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Investigating Road Safety Issues and Deaf People in the United Kingdom: An Empirical Study and Recommendations for Good Practice

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Investigating Road Safety Issues and Deaf People in the United Kingdom: An Empirical Study and Recommendations for Good Practice

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Very little research has been carried out in the United Kingdom or other countries on the views and experiences of deaf people on road safety and other aspects of travel. Historically, there has been little specific attention to either the issue of road safety for deaf people or more general travel issues affecting deaf people. Deaf-specific support, guidance, or advice on road safety from the police or other agencies has been sparse. This has led to a situation where support for deaf pedestrians, drivers, and other deaf road users has been developed on an ad-hoc basis, and available measures have not been uniformly adopted across the United Kingdom. Furthermore, although the United Kingdom police force has aimed to provide some support to deaf and hard of hearing people, this has mainly concentrated on communications support in the form of note-taking, interpreters, and video-based information. This article aims to fill the gap in knowledge of road safety issues for deaf and hard of hearing people by reporting empirical research carried out with deaf people in the United Kingdom and making recommendations to improve their road safety.

KEYWORDS *deaf people, recommendations for good practice, road safety, special needs, travel*

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Currently, there is a lack of empirical data on the effects of deafness¹ on driving performance. In particular, there is a lack of research into the importance of the role of hearing in the overall task of driving, and the resulting implications for road safety. There are several situations in which hearing could play an important role in driving and road safety. One example is that it is generally assumed that drivers and pedestrians are able to hear road sounds, including alarms, whistles, sirens, traffic, and traffic control systems. Clearly, an inability to hear this audio information could increase the potential for road safety incidents to occur (Miyazaki & Ishida, 1987) if this information is not made available in an alternative format. Whether this is the case for deaf people is yet to be proved. Research evidence suggests that in a high percentage of road safety incidents involving deaf people, the inability to hear external audible information was a contributory factor (Coppin & Peck, 1963, 1964). This is particularly apparent for deaf cyclists, where the evidence indicates an increased risk (Department of Transport, 2009). Another situation involves the inability to hear the sound of the engine and to be aware of potential problems through changes in this sound or unexpected noises in the vehicle. Yet another example is communication with the police. Research carried out by Police DC Angela Verity, Lancashire Constabulary (Verity, 1997) shows that communicating with police at the road side is often a major challenge for deaf people. As borne out by the research on the role of the police in improving road safety for deaf people (Ohene-Djan, Hersh, & Naqvi, 2010 [this issue]), many police officers have little training in communicating with deaf people, do not necessarily know how to support lip-reading and have minimal if any knowledge of sign language.

Communication may be limited to writing short notes and in many cases the deaf person may be taken to the police station to be questioned. There is a clear element of discrimination if a deaf person is required to visit the police station in situations a hearing person would not be and such visits are likely to also be stressful and time consuming. Problems may also occur when communicating with mechanics, and others who maintain vehicles due to a combination of being unable to hear sounds indicating a potential vehicle malfunction, difficulties in understanding and being understood by the mechanic, a lack of communication support, and a possible lack of knowledge of any technical terms used. Communication problems of this type can lead to the mechanic not being fully informed of the vehicle problems and not carrying out the full or an appropriate repair and the deaf person being unsure what has been done to the vehicle. This could result in a reduction in road safety due to a vehicle that is not fully road worthy or the deaf driver being unaware of particular safety measures. Another example includes communication with other drivers, pedestrians, police, and other personnel who may be deaf or hearing. The case of communication with another deaf driver or pedestrian is not necessarily unproblematic, since one may use a sign language and the other speech. Hearing

drivers often assume that other drivers and pedestrians are able to hear their vehicles and, in particular, the noise of the engine and horn. If this is not the case, a deaf pedestrian or driver may not react quickly and there is the potential for some sort of incident, possibly with serious consequences. Currently deaf people in the United Kingdom and in most other countries are able to obtain a full driving license with no restrictions after passing the standard test. However, deaf people with no useful hearing are required to record this fact on their provisional licenses and the information is stored in the central Driving Vehicle License Authority (DVLA) database. While the authors do not wish to suggest that it should be made more difficult for deaf people to obtain a driving license or that restrictions should be put on them as drivers, there is a need for research to determine how different types of hearing impairment affect driving strategies and whether and, if so, what types of communications and support are required.

