Air Travel and Academia:

Understanding the Perceived Benefits and Barriers to Reducing Air Miles

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MSc Thesis

2023

Acknowledgements

First and foremost, I would like to thank my supervisor, Professor Don Hine. Don consistently provided support of the highest degree, and I always felt that he was fully involved in every step of completing this thesis. No question was too big or too small, and every answer was deeply considered. Fifteen-minute meetings routinely ran for over an hour, a testament to Don’s ability to make any topic fascinating, as well as his willingness to dedicate time to his students. And whenever an area of the literature, or a theoretical problem, or a statistical test was beating me down, Don would not hesitate to step in. I whole-heartedly attribute this thesis to Don’s support and supervision, and I hope we are able to continue working together in the future,

Secondly, I would like to extend my gratitude to Doctor Andrew Vonasch. Andy was my supervisor for my Honours thesis and provided me with a fresh and exciting view of psychology. Andy never failed to make me question the literature, dive deeper into what was occurring in any given phenomena, and above all to be interested in what I was doing. The base of knowledge that Andy provided me, along with the expertise to carry out research in psychology, is what has allowed me to complete my research with ease and confidence.

Finally, I would like to thank my friends and family, for their continued support in helping me complete whatever challenges life puts forward. There is no way I would be in a position to be submitting this thesis without them. And, for their compassion in every area of my life, I extend the strongest gratitude.

Abstract

Air travel is hugely damaging to the environment. It is also a common practice in the academic community. This study contributes an understanding of what drives air travel amongst academics, utilising the COM-B framework and the behaviour change wheel to suggest a number of possibilities for air travel reduction strategies. A sample of 207 academics from the University of Canterbury, New Zealand were surveyed about a broad range of beliefs surrounding academic air travel, past air travel and future air travel. Exploratory factor analysis generated three reliable perceived benefit/barrier factors related to academic air travel: Networking and Conference Benefits, Perceived Low Carbon Impact, and Ease of Travel. Controlling for previous air travel and demographics: (1) stronger beliefs about the importance of networking and conferencing predicted more intended air travel in 2023, (2) stronger beliefs about importance of networking and conferences and scepticism about the impact of air travel on climate predicted less support for university-level carbon reduction policies, as well as willingness to adopt air travel reduction strategies. Additionally, early career, lower ranking academics, and academics who found travel less easy also reported lower willingness to adopt air travel reduction strategies. Implications for behaviour change strategies to reduce carbon emissions associated with academic air travel are presented.

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Air travel accounts for over 2.4% of all anthropogenic emissions of CO_2 each year (Lee et al., 2021). Given aviation is a constantly growing industry, the impact on climate change is growing. From 1960 to 2018, CO_2 emissions from air travel increased from 6.8 to 1034 Tg CO_2 yr^{-1}, with growth from 2013 to 2018 showing a marked increase. On top of this, the climate impact of air travel is not just due to the release of CO_2 into the atmosphere, but a combination of waste including nitrous oxides, resulting in the surface warming effects of air travel being as much as three times larger than other equivalent emitters of CO_2 (Lee et al., 2021). Around 18% of global air travel is performed for the purposes of business, of which the vast majority is for meetings, conferences, and networking (Gössling & Dolnicar, 2022). This air travel, in higher education institutes, falls under what are called 'scope 3' emissions, being the contribution to a university's carbon footprint caused by goods that the university has sold and/or purchased. The tracking of scope 3 emissions in universities is generally unrefined, but it is suggested that scope 3 emissions are likely to cause over 80% of higher education institutes' carbon emissions (Robinson et al., 2015). Even though air travel contributes to such a high proportion of many university's carbon emissions, it is continually ignored and neglected in carbon reduction strategies (Glover et al., 2018). This study provides an understanding of why academics are flying, and what behaviour change strategies can be employed to reduce air travel in academia.

Benefits of Business Air Travel

Air travel produces a multitude of benefits for businesses. International air travel supports an increase in perceived success, internationalisation of income, as well as allows for the professional development and growth of staff (Walsh et al., 2021). There are a number of reasons why professionals may have to travel for their business; meeting with another company or a customer in an international location, attending conferences, developing skills through training courses, and observing business practises of other nations. The globalisation of the professional sector is a huge driver of this requirement for air travel (Aguilera, 2008). Increase in the importance of the international market, companies having locations across countries, partnerships with external business, as well as an increase in outsourcing of business, have all resulted in a growing requirement for international business air travel (Aguiléra, 2014). In addition, there is personal incentive to travel for business, in combining said travel with leisure activities (Lian & Denstadli, 2004).

A recurring theme in the literature surrounding a main component of why air travel is important is face-to-face interaction (Strengers, 2015). Present through practically all business air travel is the need for communication. Communication via meetings, informal conversation, observation, and listening. Humans are inherently social , and air travel provides an opportunity for the globalisation of ‘connectedness’ (Storme et al., 2017). There is social obligation to engage in face-to-face communication, the importance of the whole body in human interaction, and the strengthened networks that are developed from informal interaction surrounding in-person business activity (Urry, 2003). There are a number of situations in which this close form of communication can be substituted by digital forms of interaction, such as videoconferencing or email, but in any occasion where nuanced communication or physical closeness is required, in person interaction is consistently preferred (Lu & Peeta, 2009).

Air Travel in Academia

Academia is an arm of the business sector where in-person interaction is perhaps seen as even more important than other professional domains. For many academics, air travel is seen as an important, and sometimes essential, part of working effectively in a global scientific community. Academia is a largely internationalised occupation, where success is often seen as how significantly one's work reaches across the global academic space (Hamann & Zimmer, 2017). Many believe that face-to-face interaction is a key component of academics' ability to be present in this globalised space (Glover et al., 2019). International air travel provides academics with the opportunity to interact with colleagues, attend and present at conferences, and communicate closely with other experts in relevant fields. Air travel is thought to be an opportunity to network, gratify institutional demands, to be noticed, and to be successful (Nursey-Bray et al., 2019; Thaller et al., 2021).

There is commonly a higher amount of air travel among more senior academic staff, with professors performing the most travel. However, academics who are earlier in their progression, specifically early career researchers, often report experiencing the strongest social and institutional pressure to fly (Arsenault et al., 2019; Glover et al., 2019). Perceptions of the importance of academic mobility is felt even more strongly in remote institutions, such as in Australia and New Zealand (Glover et al., 2018). Given the distance between remote institutions and the rest of the academic community, often coupled with smaller numbers of staff and population, there is a perception of academic isolation. There is a feeling amongst academics at these institutions that in order for career progression and success there must be physical co-presence with other academics around the globe, as well as other academics in their home countries (Glover et al., 2019). Unfortunately, the current landscape of academic mobility suggests air travel as the only real way to achieve this. Given this, it grows increasingly essential to understand exactly why academics are travelling, and how this behaviour can be best managed.

Behaviour Change Strategies and the Behaviour Change Wheel

Reduction of climate change impacts that are present as a result of air travel can come in two main forms, technological innovation and behaviour change. Unfortunately, given high costs, lack of technological readiness and materials, as well as environmental side effects, technological innovation is very unlikely to be able to reduce emissions to a satisfactory degree or in a timely manner (McLachlan & Callister, 2022). Given this, in the immediate term, behaviour change interventions are the predominant way in which universities may be able to reduce their overall carbon footprint, by reducing the total amount of flying that academics perform each year (Gössling & Dolnicar, 2022).

A large number of behaviour change models, theories and frameworks have been presented in the literature. One particularly promising framework, developed by Michie et al. (2011), is the 'Behaviour Change Wheel' (BCW). The BCW uses a comprehensive and literature-based understanding of a target behaviour in order to select effective behaviour change methods. The methodological process of the BCW wheel first involves identifying the target area and behaviour that is desired to be changed. This is followed by assessing the literature surrounding what drives said behaviour, or prevents it's change, and identifying any possible gaps in the literature for which further research has to be performed. This information is then used to identify effective behaviour change strategies, sometimes requiring the development of new methods (Michie et al., 2011).

