

The Evidential Value of Finding Glass on Head Hair and Headwear

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Introduction

Only one study has been conducted solely on head hair; a pilot study by McQuillan and McCrossan [1] dating of 1987 in Northern Ireland on the frequency of occurrence of glass fragments in hair. The overall finding from this survey was that glass fragments are not commonly encountered in hair samples. However, this study was limited to a small number of samples. More importantly, there have been no other surveys conducted investigating the prevalence of glass on either head hair or headwear, therefore no further data is available or can be compared. Furthermore, no data within Australia is available.

The purpose of this study was to gain preliminary data regarding the prevalence of glass on the head hair and headwear of members of the general population, and those in regular contact with breaking glass. The data that will be collected from this survey will provide more accurate assessment of the questions of glass evidence relating to the likelihood ratio of the evidence, in general, and enable more relevant interpretation of cases within Australia, in particular.

Method

General approach

The survey was conducted on two separate populations; members from the general population and glaziers who worked with glass. These two different populations were selected in order to evaluate not only the prevalence but also the significance of glass in head hair and headwear by comparing the results obtained from these two groups. The general population was surveyed to identify the background level of glass in people who do not work with glass and have little or no contact with broken glass. The population who worked with glass were chosen to give a contrast of results as these people were assumed to be more likely to be in contact with broken glass and therefore have a higher likelihood of finding glass in their head hair and headwear.

Collection

232 random samples were collected over a 3 month period from a number of different locations with a range of different age groups. 25 samples from the targeted group of glaziers from O'Brien® glass were collected at different job sites involving glass repair or replacement. These included the home office and shop factory and at two factories that specialised in windscreen glass. All samples from both populations were collected in the metropolitan area of Sydney, Australia.

Analysis

The identified glass particles were measured for their size and the refractive index (RI) of the glass particles was analysed using GRIM 3 (Foster & Freeman, UK). The RI values that were obtained for the glass particles found in the survey were compared and grouped. These groups were compared with known RI values of different glass types to provide a possible source of the collected glass particles.

Results and Discussion

Random Population Survey Results

A total of 230 random head hair samples were collected and analysed. 131 females and 99 males participated in the survey with a ratio of 56%: 44%. Only 6 fragments collected from 6 individuals were positively identified as glass.

The sizes of the fragments were very small with 4 (57%) being 0.1 mm and 2 (43%) being 0.2 mm. These small sizes are not unexpected as it is known that large pieces of glass will not be retained as well as smaller pieces. This result suggests that finding larger sized glass fragments in head hair of the random population is of great significance and indicate recent contact with breaking glass.

No glass fragments were found in the two headwear samples that were collected. Only 6 fragments were found in the random population that was surveyed which accounts for 2.6% of the total number surveyed in this group. No multiple glass fragments were found in the head hair of the random population from this study. This indicated that finding more than 1 fragment is highly significant.

The RI's that were measured from the recovered glass fragments ranged from 1.5155 to 1.5231. The results from the Forensic Science Services Branch (FSSB) glass database suggest that the glass fragments were more likely to have come from window glass than container.

