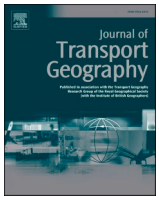
Journal of Transport Geography 96 (2021) 103204

Contents lists available at ScienceDirect

Journal of Transport Geography

journal homepage: www.elsevier.com/locate/jtrangeo



An assessment of air passenger confidence a year into the COVID-19 crisis: A segmentation analysis of passengers in Norway

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ARTICLE INFO

Keywords:
COVID-19
Norway
Aviation
Passenger behaviour
Survey

ABSTRACT

The COVID-19 crisis has become the most intense and long-lasting in the history of aviation. There is already a significant literature on the immediate impact of the outbreak, as well as on speculation on the future evolution of the industry. This paper seeks to contribute to this discussion by assessing a year into the crisis the demand related aspects and passenger behavioural impacts of the pandemic. Specifically, the paper aims to identify discrete market segments of air passengers according to their shared attitudes and preferences about air travel in light of the COVID-19 crisis, as well as past behaviour and future travel intentions. To achieve this, we analyse data from a large (n = 2096) online questionnaire survey of air passengers in Norway. The cluster analysis identifies four distinct passenger segments, with each displaying varying attitudes, behaviours, and levels of concern about air travel. One of these groups, described as the *'Apprehensive Elders'*, were identified as having the highest level of concern about flying, and subsequently showed a sharp decline in their intention to travel in the future. Another group, termed the *'Cautious Commuters'*, showed similarly enhanced levels of concerns about flying, but maintained a high propensity to fly following the pandemic despite these concerns. Regarding possible interventions to increase confidence in flying in the future, across all segments the data shows a clear preference for more 'traditional' active interventions, including wearing of face masks and enforcement of physical distancing, over and above passive or technological interventions. Norway represents a valuable case as a possible signal for future policy and practice in relation to the recovery of air travel following the pandemic. The findings have important implications for air transport managers and decision makers in terms of managing the perceptions and expectations of different passenger groups as air travel begins to return.

1. Introduction – COVID-19 and the impact on aviation

The aviation industry and commercial air transport activity are highly impacted by external factors. In recent memory, significant large-scale disruptions have included terrorist attacks like 9/11 in 2001, infectious diseases, including the SARS outbreak in 2003 (Mangili and Gendreau, 2005), natural hazards, including the Eyjafjallajökull volcanic ash cloud of 2010 (Budd et al., 2011), or IT systems failures, such as the system failure that severely affected British Airways operations in 2017 (Buck and Hollinger, 2017). These events demonstrate the vulnerability of air transport to a multitude of disruptions (Voltes-Dorta et al., 2017). In that regard, the improvement of the resilience of the air transport network has been a long-standing objective for the sector (e.g., EC, 2014). But the crisis generated by the COVID-19 outbreak has become the most intense and long-lasting in the history of commercial aviation. According to ICAO (2021), worldwide the supply of seats by airlines in 2020 declined by 50% compared to 2019, the number of passengers fell by 60%, and airlines lost US$ 371 billion in passenger operating revenues. The recovery outlook for 2021 does not look promising, with airlines maintaining the 50% reduction of capacity for the first two quarters of the year. Other industry organisations like IATA (2021), ACI (2021) and Eurocontrol (2021) point to a similar direction and only envisage a ramp-up in demand from the third quarter of 2021.

From an academic perspective, early contributions about the impact of COVID-19 on aviation have focused on aviation networks and virus propagation (e.g., Wu et al., 2020; Boldog et al., 2020; Adiga et al.,

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https://doi.org/10.1016/j.jtrangeo.2021.103204
Received 17 June 2021; Received in revised form 16 September 2021; Accepted 22 September 2021
Available online 28 September 2021

2020), the impact of travel restrictions (Chinazzi, 2020), the identification of the critical airports for controlling disease outbreaks (Nikolaou and Dimitriou, 2020), and the analysis of the air cargo sector (Li, 2020; Bombelli, 2020).

In the specific area of commercial aviation, the earliest contribution was by Suau-Sanchez et al. (2020) who conducted a series of in-depth interviews with senior industry executives to develop an early assessment of the long-term impact of COVID-19 on the demand and supply sides of the industry, and regulatory aspects. Later, Jimenez and Suau-Sanchez (2020) expanded on the impact differences between Low-Cost Carriers (LCC) and Full-Service Network Carriers (FSNC) that Suau-Sanchez et al. (2020) explored. Similarly, Zhang et al. (2021) conducted an expert survey as part of the WCTRS[1] COVID-19 Taskforce, although this focussed on other modes of transport in addition to aviation, it shows the lack of preparation to health threats. Only 27% of the cities with airports had guidelines for public health threats before the COVID-19 pandemic. A value that drops to 15% for contingency plans.

Other contributions have focused on the supply side, the network impacts and global mobility impacts of the crisis (for example, see Sun et al., 2020, Abu-Rayash and Dincer, 2020). These studies have speculated on the evolution of airline business models (Bauer et al., 2020), the limited preparedness of the industry to external shocks (Brown and Kline, 2020; Linden, 2020; Pereira and Soares de Mello, 2021) and the airlines' strategic responses (Albers and Rundshagen, 2020). Others focused their analysis on the lessons for the future (Tabares, 2020; Tisdall and Zhang, 2020; Dube et al., 2021), the operational challenges ahead after a widespread grounding of aircraft (Adrienne et al., 2020; Schultz et al., 2020), regulatory aspects related to a sudden collapse of demand (Forsyth et al., 2020), the aeropolitical unsolved issues (Macilree and Duval, 2020) or government support (Abate et al., 2020).

By comparison, contributions that focus on the demand side and the possible behavioural impacts of the crisis are more limited in the literature. Notable exceptions include Lamb et al. (2020), who surveyed more than 600 people to measure their willingness to fly during and after the pandemic. Similarly, Graham et al. (2020) also surveyed around 600 people, focusing on UK residents aged 65 years or above in order to identify the specific needs of this demand segment.

Concerning predictions about the recovery of air transport in the aftermath of the crisis, Gudmundsson et al. (2021) forecasted that the recovery of air passenger demand would take an average of 2.4 years from 2020, lasting between 2022 and 2023. This is a more positive outlook than many industry predictions that suggest the recovery of passenger volumes of 2019 will not occur before 2024 or 2025 (see, for example, IATA (2021) and ICAO (2021)). This difference in opinion regarding the likely speed of the recovery may be related to the fact that the industry predictions complement the econometric forecasts with a 'market feel' based on the low levels of passenger confidence. Indeed, industry documents setting the path of recovery highlight passenger confidence as one of the cornerstones for recuperating passenger volumes. For example, one of the most notable proposals is the Aviation Round Table Report on the Recovery of European Aviation,[2] which defines five priority areas for rebuilding the aviation sector, with the need for 'restoring public confidence' being the priority.

Indeed, while previous shocks to air transport like the 9/11 terrorist attacks had a significant impact on passenger confidence and demand for air travel (Ito and Lee, 2005), the nature and scale of the current crisis are quite different from the previous ones. Also, unlike terrorist attacks, pandemics such as COVID-19 represent an invisible threat with delayed consequences which makes them particularly worrying and a cause of anxiety for the public (see, for example, Rudenstine et al. (2020), Zhao et al. (2020) and Peteet (2020)). At this time of uncertainty and change, there is a need to better understand how passengers are likely to respond in the longer term to changes to the 'normal' air travel experience, and to better comprehend the types of interventions that are likely to elicit the greatest sense of confidence and reassurance.