Deaf people taking a driving test in the United Kingdom are entitled to have a sign language interpreter interpret the examiner's instructions and questions about the highway code and road safety. Software packages such as the *Learning the Highway Code with British Sign Language: The Official DSA DVD and Book Pack* (Driving Standards Agency, 2008) are able to support home learning by deaf drivers who sign. However, there is some evidence, borne out by the research reported here, of the lack of experience and deaf awareness of driving instructors. There is a need to investigate whether deaf people are receiving poorer quality driving instruction and whether this is having any impact on their safety as drivers. Two other important groups of road users are cyclists and pedestrians. The research reported in this article considers deaf pedestrians, but not deaf cyclists. However, existing research shows that deaf cyclists have an increased risk compared to hearing cyclists in large cities (Department of Transport, 2009). The increased risks experienced by deaf cyclists have been known for many years. Perceptions that it is the deaf cyclist who is the cause of problems are illustrated by the photograph in Figure 1 by Mary Evans, entitled deaf cyclist, in which a cyclist is wearing a placard reading "Beware, I am Deaf." However, in reality this increased risk, as the majority of risk to cyclists, results from the behavior of largely hearing drivers, who both frequently lack consideration for cyclists and assume that deaf people are able to hear vehicles approaching and warning sounds, such as car horns.

The responsibilities of the police to deaf people are detailed in the Police and Criminal Evidence Act and further guidance is provided by a pamphlet (Guidance to the Police: Communicating with Deaf People, 2008). Since they are discussed by Ohene-Djan et al. (2010; this issue), it will only be noted here that they cover issues such as communication strategies, the right to appropriate communication support, such as a sign language interpreter or lip-speaker, and the right not to be detained unnecessarily or for an excessive period of time. This article presents the authors' empirical research on issues relating to road safety and travel for deaf people.



FIGURE 1 Photograph by Mary Evans entitled “Deaf Cyclist in the 1930s.”

METHODOLOGY

Issues relating to road safety and travel for deaf people were investigated using a questionnaire comprising sections on personal information, pedestrian travel, learning to drive, asking directions, traveling by bus and coach, and traveling by train. The questionnaire involved the collection of a combination of quantitative data, through multiple choice questions, and qualitative data, through open questions. Ethical approval was obtained from the local ethics committee. In addition to more commonly occurring questions on age and gender, the section on personal information investigated communication issues, including the language used (a sign language or English), ease of communication, and ease of reading English. The section on pedestrian travel posed questions on the ability to hear nearby and distant cars or heavy vehicles and the potential reduction in safety due to difficulties in hearing traffic in various circumstances. The section on learning to drive looked at communication with driving instructors and examiners, the provision of a lip-speaker or sign language interpreter in driving tests and the desire for the highway code in alternative formats. The section on asking directions investigated difficulties in communication and the methods used

and suggestions for tools or other approaches to improving communication when asking for directions. The sections on traveling by bus or coach and train respectively investigated sources of information, where tickets are bought, the availability of induction loops and sign language interpreters, whether announcements are comprehensible and difficulties in communication. In carrying out research on deaf people, sampling of the population should take account of the language used (sign or spoken) in addition to more commonly considered factors, such as age, gender, and race. However, difficulties are frequently experienced in obtaining an appropriate sample of the population when carrying out research on deaf or other groups of disabled people. Therefore, the tendency is to use a convenience sample, while paying attention as far as possible to factors such as gender, age, race, and the main language used. In our study, three different approaches were taken to obtaining an appropriate sample: first, a number of deaf people were contacted directly by Deafax (a small nonprofit organization in the United Kingdom that works with deaf people, produces deaf friendly resources, and carries out research) and the questionnaires were completed with the aid of a British Sign Language (BSL) interpreter who translated the questions into BSL. The second approach was to send hard copy and electronic versions of the questionnaire to a number of organizations working with deaf people, who then circulated them in hard copy and/or electronic format to some of their clients. The third approach was to post the questionnaire on the Internet.

