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The Digitization Technology for the Deaf on Cruise Passenger ships "The Problems and the Solutions"

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المستخلص

الصم كيان موجود في جميع المجتمعات والبلدان. المشكلة هي أن الصم وضعاف السمع (DHH) يواجهون صعوبات كبيرة أثناء النقل بجميع أنواعه ، وخاصة البحرية منها. توضح هذه الدراسة تلك التحديات والمشكلات وتلفت انتباه الحكومات والمنظمات والجمعيات الدولية إلى ضرورة تحسين مجال النقل البحري. تم تطوير استبيان للصم لتحديد المشاكل التي تواجه الصم وكيفية إيجاد حلول لهذه المشاكل (شارك فيها حوالي ٣٨٠ شخص أصم).

تم تطوير استبيان آخر للبحارة في مجال الرحلات البحرية ونقل الركاب البحري ، من أجل التعرف على المشاكل ، كما أن هناك العديد من المقابلات مع العمال أثناء اتصالهم بالصم ومشاركتهم في تقديم الحلول ، وشارك فيها حوالي ٦٠ شخصًا.

تكشف النتائج أن مجتمع الصم لا يتمتع بجميع الحقوق في استخدام وسائل النقل. البحث له العديد من القيود ، فمن الصعب للغاية الحصول على عينة من المشاركين المختارين من DHH في الدول العربية ، كما أنه من الصعب جدًا التواصل معهم. بالإضافة إلى قلة الأبحاث والمراجع والدراسات حول هذا الشأن.

Abstract

Deaf people are an entity that exists in all societies and countries. The problem is deaf and hard-of-hearing (DHH) face major difficulties during transportation of all kinds, especially marine ones. This Study clarifies those challenges, problems and draws the attention of governments, international organizations, and associations to the requirement for improving the field of maritime transport. A questionnaire was developed for the deaf to identify the problems facing the deaf and how to find solutions to these problems (about 380 deaf people participated in).

Another questionnaire was developed for seafarers in the field of cruise and marine passenger transport, in order to recognize the problems, also there are many interviews with workers during their contacts with the deaf and their participation in providing solutions, and approximately 60 people participated in.

The results reveal that the deaf community does not enjoy all rights in transportation. The research has many limitations, it is so difficult to gain a sample of participants chosen from the DHH in the Arab countries, and also very difficult to communicate with them. In addition to, the lack of research, references, and studies on this concern.

Keywords: DHHs – Passenger ships – transportation – Deaf rights – A smartphone application

1- Introduction

It is certainly very difficult for the deaf to deal with societies that are not aware that the deaf has special treatment. It is convinced that the challenges they face are difficult and unique. Therefore, these challenges or problems facing the (DHH) are very great and the deaf cannot comprehend or solve them on their own.

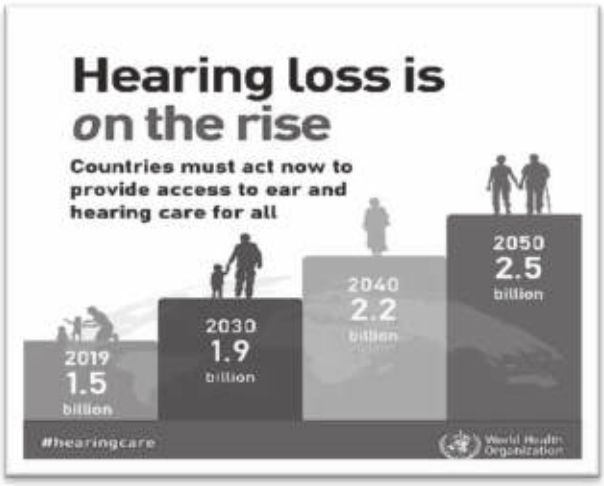

Figure (1): The number of deaf people worldwide
Source: WHO, (2019)

Deaf people are a part of society that cannot be neglected or ignored, as the number of DHH worldwide in 2019 exceeded 1.5 billion people and this number is expected to reach 2.5 billion people by 2050 according to statistics and studies from the World Health Organization (WHO) as showed in Figure (1). The number of deaf and hearing loss around the world in each region is increasing as shown in Figure (2), unfortunately in most countries, especially Developing Countries, do not offer the hearing-impaired or deaf person the least means to help he/she to pass life easily and simply.

