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The purpose of this study was to assess the attitudinal data of commercial pilots on the possible implementation of controlled rest in position (CRIP). Prior research indicated that pilot napping could be beneficial to reduce fatigue. While CRIP has been implemented by some international regulatory agencies, it remains prohibited in the United States. Through a qualitative methodology and a phenomenological approach, 30 commercial pilots from the United States presented their thoughts on an open-ended research instrument as to the possible advantages, disadvantages, and implementation aspects of CRIP. The findings indicated that 70% of participants were in favor of CRIP implementation. However, participants expressed concerns over ensuring that proper CRIP policies and procedures were implemented to ensure safety was not compromised.

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Fatigue is a significant contributor to accidents in aviation, in commercial, private, and military aircraft, and is defined as "extreme tiredness resulting from mental or physical exertion or illness" (Oxford Dictionary, 2017, n.p.). Typical fatigue mitigation techniques include work and rest scheduling, obtaining required minimum rest before a flight, and pharmacological countermeasures (Caldwell & Caldwell, 2005; Caldwell, Mallis, Caldwell, Paul, Miller, & Neri, 2009). However, Controlled Rest in Position (CRIP), or in-flight sleep, may be another potential way to mitigate pilot fatigue. Prior research has investigated consumer perceptions relating to CRIP, revealing unfavorable perceptions (Winter, Carryl, & Rice, 2015). However, it is likely that pilots feel differently about CRIP owing to their experience with fatigue in the cockpit and their knowledge of standard aviation practices. The purpose of this study is to understand commercial airline pilots' attitudes regarding controlled rest in position using a qualitative method and a phenomenological approach.

Literature Review

Causes and Outcomes of Pilot Fatigue

Pilot fatigue is a known hazard to pilots (Jackson & Earl, 2006; Rosekind et al., 1994). Pilots have reported fatigue emerging from poor work schedules, jet lag, night flights, and general time pressure (Bourgeois-Bougrine, Carbon, Gounelle, Mollard, & Coblentz, 2003). Fatigue effects can also emerge from changing flight times and inconsistent sleep schedules (Goode, 2003; Powell, Spencer, Holland, Broadbent, & Petrie, 2007).

Flight Rules. The first update to pilot rest rules and duty limitations in more than 60 years occurred with the release of 14 CFR Part 117 (Federal Register, 2012). This regulation is a data-based approach to pilot flight time limitations and required rest and was applied to commercial pilots operating under 14 CFR Part 121. This new regulation uses multiple factors to identify the amount of crew rest required such as time of reporting, time zones crossed, and flight duty time. Fatigue Risk Management Systems (FRMS) are included in the regulation as a way for carriers to collect data and provide a source of continuous monitoring to assess fatigue. While the release of this rule was considered a notable change in targeting pilot fatigue, pilots have continued to express concerns over fatigue, and 14 CFR Part 117 does not apply to all commercial pilots. For example, most pilots that fly commercially in the United States operate under the rules and guidance for airlines (14 CFR Part 121) or commercial on-demand operators, commonly called charter flights (14 CFR Part 135). Fractional aircraft ownership is covered by a different section of regulations (14 CFR Part 91 Subpart K), and another category includes personal aircraft operation, which may be for private business use (14 CFR Part 91). This suggests that existing regulation may be insufficient to combat fatigue effects and additional approaches are needed.

Empirical Research on Controlled Rest in Position

While recent regulatory changes may provide some help to reduce fatigue levels in aviation, other solutions should still be considered. One potential solution is controlled rest in position (CRIP). Controlled rest in position refers to in-flight sleep or napping in place. Napping has a myriad of benefits, including increasing alertness and combating sleep deprivation, as well as augmenting physical and mental health (Takahashi, 2003). Indeed, some foreign air carriers (e.g., Air Canada) currently allow CRIP naps as a fatigue mitigation technique for their pilots (Transportation Safety Board of Canada (TSB), 2011). However, CRIP is still currently prohibited by the Federal Aviation Administration (FAA). One study found that pilots who take a short nap (40 minutes, compared to a no-sleep control group) had shorter reaction times and higher subjective alertness ratings than those who did not nap (NASA, 1994). Also, long-haul pilots can benefit from in-flight napping to increase alertness during later, more critical portions of flight (Rosekind et al., 1995).

It is important to note that minimal research has been done as to the quality of sleep obtained while in-flight. Even in situations with cruise relief pilots, where one pilot can sleep in a crew rest compartment, little research has been completed on the quality of sleep obtained by the pilot in this situation. Some research suggests that in-flight sleep is of a lower quality than sleep experienced on the ground (e.g., in a hotel) and less time is spent in the REM stage when sleeping in-flight (Signal, Gander, van der Berg, & Graeber, 2013). Also, there may be severe decrements in functioning upon awakening from in-flight sleep. This *sleep inertia* is defined by Hartzler (2014) as a period immediately after awakening in which individuals can suffer from cognitive impairments, mood impairments, and over-reaction to stimuli.

Prior Consumer Perceptions Research on CRIP

The FAA is not the only agency impacted by regulation on CRIP. Another group that would be impacted is the traveling public. Some research has been done on the consumer perception facet of CRIP. Winter et al. (2015) performed a preliminary investigation into consumer perceptions of CRIP, including the emotionality associated with those flights. In this study, consumers were significantly less willing to fly when controlled rest was being utilized in the cockpit than when it was not (Winter et al., 2015). Females were also significantly less willing to fly in the controlled rest condition than males were (Winter et al., 2015). Furthermore, affect was shown to fully mediate the relationship between the condition and willingness to fly; showing that the decision not to fly when CRIP is in use is largely influenced by emotionality (Winter et al., 2015).

Need for a Phenomenological Approach to CRIP

This study utilizes a qualitative phenomenological approach to understand pilot perceptions. The phenomenological approach centers on individual lived and shared experiences within a particular phenomenon and are primarily assessed through qualitative methods (Lester, 1999). Though a phenomenological approach does not always lend itself well to generalization, it can be a useful tool for gauging a specific sample or population's views on a phenomenon (e.g., CRIP). This study investigates CRIP through the lens of commercial pilots. Prior research on CRIP focuses on quantitative issues such as pilot reaction times and subjective ratings of tiredness or alertness. Pilot opinions on CRIP, in general, are essentially unassessed. There is a significant gap in the literature where attitudinal data of pilots are not discussed, nor a qualitative methodology utilized.

