was hypothesised that workers using the hand wear devices will reducing their contacting time compared with 2m distance marker, signs and barriers.

Validation Experiment of Social Distancing Equipment

Subject

21 male subjects participated in the study. All subjects were healthy male workers, having no history of neuromuscular or vascular disorders and who had not suffered any serious injuries of the upper extremities in the current collaborated construction companies.

Social distancing device

HAVwear (Reactec, UK) social distancing technology uses Radio Signal Strength Indicator (RSSI) data from Bluetooth signals processed through a proprietary algorithm to determine range between devices. Each HAVwear makes its own determination of range to provide redundancy in the event of interference with or other devices. The algorithm performs a rolling average of signals received while also actively removing outliers in the form of exceptionally weak signals resulting from interference or exceptionally strong signals arising from momentarily aligned HAVwear antennas which is important for dynamic environments. A configurable contact start period is provided to adjust the length of time the triggering conditions must be maintained in order to initiate a detection. This configurable contact start period may be adjusted based on the nature of the work environment and activity level.

Experimental Procedure

To study the contacting time between workers in the construction worksite, the contacting time (times of workers within 2m distance) of workers wearing HAVwear at the worksite was measured before and after they were followed HAVwear Social Distancing information from the HAVwear as shown Figure 2. The experiment was performed on 4 different weeks as shown Table 1.



Figure 2. To manage that Social Distancing between workers is maintained.

Table 1. Experimental period and subject number.

Week	Experimental Period	No of workers	Condition
W1	29/6/2020-05/7/2020	21	Follow 2m sign
W2	06/7/2020-12/7/2020	21	Follow Equipment
W3	13/7/2020-19/7/2020	21	Follow Equipment
W4	20/7/2020-26/7/2020	21	Follow Equipment

On the first week of W1 (29/6/2020-05/7/2020), although all workers wear the Social Distancing Measurement Equipment, they followed the real worksite assigned the Social Distancing alert sign as shown Figure 1. During this W1 week period, 21 workers had to follow the 2 m sign or their 2 m consideration. However the HAVwear has been turned on for recording the contacting time between workers to follow the static signs such as Figure 1. And from W2 to W4, all workers followed the 2m Social Distancing alert from the equipment, similarly as workers previously using the device to monitor their daily vibration exposure level.

Results and discussion

Table 2 and Figures 3 and 4 show the results of the experiment. From the comparison between the W1 condition (Follow 2m sign) and W2 condition (Follow Equipment), the total contacting time of W1 is significantly decreased when compared with W2 ($p < 0.05$, Wilcoxon). From this data, when the workers wear the Social Distancing equipment, the total contacting time is decreasing from 845 mins with followed the 2m sign to 506 mins.

Table 2. Experimental results.

Week	Total Contacting Time (mins)	Av Contacting per person (mins)	Condition
W1	845	40.7	Follow 2m sign
W2	506	23.6	Follow Equipment
W3	365	17.1	Follow Equipment
W4	274	15.5	Follow Equipment

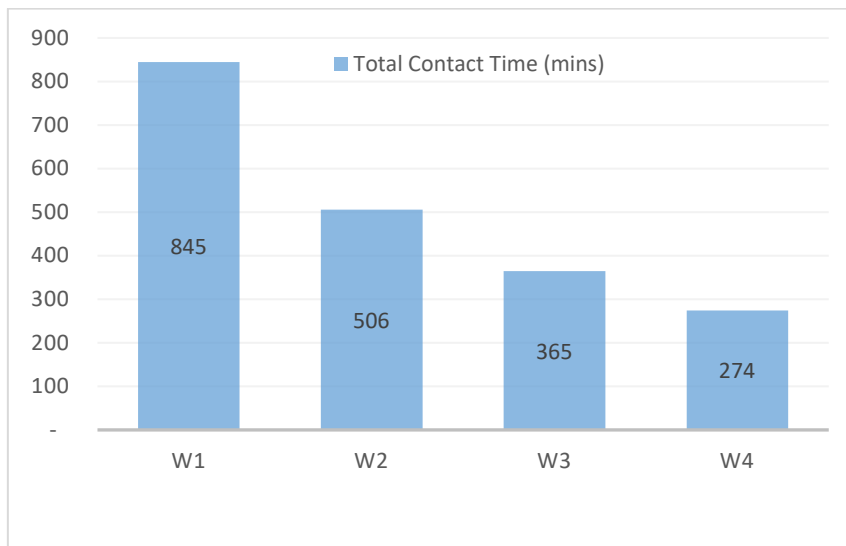


Figure 3. Relationship between total contacting time and measurement week.