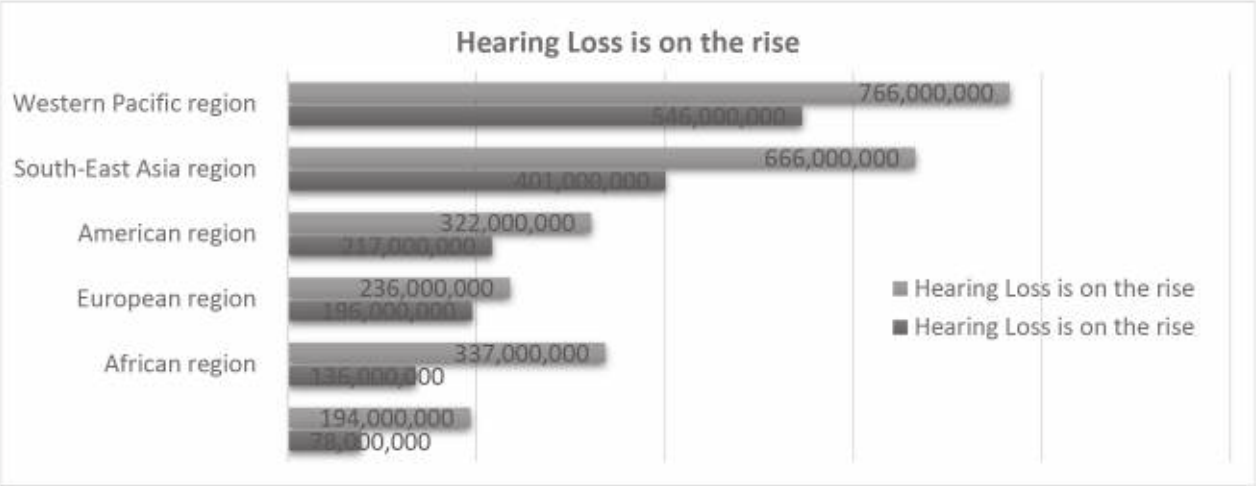

Figure (2): Number of Deaf & Hearing loss around the world regions
Source: WHO (2019)

There are immense problems that deaf people face daily in all areas, the most important of which is the field of transportation, especially daily transportation, for example, the train, bus, metro, and during plane travel, but all of the above means of transportation do not exceed hours in the life of the DHH. But for a journey on passenger ships, the matter goes beyond days not hours like other modes of transportation, which increases the challenges and problems expected to occur during cruises on passenger ships, especially in emergency situations or disasters that occur during cruises.

As stated in the World Report on Hearing (WRH), (2021).

> *"World Hearing Day is an annual global advocacy event and the largest awareness campaign that calls for action to address hearing loss and related issues. It is celebrated on the 3rd of March to raise awareness regarding hearing loss and to promote ear and hearing care at community and national levels across the world. Every year, this day addresses a specific theme, and to reflect this, activities are carried out by WHO and its partners".*

Society considers the DHH to be one of the sick or disabled people and they need specific medical treatment, but the DHH community does not consider themselves disabled or sick. However, they are societies and entities that have different associations, clubs, and languages, and other societies and entities must recognize them and fulfill their needs from all stages of education, health, and appropriate job opportunities that allow the deaf to work in most fields and to be able to earn the sums that allow them to live in a good and dignified manner.

Unfortunately, in most developing countries, a very large percentage of deaf people occupy temporary jobs and do not learn how to read or write, due to the high cost of their education which the weak budgets of developing countries cannot afford. On the other side, in some developed countries such as the USA or European countries, caring for the DHH is a priority for their attention, and large budgets are allocated to them, and there are schools, universities, and clubs dedicated to the deaf, and as a result, the DHH can read and write as well as enroll in universities, they can enroll in a very good job just like engineers, doctors, journalists, and teachers.
This paper addresses the problems and challenges that face the deaf during cruises on passenger ships, especially in emergencies, recognize the difficulties facing DHH in different modes of transportation, and deliberate the parameters that affect the DHH during emergencies designing and implementing a specialized prototype software system on a mobile smartphone or tab that allows the deaf to deal with the critical situation or emergencies on a passenger ship.