Whether or not CRIP is shown to be empirically valuable, pilots may refrain from using the process if they find it dangerous or unhelpful, and their attitudes toward it could have a significant impact on their behaviors. Similarly, some pilots may take advantage of it whether or not it is explicitly allowed. In addition, pilots have a unique insight into aviation culture implications, as well as any possible ways their superiors may take advantage of CRIP regarding scheduling. Prior research has shown a strong connection between attitudes and behavior (Ajzen, 1991; Ajzen & Fishbein, 1980; Fishbein & Ajzen, 1975).

Methods

Design and Research Questions

The study uses a qualitative design with additional descriptive statistics to identify the various research questions. This research followed ethical protocol for human participant research with oversight from the Institutional Review Board at the research university. The overall research questions under investigation in this study were: a) what will be pilot's general perceptions on the implementation of controlled rest in position in the United States, and b) what will pilots perceive as the advantages and disadvantages of the possible implementation of controlled rest in position?

Participants

The study was posted on Curt Lewis' Flight Safety Info daily newsletter (www.fsinfo.org) for two weeks. The newsletter gets emailed to subscribers each weekday, and the link to the online survey was placed within this email. There were 30 (5 female) licensed commercial pilots from the United States who voluntarily took part in the study. The mean age was 52.97 (SD = 9.06) years. In order to participate, participants must have been current commercial airline pilots.

Procedure and Materials

Participants were first provided with an informed consent form as part of the online survey, which they signed before beginning the study. They were then presented with the following description of CRIP:

> *"Controlled Rest in Position (CRIP) allows pilots to nap while remaining in the cockpit seat during the non-critical stages of flight. Take-off, climb, approach, and landing are considered the critical phases of flight, whereas when the aircraft is at cruise altitude, it is considered non-critical. Controlled rest in position (CRIP) has been suggested as a viable countermeasure to the Federal Aviation Administration (FAA) in the ongoing efforts to combat in-flight pilot fatigue. It is already in use in other parts of the world;*

> *however, it is not currently permitted in the United States. In some countries where CRIP is used, they have a strict policy on how it is implemented. For example, when the pilot wants to take a nap, s/he has to inform the co-pilot and flight attendants. When the pilot wakes, s/he cannot perform any essential tasks until s/he is fully awake (e.g., 20 minutes). However, this does not apply to emergency situations, where the pilot might be expected to operate the aircraft immediately."*

Following this, participants were asked for basic pilot demographics such as flight hours and ratings. A full list of questions can be found in Appendix A. Then participants were asked to fill out the CRIP questions also found in Appendix A. Participants were allowed to opt out of any questions, however, an initial data screening found no missing data. Participants were then asked to provide some feedback on the strengths and weaknesses of CRIP followed by any last thoughts they had on the topic. Participants were asked to provide basic demographics including age, ethnicity, gender, and nationality. Lastly, participants were debriefed and dismissed. There was no monetary compensation for this study. All participants volunteered willingly.

Results and Discussion of Themes

Descriptive Statistics

Participants reported a mean total number of flight hours as 13,469 (*SD* = 7,692) with 11,411 (*SD* = 7,480) hours of commercial flying. Twenty-four of the participants reported flying for a Part 121 air carrier, four flew Part 91 business/corporate, and the remaining participants flew Part 91K or Part 135. All but one participant reported holding an Airline Transport Pilot (ATP) certificate.

Regarding the type of flying completed by participants, 63% flew "narrowbody" aircraft and 37% flew "widebody" aircraft. Figure 1 depicts the types of routes flown. When asked what percentage of their flights were "red-eye" or overnight flights the mean response was 32.41% (*SD* = 30.90%). The range of responses to this question was from 0% to 100%, which resulted in a large standard deviation. Therefore, the median value of 20% was also calculated.

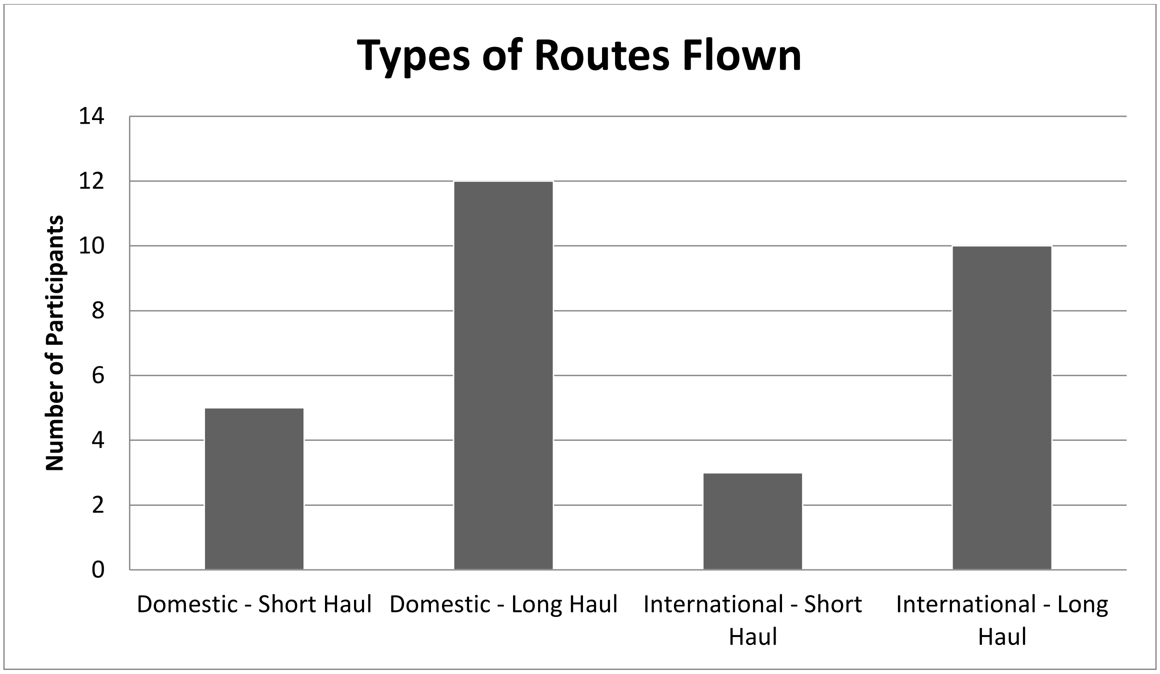

Figure 1. Types of routes flown by participants.