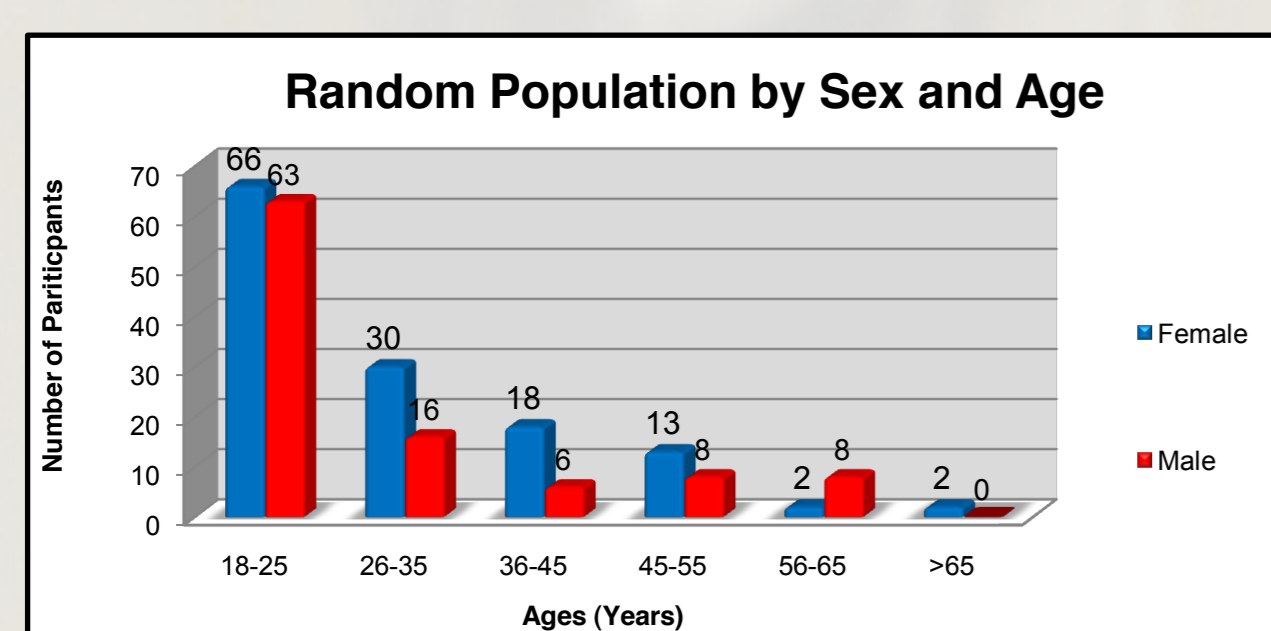


Figure 1: Random population by sex and age.