Background

Ana et al (2021) aimed to focus on the rights of persons with disabilities to transportation in Brazil. The researchers conducted a descriptive analysis of the mobility practices of people with disabilities. Researchers have found that a higher level of immobility compared to people without disabilities seriously affects their access to urban goods and services.

Forough (2019), and Gary and Timothy (1989) presented detailed and important studies on the problems that DHH suffer from and their short-term and long-term solutions or designing models. Forough (2019) discussed the nature of the problems faced by the deaf during their use of transportation at airports. Based on the survey and personal interviews, a prototype was designed and implemented to help the deaf to move and navigate at airports.

Gary and Timothy (1989) pointed out the problem of loss of communication that deaf people face with oral communication when using transportation modes and the increased risk in emergencies. The research introduced a short-term and long-term plans to solve those problems.

Elmar and Christian (2012) provided insights into the barriers faced by hearing and visually impaired passengers when using public transportation services. Through personal interviews and general surveys, the researchers found a variety of different problems experienced by disabled passengers. In addition, multiple solutions were presented.

2- Methodology

This study is classified as deductive quantitative research. Creswell, (2012) stated that there are several key characteristics of the quantitative approach. First, describe the research problem by needing an explanation of the relationship between the variables. Second, present specific, measurable, and observable research questions and hypotheses. Third, digital data collection through personal interviews or questionnaires. Fourth: Analyzing the results, taking into account the variables and hypotheses, using statistical analysis. Fifth: design and implement an application that helps DHH through emergencies on passenger ships.

The research required conducting a preliminary survey of the conditions of the DHH and the visually impaired in all fields, which produced preliminary lines for the research plan.

The Proposed Model

Clarification of the scientific research model for the relationship between hypotheses, variables, and the research goal, which is the Deaf satisfaction with transportation modes as shown in Figure(3) this model had been created by the researcher according to the previous studies. In addition, an initial plan for the research was clarified in terms of data collection, sample participants, and methods for analyzing the results, then a simplified explanation of the number and contents of the research and the expected implementation period.

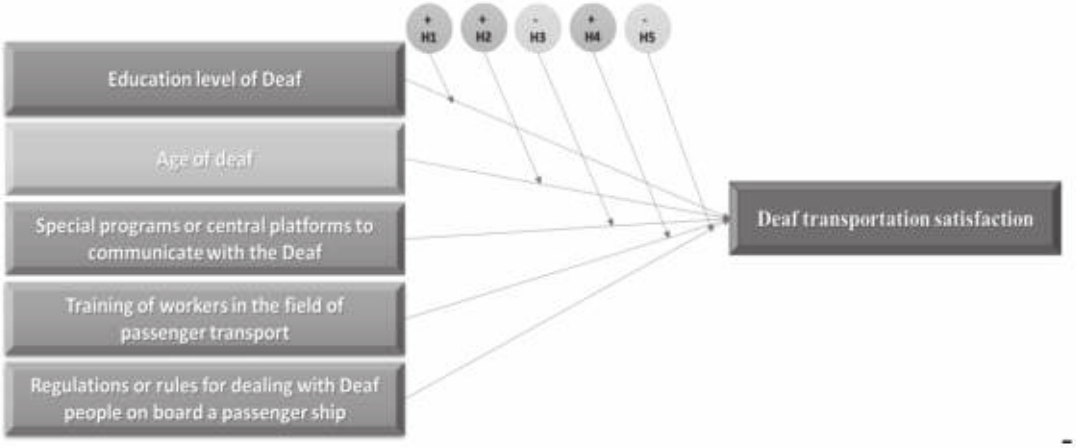

Figure (3) The research model

3- Data Collection and Questionnaire

3-1 Creating Questionnaires

One of the most important stages of the research is designing a questionnaire for DHH and another for those involved in marine tourism. A website specialized in creating questionnaire forms called QuestionPro was used. The Uniform Resource Locator (URL) address of the two questionnaires has been published on the Internet and social networking sites Facebook and Messenger, and most of the associations and institutions that support and help the deaf have been contacted, and some companies that have passenger ships have been contacted on their official websites, emails, and sometimes via WhatsApp to all Arab countries from the East to West and from north to south.