The use of clustering and user segmentation are common techniques in policy and planning for better understanding (and thus influencing) the behaviour of certain populations. In the context of COVID-19, a number of studies have adopted this approach to inform decision making on issues ranging from attitudes towards the pandemic and lockdown (Boguszewski et al., 2021), compliance with COVID-19 public health measures and the emergence of opinion-based groups (Maher et al., 2020), and attitudes towards vaccination (Kleitman et al., 2021). Various segmentation and clustering techniques have also been used in the travel behaviour research, including Khaddar and Fatmi (2021), who assessed user satisfaction with travel during the pandemic using a latent segmentation-based ordered logit (LSOL) model among citizens in Canada. However, there are few, if any, examples of similar studies in an air passenger context in the academic literature.

Against this background, the paper seeks to contribute to knowledge and understanding of the demand related aspects and passenger behavioural impacts of COVID-19 one year after the crisis began. Specifically, the paper aims to identify discrete market segments of air passengers according to their shared attitudes and preferences about air travel in light of the COVID-19 crisis, as well as their past behaviour and future travel intentions. This is achieved by presenting an analysis of data from a large ($n = 2096$) survey of people in Norway. This in turn is used to assess passenger travel decisions and plans in the context of COVID-19 and interventions that could increase passenger confidence in air travel in the future. With respect to generalizability of the results, we have not come across research that compares the Norwegian air transport market with similar markets in other countries with respect to passenger attitudes and perceptions in COVID-19 like situations. However, we do not find reasons to expect such differences, if any, to be significant. The findings have important implications for air transport managers and decision makers in terms of managing the perceptions and expectations of different passenger groups as air travel begins to return.

The following section (Section 2) provides an overview of Norway as the study setting and discusses the impacts of COVID-19 on air travel in Norway. This is followed by a description of the methodology in Section 3 and the statistical analysis in Section 4. The results of the analysis are then provided in Section 5. Concluding remarks and a discussion of the results are provided at the end of the paper, in Section 6.

2. The immediate impact of the COVID-19 crisis on Norwegian aviation activity

Although Norway is not an especially large air transport market in global terms, its specific market characteristics make it relevant as a potential signal for the direction of future policy and management decisions. Due to the population size in general, scattered settlements, challenging topography and climate, the country is highly dependent on air transport (e.g., Halpern and Bråthen, 2011, 2012). This is especially the case for travel over longer distances where road, rail or sea-based alternatives to air travel are limited; and in more peripheral parts of the country where air transport plays a vital role in securing access to basic local services such as health and education (Halpern, 2020).

As a result, Norway has good infrastructure for air services. Forty-six airports served commercial air services in 2019 excluding the Norwegian archipelago of Svalbard (see Fig. 1, Statistics Norway, 2021). This is equivalent to one airport per 116,000 inhabitants (given a population of 5.4 million in Q4/2020).According to IATA (2018), the air transport sector directly employed 52,000 people in Norway and had a gross value-added contribution of NOK 41.1 billion to GDP in 2017. This increased to 159,000 jobs and US$150.2 billion (4.8% to GDP) if air transport's impact on local suppliers, employee spending and tourism was included. Hence, air transport makes a strong contribution to the

[1] WCTRS stands for World Conference on Transport Research Society.

[2] Available at: https://www.aci-europe.org/downloads/resources/Aviation%20Round%20Table%20REPORT%20FINAL%2016.11.2020.pdf

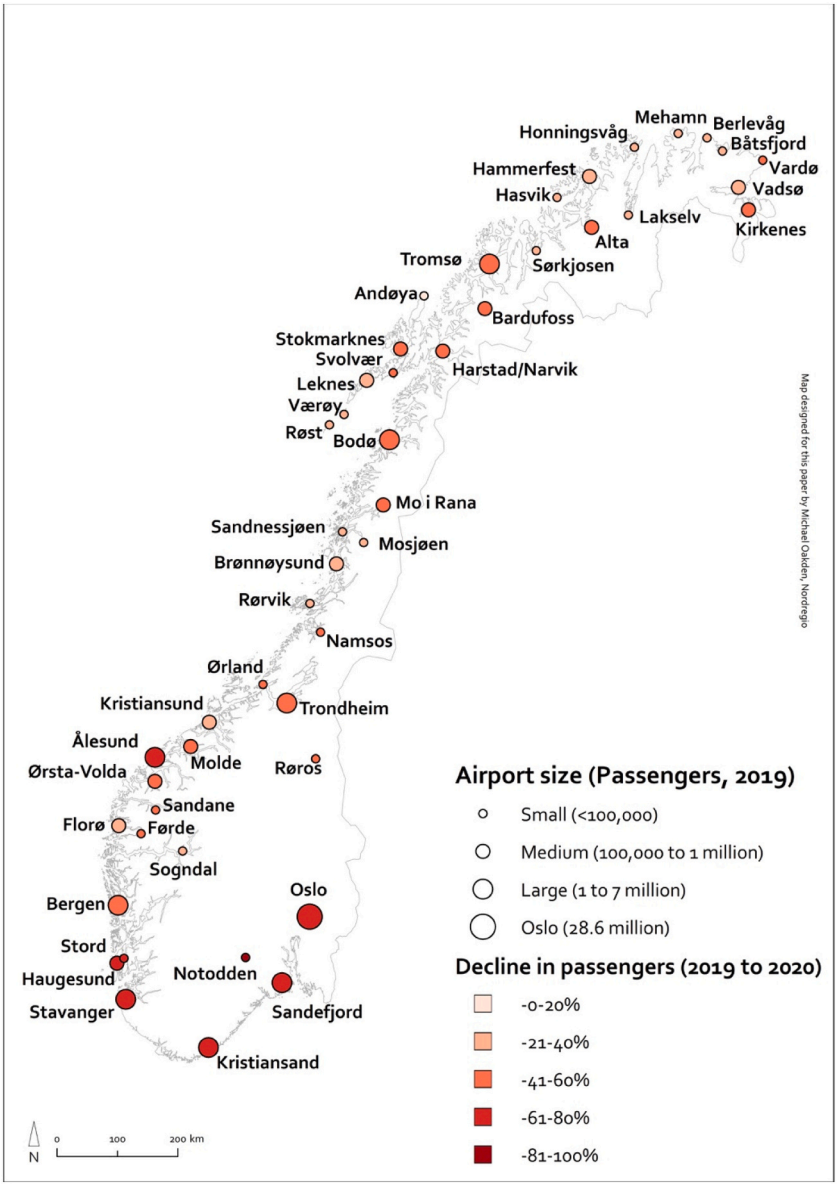

Fig. 1. Airports in Norway.
Data source: Avinor (2021) for Avinor airports; Statistics Norway, 2021 for other airports.

economy in Norway. Similar circumstances are found in other countries in Scandinavia, and across the World, where air transport plays a key role in the economic and social activity of the population at a local or regional level. The behaviour of passengers and the recovery policies and measures in a country where aviation acts as a backbone in social, economic and national terms, can provide lessons that can be scaled up in larger aviation markets. This was a key motivation for focussing on Norway for this study.

Fig. 1 shows the distribution of airports in Norway and their size according to total terminal passengers in 2019, therefore showing the situation prior to the coronavirus pandemic. Oslo is by far the largest airport in Norway – serving 28.6 million passengers in 2019. Sandefjord, located 110 km south of Oslo served 2.1 million. There are then seven large regional airports that served between 1 and 7 million each (Bergen, Trondheim, Stavanger, Tromsø, Bodø, Ålesund, Kristiansand); 15 medium-sized regional airports that served 100,000 to under 1 million each; and 22 small local airports that served less than 100,000 each. Most of these smaller airports are served by PSO routes.

Norway's airports served a record 63.0 million passengers in 2019, which is a 39.1% increase on the 45.3 million passengers served in 2009 (Fig. 2). However, as with most countries around the world, demand for air transport was decimated by the coronavirus pandemic, declining by 61.2% between 2019 and 2020. The decline was particularly strong among international passengers (77.5%) compared to domestic (49.5%).