The BCW framework suggests a combination of three main factors influencing and generating behaviour (and in turn behaviour influencing these factors), being capability, opportunity, and motivation (COM-B). Capability is an individual's psychological and physical capacity to engage in any given behaviour. Opportunity involves all factors outside of an individual which allow for the engagement in a given behaviour. Motivation involves all cognitive processes occurring in an induvial which lead towards a given behaviour. Application of the BCW involves understanding the COM-B factors that affect a target behaviour, and understanding how they increase and decrease the likelihood that a behaviour will occur. Information about these factors can inform policy decision about what behaviour change interventions are best suited to any given situation (Michie et al., 2011).

Applying the COM-B Model to Academic Air Travel

The COM-B model has been applied in a number of studies in relation to ecological and environmental issues (Hine et al., 2014; McLeod & Hine, 2019; Sundaraja et al., 2021). However, at this stage is largely underutilised when it comes to climate change behaviours (Whitmarsh et al., 2021). This research aims to utilise the BCW and the COM-B model of behaviour in order to understand and advise on how academic air travel can be effectively managed to reduce the overall impact of higher education institutions on global climate change. In order to apply the BCW to academic air travel, a comprehensive understanding of COM-B factors must be developed, which first requires a concrete definition of the behaviour that is intended to be changed. Given that past and current air travel cannot be changed, focus should be placed on air travel that academics intend to take in the future. Given the high emission rate of international flight emissions in comparison to domestic emissions, especially in isolated countries, further focus should be placed on international air travel (Smith & Rodger, 2009). Combining these two points of focus, the current study will focus on ‘academics intended future international air travel’.

As outlined above, the current literature on academic air travel presents the predominant benefit to be networking, gratification of institutional and social demand, and as a symbol of success (Nursey-Bray et al., 2019; Thaller et al., 2021). Factors preventing the reduction of air travel focus mainly around a fear of becoming academically obsolete, and falling behind in the global sphere. This is accentuated by feelings of 'remoteness' in more geographically isolated countries (Glover et al., 2019). Additionally, there is a fear amongst some academics that reducing international flying does not only cause damage to one's personal career, but through reduced internationality and visibility of research, that it can damage academic research as a whole (Kreil, 2021). For the purposes of effectively applying the BCW to academic air travel, and identifying behaviour change interventions with the highest possibility of success, a deeper understanding of the perceived benefits surrounding air travel and the barriers preventing its reduction is required. This study aims to directly apply the COM-B model to academic air travel, in order to develop an understanding of the perceived benefits of academic air travel, and the barriers to its reduction, in order to aptly determine the best possible interventions to reduce air travel and its subsequent emissions in the academic sector.

Current Study

The current study employs the COM-B model to identify and evaluate a broad set of predictors of; academics' intentions to reduce their air travel, their support for university policies to reduce carbon emissions, and their willingness to adopt a range of air travel reduction strategies. To do this, we will adopt the BCW's COM-B model of motivation to develop a set of items which can be aggregated into select subscales (Michie et al., 2011). The relationship between these subscales and intended international air travel will then be assessed, in order to ascertain what benefit/barrier aspects of academics' motivations surrounding intended international air travel have the most impact. Additionally, given that the mechanisms through which academic air travel most likely would be reduced is changes in university travel policies and subsequent buy-in by academics, we will explore the predictive effects of academic's perceived benefits and barriers associated with academic travel and their support for university policies to reduce carbon emissions as well as their willingness to adopt specific strategies to reduce their air travel. We hypothesised that higher levels of perceived benefit to air travel, and higher levels of perceived barriers to air travel reduction, will be associated with 1) higher levels of intended future air travel, 2) lower levels of support for university-level carbon emission reduction policies, and 3) less willingness to adopt air travel reduction strategies. Findings from this study will inform the development of educated air travel reduction policy and strategy, which hopefully in turn can help reduce the impact of academia on global carbon emissions.

Method

Respondents

Respondents were recruited via the University of Canterbury's staff intranet system, with the sample containing 207 (aged 23 to 70, *M* = 45.7, *SD* = 10.1) academic staff members[1] (15% of University of Canterbury academic staff). Within the sample, 105 respondents identified as male (51%), 93 as female (45%), 1 as gender diverse (< 1%), and 8 who preferred not to say (4%). With regard to the academic rank of respondents, there were 25 Lecturers (12%), 36 Senior Lecturers (17%), 22 Senior Lecturers Above the Bar (11%), 70 Associate Professors (34%), and 54 Professors or above (26%). A majority of the sample reported having family overseas (73%), while a minority of the sample reported being early career researchers (26%; within 10 years of completing their highest qualification).

Procedure and Materials

This study, delivered as an online Qualtrics survey (Qualtrics, 2005), was run in October, 2022. The study was given ethics approval by the University of Canterbury Human

[1] Forty-one professional staff also completed the study, however were removed from analyses for meeting pre-registered exclusion criteria of not being academic staff.

Research Ethics Committee prior to its distribution. Respondents were informed the survey would take around 10 minutes, and that it contained questions about their views on international air travel, their previous and intended air travel, as well as a range of possible carbon emission reduction policy initiatives aimed at reducing the University's carbon footprint. Demographics were collected, followed by previous air travel behaviours, perceived air travel benefits and barriers to reducing air travel, future air travel intentions, and finally opinions and support for a range of air travel reduction strategies (see Appendix A for all measures).

Measures

Perceived Benefits and Barriers for Air Travel

Thirty-four statements, addressing perceived benefits of international air travel and barriers of air travel reduction, were presented to respondents. All items used a 5-point response scale ranging from 1 ("*Strongly disagree*") to 5 ("*Strongly Agree*"). The COM-B model was used as a guide to develop the items to ensure core concepts of capability, opportunity, and motivation were covered. Twenty-six statements were based on a previous study, performed in 2021, distributed to University of Canterbury staff, in which qualitative responses were obtained addressing why air travel was/was not important (UC Sustainability Office, 2021). Using the COM-B model, items were developed based on responses surrounding capability to travel by air (e.g., "*I find it easy to travel internationally.*"), opportunities to partake in air travel (e.g., "*Attending international conferences in person makes it easier to establish and maintain research collaborations*."), and motivations for air travel (e.g., "*Attending international conferences in person is important for my career progression*."). Statements were also generated for the questionnaire used in this study by pulling possible benefits and barriers from the extant literature. Four items were derived from interview responses in Moberg et al. (2021), surrounding social norms (e.g., “*There are strong norms in my school about the appropriate amount of international air travel each year*.”), and climate awareness (e.g., “*Reducing the number of international flights I make each year will have virtually no impact on global carbon emissions*.”). Four items were also derived from online survey questions in Thaller et al. (2021) surrounding conference attendance for career development (e.g., “*Attending international conferences in person is important for my career progression*”.), networking (e.g., “*Attending international conferences in person makes it easier to establish and maintain research collaborations*.”), and university expectations (e.g., “*My university provides clear guidelines about how much overseas travel I can perform each year*.”).

Air Travel and Flying Intentions

To ascertain a Previous Air Travel score, respondents were asked to self-report on how many university-related international flights they took each year between 2017 and 2019 (the year before COVID-19 travel restrictions). To ascertain a 2022 Air Travel score, respondents were asked how many international flights they had/intended to take in 2022, Both Previous Air Travel and 2022 Air Travel were scored from 0 (no flights) to 10 (10 or more flights). To measure intended air travel, respondents were asked two questions, the first asking how many times respondents *wanted* to fly internationally in 2023, the second asking how many times respondents *intended* to, again scored from 0 to 10 or more (Francis et al., 2004). These measures were then aggregated into one Intended Air Travel score ($\alpha = .90$) by taking the mean.