RESULTS

Personal Information

Results were received from 45 respondents, with an approximate gender balance, good age distribution, and range of education levels and types of qualification, as well as employment status and types of employment. However, the respondents generally were better qualified and had a younger age profile than the general deaf population. Different communication modes were well-represented, although skewed toward BSL, which is not the case for the deaf community. Facility in communicating in both the first or preferred language and in reading English varied greatly. More specifically, 22 respondents were male and 21 were female, with 2 not providing this information. Referring to age, 12 respondents were aged 16–25, 17 were aged 26–40, 8 were aged 41–60, 5 were aged 61–70, and 2 were over 70, with 1 respondent not stating their age. The majority of respondents had some form of qualification, with only 11.1% having no qualifications. Just over half the respondents had post-school qualifications, with nearly a quarter (24.5%) having degrees; a fifth had post-school pre-university qualifications; and 8.9% post-graduate qualifications. 13.3% had school leaving qualifications (A level or

advanced higher), 2.2% other qualifications, and 15.6% unspecified qualifications. The largest occupational group was attending college or university (26.7%), followed by a fifth unemployed. 15.6% were in full-time employment, 11.1% in part time employment, 13.3% retired, and 2.7% taking care of the household and children full time. 6.7% of respondents were attending college or university and additionally working either part time or full time, sometimes in combination with looking after the household and children. 50% of respondents stated their type of work. This figure is considerably higher than the 34.1% in employment and includes some voluntary work, as well as responses from some respondents who did not answer the question on occupational status. The largest occupational group was in professional employment (36.4%), followed by technical jobs (22.7%), and secretarial or administrative jobs (22.7%). Manual work was relatively unrepresented (9.1%) and an additional 9.1% had other jobs. 4.4% of respondents did not state their occupational status or type of employment. An almost equal number of respondents stated BSL (40%) and English (37.8%) as their main or preferred language, with 4.4% using sign supported English (SSE), 2.2% Australian Sign Language, and 2.2% Dutch Sign Language. 6.8% stated that they used a combination of sign and spoken languages and 4.5% a combination of sign languages. However, subsequent responses indicated that the main or preferred language of two thirds of those who used a combination of sign and spoken languages was a sign language, giving a total of 57.8% with a preference for sign language and 37.8% with a preference for speech, and 4.4% of the respondents for whom the preference for sign or speech could not be determined. The main or preferred language was not the first one for half of the signers and 5.5% of the English speakers. In summary, the sample represents the diversity of the deaf community, although not totally typical of it, as it slightly skewed toward younger people, signers, and those with better qualifications and professional rather than manual employment. Half the respondents whose main language is a sign language used English sometimes, whereas a quarter did not use it at all. A small number used it occasionally (16.7%) or very occasionally (4.2%), with 1.3% not answering the question. These respondents seemed to find it easier to make themselves understood by hearing people they spoke to than to understand hearing people who speak to them. However, communication with hearing people was not easy for them, with only 8.3% generally being understood and only 16.6% finding it very easy to understand English.

Pedestrian Travel and Asking Directions

The questions on respondents' ability to hear traffic indicate serious problems. Of the 42 respondents who answered this question, even in the easiest to hear case of nearby buses, trucks, and heavy vehicles, only 13 were able to hear them either always or generally, whereas 29 could only