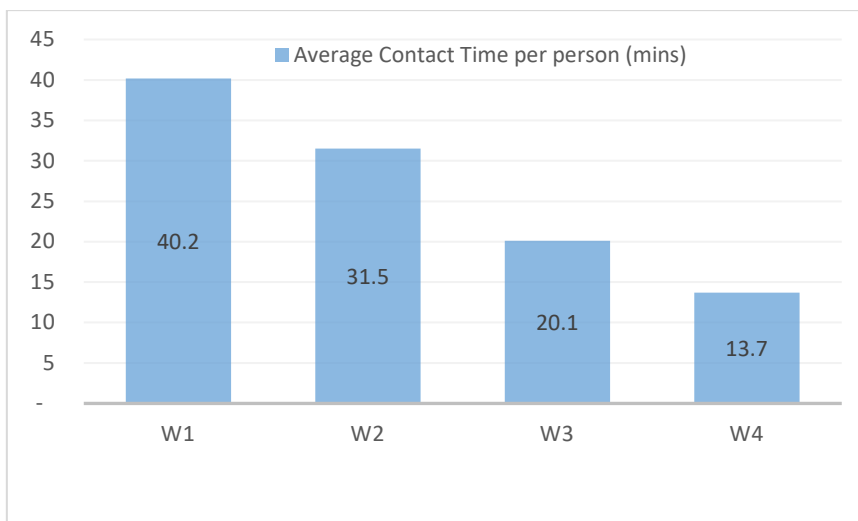


Figure 4. Relationship between average contacting time per person and measurement week.

From Table 2 and Figure 3, there is a clear trend with the experience workers gained on using this monitoring device, the total contacting time was further decreased in W3 and W4. This further reduction probably due to the learning effect on how to use the Social Distancing Equipment and re-arrange their tasks in the work site.

From Figure 4, the average contacting time per person on W1 followed the sign is 40.2 minutes. This result suggested when workers following the sign as show in Figure 1, averaging this to 5 working days, the contacting time per day is about 8 minutes, less than WHO recommended 15 minutes per day contacting time. So, from the result at this limited construction site, the COVID-19 infection might be controlled by using the 2m signs only as the prevention measures. From W1 to W2, the average contacting time per person is decreasing by 21.6%, then further reduction has been observed around 50% from W1 to W3, finally the device was able to reduce the contacting time by 65.9% in W4. From these results, it is clear that the average contacting time per person can be effectively controlled and reduced when using HAVwear Social Distancing equipment at the worksite. Although this worksite study only involves the small sample of workers and with limited worksite conditions, the benefit of using this type of Social Distancing detection equipment has been demonstrated by the reduction of contacting time.

Conclusion

In this study, two different social distancing control methods were compared and the contacting time as an indication for workers within 2m distance were measured when workers using marker, sign and barrier and workers wear the HAVwear. From the findings of this experiment, the conclusions are as follows:

- 1) Although the 2m sign at the worksite could control the contacting time between workers, it cannot record or monitor the actual contacting time to provide feedback to risk management plan,
- 2) the HAVwear Social Distancing equipment is more effective to reduce the contacting time between workers and real-time monitoring data could be used to provide feedback to the current the risk control at workplace, indicate whether additional Covid-related measures are needed. e.g. alcohol/disinfection wipe for hand/surface cleaning, face masks for workers involved in collaborative tasks need to get close within 2m, additional one-way system labels at workplace, etc.
- 3) it is clear the HAVwear Social Distancing equipment can reduce 65.9% contacting time between workers compare with the 2m sign measures.

When we will consider new normal world for a sustainable society after COVID-19, such as the Sustainable Cities and Communities of the United Nations SDG 11 and ISO/TC268, it is necessary to include the Social Distancing Equipment concept of the prevention of human labour diseases in the workplace towards a sustainable society.

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