3-2 Data Analysis.

Data were collected for the first and second questionnaires from the electronic platform and all answers were converted into Microsoft Excel tables and had been analyzed by Structural Equation Modeling (SEM). The data were analyzed according to an advanced scientific method.

4- Analysis Results

4-1 Assessing the Structural Model, I

The SEM Examed the structural model including path coefficients, collinearity diagnostics, coefficient of determination (R^2), effect size (f^2), predictive relevance (Q^2), and goodness of fit criteria GoF.

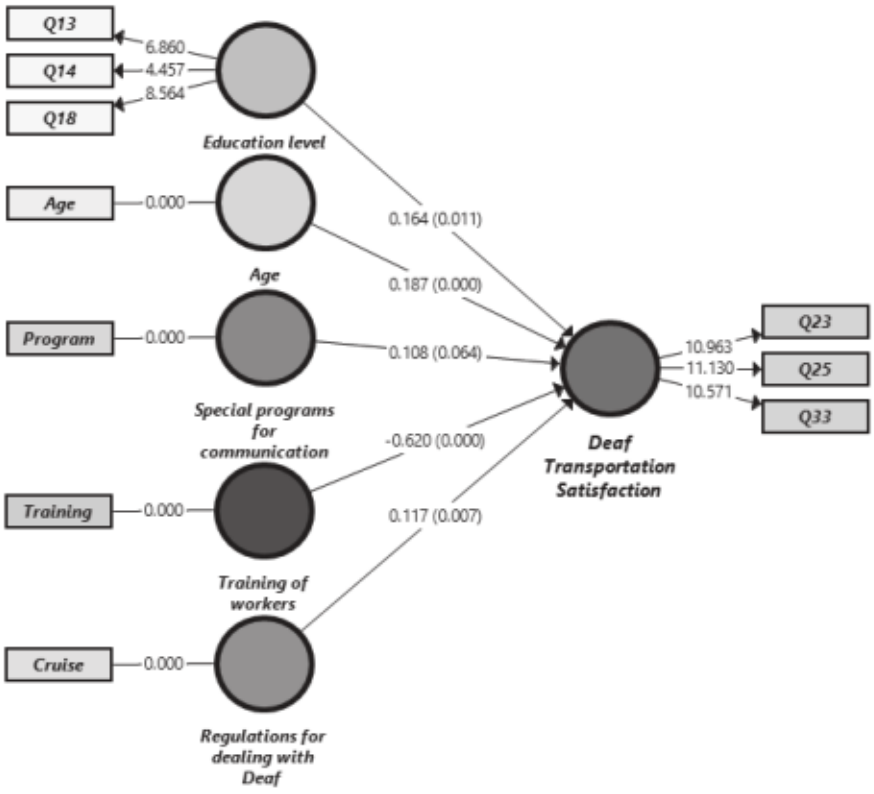

Figure (4): Model I Hypotheses Testing

Before analyzing the structural model, the collinearity between constructs was examined using Variance Inflation Factors (VIF) and found that all values were less than the threshold of 5 (Hair et al., 2017).