sometimes or never hear them, $\chi^2(1, n = 42) = 5.36, p < 0.05$. Due to one degree of freedom, the χ^2 test was carried out with the Yates correction for continuity. These difficulties in hearing traffic were reflected in the fact that more than three-fifths of respondents felt a bit or a lot less safe due to difficulties in hearing traffic when they crossed at a pedestrian crossing and four-fifths felt a bit or a lot less safe when they crossed away from a crossing and more than four-fifths a bit or a lot less safe when there is no pavement and nearly another third a bit less safe. Just over one-third (35.6%) of respondents provided suggestions of other circumstances in which they felt less safe, including not hearing the sirens of emergency vehicles, traffic when cycling, approaching cars, road works, traffic at a nearby level crossing, or traffic approaching when crossing the road in a wheelchair, making the respondent more nervous, as well as cars going across the lights when they become orange. While 8 respondents were very confident and 12 were confident about asking directions, nearly as many (17) were only moderately confident, not confident (4), or very unconfident (2), with 2 people not answering the question. Two-thirds of the respondents always (40%) or generally (26.7%) took measures before they traveled to try to avoid the need to ask directions, with another 8.9% sometimes taking measures and only 2.2% never taking measures and 2.2% not answering the question. 37.8% of respondents provided details of these measures, which included looking at hard copy and Internet maps, printing out Internet maps and directions, the use of satellite navigation (GPS) systems and asking a friend. It would be interesting to compare the experiences of these deaf respondents with those of a comparable group of hearing people to determine whether these problems are specific to deaf people. If they needed to ask for directions, just over half the respondents (51.1%) tried a combination of sources, whereas just under a quarter (24.4%) preferred passersby, 15.6% shopkeepers, and 2.2% pubs or restaurants. Thirty-one respondents at least sometimes experienced difficulties in making themselves understood, with 12 respondents never experiencing difficulties (and 2 people not answering the question), resulting in a majority of people at least sometimes experiencing difficulties in making themselves understood $\chi^2(1, n = 43) = 7.54, p < .01$, with Yates correction for continuity applied. Understanding the replies also seemed to be very difficult with 41 out of 45 respondents at least sometimes experiencing difficulties and only 4 respondents never experiencing difficulties, $\chi^2(1, n = 45) = 28.8, p < .0001$, with Yates correction for continuity applied. Three fifths of the respondents had other methods of communicating with hearing people, 6.7% did not, and 11.1% were not sure, with one of the not sures noting they lip-read a lot and 22.2% not answering the question. All the respondents who stated they have other methods provided details. In the majority of cases this involved writing with pen and paper either on its own or in conjunction with other methods, such as drawing a map, gestures, finger-spelling, writing on a mobile phone, lip-reading, and repeating what had

been said or using gestures to confirm directions. Other methods used on their own included texting, gestures, and mime. Only 22.2% of respondents provided suggestions for equipment, tools, or other ideas to make it easier to obtain information while traveling. These included GPS/satellite navigation, taking a map and showing it or writing the address, the use of paper and pen or a writing pad, the use of a mobile phone, and online traffic information.

Learning to Drive

Seven respondents noted that they were hearing at the time they learned to drive and their data has therefore been removed from the sample for this section, leaving 38 respondents who were deaf when they learned to drive, so the data in this section are based on these 38 respondents. This is the only section of the question for which this is an issue, since it is the only section that is concerned solely with the past. Nearly three quarters (71.1%) of these respondents had a driving license, just over a quarter (26.3%) did not have one, and 7.9% of the respondents did not answer the question. Similar, but reduced percentages of respondents stated that they had (68.4%) and had not (23.7%) had driving lessons. Over half (55.3%) used an instructor, just over a fifth (21.1%) family and friends, and 7.9% a mixture, with 7.9% not providing any information. Twenty-three respondents (61%) were not worried about communicating with the driving instructor, but 7 (18.4%) were worried, with 7.9% not sure and 13.2% not responding. When the number of people who were worried was compared with the number of those who were not worried, significantly more people were not worried, $\chi^2(1, n = 30) = 7.5, p < .01$, with Yates correction for continuity applied. Nevertheless, it has to be acknowledged that an absolute number of 7 out of 38 people being worried is still relatively high. As might have been expected, speech or a combination of speech and other approaches were the most common communication methods and used by over half the respondents for communicating with their instructors, with 42.1% using speech on its own and 10.5% speech in combination with basic signs, gestures, or notes; 18.4% used signing, 26.3% pen and paper, and 26.3% did not state. Communication problems were an issue for the majority of respondents with a fifth of the respondents experiencing problems often or very frequently. Just over a quarter (26.3%) of respondents provided additional information about their communication problems. The problems experienced included a lack of deaf awareness on the part of the instructor, difficulties in looking in several directions at the same time in order to drive and lip-read or listen and follow the instructor's signals, difficulties in reacting to instructions in time, for instance when there was a last minute change in direction, misunderstandings, although these were generally clarified, and problems when the windows were open, presumably due to additional noise. Respondents also noted