Like other Governments around the world, in early 2020 the Norwegian government introduced various travel restrictions to reduce the spread of coronavirus (see Norwegian government, 2021b). The impact of these restrictions on demand for air travel at Norway's airports can be seen in Fig. 3. The first case of COVID-19 in Norway was experienced in Tromsø on 26th February 2020, and the World Health Organisation declared COVID-19 a global pandemic on 11th March. In response to this, the Norwegian government advised against non-essential foreign travel from 14th March and introduced a mandatory 14-day quarantine for persons travelling into Norway from abroad. From 15th March, several municipalities in Norway (e.g. Lofoten, Vesterålen, Kirkenes, and Tromsø in the north) imposed mandatory 14-day quarantine restrictions on people travelling from southern Norway. Further restrictions were variously imposed on travellers throughout 2020,

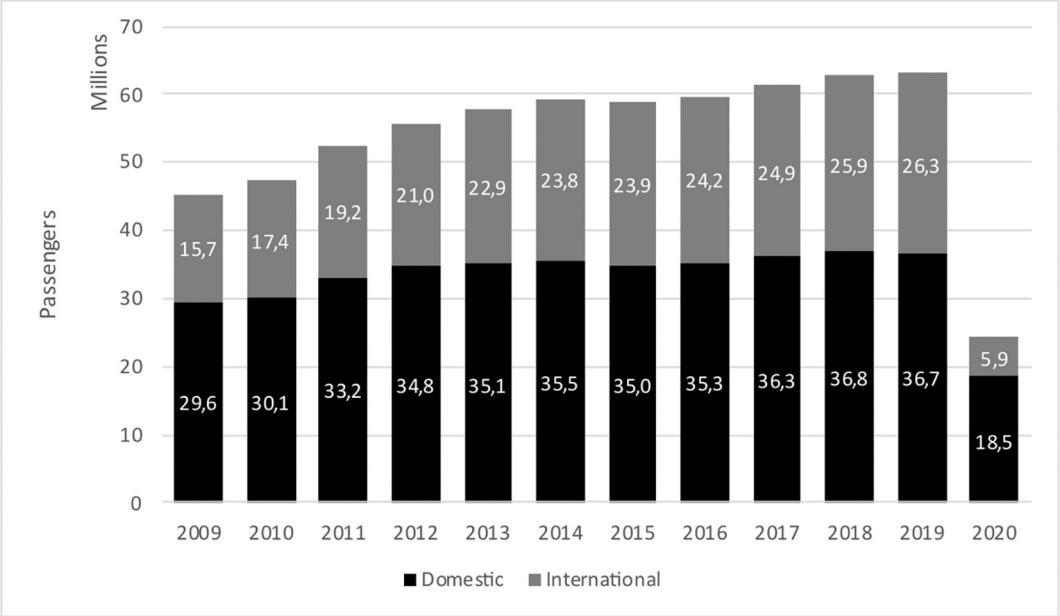

Fig. 2. Passenger traffic at airports in Norway, 2009 to 2020.
Data source: Statistics Norway, 2021.

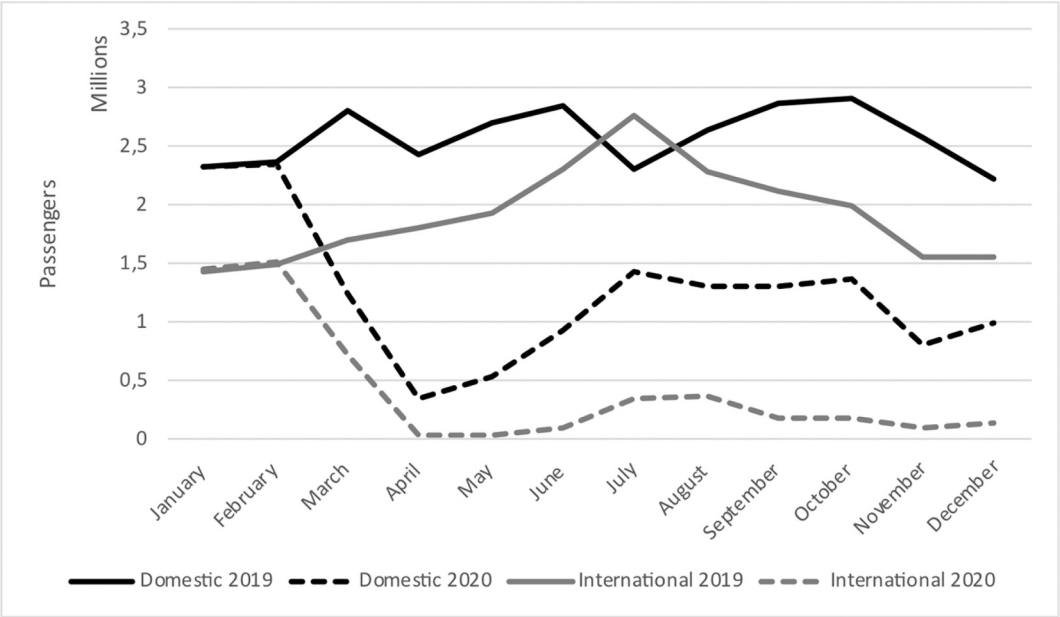

Fig. 3. Monthly passenger traffic at Avinor airports in Norway, 2019 to 2020.
Data source: Avinor (2021).

including mandatory quarantining in 'quarantine hotels' for foreign travellers in November and December.

Statistics Norway (the national statistics office of Norway) introduced a national centrality index in 2017 (see Statistics Norway, 2020). The index is calculated at the municipality level and is composed of two parts: (1) the number of jobs that inhabitants of each area can reach by car within 90 min; and (2) how many different types of service features (goods and services) inhabitants of each area can reach by car within 90 min. Numbers are weighted so that a workplace or service function close to home counts more than one further away. Index values range from 0 (which is only theoretically possible) to 1000. Using the centrality index and passenger data from Statistics Norway, 2021, we can observe a strong and significant positive relationship between the decline in passenger demand in 2020 and the centrality of the municipality that each airport is located in ($r\ (44) = 0.717$, $p < 0.001$). Decline was therefore generally greater at more centrally located airports (Fig. 4).

Fig. 4 also shows a moderate and significant positive relationship between the decline in passenger demand in 2020 and airport size ($r\ (44) = 0.393$, $p < 0.001$). This is because larger airports in more central parts of the country tend to have a greater proportion of international passengers that have been more affected by travel restrictions. Similarly, smaller airports in less central parts of the country tend to have a greater proportion of domestic passengers that use airports to access basic local services, which have been less affected by travel restrictions. In addition,