Support for Emissions Reduction Policies

Twelve possible air travel reduction policies were put forward to respondents, the majority drawn from sustainability reports and plans put forward by other universities in New

Zealand (e.g., "*Reduce air travel emissions by 30% [from 2019] by 2030*."; Auckland University of Technlogy, August, 2020; Lincoln University, 2022; Massey University, August, 2022; Vitoria University of Wellington, 2021), and the remainder being other possible policies the University of Canterbury could implement (e.g., "*Prioritising international air travel for early career researchers.*"). These 12 policies were scored from 0 ("*Strongly Against*") to 10 ("*Strongly Support*"), with scores aggregated into a single Policy Support score (α = .88) by taking the mean.

Willingness to Adopt Air Travel Reduction Strategies

Five statements were put forward with ways respondents could help to reduce the University of Canterbury's carbon footprint (e.g., "*Limit yourself to one international flight for university-related travel per year*"), with respondents asked to rate how willing they were to partake in these options from 0 ("*Very unwilling*") to 10 ("*Very willing*"). These 5 statements were aggregated into one Willingness to Adopt Air Travel Reduction Strategies score (α = .87) by taking the mean.

Preregistered Statistical Analyses

Exploratory factor analysis was used to assess the latent structure of the benefit/barrier items and generate reliable subscales from air travel benefits and barriers. Descriptive analysis and bivariate correlation were used to examine relationships between variables. Linear regression was used to examine the degree to which international air travel benefits and barriers predicted Intended Air Travel, while controlling for demographics, with Previous Air Travel and 2022 Air Travel as covariates. Linear regression was also used to examine the degree to which benefits and barriers predicted Policy Support and Willingness to Adopt Air Travel Reduction Strategies, again controlling for demographics and having

Previous Air Travel and 2022 Air Travel as covariates, with the addition of Intended Air Travel as a covariate. All analyses were performed using jamovi (The jamovi project, 2022).

Results

Air Travel Benefit/Barrier Exploratory Factor Analysis

Exploratory factor analysis (EFA) was performed on perceived benefit and barrier statements in order to generate reliable subscales (full EFA can be found in Appendix B). As seen in Table 1, ‘maximum likelihood’ extraction method was used in combination with a ‘varimax’ rotation, with inclusion of items determined by items having factor loadings ≥ 0.4, and no cross-loading ≥ 0.35. This resulted in the generation of three distinct subscales.

The first of these subscales, Networking and Conference Benefits (α = .90; *M* = 4.27, *SD* = 0.66), contains 12 items pertaining to the importance of in-person conference attendance, face-to-face interaction, networking, and the social and reputational importance of travel. Items in this subscale align with both the opportunity and motivation aspects of the COM-B model. Items present in this subscale are relevant to the opportunity for networking and attending conferences (e.g., perceived importance of air travel allowing for conferences attendance), as well as motivations for networking and conferences attendance (e.g., perceived importance of conference attendance for career progression). Higher scores on this scale indicate higher perceived importance of networking and conference attendance.

The second subscale, Perceived Low Climate Impact (α = .70; *M* = 3.25, *SD* = 0.87), contains 2 items pertaining to respondents’ perceptions about the climate impact of international air travel, and the climate impact of the respondent’s own travel. The items in this subscale align with the motivation aspect of the COM-B model, with items surrounding respondents’ perceptions of the climate impacts of air travel being relevant to their cognitive process of deciding whether or not to develop intentions to travel. Higher scores on this scale indicate higher levels of scepticism towards the climate impacts of air travel.

The third subscale, Ease of Travel (α = .72; *M* = 2.36, *SD* = 1.09), contains 3 items pertaining to the ease and enjoyment of international travel. This subscale aligns with both the capability and motivation aspects of the COM-B model. Items relate to respondents' capability to travel by air (e.g., the ease with which one can travel), and motivations to travel by air (e.g., enjoyment of travel). Higher scores on this scale indicate higher levels of ease when performing air travel.

Table 1

Exploratory Factor Analysis of International Air Travel Benefits and Barriers

Factor Loadings	Factor			Uniqueness
	1	2	3	
Networking and Conference Benefits				
Conferences to establish and maintain research collaborations.	.873			.235
Informal interactions with colleagues for maintaining and strengthening relationships.	.857			.265
Conferences for my career progression.	.745			.418
Conferences do not meet academic needs	.726			.440
Face to face meetings more beneficial than online meetings.	.709			.429
Supporting academic travel helps enhance university's reputation.	.673			.463
Conferences help keep abreast of latest developments in field.	.657			.516
Difficult to network effectively at online conferences.	.644			.571

Table 1

Exploratory Factor Analysis of International Air Travel Benefits and Barriers

Factor Loadings	Factor			Uniqueness
	1	2	3	
Academic colleagues believe that universities should support overseas travel.	.575			.563
Try to combine multiple activities when travelling (e.g., attend conferences and research meetings).	.573			.588
Difficult for me to attend virtual conferences due to time zone differences.	.520			.722
Job requires physical interaction with people and/or equipment outside New Zealand.	.433			.740
Perceived Low Climate Impact				
The overall impact of international air travel on global carbon emissions is negligible.		.639		.478
Reducing international flights will have virtually no impact on global carbon emissions.		.638		.479
Ease of Travel				
I find it easy to travel internationally.			.659	.542
I find travelling internationally to be very exhausting.[a]			.618	.602
University-related overseas travel is enjoyable.			.528	.626

Note. Items are abbreviated. ‘Maximum likelihood’ extraction method was used in combination with a ‘varimax’ rotation. Only includes items which are in final subscales. Inclusion in subscale determined by items having factor loadings ≥ 0.4, no cross-loading ≥ 0.35.

[a]Item reverse coded in subscale.

Descriptive Statistics and Bivariate Correlations

As expected, higher levels of Previous Air Travel, 2022 Air Travel, and Intended Air Travel were all moderately to strongly (r > .30; Cohen, 2013) associated with higher levels of each other (see Table 2). Intercorrelations between benefits and barrier factors showed that Networking and Conference Benefits were moderately associated (r > .30; Cohen, 2013) with Perceived Low Carbon Impact, as well as Ease of Travel. There was no relationship between Perceived Low Climate Impacts and Ease of Travel. Both 2022 Air Travel, and Intended Air Travel were weakly to moderately associated (r > .10; Cohen, 2013) with all three benefit/barrier factors. Previous Air Travel was only weakly associated with Perceived Low Climate Impact and Ease of Travel. There was no association between Previous Air Travel and Networking and Conference Benefits.

Lack of emissions reduction Policy Support was weakly to moderately associated (r > .10; Cohen, 2013) with all air travel and intentions, as well as Ease of Travel. Lack of Policy Support was strongly associated (r > .50; Cohen, 2013) with Networking and Conference Benefits and Perceived Low Carbon Impact. Willingness to Adopt Air Travel Reduction Strategies was strongly associated (r > .50; Cohen, 2013) with higher levels of Policy Support, and moderately to strongly associated (r > .30; Cohen, 2013) with lower levels of all other measures besides a lack of correlation with Ease of Travel.

Table 2

Descriptive Statistics and Bivariate Correlations

Variable		*M*	*SD*	1	2	3	4	5	6	7	8
1.	Previous Air Travel	1.74	1.47	-							
2.	2022 Air Travel	1.00	1.26	.48***	-						
				[.37, .58]							
3.	Intended Air Travel	1.23	0.81	.51***	.40***	-					
				[.41, .61]	[.28, .51]						
4.	Networking and Conference Benefits	4.27	0.66	.10	.29***	.35***	-				
				[-.04, .23]	[.16, .41]	[.22, .46]					
5.	Perceived Low Climate Impact	2.36	1.09	.20**	.33***	.38***	.47***	-			
				[.06, .33]	[.20, .44]	[.25, .49]	[.35, .57]				
6.	Ease of Travel	3.25	0.87	.15*	.25***	.21**	.30***	.11	-		
				[.01, .28]	[.12, .37]	[.08, .34]	[.17, .42]	[-.03, .24]			
7.	Policy Opinions	5.05	4.68	-.15*	-.30***	-.31***	-.59***	-.60***	-.15*	-	
				[-.28, -.02]	[-.42, -.17]	[-.43, -.18]	[-.67, -.49]	[-.68, -.51]	[-.28, -.02]		
8.	Willingness to Adopt Air Travel Reduction Strategies	2.15	2.81	-.30***	-.40***	-.55***	-.65***	-.65***	-.13	.70***	-
				[-.42, -.17]	[-.51, -.27]	[-.64, -.44]	[-.72, -.56]	[-.72, -.56]	[-.26, .01]	[.62, .76]	

Note. $N = 207$. Pearson's correlation coefficient, $r = .10$ specifies a small effect size, $r = .30$ a medium effect size and $r = .50$ a large effect size (Cohen, 2013). Values in square brackets indicate bias corrected and accelerated bootstrap 95% confidence interval per correlation.