some of the strategies used to facilitate communication, including fitting an extra mirror to facilitate lip-reading while driving, as well as the use of pen and paper and agreed signals. Just under half (48.9%) the respondents considered that their driving instructor required training in communicating with deaf people, with only 17.7% considering their instructor did not require training, 15.6% unsure, and 17.8% not responding. A third of respondents, that is, somewhat less than thought their instructors required training, provided specific suggestions for this training, including the need for it to include deaf awareness and sign language or, at least, basic signs. The other suggestions include the opportunity to learn on a private circuit; becoming aware of their “better ear” and driving accordingly; the use of pictures, including jargon words about cars; the use of an additional mirror; and the explanation of new signals, rules, and theory.

The highway code was made easier for nearly half (44.4%) the respondents and not made easier for a third, with the remainder not responding. Just over a third (34.2%) of respondents would be interested in explanations of both the highway code and road safety materials in alternative formats. However the distribution of preferences was different in the two cases, with equal preferences (13.2%) for simplified text with pictures and signed video for the highway code (with 2.6% wanting plain text and 5.3% other formats), but a majority preference (18.2%) for signed video for road safety materials, with only 10.5% wanting simplified text with pictures (and the remaining 2.6% other formats). Nearly two fifths (39.4%) of respondents considered that they knew the highway code very well, with another just over a third (36.8%) considering that they knew it fairly well. Respondents seemed more confident in their ability to drive safely than their knowledge of the highway code, with over half (52.6%) believing that they were very well able to drive safely and 18.4% to some extent. The 5.3% of respondents who did not know the highway code or how to drive safely and the 2.6% of respondents who were not sure whether they could drive safely had not had driving lessons and did not have a license, whereas the 2.6% of respondents who were unsure whether they knew the highway code had both had lessons and had a license. Of respondents, 15.8% and 18.4% did not answer the questions on knowledge of the highway code and the ability to drive safely, respectively. Just over a third (34.2%) of respondents provided comments on their experiences of learning to drive. The comments indicated the importance of the instructor being patient and having deaf awareness, although this is not always the case, as well as the instructor knowing that the person is deaf and having experience teaching deaf people. There may be advantages in learning the basics first with family or friends before taking lessons from a driving instructor. Several respondents wanted driving instructors to learn at least some basic signs. Nearly half (46.7%) of the respondents had taken a driving test once and just over a quarter (26.7%) several times, with 15.6% not having taken a test and 11.1% not replying. Of the respondents