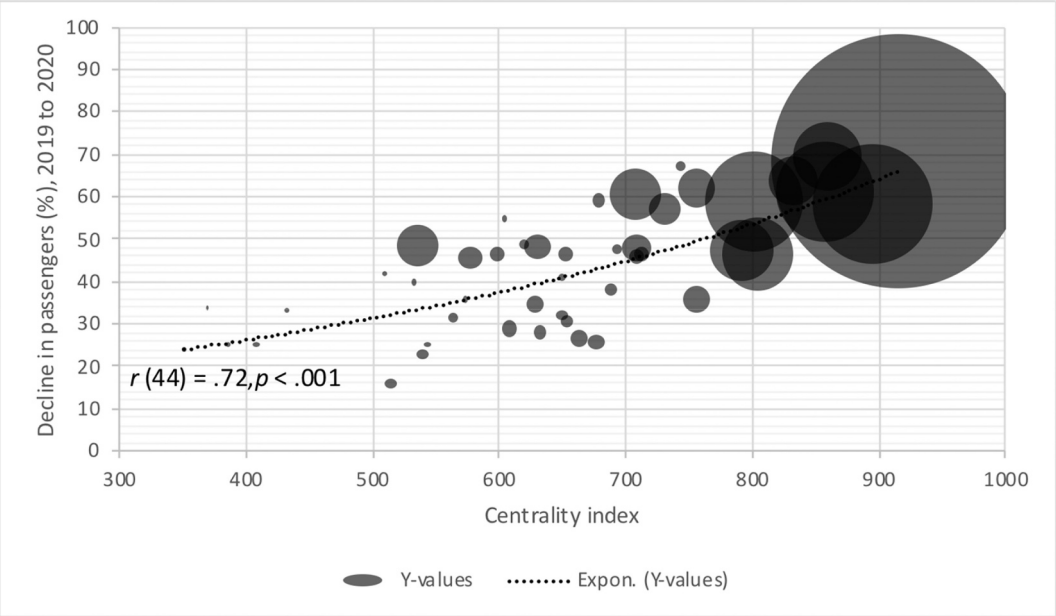

Fig. 4. Decline in passenger demand at each airport by centrality.
Data source: Statistics Norway, 2021.
Note: Passenger demand is the percent decline in total terminal passengers from 2019 to 2020; Centrality is the nationality centrality index for the municipality that each airport is located in (see footnote 3); Bubble size represents size of the airport in total terminal passengers in 2019. Pearson's Correlation: strong correlation at 0.717, p.000 (percent and centrality); 0.393, p.000 (percent and airport size); N46.

there is a supply side effect because Public Service Obligation (PSO) routes at many of the smaller airports have been operated at approximately the same Level of Service (LoS) as prior to COVID-19 whereas LOS was significantly reduced at the more central airports. For instance, Andøya Airport is located in a municipality in Northern Norway that is classified among the least central in Norway. The airport experienced a reduction of as little as 16.1% from 2019 to 2020. This compares to the two Oslo airports; Sandefjord and Oslo Gardermoen that serve Norway's more central municipalities. These airports experienced reductions of 69.6 and 68.4% respectively.

The decline in demand for air travel in Norway has had an unprecedented impact on the financial health of the country's air transport industry. According to annual reports, Norway's three major airlines reported combined losses of NOK 17.4 billion (approx. US$2.1 billion) in 2020, while the airport operator Avinor reported NOK 7.2 billion (US $860 million) in lost income for 2020, and other airports in Norway also experienced severe financial difficulties (Norwegian, 2020; SAS, 2020; Widerøe, 2020; Avinor, 2020). To try and support the industry, the Norwegian government announced a rescue package totalling NOK 21 billion (US$2.5 billion) for the industry in 2020 and 2021 (Norwegian Government, 2021c, 2021d). This includes tax exemptions; support for Avinor and non-state airports; as well as underwriting and additional compensation for Public Service Obligations (PSOs); domestic services in peripheral regions designated as having an important regional economic and social role (see Bråthen and Eriksen, 2018).

3. Methodology

3.1. Questionnaire development and data collection

To collect data, an online questionnaire was developed using Qualtrics online survey platform. The questionnaire was divided into four main topic areas consisting of 17 closed questions and scaled responses designed to gain information on specific issues pertinent to the research and allow comparisons to be made between the data. An additional open-ended question was provided at the end of the questionnaire for the respondents to add any additional comments. The questionnaire was drafted in English but then translated into Norwegian. A summary of the structure of the questionnaire is shown in Table 1.

The target sample for the questionnaire was defined as adult (18+ years) residents in Norway. Respondents were drawn from the pool of panel members hosted by the market research firm Qualtrics. Access to this large panel of respondents meant that strict quotas could be applied to generate a more balanced and representative sample, accounting for socio-demographic (age, gender, level of education, household income) and geographical variations within the sample. A response of 2000

Table 1
Online questionnaire structure.

Topic	Items	Description
A. Recent air travel behaviour	2	Number of return flights taken in 2019 (before COVID-19) Number of return flights taken since March 2020 (after the emergence of COVID-19)
B. Future air travel plans and planned return to travel	4	Current plans to fly in the next 6 months Factors that would influence a decision not to fly in the next 6 months Anticipated wait until returning to normal travel patterns after the pandemic is over Anticipated level of travel once the pandemic is over in comparison with before the pandemic
C. Assessment of passenger confidence	5	Anticipated levels of concern about carrying out certain activities onboard the aircraft Interventions that would increase confidence to fly if implemented Attitudinal statements relating to various aspects of confidence in flying and the air passenger journey
D. Socio-demographic factors	6	Gender and Age Education Level Household income Nationality, Municipality
Other comments	1	Any other comments relating to aspects of the survey

respondents was initially targeted to try and ensure a robust and representative sample.

The questionnaire was piloted in early November 2020, with minor adjustments made to some question wording as a result. The average completion time for the questionnaire was between 10 and 15 min. A 'soft launch' of the questionnaire (n = 42) was undertaken on 19th November 2020 to test the proper functioning of the survey platform. The full launch of the questionnaire took place the following day, with potential respondents invited to complete the survey by e-mail. The questionnaire was closed one week later (27th November), with a total of 2096 responses collected in total.

4. Statistical analysis

Analysis of the data involved three stages. Firstly, three composite variables were created from the data relating to person-specific revealed characteristics to be used in later analysis. These were identified from the literature and authors' knowledge as having an important (or potentially important) role in defining a respondent's confidence in flying. The three composite variables and justifications for their inclusion are below.

C1: *Current frequency of air travel* – while the survey included only respondents who had flown at least once in the previous 2 years (24 months) prior to the survey, it was thought likely that the frequency one usually travels could be an important consideration in confidence in flying again following the pandemic. For example, a relatively frequent flyer might feel confident in flying generally, but at the same time may feel less confident or anxious precisely *because* they travel regularly (and therefore, may be at an increased risk of exposure to the virus). To form the composite variable, respondent's frequency of air travel was classed as being either 'High' (12 or more return trips in the previous 2 years), 'Medium' (6–11 return trips), or 'Low' (1–5 return trips). This classification yielded a split of 'High' (n = 280, 13.4%), 'Medium 'n=482, 23.0%) and 'Low' (n = 1334, 63.6%) air traveller frequency in the sample.

C2: *Prevailing levels of concern about travel* – it was considered likely that existing levels of concern about travel would be a factor in determining confidence in returning to air travel in the future. Consequently, a respondent's perceived level of concern was determined according to their aggregated responses to 8 related attitude statements in the questionnaire. Each item covered a different aspect of the air travel journey and was measured on a 5-point Likert scale (ranging from 1 = Very concerned to 5 = Not at all concerned), with lower ratings indicating higher levels of concern. Example statements included: "*At this point, how worried would you be about sitting on a plane with other passengers?*"; "*At this point, how worried would you be about using public transport to the airport?*" (*See* Table 2).

Responses to each item were weighted equally, with respondents allocated accordingly to one of four categories.

C3: *Rural/Urban classification* – of interest in the context of this research was to examine to what extent there existed geographical variations in respondents stated confidence in flying. In particular, it was investigated whether there existed differences between urban areas and those living in more rural (and generally more isolated) communities who may rely on the connectivity air travel provides for social and economic ties to the capital, Oslo (located in the south of Norway), and to other larger urban areas. To see to what extent this was the case, respondents were classified according to the Centrality Index of their resident location, as described in Fig. 4. Three broad classifications were identified, representing respondents residing in one of the following areas:

- Large Urban (n = 402, 19.2%), areas with a Centrality Index score of 1000, comprising all respondents living in central Oslo and the immediate surrounding area.
- Urban/Peri-Urban (n = 1120, 53.4%), areas with a Centrality Index score of 800–999, including residents from other Norwegian cities and urban/peri-urban areas, and the wider metropolitan region of Oslo.
- Rural (n = 574, 27.4%), areas with a Centrality Index score of <800, including residents of small towns, villages and hamlets.