*$p < .05$ (2-tailed).

**$p < .01$ (2-tailed).

***$p < .001$ (2-tailed).

International Air Travel Benefits and Barriers Predicting Intended Air Travel

To assess the degree to which international air travel benefits and barriers could predict future air travel intentions, sequential linear regression was performed with Intended Air Travel as the dependent variable (see Table 2). Previous Air Travel and 2022 Air Travel were included as covariates in the first step, and explained 30% of the variance in Intended Air Travel (R^2 = .30, p < .001). Demographics were controlled for by adding them in the second step explaining 6% of unique variance in Intended Air Travel (ΔR^2 = .06, p = .011). Finally, international air travel benefits and barriers were included in the third step, explaining 6% of unique variance (ΔR^2 = .06, p < .001). The full model accounting for 42% of the variance in air travel Intended Air Travel (R^2 = .42, p < .001).

Measuring variance inflation factor and tolerance, there was no evidence of multicollinearity (VIF > 10, Tolerance < .20; Shrestha, 2020). A Shaprio-Wilk test suggested no non-normality in residuals (W = 0.99, p = .122; Shapiro & Wilk, 1965), and a Q-Q plot of residuals suggested no evidence of non-linearity or heteroscedasticity (see Appendix C; Marden, 2004). Using Cook's distance, no cases were identified as exerting undue influence (D_i > 1; Stevens, 1984). These factors being the case, assumption checks were satisfactorily met to assume model fits and prediction coefficients were accurate.

Of the international air travel benefit/barrier factors, only Networking and Conference Benefits was a significant predictor of Intended Air Travel (β = .18, p .009), with Perceived Low Climate Impact approaching significance (β = .13, p = .068). This shows, accounting for prior air travel and demographic factors, perception of the importance of networking and conferences is the strongest predictor of their intentions to perform future international air travel, with a higher perceived importance resulting in higher levels of Intended Air Travel. Within the COM-B framework, this shows opportunity and motivation to network and attend

Table 3

International Air Travel Benefits and Barriers Predicting Intended Air Travel

Model					R	R^2	ΔR^2
Previous Air Travel, 2022 Air Travel					.55***	.30***	
Previous Air Travel, 2022 Air Travel, demographics					.60***	.36***	.06*
Previous Air Travel, 2022 Air Travel, demographics, air travel benefits and barriers					.65***	.42***	.06***
		95% CI (*B*)					
Predictors	*B*	LB	UB	*SE* (*B*)	β	*r*	sr^2
Intercept	-0.87***	-1.88	0.14	0.51			
Previous Air Travel	0.21***	0.14	028	0.04	.38***	.51***	.10***
2022 Air Travel	0.08	-0.01	0.17	0.04	.13	.40***	.01
Age	< 0.01	-0.01	0.01	0.01	.01	-.04	< .01
Gender Identity	-0.22*	-0.42	-0.02	0.10	-.27*	-.12	.01
Academic Rank	0.07	-0.03	0.17	0.07	.12	.11	< .01
Family Overseas	0.13	-0.08	0.35	0.11	.17	.22**	.01
Early Career	0.18	-0.13	0.49	0.16	.23	-.03	< .01
Networking and Conference Benefits	0.23**	-0.13	0.49	0.16	.18**	.35***	.02*
Perceived Low Climate Impact	0.09	-0.01	0.19	0.05	.13	.38***	.01
Ease of Travel	0.05	-0.06	0.15	0.06	.05	.21**	< .01

Note. N = 207. Gender Identity uses ‘Male’ as reference level, compared to ‘Female’. ‘Gender diverse’ and ‘Prefer not to say’ not included due to minimal sample size. Family Overseas and Early Career use ‘No’ as a reference level compared to ‘Yes’.

* $p < .05$

** $p < .01$

*** $p < .001$

conferences are of predominant relevance when assessing behaviour change interventions for air travel reduction. Unsurprisingly, outside of international air travel benefits and barriers, Previous Air Travel was a significant predictor of Intended Air Travel (β = .38, $p < .001$). Although, most likely due to the ongoing travel restriction effects of COVID-19, 2022 Air Travel only approached significance (β = .13, $p = .063$). With regard to demographics, only 'Gender Identity' was a significant predictor ($B = -0.22$, $p = .029$), with being male predicting higher levels of Intended Air Travel than being female.

Perceived Air Travel Benefits and Barriers Predicting Support for Emissions Reduction Policies

To assess international air travel benefits and barriers predicting support for emissions reduction policies, the same regression analysis as for Intended Air Travel was performed, with Policy Support as the dependent variable (see Table 3). In order to isolate effects on Policy Support from any variance explained by intended travel, Intended Air Travel was also included as a covariate. Assumption checks were all met (see Appendix C).

Previous Air Travel and 2022 Air Travel explained 14% of the variance in Policy Support ($R^2 = .14$, $p < .001$). Demographics then explained 11% of the unique variance in Policy Support ($\Delta R^2 = .11$, $p < .001$). International air travel benefits and barriers explained 29% of the unique variance in Policy Support ($\Delta R^2 = .29$, $p < .001$). The full model explained 54% of the variance in Policy Support ($R^2 = .54$, $p < .001$). Networking and Conference Benefits (β = -.41, $p < .001$) and Perceived Low Climate Impact (β = -.35, $p < .001$) were both significant predictors of Policy Support, such that academics' stronger perception of the importance of networking and conferences, and stronger perception that international air travel has low impact on carbon emissions, predicted less support for carbon emission reduction policies. Under the COM-B model, this shows opportunity and motivation

Table 4

International Air Travel Benefits and Barriers Predicting Policy Support

Model	R	R^2	ΔR^2
Previous Air Travel, 2022 Air Travel, Intended Air Travel	.37***	.14***	
Previous Air Travel, 2022 Air Travel, Intended Air Travel, demographics	.50***	.25***	.11***
Previous Air Travel, 2022 Air Travel, Intended Air Travel, demographics, air travel benefits and barriers	.74***	.54***	.29***

Predictors	B	95% CI (B) LB	95% CI (B) UB	SE (B)	β	r	sr^2
Intercept	11.72***	9.30	14.14	1.23			
Previous Air Travel	-0.03	-0.21	0.15	0.09	-.02	-.15*	< .01
2022 Air Travel	-0.18	-0.39	0.02	0.11	-.11	-.30***	< .01
Intended Air Travel	0.04	-0.30	0.38	0.17	.01	-.31***	< .01
Age	-0.02	-0.05	0.01	0.02	-.09	.05	< .01
Gender Identity	0.77**	0.30	0.30	0.24	.36**	.11	.01
Academic Rank	0.21	-0.04	0.45	0.13	.13	-.02	.01
Family Overseas	0.35	-0.16	0.86	0.26	.16	-.09	< .01
Early Career	0.55	-0.19	1.29	0.37	.26	.10	.01
Networking and Conference Benefits	-1.35***	-1.77	-0.93	0.21	-.41***	-.59***	.10***
Perceived Low Climate Impact	-0.68***	-0.92	-0.45	0.12	-.35***	-.60***	.10***
Ease of Travel	0.10	-0.16	0.36	0.13	.04	-.15*	< .01

Note. $N = 207$. Gender Identity uses ‘Male’ as reference level, compared to ‘Female’. ‘Gender diverse’ and ‘Prefer not to say’ not included due to minimal sample size. Family Overseas and Early Career use ‘No’ as a reference level compared to ‘Yes’.