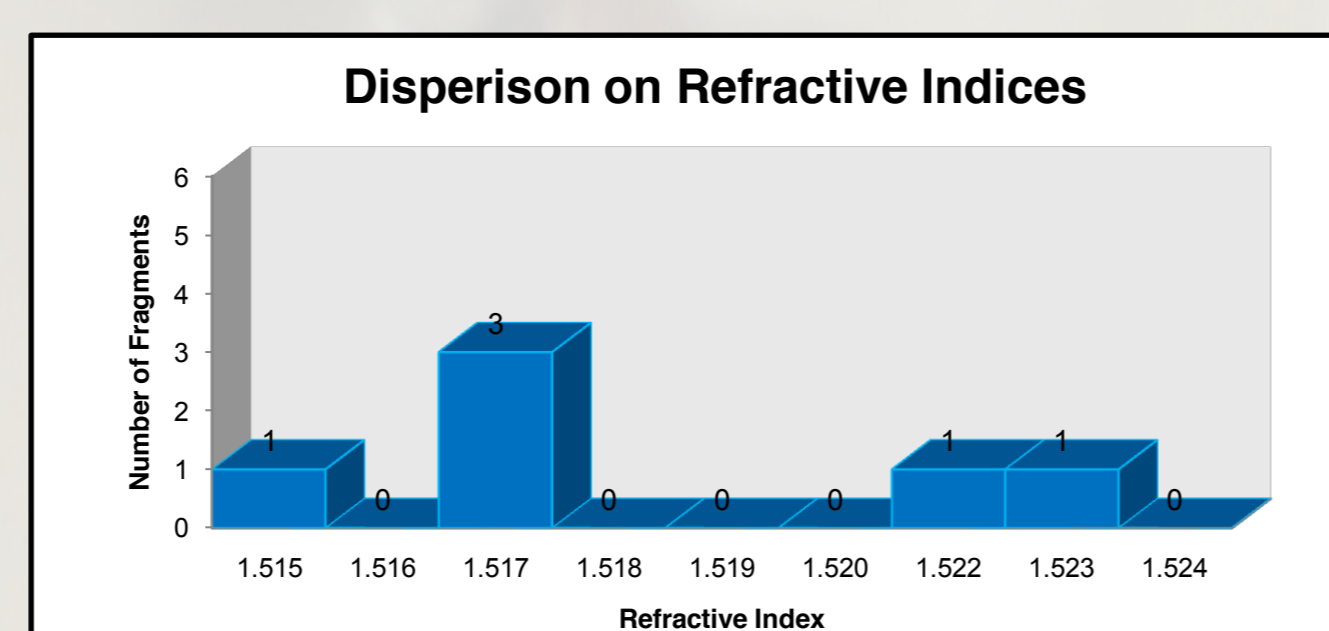


Figure 2: Dispersion of refractive indices from the random population survey.

Results and Discussion

Survey of glaziers from O'Brien®

A total of 138 glass fragments were recovered from the 25 samples with 109 of them coming from the 18 head hair samples and 29 from the 7 headwear samples.

17 of the 18 glaziers (94.4%) from O'Brien® had glass in their head hair. The highest number of glass fragments that was found from one collection was from sample number 13 with a total of 73 fragments recovered from the head hair. The sample was taken approximately 1 hour after the participant had physically removed the pieces of a broken rear window of a car before replacing the glass. This is a highly significant finding as it demonstrates the large number of particles of glass in the hair of a person who is near a window when it is broken.