In the second stage of the analysis, an Exploratory Factor Analysis (EFA) was then used on responses to 16 attitude statements in the questionnaire. This step was undertaken to establish a number of latent psychological factors relating to respondent's confidence/concern about flying and to derive a series of factor scores for use in the third stage of the analysis. An EFA was considered more appropriate here than a Confirmatory Factor Analysis (CFA), given the exploratory nature of the study and the lack of underlying preconceptions about the structure of the data, where a CFA might have been more suited.

Consequently, 16 attitude statements pertaining to different aspects of air travel and flying in the context of COVID-19 were subjected to a principal components factor analysis with Varimax rotation. Factor rotation seeks to maximise the dispersion of factor loadings within factors, attempting to load a small number of variables highly onto each factor to allow for a clearer distinction of factor groupings (see Field, 2013 for a detailed description of factor analysis).

As shown in Table 3, the analysis yielded three factors representing general attitudes towards air travel in the context of COVID-19 (F1_GEN), concerns relating to the airport experience (F2_APRT) and concerns relating to being on board the aircraft (F3_PLANE). These factors were those that exhibited eigenvalues above Kaiser's criterion of 1 (factors with eigenvalues <1 are typically discounted) and collectively they explained 51.6% of the variance in the data. Attitude statements were considered to load onto a factor if they exhibited a factor loading of greater than or equal to 0.5. The Kaiser-Meyer-Olkin measure verified the sampling adequacy for the analysis (KMO = 0.822, with values >0.7 are generally considered acceptable). All of the 16 items loaded strongly onto one factor (>0.5) and weakly onto the other factors (<0.5). Two of three factors had an acceptable internal reliability (Cronbach's alpha α >0.7). Internal reliability for the third factor was slightly lower (α =0.632) but it was still retained for the analysis considering the face validity of its indicators.

As mentioned, the main purpose of the factor analysis was to calculate a series of three factor scores (Anderson-Rubin method) for each respondent (i.e., one for each of the three factors identified). These

Table 2
Classification and summary of composite variable for concern about flying (C2).

Group	Composite score	N	%
Very concerned	8–15	104	5.0
Fairly concerned	16–23	681	32.5
Not very concerned	24–31	1023	48.8
Not at all concerned	32–40	288	13.7

Table 3
Summary of exploratory factor analysis.

Factor	Example attitude statement (item loading highest on factor)	Items loading on factor	Cronbach's α
F1_GEN General attitudes towards air travel in the context of COVID-19	"My desire to travel is greater than my fear of being infected with the virus"	5	0.789
F2_APRT_ Concerns relating to the airport experience	"I would find it reassuring if staff and passengers wear face mask at the airport."	8	0.757
F3_PLANE_ Concerns relating to being onboard the aircraft	"I'm worried about the air quality inside the plane."	3	0.632

give an indication of how a respondent scores for each of the three factors, which in this case indicated their relative concerns about air travel.

In the third stage of the analysis, the three composite variables (C1, C2 and C3) and the various factors were subjected to cluster analysis. This is an exploratory technique commonly used in segmentation analysis that seeks to determine subgroups (or clusters) of individuals or items based on their shared similarities or differences on key selected characteristics. This process is achieved by concurrently maximising statistical homogeneity within each cluster and heterogeneity between each cluster (see Hair et al., 2005 for a detailed description). Cluster analysis has been widely used in the academic literature to determine market segments of individuals, both in an air transport context (for example, see Budd et al. (2014), Mayer et al. (2013), Halpern et al. (2021a)), and in the general transport literature (for example, see Anable (2005) or (Ryley, 2006)).

Following similar previous studies, a two-stage approach was adopted for the cluster analysis procedure. To begin with, a hierarchical (agglomerative) procedure (Ward's Method) was implemented to examine the underlying structure of the data and to establish the possible number of clusters. Having established the required number of clusters the procedure was then repeated using a robust non-hierarchical (divisive) clustering technique (K-Means). Once the clustering solution had been finalised, each cluster was profiled in terms of their shared attitudinal and other key characteristics to determine a profile or 'persona' for each group. The results of this are described in the following section.

5. Results

5.1. Attitudinal profile of the passenger segments

The cluster analysis yielded four distinct segments, with each exhibiting varying characteristics and attitudinal profiles. Using this information, names or 'personas' were assigned to each group to try and summarise their general attitudinal outlook and characteristics (Table 4). It is recognised of course that this is a subjective process. There will always remain some variation within a particular segment, with individual members exhibiting certain characteristics to more or less of a degree than others. Nonetheless, it is considered a useful exercise in summarising the overall traits of a particular group following a cluster analysis.

The four segments were defined predominantly by their varying attitudinal responses to the constructs included in the FFA; namely their general attitudes towards air travel (F1_GEN), concerns about the airport experience (F2_APRT) and the concerns about being onboard the aircraft (F3_PLANE), albeit to lesser degree. A summary of this attitudinal profile is presented in Fig. 5 which shows the average derived factor scores for each segment on each factor. Because of the way the attitude statements were coded in the questionnaire, higher factor scores correlate with a lower level of concern for each factor. Consequently, positive factor score stretching to the right of the vertical axis generally show lower levels of concern, while negative factor scores (to the left of the vertical axis) show higher levels of concern for each factor (Fig. 5).

As shown in Fig. 6, the *Intrepid Explorers* demonstrate the most positive attitude towards air travel in the context of COVID-19 (F1_GEN), and the lowest levels of concern, both in terms of travelling through the airport (F2_APRT) and onboard the aircraft (F3_PLANE). Conversely, the *Apprehensive Elders* exhibit the least positive attitude towards flying overall and show the most concern about being onboard the aircraft. The *Sanguine Shielders* are a segment characterised by a generally positive (or at least, not strongly negative) view of air travel, and relatively low levels of concerns about being onboard the aircraft. The concerns for this segment lie more in the airport-related aspects of the journey, although these appear to be only mild concerns in comparison with the other segments. The attitudinal traits of the *Cautious Commuters* are interesting in that they exhibit similar general attitudes towards air travel as the *Sanguine Shielders,* but the highest level of concern regarding items relating to the airport experience. It would seem that the concerns of this segment stem from the airport related experience more than being onboard the aircraft.

The four segments were also differentiated by their stated levels of concern about travel (C2). The *Sanguine Shielders,* for example, exhibited the largest share of people who were classified as belonging either to the 'Not very concerned' or 'Not at all concerned' group (87.8%). By comparison, the *Apprehensive Elders* exhibited much higher levels of concern overall, with 73.6% of the segment falling within the 'Fairly concerned' or 'Very concerned' group. The level of concern exhibited by the *Cautious Commuters* is more balanced, with 60.9% of this segment falling withing the 'Not very concerned' or 'Not at all concerned', but 31.3% classed as 'Fairly Concerned.' The *Intrepid Explorers*, as their name suggests, were also generally characterised by respondents who were 'Not very concerned' (52.9%) or 'Not at all Concerned' (25.0%).

The frequency of air travel (C3) also varied between the four segments. Indeed, it would appear from our results that one's typical air travel behaviour could have an important role in determining stated levels of concern about flying. For example, the *Cautious Commuters* were the segment who flew by air the most often, with each member on average taking just under 9 return trips (8.93 on average) in the past 2 years. Equally, they were also the segment, on average, with the highest number of trips in the sample (1.25) planned for the next six 6 months, at the time of completing the survey in November 2020. The fact that this group exhibited relatively high levels of concern about flying is perhaps not surprising, given that they use air travel relatively frequently and are likely to continue to use air travel in the future. Given that *Cautious Commuters* also exhibited a higher share of past business trips than the other groups (as their name suggests), it seems quite likely that the use of air travel for this group is linked more to necessity rather than for discretionary purposes, and in turn this might be where the source of their concern lies.

