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Face dimension and passports requirements

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ABSTRACT

In China, The Netherlands and Greece the requirements for a photo in travel documents include a ratio between head height and face width. 2.7 to 4.7% of the population falls outside the ratio limits. Therefore, millions of travelers do not meet the criteria. In practice, they generally do receive a passport but sometimes after elaborate discussion and procedures. We recommend abolishing face width as a criterion to bring rules and common practice more in line.

INTRODUCTION

Face recognition is important for border control. The photo in the passport therefore has to meet a large list of criteria in each country where the passport is issued. ISO/IEC 19794 part 5 specifies the biometric data interchange formats of the face. EU directive C92006_2909 of June 28th 2006 further specifies the criteria. A corrigendum of ISO/IEC 19794, published July 1st 2008, presents results of a study in which 7200 digital passport images of various countries were processed. About 6% of the images did not meet the ISO 19794 criterion that the center of the face should be in the upper half of the image.

In order to prevent drop outs during passport control, criteria are enforced during submission of a photo when applying for a passport.

The criteria generally include clearness of the picture, resolution of the picture, facial expression, positional orientation towards the camera, type of glasses and reflection in glasses, opening of the eye and mouth.

Another requirement is that a considerable part of the photo is covered by the face, since this contains most information. For citizens of Australia, for instance, the length of the photo has to be from 45-50 mm and the distance from the chin to the top of the head (head height) has to be 32 to 36 mm (<https://www.passports.gov.au/Web/requirements/Photos.aspx>). This means that the percentage of length that is covered ranges from 64 to 80%.

In the US the required percentage of the photo covered by the face is less (http://travel.state.gov/passport/guide/composition/composition_874.html)

but the photo has a larger size. The facial length is allowed to range from 28 to 35 mm on a picture of 51 mm length. This means a covered range from 55 to 69 %.

Table 1 shows an overview of photo requirements for selected countries, including the ten most populated countries in the world.

Three countries have requirements regarding head height and face width: The Netherlands, China and Greece.

The Dutch requirements

(www.paspoortinformatie.nl/nederlands/Reisdocumenten/Pasfoto) require the head height to be from 26 to 30 mm (58 to 86% of photo height) and the face width has to be between 16 and 20 mm (46 to 57% of photo width). The consequence is that the ratio of head height and face width has to fall between 1.3 (equals 26/20) and 1.875 (equals 30/16). For China, the ratio has to be from 1.17 to 1.57. Face width for the Chinese passport is defined as the maximal width including the ears (and even the hair when it is wider than the ears). For the Netherlands passport, the face width excludes the ears. The Greek limits in head height / face width ratio are 1.24 and 1.75.

The risk of the approach to use head height/face width ratios may be that some citizens may have head dimensions that are outside of this ratio. In that case, the civil servant can apply a rule that the citizen is considered as an exception and still supply a passport, but this takes extra time and is often unpleasant for the citizen. The purpose of this study was to investigate how many citizens from The Netherlands, Greece and China would be excluded from a passport for this reason.

METHODS

The database from the Civilian American and European Anthropometry Resource (CAESAR) anthropometric survey was used for the calculations regarding The Netherlands (Blackwell et al., 2002). This survey included manual measures and 3D whole body scans from the US, Italian and Dutch population. In The Netherlands 1247 subjects representative for

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Table 1
Overview of photo requirements for selected countries

country	photo		head height		face width		vertical range		length/width ratio	Remark
	length mm	width mm	min mm	max mm	Min mm	max mm	min %	max %		
Australia	45	35	32	36			71.1	80.0		Photo length up to 50 mm is accepted no specific requirements
Bangladesh	50	40								
Brasil	45	35	31	36			68.9	80.0		
Canada	45	35	31	36			68.9	80.0		
China	48	33	28	33	21	24	58.3	68.8	1.17 - 1.57	
Finland	47	36	32	36			68.1	76.6		
France	45	35	30	30			66.7	66.7		head height should be about 3 cm
Germany	45	35	32	36			71.1	80.0		
Greece	60	40	31	35	20	25	51.7	58.3	1.24 - 1.75	
India										specifications change from state to state
Indonesia	50	50	25	35			50.0	70.0		
Italy	40	30								no specifications
Japan	45	35	33	35			73.3	77.8		
Netherlands	45	35	26	30	16	20	57.8	66.7	1.3 - 1.875	
Nigeria	45	35								head should cover 70-80% of photo
Pakistan	51	51	25	35			49.0	68.6		
Russia	45	35								head should cover 70-80% of photo
UK	45	35	29	34			64.4	75.6		
USA	51	51	25	35			49.0	68.6		

the Dutch population were measured. The measurements were performed in 1999-2000 and included ages 18-65 years.