Table (1): Structural model I assessment

Path	β	t-value	P-value	Remark	F Square	VIF
					≥0.02	<5
H1: Age -> Deaf Transportation Satisfaction	0.187	3.535	***	Supported	0.063	1.039
H2: Education level -> Deaf Transportation Satisfaction	0.164	2.552	0.011*	Supported	0.043	1.196
H3: Regulations for dealing with Deaf -> Deaf Transportation Satisfaction	0.117	2.684	0.007**	Supported	0.024	1.085
H4: Special programs for communication -> Deaf Transportation Satisfaction	0.108	1.855	0.064†	Supported	0.02	1.216
H5: Training of Seafarers -> Deaf Transportation Satisfaction	-0.62	12.273	***	Supported	0.639	1.131
Overall Model Fit: R Square (>0.1)=0.465, Q Square (>0)=0.171, GoF (>0.1)=0.621						

$^{***}P < 0.001$; $^{**}P < 0.01$; $^{*}P < 0.05$; $^{\dagger*}P < 0.1$. Cut-off values reference Chin (1998), Cohen (1988), Hair et al. (2017), and Wetzels et al. (2009).

The results of the first hypothesis in Table (1) showed that; Age has a statistically significant positive effect on Deaf Transportation Satisfaction since ($\beta = 0.187, t = 3.535, P < 0.001$), this suggests DHH will be more satisfied if he gets older, so that the first hypothesis is accepted. The results also showed that Education level has statistically significant positive effect on Deaf Transportation Satisfaction since ($\beta = 0.164, t = 2.552, P < 0.05$), this suggests DHH will be more satisfied if he is well educated, so that the second hypothesis is accepted. Moreover, Regulations for dealing with the Deaf has statistically significant positive effect on Deaf Transportation Satisfaction since ($\beta = 0.117, t = 2.684, P < 0.01$).

This means as there exist more regulations for dealing with the Deaf, this suggests they will be more satisfied, so that the third hypothesis is accepted. Furthermore, Special programs for communication has a statistically significant positive effect on Deaf Transportation Satisfaction since ($\beta = 0.108, t = 1.855, P < 0.1$), this means there exist more special programs for communication, which suggests they will be more satisfied, so that the fourth hypothesis is accepted. Finally, the training of Seafarers have statistically significant effect on Deaf Transportation Satisfaction since ($\beta = -0.62, t = 12.273, P < 0.001$), and so the fifth hypothesis is accepted.

4-2 Coefficient of Determination (R^2)

The coefficient of determination (R^2) refers to the effect of independent variables on the dependent latent variables, which is one of the quality measures of the structural model (Hair, Sarstedt, Hopkins, & Kuppelwieser, 2014). R^2 estimates vary from 0 to 1, in which 0 means low explained variance and 1 means high explained variance. Researchers have used a different cut-off of R^2 value. In our case R^2 equals to 0.465 which is a medium explained variance.

4-3 Effect Size (f^2)

The f^2 effect size is the measure of how much impact the endogenous construct will have if an exogenous construct was removed from the model. A construct is considered to have a small effect if its f^2 value is between 0.02 and 0.14, while it is considered to have a medium effect if its f^2 value is between 0.15 and 0.34, and a large effect if its f^2 value ≥ 0.35.

A construct with an f^2 value < 0.02 means it does not affect the endogenous construct (Hair et al., 2017). The Results in Table (1) indicate that which mean $R^2 = 0.465$ of the variation in Deaf Transportation Satisfaction is explained by the variation in the independent variables with a small Cohen's effect size for age ($f^2 = 0.063$), an Education level ($f^2 = 0.043$), Regulations for dealing with Deaf ($f^2 = 0.024$), Special programs for communication ($f^2 = 0.02$), and high Cohen's effect size Training of Seafarers ($f^2 = 0.639$).

4-4 Predictive Relevance (Q^2)

Q^2 value indicates the model's out-of-sample predictive power. When a model is said to have predictive power or predictive relevance, it means that it can accurately predict data not used in the model estimation. The analysis evaluated predictive relevance by assessing Stone-Geisser's Q^2 Blindfolding a sample reuse technique that can be used to calculate Q^2 values for latent variables. Executed the blindfolding procedure and calculated the Q^2 values for *Deaf Transportation Satisfaction* (Q^2 =0.171) which is greater than zero, thus indicating predictive relevance for endogenous latent variables in our PLS path model (Hair et al. 2017).