The counter to this is the *Sanguine Shielders,* a segment characterised by the lowest levels of air travel in the sample (4.22 return trips on average in the two years prior to COVID-19) and the lowest level of return to air travel (0.34 return trips planned for the next six months, at the time of completing the survey in November 2020). It is quite possible that passengers in this segment are less concerned by air travel *precisely* because they do not travel regularly and can reduce or stop flying if they want to without negatively affecting their jobs or other aspects of their livelihoods..

It is notable in the output from the cluster analysis that the variable relating to a respondent's Rural/Urban classification (C3) had little, if any, impact in terms of differentiating the sample. Indeed, across all four segments, the split between residents in large urban areas (Oslo), other urban/peri-urban, and rural areas was almost directly proportional to the split across the sample.. This is to say that, according to our findings at least, the feelings of concern around flying and at different stages of the passenger journey does not have a strong geographical determinant, with each group represented equally in each of the three settings we used for the analysis. We think the within segments findings can be generalised. Although the composition of segments may vary between large countries, we think threre are good reason to not expect large variations in the different concerns about flying within each segment, when studied across countries. Even if the Norwegian airports are

Table 4
Summary of respondent segments from the cluster analysis.

Segment	n	Share (%)
'Intrepid Explorers'	276	13.2
'Sanguine Shielders'	737	35.1
'Cautious Commuters'	473	22.6
'Apprehensive Elders'	610	29.1

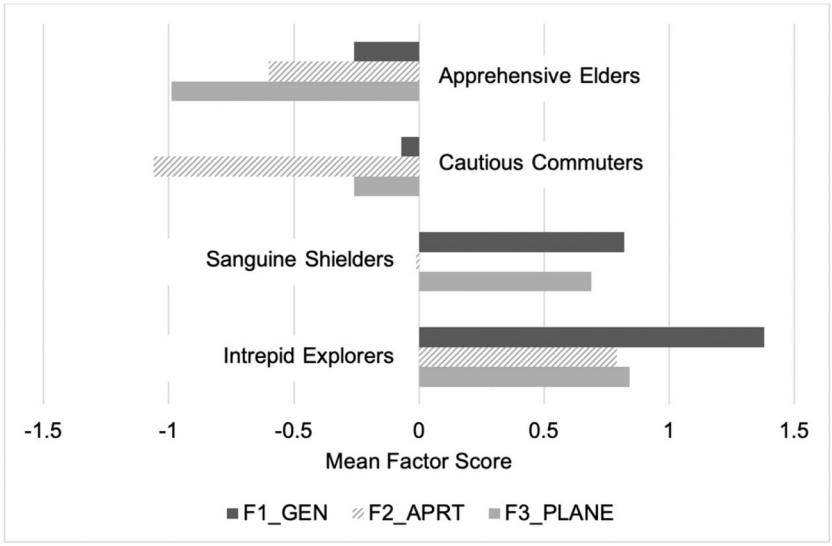

Fig. 5. Mean factor scores for the four passenger segments.

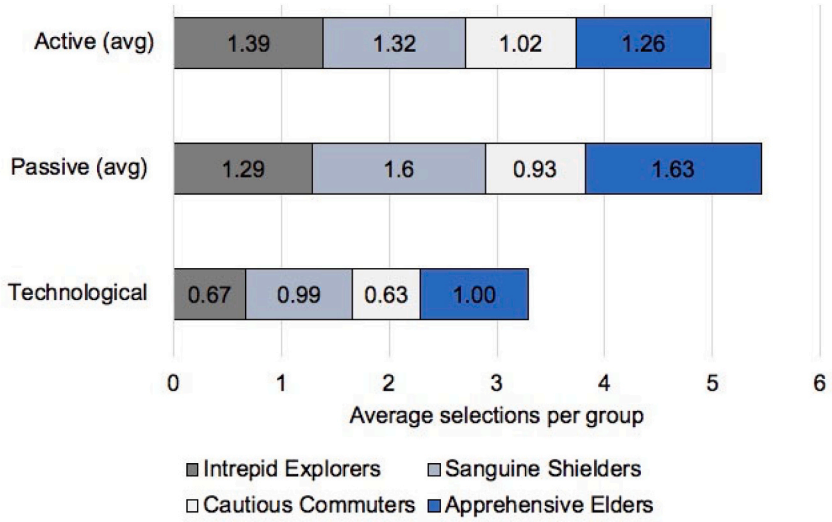

Fig. 6. Preferred type of intervention by passenger segment.

mainly run by a common operator, they are not homogenous. For example, their design and their perceived crowding of people inside the terminals and gates vary (Halpern and Bråthen, 2011).

In Table 5, the age and gender profiles of the four segments are also presented. These items were not included as variables in the clustering procedure, but they can be used to further develop an understanding of the overall make-up or persona for each group. As can be seen in Table 5, there is some notable variation in the age and gender profile of the four segments which could also be instructive in interpreting the attitudinal profile and subsequent behaviour of each segment.

From this, a clearer picture of the four groups can be developed. According to the analysis, respondents classed as *Sanguine Shielders* were proportionately more likely to be female (60.1%), while the *Cautious Commuters* were more likely to be male (59.4%). Perhaps of greater relevance in terms of the attitudinal profiles, there are also some notable differences in terms of age profiles. The *Apprehensive Elders,* in particular, is characterised by a higher proportion of older people, with nearly a third (32.1%) of this group being 65 years or older (compared with 20.6% in the sample overall). By comparison, younger age groups are disproportionately represented in the *Intrepid Explorers* segment (40.2% below the age of 35 years) and the *Cautious Commuters* (49.9% below the age of 35 years), compared with 30.1% in this age category for the sample overall. Given that much of the response to the COVID-19 pandemic has focussed on the increased vulnerability of older people to the virus, it is perhaps not surprising that a segment with a higher share of older people exhibited higher levels of concern (Fig. 6) than the *Intrepid Explorers,* a segment that tended to be younger in age. However,

Table 5
Demographic profiles of the four segments.

		Intrepid explorers (%)	Sanguine shielders (%)	Cautious commuters (%)	Apprehensive elders (%)
Gender	Male	54.3	39.9	59.4	55.2
	Female	45.7	60.1	40.6	44.8
Age	≥65 years	5.4	25.1	7.4	32.1
	45–64 years	28.6	34.4	17.6	32.3
	35–44 years	25.7	16.7	25.2	14.9
	<35 years	40.2	23.7	49.9	20.6

it is worth recognising that the *Cautious Commuters* have the highest share of younger people and also exhibit a relatively high level of concern, so the link between age and concern around air travel is not clear cut.

5.2. Assessing interventions to increase passenger confidence

A key objective of the segmentation analysis was to determine the potential for different intervention measures to increase passenger confidence in flying following the COVID-19 pandemic. Since the outbreak of the pandemic, several intervention measures have been proposed, and some have already been trialled and implemented by operators around the world (including in Norway)., However, because of the need to deploy these interventions rapidly in response to the outbreak, little research has been conducted to determine to what extent these various intervention measures do actually instil feelings of confidence in passengers, and whether different types of passengers are more or less likely to respond positively to different measures. This is not a trivial issue, given the resource and commercial investment implications for an operator seeking to integrate interventions as well as related operational impacts for the airport. This is especially the case with regards to technological interventions that may have been seldomly used before in aviation and/or could be costly to implement. At a time when capital expenditure and investment across the aviation sector have also been negatively affected by the pandemic, the need for the targeted use of interventions where they are likely to yield the greatest benefit is of paramount importance.