Participants were asked to identify how strongly they would disapprove or approve of controlled rest in position being implemented in the United States. Figure 2 identified the responses from participants and 70% either would approve or strongly approve.

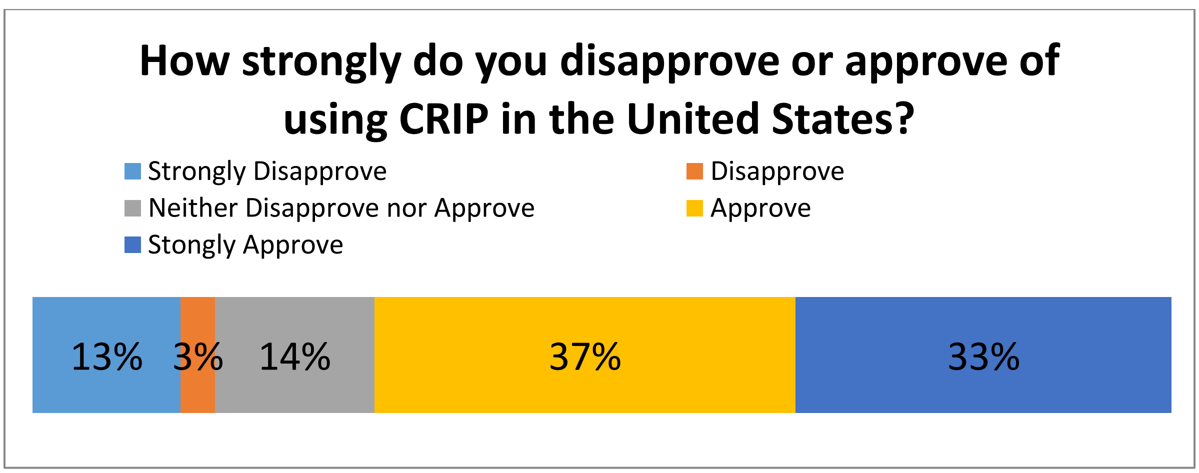

Figure 2. Participants disapproval or approval on the hypothetical implementation of CRIP.

Participants were then asked a series of questions as shown in Table 1 to gather their insights into how they felt CRIP should be applied if implemented in the United States. Participants, on average, felt 1-2 naps should be completed per four-hour block, with the length of each nap just less than 45 minutes. Participants indicated that they felt the napping pilot should be awake for just over 15 minutes to get over sleep inertia before re-engaging in-flight responsibilities (assuming a non-emergency scenario). When multiple CRIPs would be allowed within a single flight, participants felt there should be just under 70 minutes between naps. Participants were somewhat divided on their views of whether CRIP could be used differentially dependent upon pilot flight hours. While some expressed the need for experience, others stated that fatigue effects all pilots regardless of experience. Lastly, participants were asked how long from takeoff and how long before landing should CRIP be allowed. On takeoff, many expressed CRIP should not be used any sooner than the top of climb plus 15 minutes, or around 45 minutes, on average. Before landing, many participants stated CRIP should be used no later than 30 minutes before the top of descent or just over one hour before landing.

Lastly, participants were asked whom the flight crew should notify before CRIP and who should wake the pilot. Many participants indicated multiple individuals should be notified before CRIP; most commonly the other pilot and lead flight attendant. Most participants felt the other pilot should be the one to wake the napping pilot, but many also indicated any flight crewmember.

Table 1

Participant feedback on the application of CRIP

Questions on hypothetical CRIP Application in the U.S.	*Mean* (*SD*)
What should be the **maximum number** of CRIPs allowed per pilot per four-hour block during a flight?	1.44 (0.63)
What should be the maximum time (**in minutes**) allowed per CRIP?	42.41 (28.30)
How long (**in minutes**) should the pilot be required to be awake after a CRIP before continuing flight operations (assuming a non-emergency scenario)?	16.64 (13.40)
If multiple CRIPs were allowed per flight, how long a duration (**in minutes**) should there be between each CRIP for a single pilot?	68.50 (54.87)
What should be the minimum flight length (**in minutes**) before allowing CRIP?	120.92 (94.58)
What should be (if any) the minimum type specific **flight hours** (in model) a pilot has before being allowed to use CRIP? (For example, if a pilot is on IOE or a high minimums captain).	118.40 (175.97)
How far from to takeoff (**in minutes**) should CRIP be allowed?	45.89 (34.51)
How close to landing (**in minutes**) should CRIP be allowed?	66.12 (34.82)

Qualitative Analyses

The primary goal of this study was to examine the pilot's responses to the potential use of CRIP in the United States and what regulations should be in place if CRIP were to be implemented. In order to gather this information, participants were asked to provide information on the following topics: a) What should the non-CRIP pilot be required to do during CRIP; b) What conditions should preclude CRIP; c) What are the strengths of CRIP; d) What are the weaknesses of CRIP; e) If CRIP were implemented, what recommendations did they have to offer about CRIP; and f) What additional feedback did participants have? The results of each question are presented in order below.

The data from these six questions were analyzed with NVivo; a software program designed specifically to organize, analyze and code qualitative responses from participants. NVivo provided word clouds that revealed the most common phrases and terms that participants used in their responses. It also helped collate the data regarding participants' attitudes and perceptions about CRIP. Figure 3 presents a visualization of the process used to complete the qualitative analysis portion of the study. In summary, the first four questions of interest were collated and summarized on the basis of the linguistic answers provided. The first question on the actions of the non-CRIP pilot was condensed into a word count of suggested actions. The second question regarding preconditions leading to CRIP was summarized as a table identifying the most common responses of conditions that prohibited the use of CRIP. The third question about the strengths of CRIP was summarized into a set of common themes through a group map. The fourth question involving weaknesses of CRIP was analyzed via a hierarchy chart. In each of the following analyzes representative qualitative responses are provided in support of the key ideas and the comments are preserved verbatim. Questions five and six were coded manually for common themes. Recommendations for CRIP implementation is discussed in its own section while responses to question six are included throughout the results where appropriate.