4-5 The Goodness of Fit of the Model

Tenenhaus et al. (2005), proposed the Goodness of Fit (GoF) as a global fit indicator; it is the geometric mean of the average R^2 the average variance extracted from the endogenous variables. The aim of GoF's is to take into consideration the research model at all stages, i.e., the measurement model and the structural model, with an emphasis on the overall model performance (Henseler & Sarstedt, 2013). The GoF value (0.621) is above 0.36, suggesting a high fit, hence it can be safely concluded that the GoF model has a higher level of fit to be considered a sufficient valid global PLS model.

The GoF was introduced by Tenenhaus et al. (2005) as a global fit metric. The GoF criterion for determining if GoF values are too little, too moderate, or too high to be considered a globally adequate PLS model.

4-6 Assessing the Structural Model II

Examining the structural model includes path coefficients, collinearity diagnostics, coefficient of determination (R^2), effect size (f^2), predictive relevance (Q^2), and goodness of fit criteria. Before analyzing the structural model, the collinearity between constructs was examined using (VIF), and found that all values were less than the threshold of 5 (Hair et al., 2017).

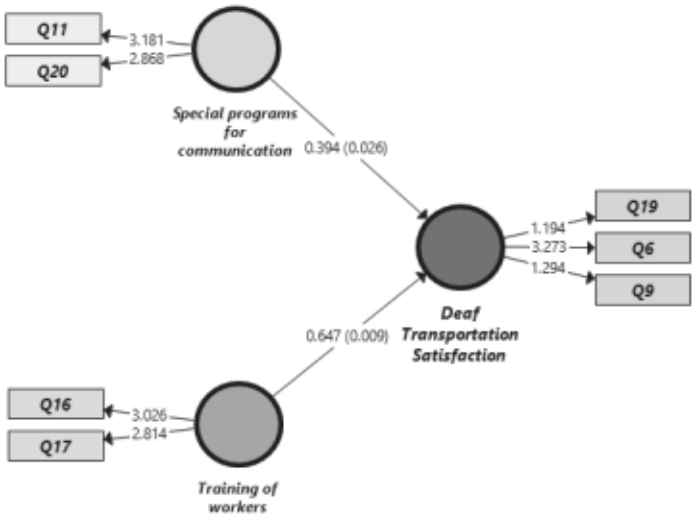

Figure (5): Model II Hypotheses Testing

The results of the first hypothesis in Table (2) showed that; Special programs for communication have a statistically significant positive effect on Deaf Transportation Satisfaction since ($\beta = 0.394, t = 2.233, P < 0.05$), this means as there exist more special programs for communication, this suggests they will be more satisfied, so that the first hypothesis is accepted. Finally, Training of Seafarers has a statistically significant positive effect on Deaf Transportation Satisfaction since ($\beta = 0.647, t = 2.6, P < 0.01$), this means there exists more Training of Seafarers, this suggests they will be more satisfied so that the second hypothesis is accepted. The Results in Table (2) indicate that about 51.3% of the variation in Deaf Transportation Satisfaction is explained by the variation in the independent variables with moderate Cohen's effect size for Special programs for communication (f^2 =0.301), and high Cohen's effect size Training of Seafarers (f^2 =0.812).

Table (2): Structural model II assessment

Path	β	t-value	P-value	Remark	*F* Square	VIF
					≥0.02	<5
H1: Special programs for communication -> Deaf Transportation Satisfaction	0.394	2.233	0.026*	Supported	0.301	1.004
H2: Training of Seafarers -> Deaf Transportation Satisfaction	0.647	2.6	0.009**	Supported	0.812	1.004
Overall Model Fit: R Square (>0.1)= 0.513, Q Square (>0)= 0.032, GoF (>0.1)= 0.590						

$^{***}P < 0.001$; $^{**}P < 0.01$; $^{*}P < 0.05$; $^{\dagger*}P < 0.1$. Cut-off values reference Chin (1998), Cohen (1988), Hair et al. (2017), Wetzels et al. (2009).

