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Pilot Study on Annual Horse Movements by Air and the Possible Effect of the Covid-19 Pandemic

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1 **Pilot study on annual horse movements by air and the possible effect of the COVID-19**  
2 **pandemic**

3  
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26 **Abstract**

27           There is a lack of information on the number of horses shipped globally by air annually,  
28 the purpose of air travel and the routes of their journeys. This pilot study aimed to collect  
29 retrospective data on the international movements of horses by air from 2018 to 2021, describe  
30 their routes, and identify the possible effects of the coronavirus SARS-CoV-2 (COVID-19)  
31 pandemic. Equine transport data was gathered from 7/15 international shipping companies  
32 (ISCs) and 5/8 airlines contacted by email. The seven ISCs performed a median of 10,401  
33 horse movements annually, ranging from a few hundred to several thousand movements per  
34 company, most frequently in Europe (Western and Northern Europe), Middle East/Africa  
35 (Middle East, Southern Africa), Asia Pacific (Australia), and the Americas (North and South  
36 America). The five airlines performed a median of 10,656 horse movements annually,  
37 importing and exporting horses to and from Europe, North America, Australasia, and the  
38 Middle East. For all but one airline, the number of horse movements decreased in 2020. The  
39 number and journey characteristics of horses transported by air require further scientific studies  
40 focused on the epidemiological and welfare risks unique to this type of transport to enable the  
41 development and implementation of best practices and regulations based on objective evidence.

42

43 *Keywords:* air transport; movements; COVID-19; horse; routes

44

## 45 **1. Introduction**

46           After humans, horses are the species that travel the most by air [1] for various reasons,  
47 including breeding, equestrian competitions, racing or sales transactions [2, 3]. Horse  
48 movement, even with quarantine, is a biosecurity risk [1]. For example, the 2007 Australian  
49 equine influenza outbreak occurred when an infected stallion entered quarantine, and the virus  
50 escaped, most likely via human error. Air transportation of horses also increases their risk of  
51 poor health and welfare [4]. The most reported health events associated with air transport are  
52 body weight loss, dehydration, leucocytosis, and respiratory and gastroenteric disorders [5].

53  
54           The collation of basic information for each horse movement event (e.g., number of  
55 annual horse air movements and air routes) is an essential first step in understanding the  
56 biosecurity and welfare risks associated with air travel. However, information on the number of  
57 horses moved by air annually and air routes are not publicly shared [6, 7]. Moreover, it is  
58 unclear whether the coronavirus SARS-CoV-2 (COVID-19) pandemic affected the equine air  
59 transport industry, as reported in other transportation sectors [8]. Our study aimed primarily to  
60 collect the number of horse movements yearly between 1 January 2018 and 31 December 2021  
61 and the traveled routes, and secondarily to detect possible effects of the pandemic.

## 62 63 **2. Material and methods**

### 64           *2.1 Data collection*

65           In 2022 one of the authors (BP), a member of the Animal Transportation Association  
66 (ATA), asked ATA for the contact list of its members involved in the movements of horses by  
67 air. After receiving the contact list, the researchers emailed all these members, namely  
68 international shipping companies (ISCs) and airlines transporting equids, to collect details on  
69 the number of horses moved annually by air. ISCs and airlines were contacted several times by  
70 the researchers to obtain the precise number of horses moved. Despite this, ISCs and airlines

71 could not provide precise data on horse numbers since they do not record data based on the  
72 horse's identification but as "horse movement". It was consequently agreed with both ISCs and  
73 airlines that they would share the total number of 'horse movements' (i.e., single (one-way)  
74 movement from one location to another) performed each year from 2018 to 2021. Seven of the  
75 fifteen ISCs and five of the eight airlines agreed to provide data on horse movements and  
76 traveled routes. Companies that declined did so because they deemed these data commercially  
77 sensitive. The companies that provided data gave it in an aggregated form. Aggregation made it  
78 impossible to determine how many times an individual horse flew or to combine data from  
79 ISCs and airlines to produce a single list of horse movement events. The ISCs are hired to  
80 ensure the logistics of the movement and will work with different airlines depending on the  
81 availability of routes. Therefore, data from ISCs and airlines are presented separately.