The face width was determined using calipers. The head height was calculated indirectly as the sum of the menton-sellion length for the lower part of the face and the difference between sitting height and eye-height sitting for the upper part of the face. It is previously shown that the eye height is lower than the height of the sellion: for males 9 mm has to be added and for females 22 mm (Open Ergonomics Ltd, 1998). Therefore, this correction was applied to the Dutch data.

For China, the measurements were taken from Size China (www.sizechina.com). This 3D-anthropometric survey of Chinese head shapes included 783 males and 780 females, measured in six locations (Beijing, Chongqing, Guangzhou, Hangzhou, Lanzhou and Shenyang). A random sample of 70 males and 70 females was used for this study. All subjects were 18 years or older. Head length and face width were calculated from frontal views of the 3D scans.

For Greece, the data of the NATO survey of 1071 Greek military was used. The ratio between head length and bizygomatic breadth (distance between most protruding parts of the cheek bones) was used as the dependent variable. Unfortunately, only relatively old anthropometric data was available for Greece (Hertzberg et al., 1963).

The statistical processing of the Dutch population was performed using ANOVA with the ratio between head length and face width as the dependent variable

and gender and age group as main effects (Statsoft, 2007). All interaction terms were included in the analysis. The distinguished age groups were 18-30 years, 31-45 years and 46-65 years. For the Chinese population the same ratio was taken as the dependent variable. For both the Dutch, Chinese and Greek population, the number of subjects outside the ratio boundaries was determined.

RESULTS

For The Netherlands, the ratio between face length and face width should be at least 1.3 to satisfy the criteria for a passport. Only 0.08% of the Dutch population did not meet this criterion. However, 2.65% had a ratio exceeding 1.875. Thus 2.7% of the population should have fallen outside the criteria when they applied for a passport. In The Netherlands there are about 14 million subjects older than 14 years that are obliged to have a piece of identity. This means that over 378,000 subjects in The Netherlands do not fulfill the requirements.

Age and gender have an influence on rejection rate (significant main effects $p < 0.001$). In particular young females are prone to rejection: 7.5% of the females aged 18-30 years would fall outside the criteria range.

For China, four subjects (2.9%) had a ratio lower than 1.17; one subject had a ratio exceeding 1.57. Therefore, a total of 5 out of 140 subjects (3.6%) did not meet the criteria. The average ratio was 1.32, the middle of the criteria was $((1.17+1.57)/2)$ 1.37. Therefore, the subjects had a relatively low ratio as compared to the criterion.

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For China, the population amounts to 1.345 billion inhabitants (www.geohive.com) and about 80% is older than 15 years (http://en.wikipedia.org/wiki/Demographics_of_the_People's_Republic_of_China). If we assume that this group may be eligible for a passport, 3.6% of 1,076 billion which is at least 38 million inhabitants would face problems in getting a passport.

For the Greek population, 50 of the 1071 subjects (4.7%) had a ratio lower than 1.24. The average ratio was 1.33 (range 1.15-1.54, standard deviation 0.06). None exceeded the ratio upper limit of 1.75. Greece has about 11 million inhabitants (www.geohive.com) and 85% is older than 14 years (<http://en.wikipedia.org/wiki/Greece#Demographics>). If we assume that this group may be eligible for a passport, 4.7% of 9.35 million, which is almost 440 thousand inhabitants, would face problems in getting a passport.

DISCUSSION

It is important for face recognition that the photographs on the pieces of identity are uniformly defined and that the face occupies a large part of the picture. Therefore, exact dimensions are given for head length in all investigated countries. Since no distortion (different scaling of horizontal and vertical axis) of the photo is allowed in any country, the resulting face width on the photo of each individual is dependent on head length. In The Netherlands, China and Greece, however, specifications are given for face width as well. This is not necessary according to ISO/IEC 19794-5; this standard offers several options for image face types and criteria. The Netherlands follow the recommendations 'best practices for full frontal images on travel documents' (annex 3.2.3) that contains minimal and maximal requirements for head length and face width.