who had taken a driving test, only one did not have a license, indicating that about three fifths of those who have taken a test were successful in passing it the first time. In total 23 respondents had taken a driving test one or more times and were deaf at the time. The data about driving tests will be given for these respondents. Only 8.9% of the respondents who had taken a test asked for a sign language interpreter and 15.6% for a lip-speaker, with one respondent asking for both, and 20% and 26.7% respectively not responding. All the respondents who asked for a lip-speaker were signers rather than speakers, so this group may be more assertive. However, it is intriguing that they chose to ask for a lip-speaker rather than a sign language interpreter. A lip-speaker or interpreter was made available whenever requested. Three of the four respondents who asked for an interpreter, including the one who asked for both an interpreter and a lip-speaker, were very satisfied, with the fourth noting that the interpreter used a different sign language. One of the six respondents for whom a lip-speaker was provided was very satisfied and two were reasonably satisfied, but three were neither satisfied nor dissatisfied. One respondent who did not ask for an interpreter stated that they were very dissatisfied that one was not provided. This indicates the need for a more proactive approach to determining accessibility requirements, including the need for communication support, when people book driving tests. Only just over a fifth (21.7%) of the respondents who had taken a test always understood the examiner, with another 30.4% understanding most of the time, 13.0% some of the time, and 17.4% occasionally, with 13.0% never understanding and 30.4% not replying. One of the respondents who had never understood the examiner indicated that they used pen and paper, but did not make it clear whether or not this resolved the communication problem. This indicates a serious communication problem, since even understanding most rather than all of the time is not really satisfactory in a test situation. Just over two fifths (40.6%) of the 32 respondents who had taken driving lessons, whether with an instructor or family and friends, commented on their experiences of learning to drive, and just over two fifths (41.7%) of the 24 respondents who had had lessons with an instructor made suggestions for improving communication with a driving instructor. Just over half (52.2%) of the respondents who had taken a driving test commented on their experiences and just over a third (34.7%) of them provided suggestions for improving communications with driving instructors. Negative comments included the following: the examiner knew little about deaf people and how to communicate with them, but this was back in 1992; the examiner had a very quiet voice that added to the stress; deaf people require additional time to process spoken information, making it more difficult to respond to instructions (e.g., to turn). Positive comments included the use of communication strategies, such as cards, pictorial boards, BSL, pointing, and the examiner repeating or adapting the route or stopping to give instructions, helpful instructors who sat in the back and/or described everything in advance, and an

instructor who knew Australian Sign Language. Other comments included the need for deaf/hard of hearing awareness and the family insisting that the respondent learned about the test, when this information was not provided during driving lessons. Suggestions for improving communications with driving instructors and examiners included the following: the need for deaf awareness, training in the use of interpreters, the use of pictures, some knowledge of BSL if at all possible, and the right to request another instructor with a louder/clearer voice.

Traveling by Bus, Coach, and Train

Buses, trains, and, to a lesser extent, coaches provided an important mode of transport for the respondents, with nearly daily travel by 47.6% by bus, 37.8% by train, and 6.7% by coach. In this context, Internet use was very popular, with nearly half the respondents (44.4%) using the Internet to find out which bus and stop they required. Other methods used for finding out this information included bus timetables, both paper and at the bus stop, information at the bus station, information on screen, and a journey planner, as well as asking the driver or other passengers, in some cases using lip-reading or guessing. The most frequently used ways of determining the correct stop to get off (if there was no visible indication) were asking the driver or another passenger to alert them. Other methods included counting the stops and possibly risking getting off at the wrong stop and using the electronic text with the stop name, as well as remembering the bus stop if they had alighted there previously. The other respondents asked the driver, used the Internet, or asked a friend. One respondent noted that bus drivers could be impatient and often expected people to know the fare. A third of respondents had experienced problems communicating with the driver on a few occasions, with another quarter always (13.3%) or generally (11.1%) having communication problems. Only 13.3% of respondents had never experienced problems and another 13.3% had experienced problems once or twice, with 15.6% not answering the question. Nearly a quarter (24.4%) of respondents purchased their tickets from a bus station and a fifth from the Internet, with the other main methods being the driver (8.9%), a ticket machine (4.4%), and a combination of these approaches (13.3%). Most buses and coaches and the information centers at bus and railway stations were not equipped with induction loop systems, although there was a demand for them. There was a demand for induction loops on both local and long distance buses from between a fifth and a quarter of respondents. Availability of sign language interpreters at bus and railway station information centers was even more limited, with only 4.4% and 2.2%, respectively, sometimes finding them available and well over two-fifths finding them never available. There was a demand for sign language video systems to provide train times and routes and book tickets, although this was greater in the case of