* $p < .05$

** $p < .01$

*** $p < .001$

to network and attend conferences, as well as motivations based on climate perception, to be of relevance when assessing behaviour change interventions involving Policy Support. ‘Gender Identity’ was a significant predictor of Policy Support (*B* = 0.77, *p* = .001), with being female predicting higher Policy Support than being male.

Perceived Air Travel Benefits and Barriers Willingness to Adopt Air Travel Reduction Strategies

To assess international air travel benefits and barriers predicting Willingness to Adopt Air Travel Reduction Strategies, the same regression analysis as for Policy Support was performed, with Willingness to Adopt Air Travel Reduction Strategies as the dependent variables (see Table 4). Assumption checks were all met (see Appendix C).

Previous Air Travel and 2022 Air Travel explained 34% of the variance in Willingness to Adopt Air Travel Reduction Strategies (R^2 = .34, p < .001). Demographics explained 11% of the unique variance in Willingness to Adopt Air Travel Reduction Strategies (ΔR^2 = .11, p < .001). International air travel benefits and barriers explained 25% of the unique variance in Willingness to Adopt Air Travel Reduction Strategies (ΔR^2 = .25, p < .001). The full model explained 70% of the variance in Willingness to Adopt Air Travel Reduction Strategies (R^2 = .70, p < .001). Networking and Conference Benefits (β = -.41, p < .001), Perceived Low Climate Impact (β = -.30, p < .001) and Ease of Travel (β = .11, p = .009) were significant predictors of Willingness to Adopt Air Travel Reduction Strategies. Academics’ stronger perception of the importance of networking and conferences, stronger perception that international air travel has low impact on carbon emissions, and lower ease of travel, predict less Willingness to Adopt Air Travel Reduction Strategies. Within the COM-B framework, this again suggests the opportunity and motivation to network and attend conferences, and motivation surrounding climate impacts to be relevant.

Table 5

International Air Travel Benefits and Barriers Predicting Willingness to Adopt Air Travel Reduction Strategies

Model	R	R^2	ΔR^2
Previous Air Travel, 2022 Air Travel, Intended Air Travel	.58***	.34***	
Previous Air Travel, 2022 Air Travel, Intended Air Travel, demographics	.67***	.45***	.11***
Previous Air Travel, 2022 Air Travel, Intended Air Travel, demographics, air travel benefits and barriers	.84***	.70***	.25***

		95% CI (B)					
Predictors	B	LB	UB	SE (B)	β	r	sr^2
Intercept	14.91***	12.35	17.47	1.30			
Prior Air Travel	-0.09	-0.28	0.10	0.10	-.05	-.30***	< .01
2022 Air Travel	-0.29*	-0.51	-0.07	0.11	-.13*	-.40***	.01
Intended Air Travel	-0.66***	-1.01	-0.30	0.18	-.19***	-.55***	.03*
Age	< 0.01	-0.03	0.03	0.02	-.01	.15*	< .01
Gender Identity	1.24***	0.75	1.74	0.25	.44***	.16*	.01
Academic Rank	0.30*	-0.56	-0.04	0.13	-.14*	-.03	.01
Family Overseas	0.13	-0.41	0.67	0.27	.05	-.19**	< .01
Early Career	-1.37***	-2.15	-0.59	0.40	-.49***	-.05	.01
Networking and Conference Benefits	-1.76***	-2.20	-1.32	0.22	-.41***	-.65***	.10***
Perceived Low Climate Impact	-0.77***	-1.02	-0.52	0.13	-.30***	-.65***	.07***
Ease of Travel	0.37**	0.09	0.64	0.14	.11**	-.13	.01

Note. $N = 207$. Gender Identity uses 'Male' as reference level, compared to 'Female'. 'Gender diverse' and 'Prefer not to say' not included due to minimal sample size. Family Overseas and Early Career use 'No' as a reference level compared to 'Yes'.

* $p < .05$

** $p < .01$

*** $p < .001$

However, when assessing behaviour change interventions in light of academics Willingness to Adopt Air Travel Reduction Strategies, capability to easily travel, and motivation due to enjoyment of travel, are also important considerations. Intended Air Travel ($\beta = -.19$, $p < .001$) and 2022 Air Travel ($\beta = -.13$, $p = .01$) were both significant predictors of Willingness to Adopt Air Travel Reduction Strategies, such that high levels of 2022 Air Travel and Intended Air Travel predicted lower Willingness to Adopt Air Travel Reduction Strategies. ‘Gender Identity’ was a significant predictor of Willingness to Adopt Air Travel Reduction Strategies ($B = 1.24$, $p < .001$), being female predicting higher willingness than being male. ‘Academic Rank’ ($\beta = -.14$, $p = .026$) and ‘Early Career’ ($B = -1.37$, $p < .001$) were both significant predictors of the criterion variable. Higher ranking academics and early career academics both expressed lower Willingness to Adopt Air Travel Reduction Strategies.

Discussion

In this study we aimed to improve our understanding of the perceived benefits and barriers related to international air travel by academics, and determine how these perceptions predict academics’ intended future air travel. To do so, we surveyed 207 academics from the University of Canterbury. A group of statements surrounding the benefits of international air travel, and barriers to reducing air travel, were developed. Factor analysis was then used on these statements to create three distinct and reliable subscales. These subscales are Networking and Conference Benefits, Perceived Low Climate Impact and Ease of Travel. Intended Air Travel was then regressed on these perceived benefits and barriers while controlling for Previous Air Travel, 2022 Air Travel, and demographics. Results indicated that higher levels of perceived importance of networking and conferencing, as well as identifying as male, predicted higher levels of Intended Air Travel amongst University of

Canterbury academics. Higher levels of belief that air travel has a negligible climate impact was positively associated with Intended Air Travel, but just failed to reach statistical significance in the regression analysis.

Respondents' opinions toward carbon emission reduction policies, and their willingness to adopt air travel reduction strategies were then also regressed on benefits and barriers (two separate regressions), again controlling for Previous Air Travel, 2022 Air Travel, and demographics, as well as controlling for Intended Air Travel. Higher levels of perceived importance of networking and conferences, belief that air travel has low carbon impact, and being male, all significantly predicted lower policy support and willingness to adopt air travel reduction strategies. Additionally, lower levels of ease when travelling, being of lower academic rank, and being an early career researcher all predicted lower levels of willingness to adopt air travel reduction strategies.

Framing the Prediction of Air Travel Intentions in the COM-B Model

In order to use the BCW to apply specific and effective behaviour change strategies to reduce air travel amongst academics, the perceived air travel benefit/barriers identified in this study can be considered within the COM-B model (Michie et al., 2011). Framing COM-B factors with air travel intentions, capability would be an individual's physical and psychological capacity to adopt air travel intentions, opportunity would be all factors outside of an individual which allow for air travel intentions to be adopted by that individual, and motivation would be all cognitive processes occurring in an induvial which lead towards air travel intentions. Within this framework, the perceived importance of networking and conferences can be understood as a combination of opportunity and motivation. Networking and conferences provide opportunities, present outside of an academics' control, which give reason for academics to fly internationally. Networking and conferences provide motivation through the cognitive process of seeing events and social opportunities as priority, and results in those same intentions to fly. The belief that international air travel has little impact on climate change can largely be understood as a motivation factor, in that it is part of an academic's cognitive calculation regarding whether it is morally and environmentally reasonable to develop air travel intentions. Finally, ease of travel can be seen as a capability factor, in the sense that one's physical and mental capacity to travel with/without ease effects their intentions to adopt air travel. Putting these benefits and barriers together, we have an understanding of air travel in the COM-B framework such that the capability to travel with ease, the opportunities for networking and conferences, and the motivation to network and attend those conferences whilst accounting for the climate impacts of air travel, all have the potential to impact an academic's future air travel intentions (Michie et al., 2011).