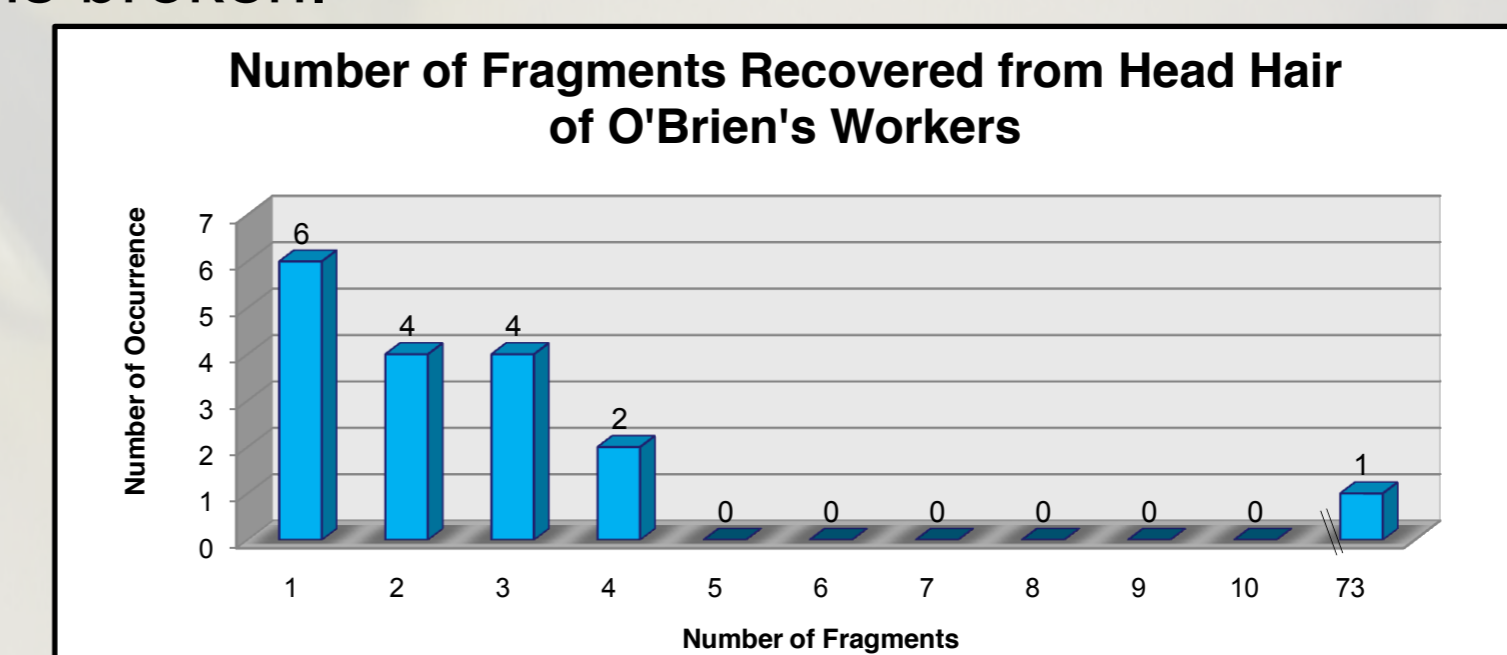


Figure 3: Number of fragments recovered from the head hair of the glaziers, including sample 13.

The majority of the glass fragments that were found, excluding those found in sample 13, were of similar size to those found in the random population survey. A small portion of the fragments found were larger in size but the main distribution was in the region of 0.1 mm and 0.25 mm. The size of the glass fragments that were recovered from sample 13 ranged from 0.1 mm to 2.6 mm.