information than booking. As was to be expected, all the respondents who would like a sign language video system were signers, giving 41.7% and 29.2% of this group who would like a sign language video system to provide information and to book their tickets respectively. A third of the respondents provided additional comments, which included the need for a BSL interpreter and signs indicating the next stop, as well as problems caused by not hearing the driver, including announcements and the poor attitudes of some drivers. Other comments related to writing things down and the need to verify that the correct stop had been reached. Suggestions for improving travel included the need for deaf awareness training, visual displays of stop names, similar to those on trains and drivers being informed when there were deaf passengers. The Internet was also popular for obtaining information about train times and fares, with half the respondents using it to obtain information either on its own (26.7%) or in combination with another source (22.2%). Nearly a quarter (24.4%) used timetables, 13.3% the information center, and 6.7% asked a friend, with 8.9% not answering. However, information centers were considerably more popular (40%) than the Internet (15.6%) for buying tickets, with 8.9% of respondents having a pass, 6.7% using a ticket machine, 20% using different approaches at different times, and 8.9% not replying. Many respondents experienced difficulties in communicating at the information center or ticket window with over two fifths finding this very difficult.

Understanding the announcements of train platforms and platform changes was a significant problem for the majority of respondents, with 60% never understanding these announcements, only 11% understanding them either always (4.4%) or generally (6.7%), sometimes (13.3%) and occasionally (8.9%), with 6.7% not replying. This implies that other, preferably visual indications, of platform changes are required. Nearly half (48.9%) obtained information at an unfamiliar station from railway staff, with 11.1% using the information board, 28.9% a number of sources, 2.2% asking members of the public, and 8.9% not replying. Obtaining information at an unfamiliar station was again a source of difficulty, with a third of respondents finding it always (13.3%) or generally (17.8%) difficult, and 4.4% sometimes difficult. Only 15.6% never encountered difficulties and 8.9% did not reply. Additional comments related to difficulties in hearing announcements, including at airports, of delays on the underground, platform changes, and of emergencies. Other problems related to a lack of regular updating of the arrival and departure screens at stations and feeling embarrassed at the need to write when seeking information, particular in a queue. Two respondents noted that they had missed trains or got on the wrong train due to being unable to follow the announcements. Another respondent stated that they had not known what was happening during a train breakdown and had had to ask other passengers and follow them. In a more serious incident in which passengers are panicking this could put deaf passengers at greater

risk of injury or even death. The suggestions focused on ways to provide information visually, so that deaf people were not dependent on audio information. They included a captioned board with announcements in one train carriage, more information to be made available in writing and/or as text on a screen and the provision of sign language information on train changes. Other changes included changing attitudes, providing training, including on BSL, the importance of friendly staff, and the importance of staff being aware of deaf passengers.

DISCUSSION

In conclusion, respondents experienced serious problems in hearing traffic, even in the most audible case of nearby buses, trucks, and heavy vehicles. These difficulties in hearing traffic were reflected in feelings of reduced safety. Many respondents also felt less secure in other circumstances, which included not hearing the sirens of emergency vehicles, traffic in various situations, and road works. Deaf people who get lost or are unsure of where they are while traveling are likely to find it difficult to communicate with hearing people in order to obtain help. Thus, there is a need for additional resources to support and provide information to deaf people when traveling. While it is clearly necessary to improve training for the police in communicating with hearing impaired people, as discussed by Ohene-Djan et al. (2010 [this issue]), this will not be sufficient to fully resolve the problem. Suggestions for equipment and tools to make it easier to obtain information while traveling included GPS/satellite navigation, using a map, writing down the address, the use of paper and pen, a writing pad, or a mobile phone and online traffic information. Many of these options could be tried out by an individual deaf person, although the online traffic information system would be required to be set up and possibly staffed. Therefore, further research with end-users would be useful to determine exactly what type of interactive online system would be of most use to deaf pedestrians and drivers and to ensure that it does not only consider the needs of deaf drivers and ignore those of deaf pedestrians. Nearly a fifth of respondents were worried about communicating with the driving instructor. Probably unsurprisingly, almost half of the respondents considered that their driving instructors required training in communicating with deaf people and less than a fifth that they did not. Suggestions for this training included at least basic signs and deaf awareness. Suggestions for improving driving instruction included the opportunity to learn on a private circuit, the provision of an additional mirror and explanation of new signals, rules, and theory. Where appropriate, deaf people should also drive favoring their "better ear." Other suggestions that could be equally well applied to both driving instructors and examiners were experience of teaching or examining deaf people, patience, at least a basic knowledge of BSL, experience of working with interpreters, and a loud, clear

voice (with respondents wanting the option to ask for another examiner if this was not the case).