Subsequently, the results of this study indicate that it is the opportunity and motivation developed by networking and conferences that appear to play particularly important roles in predicting academics' air travel intentions. This strongly aligns with the surrounding literature, supporting the notion that academics see air travel as a necessity due to its capacity for networking, success, and the distribution of knowledge (Hamann & Zimmer, 2017; Nursey-Bray et al., 2019; Thaller et al., 2021). Included in the Networking and Conference Benefits subscale, are also two items surrounding how traveling impacts both career progression and the reputation of the respondents' university. Results indicating that high scores on this subscale result in more intentions to travel internationally support findings in the literature surrounding academics' belief that air travel is a crucial part of institutional and personal career development (Glover et al., 2019; Kreil, 2021). It should also be noted that this effect of networking and conferences being a strong predictor is very likely to be affected by the remoteness of the sample population, given that the University of Canterbury is located in New Zealand (Hopkins et al., 2016; Nursey-Bray et al., 2019).

Applying the Behaviour Change Wheel

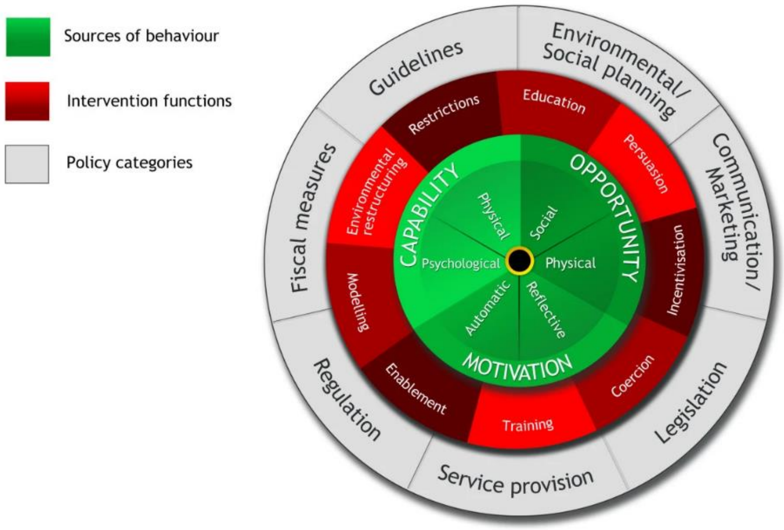
In understanding the driving factors of air travel intentions in academics, there is now the potential to use this information to ascertain the most suitable behaviour change strategies to employ in order to reduce said intentions (and subsequent actual travel). Using the BCW, a number of approaches could be used to reduce air travel intentions (Michie et al., 2011). Below are three possible behaviour change strategies that could be employed.

Education Surrounding the Impact of Air Travel on Academic Success

The first possible approach relates to academics' perceptions that air travel is essential for professional success (Thaller et al., 2021), shown in this study by the perceived importance of networking and conferencing resulting in stronger air travel intentions. In a paper by Wynes et al. (2019), no actual relation was found between air travel and academic success. It was shown that frequency of air travel by academics at the University of British Columbia was not a statistically reliable predictor of their h-index, a score which indicates an academic's impact within the literature, and a predictor of professional success in academia (Bornmann & Daniel, 2005; Wynes et al., 2019). Further to this there is increasing opportunity for networking, as well as conference attendance, without the need to travel (Donelan, 2016). Through means such as social media and online conferences, academics can seek the same benefits that international travel provide, without increasing their carbon footprint. As seen in Figure 1, one intervention function within the BCW is education (Michie et al., 2011). By educating academics of the limited impact of air travel on success, the motivation component of academic's perceptions surrounding the importance of networking and conferences could be altered. In understanding that air travel may not be as effective as previously thought at enhancing one's career, and having alternatives provided, air travel intentions may be reduced.

Figure 1

The Behaviour Change Wheel



Note. Michie et al. (2011).

Incentive for Local Networking and Conferences

Given the significantly higher mileage and subsequent emissions of long-haul international travel, when comparing it to domestic or even short-haul international travel, one option to reduce an institution's carbon emissions is to encourage academics to prioritise more local networking and conferences (Smith & Rodger, 2009). Furthermore, with the improvement in online conferences and the development of hub conferences, there is further opportunity to reduce travel (Fraser et al., 2017; Parncutt et al., 2021). To do this, a combination of incentivisation and environmental restructuring (see Figure 1) could be utilised. Incentivisation is the expectation of reward, with environmental restructuring being the alteration of physical or social context (Michie et al., 2011). By restructuring the social expectation of international air travel within academia to a more domestic and short-haul focused network, simultaneous with incentivising academics to travel more locally by rewarding this behaviour with career or benefit incentives, motivations toward engaging in air travel can be moved from international air travel to local air travel (Hamann & Zimmer, 2017). The risk of only using this behaviour change method is that it may rely on a comprehensive restructure of the academic landscape, which would involve a severe time commitment, and require multiple institutions to be a part of the change (Glover et al., 2018).

Restriction and Substitution of Travel

Although perhaps a less attractive solution for many academics, given that a large part of networking and conferences as a driver of air travel intentions is the opportunity factor, one way to reduce these intentions is to remove the opportunity. This could be done by internal restriction of travel, where an institution limits the amount of travel academics can perform, or it could be done in a more outward way, where conference organisers limit the number of physical attendees in substitution for other forms of attendance (i.e., virtual attendance). The cost of this method is that it may appear highly unattractive to academics who see air travel as a crucial part of their career progression, and as such any restrictions should also come with education in the form of rationale and justification of those restrictions. Relevant to the timing of this study, one aspect which could make travel restriction easier is that it has had somewhat of an enforced test-period due to the COVID-19 pandemic. Implications of pandemic related travel restrictions are still being explored, but it does give a lens for how things such as substituting travel with virtual conferences could look for the global academic community (Jack & Glover, 2021).

Implications of Policy Support and Willingness to Adopt Air Travel Reduction Strategies

When assessing which behaviour change methods to select, academics' likelihood to support policies and their willingness to adopt air travel reduction strategies should be considered. Results of this study show that, beyond effects due to perceived importance of networking and conferencing, a number of other factors also affect academic's policy support and willingness to adopt air travel reduction strategies. Firstly, lower support for emissions reduction policies, and lower willingness to adopt air travel reduction strategies being predicted by stronger belief that air travel has a negligible climate impact suggests that any behaviour change intervention should be accompanied by educating academics about the climate impacts of air travel emissions. While education in sustainability may not reduce travel intentions, it may help entice support and willingness towards more effective behaviour change methods for reducing academic air travel (Schrems & Upham, 2020). Secondly, willingness to adopt air travel reduction strategies being less in lower ranking academics and early career researchers suggests that individuals in this category should perhaps be the main focus of any education policies surrounding academic success. One way to provide uniquely tailored interventions that address specific concerns of subgroups in academia is audience segmentation (Hine et al., 2014). Given the likelihood that early career academics feel a stronger sense of institutional pressure and desire for success, education around the lack of relationship between academic success and air travel could greatly help any discomfort surrounding air travel reduction that early career academics feel (Glover et al., 2019; Wynes et al., 2019). For more senior staff, incentivisation for local travel, and restriction of travel, may be sufficient.

Limitations and Future Research

A limitation of this study is the nature of a self-report air travel intentions measure, and how it may relate to actual travel. The first issue with a self-report intentions measure is the possibility of social-desirability bias, although this would hopefully have been avoided given the neutral framing of the survey instrument (Nederhof, 1985). The second, and perhaps more important issue, is the lack of guarantee that air travel intentions will align with actual air travel. There was attempt to mitigate this issue by assessing intentions using both direct self-report of intentions in combination with reported ‘wanting’ to travel, however it should not be assumed that intentions will perfectly replicate with actual future travel (Francis et al., 2004). Given a cross-sectional nature, this study cannot be said to assess a causal relationship between air travel benefits and barriers, and intentions, however the association of benefit/barrier factors with intentions gives strong impetus for future causal research in focused areas (Wang & Cheng, 2020). Finally, given the sample population being academics from one university in a relatively isolated location, it should not be assumed that results would generalise to other institutions or the tertiary education system in general.