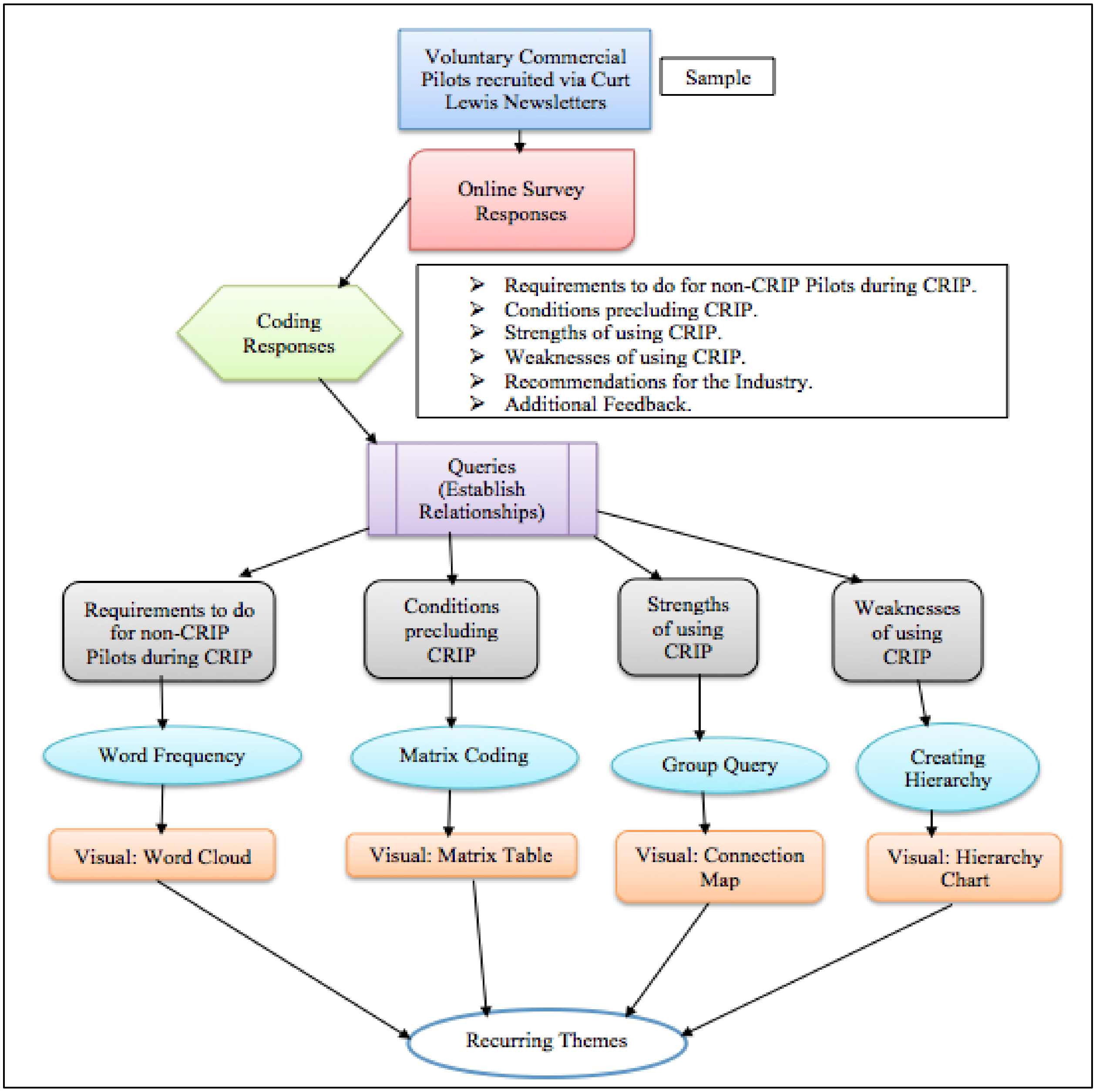

Figure 3. NVivo - Qualitative Data Analysis Software – Data Visualization

Non-Pilot Activity. The first qualitative question asked, “what should, if anything, the non-CRIP pilot be required to do during the CRIP”? NVivo provided a word frequency count for these data identifying which terms were most commonly associated with actions for the non-CRIP pilot. These data are also visualized in Figure 4 that demonstrates not only the frequency of the word responses but the thematic distance between terms, such as "stay" and "awake" being terms that appear frequently in tandem as identified by how proximal each word is to the other. These data revealed that staying awake was the most important topic in the participants' minds. A majority of participants responded to this question with the answer of "stay awake," with one participant highlighting that this can be a real concern in the cockpit by stating “remain awake-have seen both pilots asleep before.”