Respondents seemed to be fairly frequent travelers. The Internet was frequently used either on its own or in combination with other methods to obtain information about buses, trains, and coaches. Buses and coaches rarely had induction loops. Availability of sign language interpreters and induction loops at information centers and ticket windows at bus, coach, and railway stations was also minimal. Respondents had experienced problems communicating with bus drivers or at railway information centers and ticket windows. Understanding the announcements of train platforms and platform changes was a particular problem. There is thus a need for visual indications of platform changes and measures to support communication. There was also a demand for sign language video systems to provide train times and routes and book tickets. In some cases the consequences of a lack of accessible information are irritating, but not life threatening. However, not knowing what was happening during a train breakdown could have put the deaf and possibly other passengers at risk of injury or even death in the case of a more serious incident. Suggestions for improvements focused on ways of providing information visually, such as visual displays of stop names (similar to those on trains), a captioned board with announcements in one train carriage, the provision of written information and text on screens, and sign language information. Suggestions for training included BSL and deaf awareness.

RECOMMENDATIONS AND CONCLUSIONS

Following the study, the authors are making the following eight key recommendations for improving the road safety and experiences of travel of deaf people. (1) Training: All transport personnel, including driving instructors, bus drivers, and staff at railway and bus stations, should have some training in communicating with deaf people, deaf awareness, and basic sign language. An additional module on working with deaf people should be developed for driving instructors, so that deaf learners can choose an instructor who has passed this module. (2) Visual indications of information: This should include visual signage at bus stops, information boards in trains, and visual information about breakdowns and delays on vehicles and at stations. (3) A proactive approach to providing communication support for driving tests: This could include asking about the need for sign language interpreters, lip-speakers, and other requirements as part of the standard procedure in driving test applications. (4) The development and provision of material on road safety should be fostered along with the highway code aimed specifically at deaf people and using alternative formats, including simple text and graphics, and sign language. (5) Consultation, involvement, and outreach to the deaf community: The deaf community should be

involved in the development of all materials and training aimed specifically at it. Public transport operators and driving schools should have regular consultations with deaf people in order to better understand their requirements and how services can be improved to better meet their needs as well as to inform them of what is currently available. (6) An interactive information line: This should cover all aspects of travel, including support and help when lost, obtaining information about trains, buses, underground, trams, air, and taxis, and booking tickets. There should be a choice of user interfaces, including through sign language, speech, text, and images or a combination. (7) Induction loops and interpreters: Induction loops should be introduced in stages over a short period of time to all buses and coaches. Both induction loops and sign language interpreters should ideally be made available at all bus and rail stations. However, the limited availability of sign language interpreters and the many calls on their time are recognized, giving a need for BSL training on at least a basic level for all railway and bus station staff and an increase in the number of fully qualified BSL interpreters. (8) Research on travel aids: Research is required to determine effective ways to provide deaf people with the audio content of audiovisual road and travel information. This includes the sirens of emergency vehicles and approaching traffic, particularly from behind.

The research reported in this article is one of the first studies on road safety and travel issues that affect deaf and hard of hearing people. The results of this research show that communication difficulties and the associated problems in accessing information make travel more difficult for deaf people and, in some circumstances, could reduce their safety. Since deaf people generally experience difficulties or do not have access to the audio component of audiovisual information, they may require purely audio signals to be made accessible to them in visual or tactile form possibly supplemented by a vibro-tactile signal. Therefore, there is a need for research to investigate alternatives, such as vibrating pagers, and to determine the most effective means of alerting deaf people to emergency vehicles, as well as approaching traffic, particularly from behind.

NOTE

1. In this article, the noun deafness and the adjective deaf are used to denote people with some degree of audiological deafness or hearing impairment and not just people who are profoundly deaf (or culturally Deaf).

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