To address the above limitations, and further the benefit of this study to the literature, future research could be performed analysing the accuracy of the relationship between intentions for future air travel, and actual air travel when it comes to the time period in which said intentions were directed. Furthermore, the behaviour change methods outlined above, or of other methods based on the results of this study, could be implemented with subsequent effects on air travel quantity being tracked to ascertain causal relationship. It is strongly recommended to academic institutions that this research be utilised in order to implement carbon emission reduction policy amongst academic staff, with the result of any intervention being assessed and used to further develop theory and practical strategies for reducing carbon emissions. Finally, it is also recommended that similar research also be performed in non-isolated countries to assess any differences in results.

Conclusion

This study applied the COM-B framework to increase our understanding of the perceived benefits/barriers related to international air travel in a sample of academics from the University of Canterbury, New Zealand. Results suggest international air travel benefits and barriers explain a significant proportion of variance in academics’ air travel intentions, and that stronger perceived importance of networking and conferences is the main predictor of higher intentions to fly internationally amongst academics at the University of Canterbury. Additionally, stronger perceived importance of networking and conferences and beliefs that air travel has negligible climate impacts predict less support and willingness for carbon emission reduction policies and strategies. Early career researchers, lower ranking academics, and academics who find travel to be relatively easy expressed less willingness to adopt air travel reduction strategies. Opportunities for using these results to develop behaviour change methods include education surrounding the lack of relationship between air travel and academic success; incentivisation for substituting long-haul for more local travel; and travel restrictions. Possible strategies for increasing support and adoption of these methods are education surrounding climate impacts; and focusing on education of early career and lower ranking academics on the relationship between air travel and academic success.

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Appendix A

Measures

Table A1

Demographics

Demographic	Question	Possible Responses
Age	What is your age? (In years)	Number
Gender Identity	How would you describe your gender?	Male
		Female
		Gender diverse
		Prefer not to say
Academic Rank	What is your academic rank?	Lecturer
		Senior Lecturer
		Senior Lecturer Above the Bar
		Associate Professor
		Professor or Above
Family/Whānau Overseas	Do you have immediate family/whānau who live overseas?	Yes/No
Early Career Researcher	Are you an early career researcher? (Within 10 years of completing your highest research qualification)	Yes/No

Table A2

Air Travel Benefits and Barrier Statements

Statement
Networking and Conference Benefits (α = .90)
Attending international conferences in person makes it easier to establish and maintain research collaborations.
International travel allows for informal interactions with colleagues which are important for maintaining and strengthening relationships.
Attending international conferences in person is important for my career progression.
Online conferences do not meet the needs of academics working in my field.
Face to face meetings with overseas colleagues are more beneficial than online meetings.
Supporting academic travel helps enhance my university's global reputation.
Attending academic conferences outside Aotearoa New Zealand helps me keep abreast of the latest developments in my field of expertise.
It is difficult to network effectively at online conferences.
Most of my academic colleagues believe that New Zealand universities should support overseas travel.
When I travel outside of Aotearoa New Zealand, I usually try to combine multiple activities (e.g., attend both conferences and research meetings).
It's difficult for me to attend virtual conferences because time zones often don't align well with Aotearoa New Zealand.
My job requires me to physically interact with people and/or equipment located outside Aotearoa New Zealand.

Table A2

Air Travel Benefits and Barrier Statements

Statement
Perceived Low Climate Impact (α = .70)
The overall impact of international air travel on global carbon emissions is negligible.
Reducing the number of international flights I make each year will have virtually no impact on global carbon emissions.
Ease of Travel (α = .72)
I find it easy to travel internationally.
I find travelling internationally to be very exhausting.
University-related overseas travel is enjoyable.
Uncoded
Progressing my career is more important to me than reducing my carbon footprint.
There are strong norms in my school about the appropriate amount of international air travel each year.
I believe that climate change is mostly caused by natural processes that we cannot control.
University-related travel has become a habit. I don't give it much thought.
I am very concerned about climate change and its implications for the future.
There are few online conferences available in my academic field.
Travelling internationally enables me to teach and/or supervise students in overseas locations.
Purchasing carbon offsets is an effective way to reduce the negative impacts of air travel on greenhouse gas emissions.

Table A2

Air Travel Benefits and Barrier Statements

Statement
There are conferences or events held in Aotearoa New Zealand relevant to my academic field.
I prioritise travel such that I only attend international conferences which I consider to be essential, declining to attend events which are not as important.
I don't have access to a suitable space at my university to complete my research.
My university provides clear guidelines about how much overseas travel I can perform each year.
I believe that responsibility for limiting climate change should fall on governments and international corporations, not individual citizens.
I have personal obligations (i.e. family) which prevent me from partaking in university-related overseas travel.
When travelling overseas for conferences and/or research, I also often visit family and friends.
My job has specific requirements, unrelated to conferences and research, that require me to travel internationally.
I am aware of strategies I could employ which I could use reduce my university-related air travel.

Note. Statements scored from 1 "*Strongly Disagree"* to 5 "*Strongly Agree*".

[a]Item is reverse coded.

Table A3

Air Travel and Intentions

Measure	Question
Previous Air Travel	Between 2017 and 2019, how many return flights did you typically take to international locations (besides Australia) per year?
2022 Air Travel	How many return flights have you taken, or plan to take, to international locations (besides Australia) this year (2022)?
Intended Air Travel (α = .90)	How many times do you want to fly Internationally (besides to Australia) in 2023?
	How many times do you intend to fly internationally (besides to Australia) in 2023?

Note. Scored from 0 to 10 or more flights. Travel to Australia was also measured, but used only for institutional purposes, and not used in this study.

Table A4

Policy Support and Willingness to Adopt Air Travel Reduction Strategies

Measure	Statement
Policy Support[a] (α = .88)	Reduce emissions from air travel by 50% (from 2019) by 2025
	Add a 5% carbon fee on all flights booked and paid for by the university
	Require that all university-funded flights have full carbon offsets
	Integrating a feature into the university travel booking system which shows the least greenhouse gas intensive options
	Encouraging academics to group several activities (e.g., conferences, workshops, research etc.) into single international trips
	Reduce air travel emissions by 30% (from 2019) by 2030
	Improve digital-enabled technology for meetings and conferences
	Capping international air travel to meet university carbon reduction targets
	Prioritising international air travel for early career researchers.
	Prioritising international air travel for academics with external research grants.

Table A4

Policy Support and Willingness to Adopt Air Travel Reduction Strategies

Measure	Statement
	Prioritising international air travel for academics whose teaching and research are aligned with the University's academic strategy.
	Reduce air travel by 5% every year until 2030.
Willingness to Adopt Air Travel Reduction Strate[b] (α = .87)	Travel overseas on university-related business only every second year
	Limit yourself to one international flight for university-related travel per year
	Group all your international university-related travel activities into a single overseas trip each year
	Cease all University of Canterbury-funded international travel
	Travel no more than two times each year

[a]Scored from 0 ("*Strongly Against*") to 10 ("*Strongly Support*").

[b]Scored from 0 ("*Very Unwilling*") to 10 ("*Very Willing*").