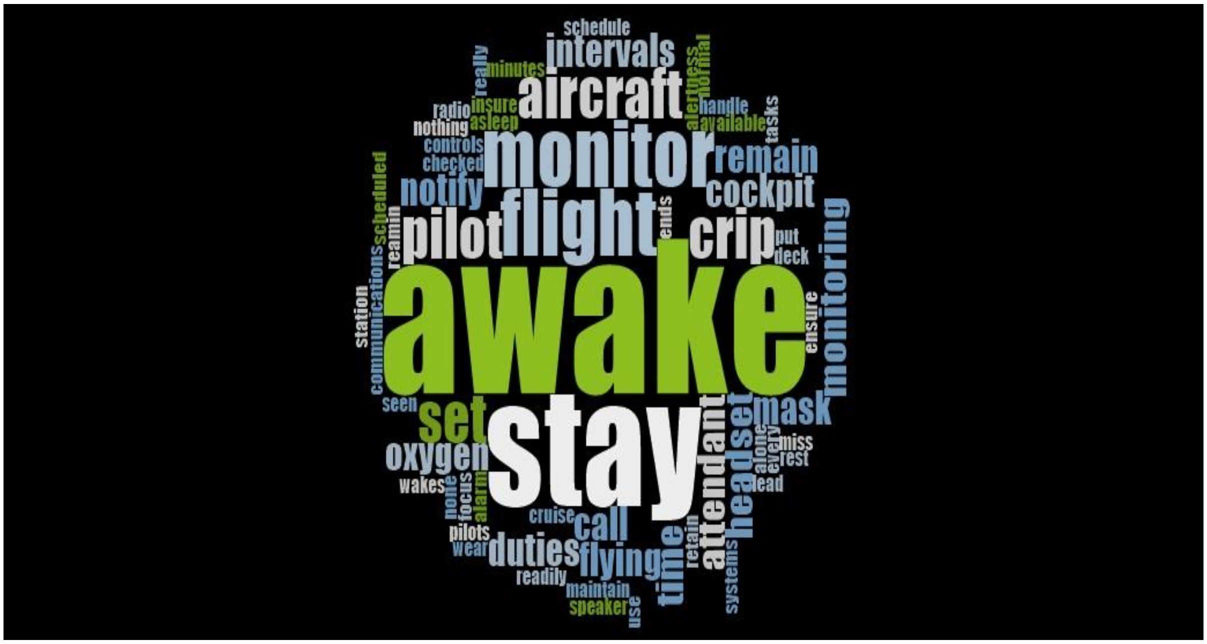

Figure 4. Requirements to do for non-CRIP Pilots during CRIP.

Along with this advice, pilots mentioned several other things that the non-CRIP pilot should do during a CRIP period, including monitoring tasks in the cockpit and notifying the flight attendant at scheduled times as identified by quotes such as "monitor flight controls and communications," "cockpit monitoring tasks on set schedule," "flying the aircraft, monitoring systems," "monitor aircraft and ensure CRIP pilot wakes on time," and "monitor rest time for CRIP pilot. Lastly, participants suggested to notify flight attendant[s] at scheduled intervals (or be checked by a flight attendant at set intervals (about every 10 minutes)."

Another common theme was to either don an oxygen mask or have it at the ready; this follows compliance with Federal regulations in the United States that requires, one pilot to don an oxygen mask when the other pilot leaves the flight deck if the aircraft is above FL 350. Comments from pilots in this theme included "stay in flight deck, only in cruise. Put on O2 mask," "remain on oxygen mask," and "have Oxygen readily available."

A fourth theme revolved around maintaining position at the station and avoiding distracting activities, presumably so that the non-CRIP pilot does not lose track of time or situation awareness. Quotes in this category included "remain at their station," "wear headset. To retain focus and not miss a radio call," "maintain alertness and SA," and "use headset – not speaker."

These four themes of staying awake, monitoring the cockpit, donning an oxygen mask, and maintaining awareness demonstrate that pilots feel there are activities required by the non-CRIP pilot to be performing in order to maintain safety under the conditions of the other pilot pursuing CRIP.

Conditions Preventing CRIP. Figure 5 is a matrix frequency table that reveals that weather and diversions were significant themes for the question regarding which conditions should prevent the use of CRIP. A particular type of query within NVivo software is the matrix coding query, where different nodes such as weather conditions and deviations were defined as rows and conditions precluding CRIP was as a column, respectively. The matrix table presents the coded qualitative data in numerical form, where each unit represents the number of times the information was coded in each node. The entities of matrix frequency table were presented in descending alphabetical fashion. The analysis of results from matrix coding query indicated that many of the respondents focused on weather issues, indicating that they did not feel it was safe to use CRIP during poor weather conditions, abnormal situations or time requiring diversions. Typical quotes supporting this theme include statements such as “severe weather…any other condition that is not normal cruise operations,” “turbulence, storms, anything that would disrupt a normal cruise,” “absolutely – adverse weather, mechanical, diversion, reroute…,” “deviating through weather,” and “severe WX, if diversion necessary, cabin disruption.”

A second common theme for conditions preventing the use of CRIP included course deviations not related to weather, including traffic and complicated airspaces. Respondents clearly felt that pilots should stay awake during any period of time that was outside of normal cruise operation such as “diversions, abnormal systems operation,” “any deviation from course, alt chg, clearance modification, etc.,” “poor weather, diversions, abnormal procedures,” “weather requiring deviations, abnormal operations,” and “any conditions that would require a change of course.”

	A : Conditions precluding CRIP
1 : Weather	10
2 : Unusual	1
3 : Turbulence	3
4 : Threat	1
5 : Storms	1
6 : Severe	2
7 : Safety	1
8 : Operations	2
9 : Normal	5
10 : Judgement	1
11 : Fuel	1
12 : Events	2
13 : Emergency	1
14 : Diversions	6
15 : Disruption	1
16 : Deviations	3
17 : Cruise	3
18 : Conditions	1
19 : Clearance	1
20 : Change	1
21 : Cabin	3
22 : Adverse	2
23 : Abnormal	6

Figure 5. Conditions when CRIP should be precluded depicted as a matrix table.

The last big theme in the responses to this question involved unusual cabin activities and other non-normal situations, including emergencies. Qualitative statements in this category included "non-normal passenger cabin situations," "if disagreeable customers were identified in the cabin previously," "CRM applies," "WX, non-normal events, any event that require crew coordination," "emergency situations," and "any non-normal or abnormal situation, including non-routine routings and crew pairings."

When questioned about conditions that preclude the use of CRIP pilots provided responses that suggested that three key themes are of concern: weather and environmental factors, course deviations, and abnormal situations. These responses from pilots identify that pilots are sensitive to factors that influence the use of CRIP in the cockpit.