With this in mind, respondents to the questionnaire were presented with 12 different intervention measures and asked to choose up to a maximum of 5 that they thought would increase their confidence in flying if they were to be implemented. For the purpose of further analysis the 12 measures were further classified according to whether they represented an 'Active' intervention (i.e. a dedicated action or process specifically designed to reduce the risk of spreading/catching COVID-19 at a particular stage across the passenger journey); a 'Passive' intervention (i.e. an action or activity that might have an indirect effect on reducing transmission), or a 'Technological' intervention (i.e. the use of entirely new technology or the adoption of technological solutions from a different sector aimed at reducing the risk of transmission). The list of interventions and their classification is shown below.

- Active interventions
  - o Temperature Screening when entering the airport
  - o Mandatory testing at the departure and/or arrival airport
  - o Mandatory submission of a health declarations certificate
  - o Cleaning of surfaces to prevent virus transmission
- Passive Interventions
  - o Mandatory wearing of face masks
  - o Observation of regular cleaning of surfaces
  - o Enforcement of physical distancing
  - o Safe travel certification of operators
- Technological interventions
  - o Touchless surface and processes
  - o A track-and-trace system that alerts passengers if they have been in contact with infected people
  - o 'Smart' ventilation and filtration systems for filtering out pathogens
  - o Virtual queueing procedures where passengers receive a time 'slot' for passing through security to avoid the need to queue.

As can be seen in Fig. 6, overall, the results showed a preference for passive intervention measures across the sample, followed closely by active interventions. The 'Intrepid Explorers' were the group most likely to favour active interventions (1.38 on average), while the 'Apprehensive Elders' were the group who favoured passive intervention measures most readily. By comparison, technological interventions were the least preferred by each of the four segments, with members of each segment choosing less than 1 technological intervention on average.

With regards to specific intervention measures, those found to instil confidence in the most respondents were; 'Mandatory wearing of face masks' (chosen by 59.7% of the sample), 'Mandatory testing at the departure and/or arrival airport' (46.8%) and 'Enforcement of physical distancing (37.6%)' (Fig. 7). By comparison, the interventions chosen by the least number of respondents were "Smart' ventilation and filtration systems' (15.9%), 'Mandatory submission of a health declaration certificate (15.9%)', and 'Safe travel certification for operators (11.5%)'. It is interesting to note that while much of the narrative and attention around the response to COVID-19 and increasing passenger confidence has focussed on technological interventions, our results suggest that passengers value the more 'traditional' measures like face masks, testing and enforcement of physical distancing over purely technological adjustments. Indeed, the most preferred technological intervention, 'Touchless surfaces and processing' was only chosen by just over a quarter of respondents (27.1%), equating to only the 7th preferred option overall. This could suggest that the passengers value technological interventions only when the fundamental 'basics' of reducing viral transmission have been fulfilled, and that technological fixes would not be relied upon alone as a quick-fix or 'silver bullet.' Further investigation of this could form an important avenue for further research in the literature.

As can also be seen in Fig. 7, the preferences of the four different segments are broadly reflective of the overall sample, with the mandatory wearing of face masks and mandatory COVID-19 testing at the departure/arrival airport in each case being the two most preferred options. The *Cautious Commuters* were the only group to value mandatory testing (39.1%) over the wearing of face masks (33.6%), albeit only marginally. This group also were those who selected the least number of interventions overall; respondents were asked to select up to 5 options but many in this group chose fewer than 5 interventions, or in some cases, none at all. This could imply either that there are interventions that were not included in the survey that respondents value, or that respondents felt that there is little that could be done to increase their confidence in flying at the time of completing the survey.

While the preferred interventions for each segment were similar to the overall sample, the high share of respondents in the *Sanguine Shielders* (71.0%) and *Apprehensive Elders* (70.5%) who favoured the use of mandatory wearing of face masks lends further support to the use of traditional interventions (as opposed to purely technological fixes) in restoring confidence. This is further supported by the finding that for each segment, 'Active' and 'Passive' interventions were selected on average more often than technological interventions (see Fig. 7). Three of the four segments tended to favour 'Active' interventions, while the *Sanguine Shielders* were the only segment to show a slight preference for passive interventions (1.60) over more active interventions (1.32), albeit only marginally.

6. Discussion and conclusion

For policy and decision makers, the value and rationale for segmentation lies in the ability to identify distinct groups of people based on their shared characteristics, attitudes, and perceptions, and then to target interventions accordingly to where they stand the greatest chance of success. In other words, it assumes that it is relatively ineffective to try and address the 'average' person given the typically divergent views, experiences, and expectations of any given population. The analysis presented in this paper has sought to apply this rationale in the context of developing a more nuanced understanding of a major challenge currently facing the aviation industry; namely, increasing passenger confidence in flying in the recovery from the COVID-19 pandemic. In turn, the paper has also sought to build on the growing body of academic research concerning the demand and passenger behavioural impacts of the COVID-19 crisis.

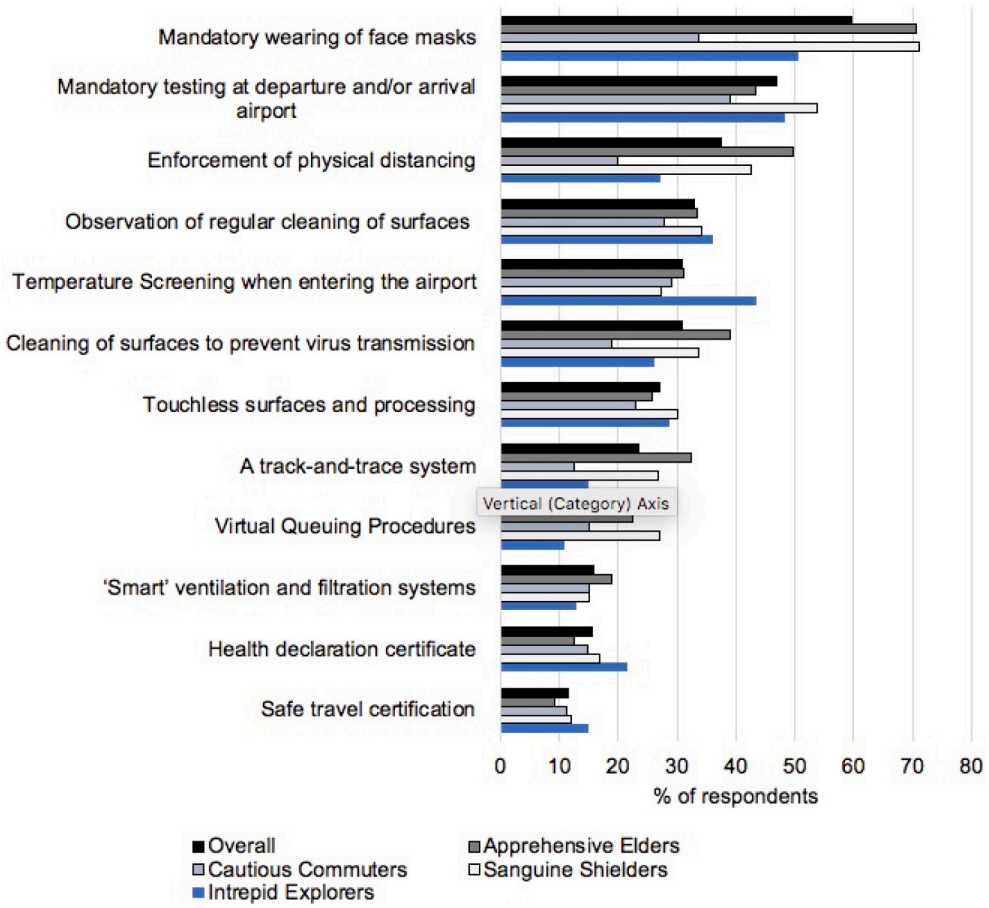

Fig. 7. Preferred intervention measures for increasing confidence in flying by passenger segment.