Appendix B

Exploratory Factor Analysis of International Air Travel Benefits and Barriers

Table B1

Full Exploratory Factor Analysis of International Air Travel Benefits and Barriers

Factor Loadings	Factor			Uniqueness
	1	2	3	
Conferences to establish and maintain research collaborations.	.873			.235
Informal interactions with colleagues for maintaining and strengthening relationships.	.857			.265
Conferences for my career progression.	.745			.418
Conferences do not meet academic needs	.726			.440
Face to face meetings more beneficial than online meetings.	.709			.429
Supporting academic travel helps enhance university's reputation.	.673			.463
Conferences help keep abreast of latest developments in field.	.657			.516
Difficult to network effectively at online conferences.	.644			.571
Academic colleagues believe that universities should support overseas travel.	.575			.563
Try to combine multiple activities when travelling (e.g., attend conferences and research meetings).	.573			.588

Table B1

Full Exploratory Factor Analysis of International Air Travel Benefits and Barriers

Factor Loadings	Factor			Uniqueness
	1	2	3	
Difficult for me to attend virtual conferences due to time zone differences.	.520			.722
Job requires physical interaction with people and/or equipment outside New Zealand.	.433			.740
The overall impact of international air travel on global carbon emissions is negligible.		.639		.478
Reducing international flights will have virtually no impact on global carbon emissions.		.638		.479
I find it easy to travel internationally.			.659	.542
I find travelling internationally to be very exhausting.[a]			-.618	.602
University-related overseas travel is enjoyable.			.528	.626
Career more important than reducing carbon footprint.	.486	.441		.456
Strong norms in school about appropriate amount of international air travel each year.		.435		.790
I believe that climate change is mostly caused by natural processes that we cannot control.		.361		.850
University-related travel has become a habit.			.401	.838
Concerned about climate change and its implications for the future.			-.394	.759

Table B1

Full Exploratory Factor Analysis of International Air Travel Benefits and Barriers

Factor Loadings	Factor			Uniqueness
	1	2	3	
Few online conferences available in my field.				.783
Travelling internationally to teach and/or supervise students.				.808
Purchasing carbon offsets an effective way to reduce negative impacts of air travel.				.881
There are conferences in Aotearoa New Zealand relevant to academic field.				.930
Prioritise travel to only attend international conferences considered to be essential.				.945
Don't have access to a suitable space at my university to complete my research.				.977
My university provides clear guidelines about how much overseas travel I can perform each year.				.909
Responsibility for limiting climate change should fall on governments and international corporations.				.911
I have personal obligations which prevent me from partaking in university-related overseas travel.				.875
When travelling overseas for conferences and/or research, I also often visit family and friends.				.878

Table B1

Full Exploratory Factor Analysis of International Air Travel Benefits and Barriers

Factor Loadings	Factor			Uniqueness
	1	2	3	
Job has specific requirements, unrelated to conferences and research, that require me to travel internationally.				.928
I am aware of strategies I could employ which I could use reduce my university-related air travel.				.978

Note. Items are abbreviated. ‘Maximum likelihood’ extraction method was used in combination with a ‘varimax’ rotation.

Appendix C

Assumptions Checks for Linear Regressions

Table C1

Assumption Checks for International Air Travel Benefits and Barriers Predicting Intended Air Travel

Collinearity Statistics

Measure	VIF	Tolerance
Previous Air Travel	1.18	0.85
2022 Air Travel	1.26	0.79
Age	1.46	0.68
Gender Identity	1.05	0.95
Academic Rank	1.62	0.62
Family/Whānau Overseas	1.09	0.92
Early Career	1.56	0.64
Networking and Conference Benefits	1.30	0.77
Perceived Low Climate Impact	1.25	0.80
Ease of Travel	1.09	0.92

Shapiro-Wilk Test

W	*p*
0.99	.122

Cook's Distance

		Range	
M	*SD*	Min	Max
0.007	0.02	< .001	0.21

Figure C1

Q-Q Plot of Residuals for International Air Travel Benefits and Barriers Predicting Intended Air Travel

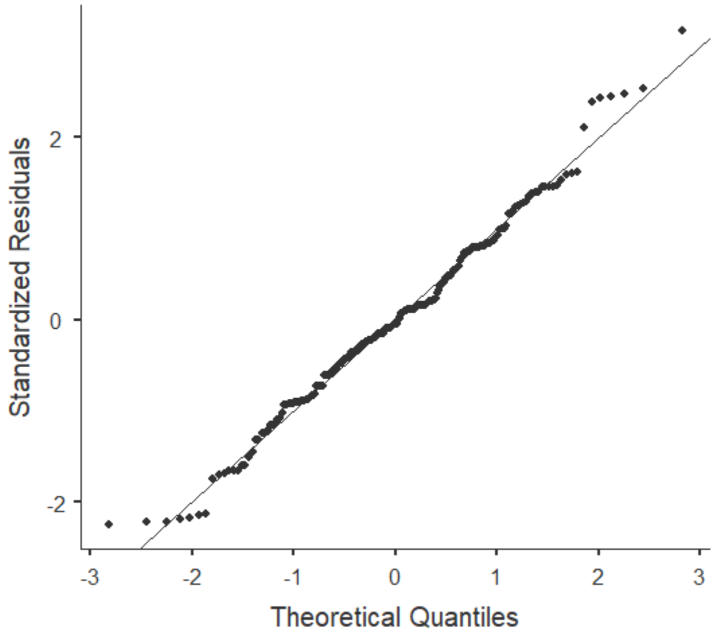

Table C2

Assumption Checks for International Air Travel Benefits and Barriers Predicting Policy Support

Collinearity Statistics

Measure	VIF	Tolerance
Previous Air Travel	1.28	0.78
2022 Air Travel	1.27	0.79
Intended Air Travel	1.31	0.76
Age	1.46	0.68
Gender Identity	1.06	0.94
Academic Rank	1.62	0.62
Family/Whānau Overseas	1.09	0.91
Early Career	1.57	0.64

Table C2

Assumption Checks for International Air Travel Benefits and Barriers Predicting Policy Support

Networking and Conference Benefits	1.33	0.76
Perceived Low Climate Impact	1.26	0.80
Ease of Travel	1.09	0.92

Shapiro-Wilk Test

W	*p*
0.99	.298

Cook's Distance

		Range	
M	*SD*	Min	Max
0.006	0.02	< .001	0.109

Figure C2

Q-Q Plot of Residuals for International Air Travel Benefits and Barriers Predicting Policy Support

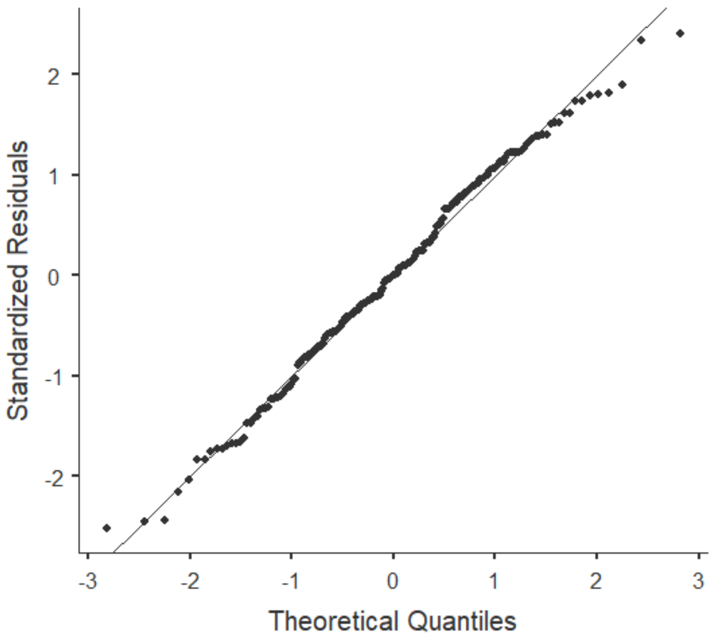

Table C3

Assumption Checks for International Air Travel Benefits and Barriers Predicting Willingness to Adopt Air Travel Reduction Strategies

Collinearity Statistics

Measure	VIF	Tolerance
Previous Air Travel	1.28	0.78
2022 Air Travel	1.27	0.79
Intended Air Travel	1.31	0.76
Age	1.46	0.68
Gender Identity	1.06	0.94
Academic Rank	1.62	0.62
Family/Whānau Overseas	1.09	0.91
Early Career	1.57	0.64

Table C3

Assumption Checks for International Air Travel Benefits and Barriers Predicting Willingness to Adopt Air Travel Reduction Strategies

Networking and Conference Benefits	1.33	0.76
Perceived Low Climate Impact	1.26	0.80
Ease of Travel	1.09	0.92

Shapiro-Wilk Test

W	*p*
0.99	.361

Cook's Distance

		Range	
M	*SD*	Min	Max
0.004	0.01	< .001	0.093

Figure C3

Q-Q Plot of Residuals for International Air Travel Benefits and Barriers Predicting Willingness to Adopt Air Travel Reduction Strategies