Strengths of CRIP. Figure 6 displays a group query that gives some clues about what participants were thinking when they responded to the question about the benefits of using CRIP during flights. Group query is a technique that helps to find the associations between concepts discussed under strengths of using CRIP. The corresponding visual for the group query was a connection map, where the nodes show associations between strengths of using CRIP (scope item) and different concepts like tool, tired, or staffing. The scope item is defined as the primary theme, in this case, the strength of CRIP, which is then associated with other second level items (range items). The range items are defined as the items grouped under the scope item. In context of this study, various range items grouped under strengths of using CRIP (scope item) were tool, tired, staffing, schedule, safer, rules, rested, recovery, nap, mitigation, mistakes, landing, immediate, hours, haul, fatigue, critical, crews, blame, awake, approach, alertness, and ability. In Figure 6, the branches of the connection map were presented with a hierarchy of nodes (for example, Strengths of CRIP\Tool or Strengths of CRIP\Tired), and this redundancy of items cannot be eliminated, which was considered as a limitation of NVivo software. From Figure 6a and 6b, fatigue and alertness are critical issues for maintaining safe conditions during flight, and most participants felt that CRIP would help to relieve these issues as evidenced by responses such as "fatigue is real and affects performance," "small controlled naps following prescribed rules allow recovery from fatigue for 3-4 hours," "improve crew alertness," "the ability to regain full capability during a long flight/back side of the clock operation," "it 'does' help with fatigue if managed properly," and "helps pilots recharge and be more alert."

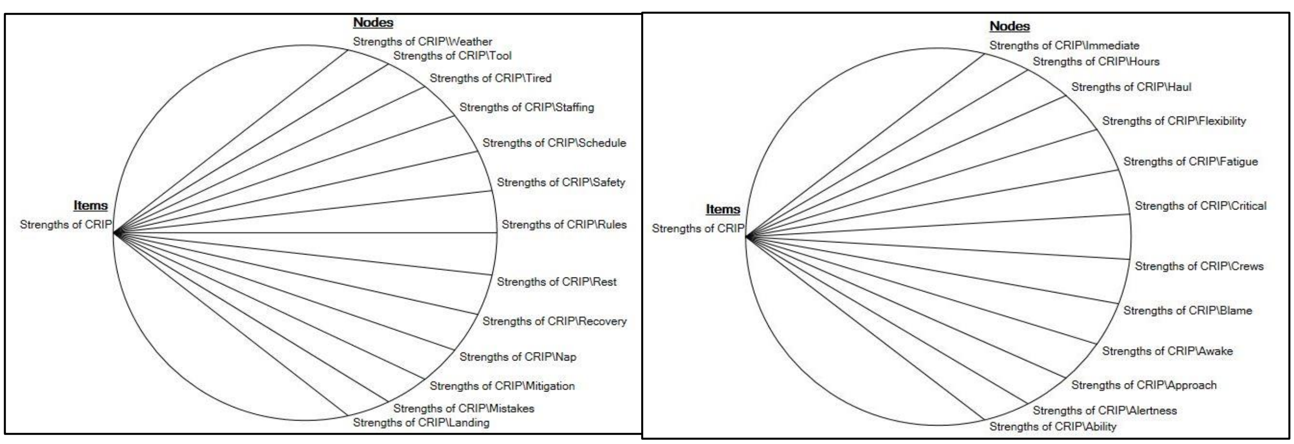

Figure 6a (left) and 6b (right). Strengths of CRIP depicted in a group query analysis. The branches depict the common themes in response to the question.

Participants also felt that CRIP would legitimize the rest periods as demonstrated by comments such as "legitimize tool to combat inflight fatigue," "20-minute power nap," and "it's much better to nap than nod." These data demonstrate that pilots do feel that CRIP has multiple benefits to its use even to the point of legitimizing unsanctioned behavior that is already occurring.

Weaknesses of CRIP. Participants were not all positive about CRIP and the opportunity to point out any weaknesses associated with CRIP was provided to respondents. Figure 7 is a hierarchy chart that serves as a visualization tool for nodes. The hierarchy chart was presented as a collection of nested rectangles of different sizes. Size is an important parameter of the hierarchy chart where bigger sized rectangles indicate a node with a significant amount of information coded. The algorithm behind the hierarchy chart was designed to place the larger rectangles at the top left of the chart, and smaller ones were displayed towards the bottom right of the chart. The aggregate data on weaknesses of using CRIP was presented as various themes in the hierarchy chart, such as pilots, tiredness, or policies. Additionally, major themes like pilots, no weaknesses, or asleep have more coded information when compared to other themes like dozing, cockpit, or alarms that are placed at the bottom right of the chart.

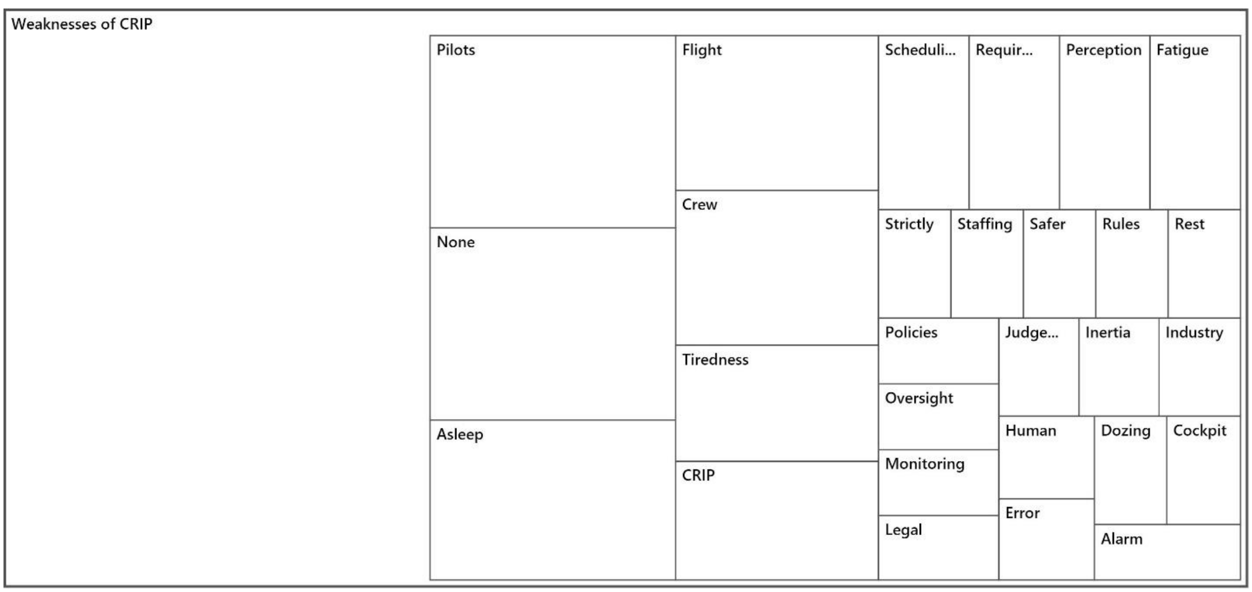

Figure 7. Weaknesses of CRIP shown in a hierarchy chart. Word position and size of the box indicates how commonly terms appeared in participants' answers.