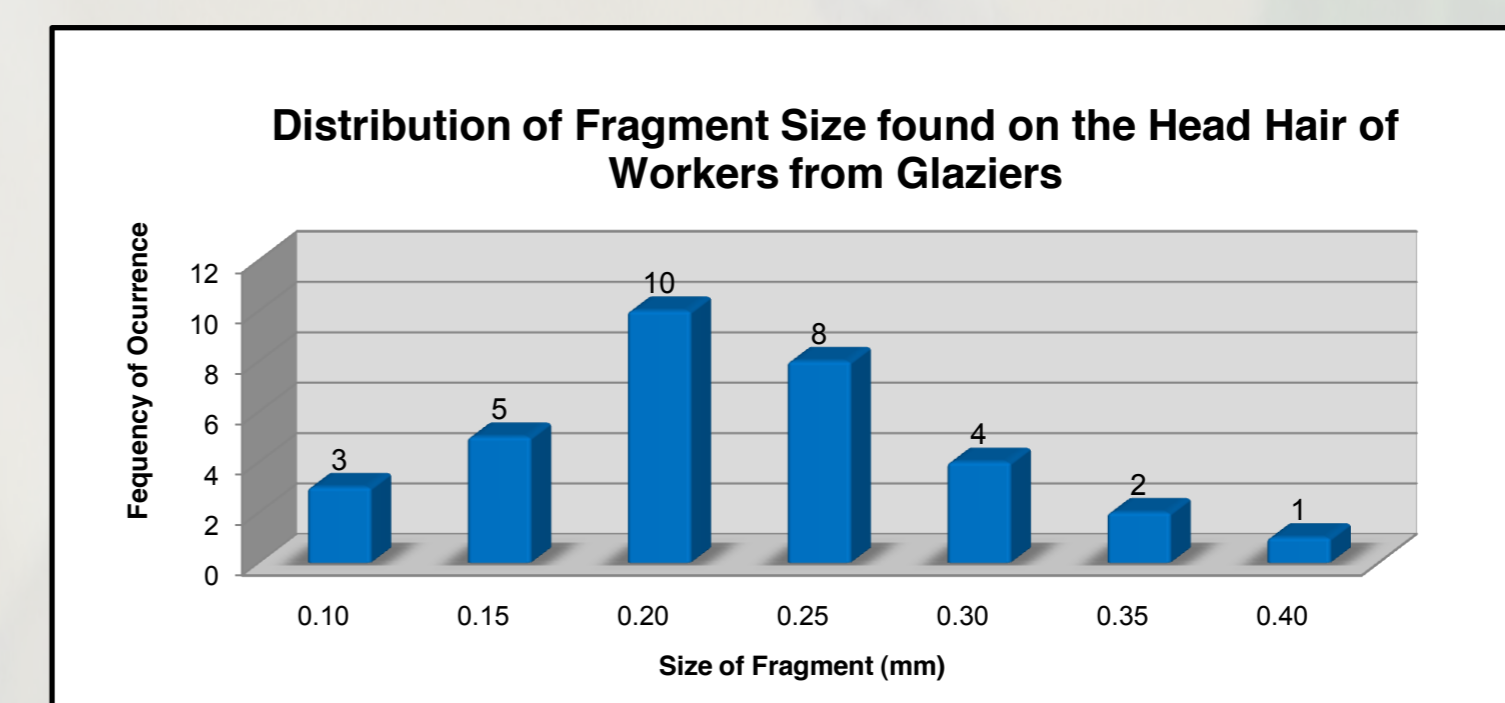


Figure 4: Distribution of the fragment sizes found in the head hair of the glaziers, excluding sample 13.

The headwear samples collected from the glaziers all contained at least one glass fragment, one sample contained 10 fragments. Most of the headwear that was sampled contained more than 1 glass fragment with two samples containing the largest number with 6 and 10 fragments respectively. The largest number of fragments was recovered from a beanie made from wool material.

The glass fragments that were found in the headwear of the workers were of similar size to those that were found on the head hair. Again there was a high occurrence of 0.2 and 0.3 mm sized fragments that were recovered on the headwear.

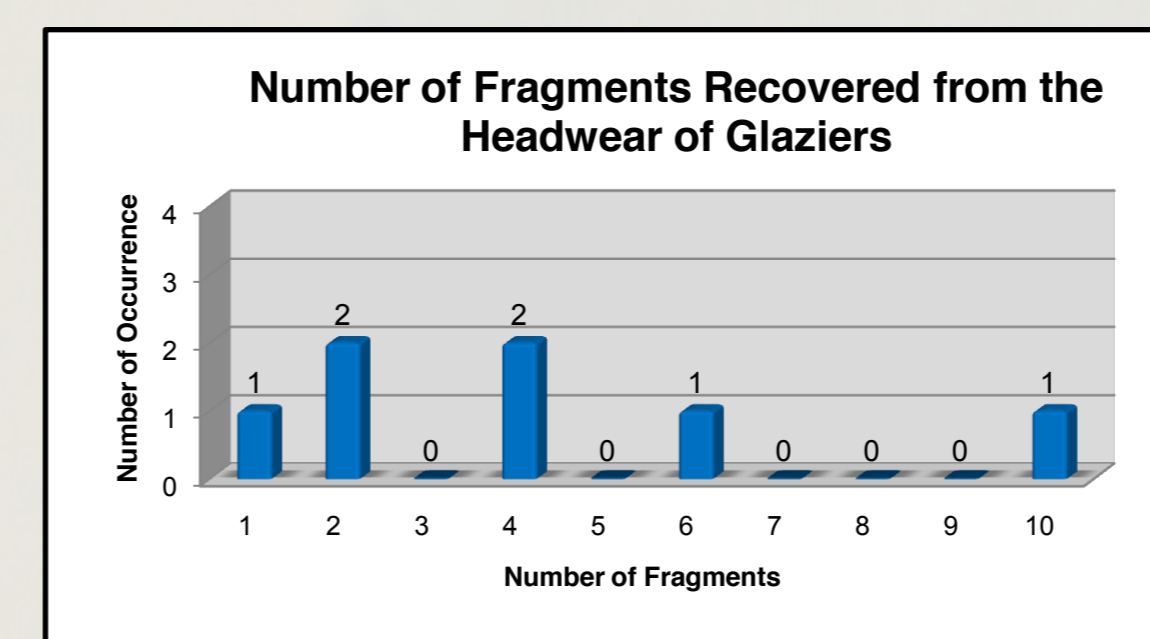


Figure 5: Number of fragments recovered from the headwear of the glaziers.