The combination of head length and face width leads to a range of accepted ratios. In The Netherlands the acceptable ratio of head length to face width equals 1.3 to 1.875. Although this is a wide range, the variability in face dimensions exceeds this range. About 2.7% of the Dutch population aged 18-65 falls outside the specified range. The same is true for 3.6% of the Chinese population, but the reliability of the estimate is less since the dataset is smaller. In practice it is not ethical to refuse people for this reason and subjects do receive this piece of identity, albeit sometimes after long discussions. ISO/IEC 19794 allows for individual exceptions, and in The Netherlands the civil servants generally accept deviating photographs.

The number of complaints reaching the Ministry of Internal Affairs and Kingdom Relations is very small.

Since the practice is in conflict with the requirements, we recommend abolishing the requirements for face width.

There were no direct measurements of face length in the CAESAR database. Therefore, it had to be assessed using three other dimensions: menton-sellion length, sitting height and eye height sitting. The sellion is located higher than the eye. Therefore, we used the correction factors of 9 mm for males and 22 mm for females (Open Ergonomics Ltd, 1998) for each individual. These correction factors were similar for the population of the UK and the USA. Unfortunately, no correction factors were available for the Dutch population.

The Dutch database contains subjects aged 18 to 65 years. The population that needs a piece of identity, however, is aged from 14 years onwards. Therefore, differences in the ratio may exist for subjects 14-18 and over 65 years old. The real impact of this effect is unknown, but it is known that head dimensions vary less than other body dimensions in growing adolescents (Sinclair and Dangerfield, 1998).

In summary, we showed that combining requirements of head length and face width for photos in a passport leads to exclusion of about 2.7% for the Dutch, 3.6% for the Chinese population and 4.7% for the Greek population. Therefore, we recommend setting only requirements for vertical face dimensions, as is current practice in most countries.

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A Research Network in Travel Medicine

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Introduction

Research in travel medicine is actively conducted at both a national and international level but is arguably in its infancy, with many research questions currently being identified and an evidence base that is sometimes quite actively debated. Research in this discipline in the British Isles has traditionally been somewhat piecemeal with a few individuals conducting pieces of work in relative isolation, although this may be a reflection of the relatively low level of funding such research attracts. This is particularly true of the work that attempts to investigate the activity of practitioners and the behaviour and attitudes of travellers.

It has been proposed by the British Travel Health association (BTHA) and the Travel Medicine Society of Ireland (TMSI) that a useful exercise might be to explore setting up a collaborative research network amongst its own members. This network could potentially gather data to help answer specific questions in travel medicine that had been identified as relevant to practice by the membership of the two organisations.

The aim of the project was to gauge the interest and potential involvement of BTHA and TMSI members in a research network as well as to identify what they perceived as the type of projects that could be usefully conducted through such a network.

Method

Members of the BTHA and TMSI for whom email addresses were held were sent a simple electronic survey to gather and explore the opinions of various healthcare professionals involved in travel medicine, including Doctors, Pharmacists and Nurses. The survey tool has been previously validated and piloted and consists of mainly structured closed questions with free text boxes where appropriate. The email and web link for the survey was disseminated over summer 2009 and data were analysed using Microsoft Excel. The chi squared test was used to analyse the statistical significance of categorical data using Minitab 10.

Ethics approval was granted from the De Montfort University Health and Life Sciences ethics committee.

Results

Email addresses were available for 328 members of the BTHA and 310 members of TMSI. A total of 106 questionnaires were received through the BTHA (response rate 32%) and 39 through TMSI (13% response rate). 75% of BTHA respondents were interested in participating in a research network compared to 43% of TMSI. The profile of respondents is shown in Table 1.

Figure 1 compares the respondents' views of the main barriers to research in travel medicine from the following:

- Insufficient time
- Lack of financial incentive
- Lack of motivation
- Not having a personal interest in the topic
- Poor support from employer

Figure 2 gives an indication of the methods of data collection respondents would be willing to undertake.

Figure 3 shows the responses concerning how areas of research could be prioritised, which were:

- The quality of advice given to travellers during a pre-travel consultation
- Incidence of travel health related illness on return
- Knowledge, attitude and compliance of travellers to advice given
- Accidents and trauma abroad.
- Comparison of level of service delivery between travel clinics
- How the cost of travel medicine is perceived by the traveller

In the UK more nurses than doctors considered lack of support from the employer (69% v 34%, $p < 0.001$ chi square = 3.9, DF=1), and not having a personal interest (37% v 18% $p < 0.001$, chi square = 11.7, DF=1) as potential barriers. In the UK more nurses than doctors gave a higher priority to research into the quality of advice (77% v 50%, $p < 0.05$ chi square = 5.6, DF=1).