This hierarchy chart reveals that many of the participants were of the opinion that there were no weaknesses to CRIP as long as it was implemented properly. Quotes illustrating this point include "none !! its definitely needed to be legal. Its being done anyway," "none provided there is external monitoring of crew to avoid non-CRIP pilot from dozing off," and "none – a safer way to fly."

However, some participants suggested possible weaknesses to CRIP. One common theme that seemed to arise was the fear that airlines would take advantage of CRIP in various ways that could only be implemented if CRIP were legal. These included comments such as "the industry will try to use this to weaken augmented flight crew requirements," "a patch for a failed scheduling and crew pairing vice a viable solution of better crewing and staffing," and "that crews would not strictly adhere to the polices, or that some pilots would scoff at or not allow CRIP on their flight. All of the crew must be in agreement to employ CRIP."

Another concern to pilots was whether or not the non-CRIP pilot could stay awake during a CRIP. Several participants were concerned that implementing CRIP could more easily result in both pilots falling asleep. Another related concern was that the non-CRIP pilot would wake up the CRIP pilot and then go to sleep herself/himself immediately afterward. For example, comments were provided like "what happen[s] when both pilots fall asleep due to a Fatigued schedule. Who is flying the aircraft then," "how to make sure other pilot doesn't go to sleep," and "both pilots falling asleep. Need loud alarm like B777 has."

Finally, two participants pointed out that using CRIP may not be conducive to public perception. These two comments were "would American passengers be willing to fly in an airplane when they know the pilots are allowed to sleep during cruise" and "public perception [will be negative]."

The responses to the question of weaknesses of CRIP were mostly uniform in the lack of weakness save for some concerns about the format of implementation and its impact on the pilots in the cockpit depending on that implementation. These comments suggest a generally positive view of CRIP with some caveats.

Pilot Recommendations for CRIP. There were quite a few responses to this question as participants highlighted several themes here. The first theme revolved around making sure that CRIP was used as a fatigue management tool, and not a substitute for getting good rest as reflected in the comment "use CRIP as a fatigue management tool, not a substitution for crew rest."

Another theme revolved around making sure that CRIP was correctly implemented, with safety taking the forefront in its implementation. This theme was seen in the following examples: "implement it but with training and safety guards in place," "during CRIP, crew should be checked every ten minutes by a non cockpit crew member. CRIP should not be allowed without external monitoring of crew," "have a defined and explicit plan, and the ability to CRIP should be part of the crew brief," and "industry wide data collection from multiple airlines and combined effort from scientific consultants would be needed for FAA approval. Each airline would have to adopt the same procedures." Two other comments included "minimize the required parameters. Professionals know how to operate have the ability to operate in the safest way," and "strictly monitor results and modify procedures, staffing, crew pairings via the FRMS."

Lastly, many participants indicated that they would want post-implementation data to ensure that CRIP is working and is being used properly. This should be supported by both the FAA and the pilot unions as seen in statements such as "strictly monitor results and modify procedures, staffing, crew pairings via the FRMS," "some confidential way to keep track of how much it is being used," "qualified pilots would have to ride in jumpseat to protect the flying public from data collection phase with one pilot sleeping until FAA approves practice under FRMS," and "include it in CRM [Crew Resource Management] training."

A typical series of suggestions regarding the implementation of CRIP from pilots included concerns about CRIP being used as a replacement for getting solid rest, proper implementation, and a need for proper assessment once CRIP was implemented to make sure this regulation did not generate a detriment to pilot performance.

Feedback from Current CRIP Implementation. There were some comments provided in the section of the survey that provided additional feedback. Many of these comments repeated what was reported already; however, some additional comments were not captured in the previous analyses. Twelve additional participants who identified as flying for international airlines and who may already use CRIP also participated in the data collection. Since these individuals were outside of the scope of the current study, their responses were removed from the dataset before the reported analysis of the data because there were outside of the United States and may already be using CRIP. However, their comments are valuable as a lens for understanding ideas from those who are already experienced with CRIP. Their comments are included for this section only in combination with the other participants. Many of these twelve international participants saw that CRIP does work for them and should be implemented with a minimal rule set. Other participants noted that it is already being used elsewhere and should be used in the United States as well. Quotes from pilots in this area were numerous and included statements such as "CRIP works best with a general common-sense minimal rule set. I have been flying with it for over 20 years," and:

> I've been using CRIP for almost 12 years now. It works well. Our procedures says to turn the loudspeakers down but I keep it up. There are times when I am in a light sleep and can still hear the radio calls and can help the other pilot. If it is too quiet in the cockpit, the tendency is to oversleep. Worse is to extend your sleep to find the other pilot micro-sleeping. CRIP is better than micro-sleeping on descent and approach.

Other comments include "we CRIP in QUANTAS and under a FRMS it will become another fatigue mitigator PS," "CRIP works VERY well," "pilots have always used and are currently using crip to manage alertness," and "ICAO has adopted CRIP, the US Military has adopted CRIP and several foreign carriers are as well. NZ, and Air Canada being two."

It is clear from comments like this that CRIP is already implemented in other countries and is viewed in a favorable light.

General Discussion

The purpose of this study was to assess the attitudinal data of commercial airline pilots regarding the possible implementation of controlled rest in position. Prior research has studied and demonstrated the benefits of CRIP (NASA, 1994; Rosekind et al., 1995) and the perspectives of consumers (Winter et al., 2015), but a gap existed in the literature on how commercial airline pilots viewed CRIP.