Then, the analysis evaluated predictive relevance by assessing Stone-Geisser's Q^2 Blindfolding a sample reuse technique that can be used to calculate Q^2 values for latent variables. We executed the blindfolding procedure and calculated the Q^2 values for Deaf Transportation Satisfaction (Q^2 =0.032) which is greater than zero, thus indicating predictive relevance for endogenous latent variables in our PLS path model (Hair et al. 2017). The GoF value (0.590) is above 0.36, suggesting a high fit, hence it can be safely concluded that the GoF model has a higher level of fit to be considered a sufficient valid global PLS model.

5- Conclusion

This study included five components that are considered the main drivers of research, which are age, education, smartphone applications, training of workers in the field of passenger maritime transport, and safety laws on passenger ships for the deaf. The results were consistent with most of the hypotheses. Entering the deaf community had a positive impact on getting an idea of how to deal with deaf people, designing a questionnaire, and designing a prototype for an application that helps deaf people during emergencies on board passenger ships.

Personal interviews played a major role in involving deaf people in answering the questionnaire. The results of the questionnaire analysis for DHH were reasonable and acceptable. 387 DHH respondents participated in answering the questionnaire, but only 291 completed the questionnaire as a result of the inability of some deaf people to read or embarrassment from the social standard

of living. Hearing-impaired people often lack oral communication when using transportation, resulting in a loss of communication and increased risk in an emergency situation, which only exacerbates the problem.

As for the second questionnaire about seafarers working on passenger ships and the way they deal with the disabled, especially the deaf, more than 60 participants from seafarers working on passenger ships have never met a person with a disability. None of them are trained to deal with the deaf, as well is no evidence of handling or steps to follow during the risks DHH is exposed.

Based on the results of the two questionnaires, personal interviews, and previous studies, it was found that all individuals are correct and compatible with the message model and that the relationships between the independent variables and the dependent variable are correct, reliable, and reliable, as indicated by the statistical results of the questionnaire questions. Accordingly, the research continued its natural course after the results of the statistical analysis of the questionnaire, where it was found that a method must be devised for the deaf to help them act during emergencies while they are on passenger ships.

Accordingly, communication was made with one of the leading companies in the transportation of passengers, and sign language translation was included in the special video safety instructions on passenger ships during cruises. The research continued its course by devising another way to direct the DHH to the meeting points on ships in case of emergency, and a model application was made to guide the deaf to go from different places such as the restaurant, café, and bedrooms to the assembly point to board the lifeboat, and all the steps were translated in Arabic sign language. Accordingly, the results of the questionnaire led the study to most of the needs required to complete the study in full.

Deaf people should not be seen as perpetual victims of circumstances whose only desire is to connect with the hearing world, but rather promise a tomorrow of an ethic in which deaf individuals are embraced as normal people looking for ways to make life simpler and more enjoyable.

6- Recommendations

According to this study, the most basic aspects of a deaf person's life emphasize the need to take care of this entity. Also many external factors affect the interaction of the deaf with others or vice versa while using all kinds of transportation

6-1 In the Field of Education and Training:

Educational and governmental institutions must provide an appropriate number of schools based on healthy and developed educational foundations to improve the educational level of the deaf and ensure the competence of teachers and educators. Universities specializing in the field of languages, media, and communication should include an educational curriculum for sign language and how to deal with deaf communities, in a way that helps spread environmental awareness through dialogue between deaf people and others.

6-2 In the Field of Passenger Maritime Transport:

It was found that most tourism companies and passenger transport companies have a clear interest in quiet tourists (deaf) to improve the level of navigational tourism for the disabled. Maritime institutions and academies should add an intensive program for students in maritime transport and graduates while renewing nautical certificates and declarations.

International organizations and international institutions concerned with human rights and the rights of the deaf must include paragraphs in all legal manuscripts by forcing companies specialized in passenger transport or tourism companies to allocate rooms equipped with all modern equipment that allows deaf people to remain calm and safe from risks, accidents, and disasters. It was found from the prototype on the smartphone that was designed that the rooms for the disabled and the deaf should be chosen near the meeting points in case of emergency so that the deaf would not find it difficult to board the lifeboats.

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