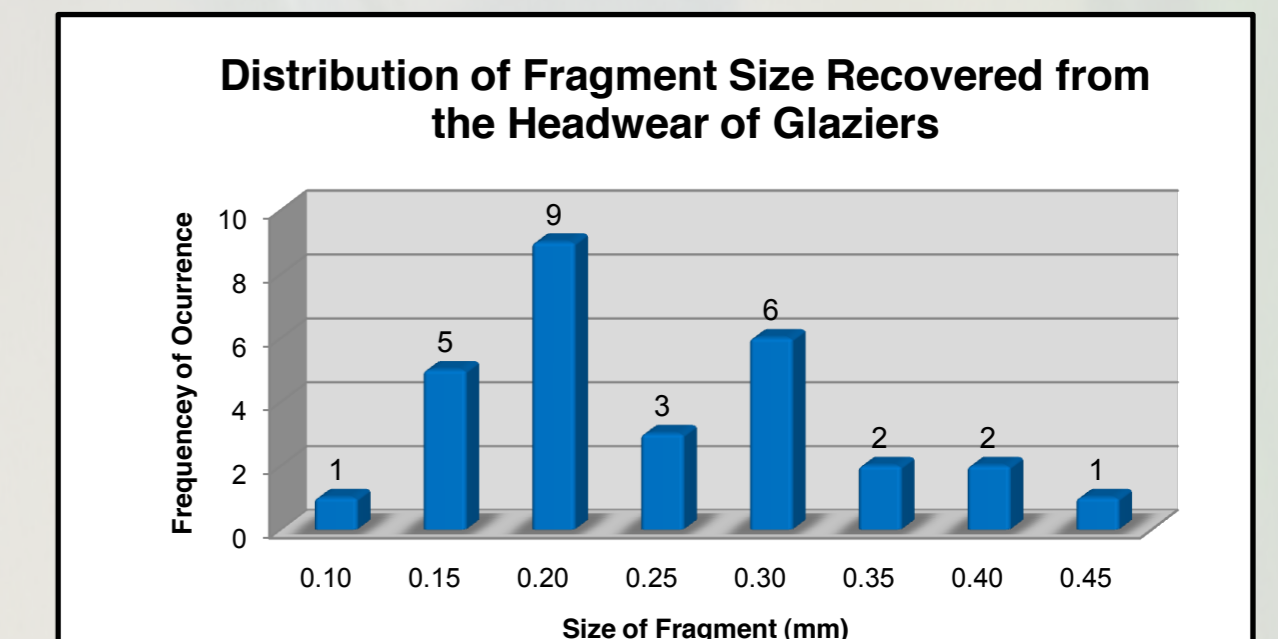


Figure 6: Distribution of the size of the fragments found on the Headwear of the glaziers.

Overall Comparison of Survey Results

These results indicate that finding multiple glass fragments on head hair and headwear is more likely if the person has been in recent contact with broken or breaking glass than if they have not been in recent contact with broken or breaking glass.

Conclusion

A total of only 6 glass fragments were found on the head hair and head wear of the random population. No multiple fragments were found. The low number of fragments found during this survey suggests that the prevalence of glass in the head hair and headwear of the random population is very low.

These results were in contrast to those for the head hair and head wear of the glaziers from O'Brien® where not only were a higher number of glass fragments recovered but also the fragments were larger in size and there was a high occurrence of multiple fragments.

These findings provide valuable information to assist forensic glass experts to assess the significance of cases involving the recovery of glass fragments on such surfaces.

Reference

[1] McQuillan, J. and S. McCrossan (1987). The frequency of occurrence of glass fragments in head hair samples- a pilot investigation. Belfast, Northern Ireland Forensic Science Laboratory.