The majority of participants approved or strongly approved the use of CRIP in the United States. The suggested time lengths of naps seemed to parallel that suggested in the scientific research. Therefore, it is possible that participants may be familiar with existing information on controlled rest in position or their practical experiences match what was found in the scientific research. Regardless of the reason (which is impossible to determine from this study), the data indicates that the attitudinal data of participants is similar to that recommend through scientific investigation. This commonality may be useful if regulators ever attempt to implement policies and procedures that would allow CRIP in the United States.

Participants identified the importance of the second pilot remaining awake when the other pilot was resting. Maintaining a set schedule of tasks, oxygen usage, and headset usage were all items suggested by participants to maintain the awareness and alertness of the non-resting pilot. However, participants also recognized that there were conditions in which CRIP should not be used such as during periods of severe weather en route or if a disruptive passenger was identified in the cabin. These conditions could undoubtedly increase the workload of pilots, and therefore, may require more attention of both pilots, suggesting CRIP would not be appropriate in those situations.

Participants seemed to acknowledge the effect fatigue has on performance. A common theme identified by participants was how the use of a short nap (20-30 minutes) could improve alertness for 2-4 hours. However, participants also indicated that implementation of CRIP might affect (perhaps unintended) on the overall scheduling of crews that could result in increased fatigue due to shorter rests between shifts due to the assumption that the pilots would nap during the flight and rest via CRIP. If CRIP is pursued, there should be a balanced approach between CRIP implementation and the legal flight duty limitations.

Finally, pilots stressed the importance of adequately implementing CRIP. Pilots indicated that passengers might not like the idea and pilots emphasized the need for training and safeguards to prevent a reduction in safety. Suggestions included the airlines working together with government to obtain the needed approvals and adoption of the same procedures.

Practical Applications and Recommendations

This study offers valuable information from the group of individuals that would be most affected by CRIP implementation: the pilots. The data from this study offers some valuable insight into the attitudinal data of current commercial airline pilots. While the majority of participants favored the use of controlled rest in position, there were still concerns over how CRIP, if adopted by the FAA, could impact crew scheduling. Participants also expressed an interest in follow-up studies to verify any implementation of CRIP had the desired outcomes. If CRIP is considered for implementation in the United States, regulators should consider the end users, pilots, as they draft legislation to help ensure the rule change would have the desired outcome of reducing pilot fatigue.

Industry representatives, members of the government, and regulators may be interested in the findings of these studies. While prior research (Rice, Winter, Tamilselvan, & Milner, 2017; Winter, Carryl, & Rice, 2015) has demonstrated consumers may be less willing to fly if CRIP was used, pilots have expressed a strong desire for its implementation. The data presented by participants in this study provides valuable thoughts and insights that could be utilized by those who would be in charge of proposing, implementing, and monitoring CRIP in the United States. While participants tended to favor CRIP implementation, they still identified areas of concerns related to government and regulation such as proper policies and procedures and ensuring safety. If CRIP would be implemented, continued research should be conducted to measure the effect of the new rules and its implementation.

Limitations

Certain limitations were present in the current study. The participants that were used in this study only consisted of those that received the Flight Safety Newsletter, and therefore, their attitudes may not match the attitudes of the greater population of commercial airline pilots. The study also only collected data at one point in time over a two-week period and therefore a longitudinal study may reveal differing attitudes of participants toward CRIP. Lastly, the researchers developed the instrument used in the data collection. Further validation of the instrument and findings is recommended.

Conclusions

The purpose of this study was to fulfill a gap in the research on controlled rest in position; that being the attitudinal data from commercial airline pilots. While a few countries have implemented the used of CRIP the United States has not. This study sought the input from commercial airline pilots on the advantages, disadvantages, and implementation aspects of CRIP. The findings indicate that the majority of participants favor the use of CRIP, but many expressed the need to have proper policies and procedures in place to ensure safety was not compromised. There were specific issues in which participants indicated that CRIP should not be used, such as thunderstorms or a disruptive passenger in the cabin. Concerns were expressed that implementation of CRIP may have unintended consequences of harsher crew scheduling, and procedures should be in place to prevent both flight crew members from falling asleep. Participants provided their recommendations on how often, how long, and how they thought CRIP could be successfully implemented in commercial aviation.

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Appendix A: Instrument

Pilot Demographics

How many commercial flight hours do you have?

Please indicate the highest pilot certificate and ratings that you have (check all that apply):

How many total flight hours do you have?

Do you primarily fly (please select one)?

CRIP Questions

If CRIP were used in the United States, what should be the maximum number of CRIPs allowed per pilot per four-hour block during a flight?

In general, how strongly do you approve or disapprove of using CRIP in the United States?

If CRIP were used in the United States, what should be the maximum time (in minutes) allowed per CRIP?

If CRIP were used in the United States, how long (in minutes) should the pilot be required to be awake after a CRIP before continuing flight operations (assuming a non-emergency scenario)?

If CRIP were used in the United States, who should the pilot be required to notify before using CRIP? (Check all the may apply).

If CRIP were used in the United States, who should be allowed to wake up the pilot from a CRIP?

If multiple CRIPs were allowed per flight, how long a duration (in minutes) should there be between each CRIP for a single pilot?

How close to landing (in minutes) should CRIP be allowed?

How far from to takeoff (in minutes) should CRIP be allowed?

What should be the minimum flight length (in minutes) before allowing CRIP?

What should, if anything, the non-CRIP pilot be required to do during the CRIP?

What should be (if any) the minimum type specific flight hours (in model) a pilot has before being allowed to use CRIP? (For example, if a pilot is on IOE or a high minimums captain).

Are there any type of environmental/weather conditions that should preclude CRIP? If yes, what environmental/weather conditions?

Additional Feedback

What do you view as the strengths offered by using CRIP (if any)?

What do you view as the weaknesses offered by using CRIP (if any)?

What recommendations would you offer to the industry if CRIP was implemented?

Please provide any additional feedback that you wish to share. Again, your responses are completely confidential.

Demographics

What is your Age?

What is your ethnicity?

Are you male or female?

What country are you from?