To this end, the analysis sought to identify segments of air passengers in Norway. Four distinct segments were derived from the cluster analysis, with each displaying varying attitudes, behaviours, and levels of concern. The *Cautious Commuters* (22.6% of the sample) and *Apprehensive Elders* (29.1%) were the segments shown to have the highest level of concern in the sample and were also frequent users of air travel. On the one hand, the *Apprehensive Elders* showed a sharp decline in their intention to travel in the future. This is in line with Graham et al. (2020) that consider that in the short term the elderly market segment - previously considered as a potential growth market – may not be viewed in such a favourable light and may need more encouragement from the industry than other segments to return to previous levels of travel. On the other hand, the *Cautious Commuters* showed a strong propensity to continue to fly despite these concerns. For this group, it would seem that the perceived benefits of air travel, or perhaps their reliance upon air travel, outweigh any concerns they have about flying. This raises an important issue, namely, that addressing passenger confidence is not only a challenge in terms of encouraging passengers back to air travel, but also managing the confidence of existing passengers who have (and will continue) to travel frequently. In other words, a stated higher propensity to fly does not necessarily indicate an individual's increased level of confidence in flying.

An awareness that confidence and concern can fluctuate is also important when considering the two segments that exhibited higher levels of confidence (and lower concern) in flying; the *Intrepid Explorers* (13.2% of sample) and *Sanguine Shielders* (35.1%). For the latter, lower levels of concern in this segment are quite possibly linked to the fact that this segment exhibit lower levels of air travel even before the pandemic, and showed little demand to return to air travel following the pandemic. In the same way that the heightened levels of caution found among the *Cautious Commuters* could stem from their reliance and need to use travel, the opposite is true for the *Sanguine Shielders*, who's apparent lack of concern about air travel may be simply because they can avoid air travel if they need to. If for any reason members of this segment needed to increase their use of air travel, it could well have an impact on their general views towards air travel. Recent research on socioeconomic disparities in general travel behaviour during the COVID-19 pandemic point towards similar directions. For example, more educated and higher income groups with more regular travel (i.e., commuters) tend to be more cautious and travel less than other groups (see, for example, Brough et al., 2020).

Equally, just because the *Intrepid Explorers* segment showed higher levels of confidence in flying and lower levels of concern than the other passenger segments in the sample, it does not necessarily mean that their confidence is static. For example, at the time of conducting the analysis, several new variants of the COVID-19 virus linked to particular countries (namely linked to the UK, South Africa, Brazil and India) emerged and were widely reported in the media. While our survey asked respondents to consider their confidence in air travel in general terms, it makes sense that contemplating flying to a location known to be experiencing an outbreak of the virus, compared with flying domestically or to a location with much lower levels of infection, could elicit a very different response from an individual. For example, previous research during the avian influenza outbreak showed that different groups showed contrasting willingness to take health risk (Aro et al., 2009). This is not something that was captured in this study, but investigating the extent to which confidence/concern fluctuates with destination or the type of flight taken is an interesting avenue for further research. Following this, it would be valuable to then determine to what extent additional interventions might be needed over and above baseline expectations. In

other words, while mandatory wearing of face masks and enforcement of physical distancing may help alleviate concern on a 'normal' flight, would the same also be true for a flight deemed as being higher risk, and if not, what else might be needed to reassure passengers?

A key focus of this study was to learn more about the types of interventions that would increase passenger confidence in flying. Across the sample, the data shows a clear preference for more 'traditional' active interventions, including wearing of face masks and enforcement of physical distancing, over and above passive or technological interventions. This finding adds further weight to the notion that confidence and reassurance can come from relatively simple, visual interventions, and while technological advances and other mechanisms may have a role to play, it seems that these would be valued only *in addition to*, rather than *instead of*, well established and more fundamental measures. Research on the acceptance of protective measures during the COVID-19 pandemic highlight the importance of trust (Dohle et al., 2020; Siegrist et al., 2020). In that regard, trust in technology might require additional effort from stakeholders and governments to be strengthened. On the other hand, simple and visual interventions are easy to communicate and to understand by the public. In addition, communication strategies to accomplish proper dissemination of the messages conveyed work better if they are group specific (Kamenidou et al., 2020).

By focussing this study on air travel in Norway, the paper has provided an examination of air travel demand and passenger behaviour in an air transport market with quite specific characteristics. While Norway does not have a major role to play in a global air transport sense, at least in terms of its network or overall passenger numbers, it does represent a valuable case as a possible signal for future policy and practice in relation to the recovery of air travel following the pandemic. This is true both for other markets with similar characteristics (most notably, Norway's neighbouring countries in Scandinavia), but also in terms of the general role of Norway as an innovator in aviation policy and practice. For example, in 2018 Norway was the first nation to make a commitment that all domestic flights being conducted by electric or hybrid electric aircraft by 2040 on environmental grounds. Since then, several other European nations have followed suit with similar commitments to reduce domestic aviation emissions and further the development of new aircraft technologies. Similar innovations and development in Norway are evident in other areas, including the early adoption of remote air traffic control technologies, digitalisation and airport security technologies (Halpern et al., 2021a, 2021b). It figures that Norway may also act as an early adopter or pioneer of innovations in response to the challenge of recovering traffic following the pandemic.

This study is not free of limitations. While a key area of focus for this study concerned the possible role of intervention measures that could be enacted by operators to increase passenger confidence, it did not consider the role vaccination and vaccination programmes have on passenger confidence. Although it is recognised that vaccination is likely to have a positive impact on passenger confidence, it is not something that an air transport operator is likely to have much (if any) control over, so was not considered to be of much value here in terms of providing actionable recommendations for future management decisions. Also, while some nations have progressed rapidly in terms of vaccination programmes, the speed of vaccination programmes in other parts of the world remains much slower, hence, there is still a need in these regions to adopt interventions before a fuller roll-out of the vaccine can occur.

Indeed, it will be interesting to see to what extent increased vaccination rates do result in increased passenger confidence in flying and, in turn, a return to air travel. So far, research show that travel restrictions are the key factor impacting in air travel activity (e.g., Liu et al., 2021). Additionally, it will be interesting to see to what extent existing interventions, like physical distancing and face coverings, will remain in place and valued by passengers once thorough vaccinations programme have taken place worldwide, or whether we will see longer term changes to the passenger experience as a result of the pandemic. There has been much discussion about the prospect of a 'new normal' as a result of the pandemic, in an air travel context it will be interesting to see to what extent there are indeed longer-term changes to passenger expectations, or whether there will in fact be a gradual return to established patterns of behaviour and the *modus operandi* in air travel. These represent potential avenues for further research following this study.

Acknowledgments

This paper forms part of a project funded by the Research Council of Norway on the "Digital capabilities and passenger benefits of a seamless and resilient Norwegian airport system", project number 283349. It is an international collaboration between Kristiania University College and Molde University College in Norway, and Cranfield University in the UK. Avinor who operate 44 airports in Norway are an industry partner to the project.

We would also like to thank Michael Oakden and Nordregio for their help with the map in Fig. 1.

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2021-09-28

Budd T, Suau-Sanchez P, Halpern N, et al., (2021) An assessment of air passenger confidence a year into the COVID-19 crisis: A segmentation analysis of passengers in Norway. Journal of Transport Geography, Volume 96, October 2021, Article number 103204

https://doi.org/10.1016/j.jtrangeo.2021.103204