82

### 83 *2.2 Data analysis*

84 Descriptive statistics were performed using Statulator® [9], while the Kruskal-Wallis  
85 test was used to evaluate the effect of "pre/post-COVID years" (2018/2019 vs. 2020/2021) on  
86 the horse movements [10].

87

## 88 **3. Results and discussion**

89 The participating ISCs organized a median of 10,401 horse movements annually  
90 (Interquartile Range (IQR): 9,013-11,700; minimum 8,399; maximum 12,048), mostly from  
91 and to Europe, Middle East/Africa, Asia Pacific, and the Americas (Table 1, Figure 1). Over  
92 the study period, the ISCs organized 41,248 horse movement events (Table 2).

93 The participating airlines made a median of 10,656 horse movements annually (IQR =  
94 9,091-12,759; minimum = 8,868; maximum = 14,596) on multiple international air routes  
95 (Figure 1). During the four years 2018-2022, the five airlines reported 44,776 horse movement  
96 events (Table 2). The difference in horse movements between ISCs and airlines is unsurprising

97 because we obtained data from only some of the ISCs or airlines that transport horses by air. It  
98 is worth noting that many companies refused to provide data, and others agreed only to provide  
99 it in aggregate form. This manner offers privacy to both industry members and horse owners.

100  
101 The ISCs data reported the highest number of movement events in 2018 and 2019  
102 (Table 2). The number reduction coincided with the 2020 start of the global COVID-19  
103 pandemic. Interestingly, the drop in horse movements was only observed for the median values  
104 and without demonstrable statistical significance in both ISCs and airlines data set (Figure 2).  
105 The years with the highest number of movements in the airlines' data set were 2019 and 2021  
106 (Table 2). The unexpected finding in the airlines' data can be explained by a single company  
107 that managed to increase the number of horse movements year-on-year despite the global  
108 COVID-19 pandemic. Whether this can be attributed to its position on routes less impacted by  
109 the pandemic, the company's ability to pivot, chance, or a combination of all three is unclear.  
110 The other airlines reported fewer horse movements in 2020, with the number increasing in  
111 2021.

112  
113 The reduction in horse movements in 2020 can be linked to several pandemic-related  
114 factors. Firstly, the movement of horses was reduced because of restrictions on racing,  
115 equestrian activities, and tourist activities [11]. Secondly, ISCs had to contend with a reduction  
116 in the workforce because flight grooms had to comply with quarantine periods, often at both  
117 ends of the trip [11]. Thirdly, the cost of transporting horses increased to accommodate  
118 increased spacing requirements [12].

119  
120 In the literature, Europe, the Middle East, and North America are the regions reported  
121 as being most frequently involved in equine horse transportation by air [13, 14]. However, in  
122 our study, Central and South America, Southern Africa, and Australasia were substantial

123 participants in the horse air transport business, making it a global transport practice. For this  
124 reason, horse air transport may constitute an important epidemiological risk for international  
125 disease transmission [1, 15] and a hazard for horse welfare [5].

126  
127         One of the significant limitations of the present pilot study is that only some global  
128 ISCs and airlines could be contacted. Of those contactable, only some agreed to share their  
129 aggregated data. Consequently, the yearly number of horse movements is likely an  
130 underestimate. Moreover, the precise number of horses moved yearly remained unknown  
131 because both ISCs and airlines count the single horse movements from one location to another,  
132 so a horse traveling two ways or more times in a year on different routes may have been  
133 counted multiple times in our dataset. Notwithstanding these limitations, this study has  
134 increased our knowledge of the number of horse movements performed by air annually, their  
135 routes and how the industry was affected by the pandemic. Furthermore, based on current  
136 industry approaches, air travel data collection markedly increases the difficulty of determining  
137 how many horses travel by air worldwide annually.

138

#### 139 **4. Conclusion**

140         Over the study period, approximately 10,000 horse air movements were documented  
141 annually, with a reduction in horse air movements in 2020 attributed to several COVID-19  
142 pandemic-related factors. The number of horse air movements is underestimated, and both this  
143 number and the travel routes information were obtained from a limited sample of participating  
144 shipping and air companies. The present study highlights the difficulty of estimating the  
145 number of horses and horse movement events in a year and the details of their journeys. It is,  
146 therefore, crucial that air transport industry members collaborate with scientists and competent  
147 authorities to provide data to underpin studies on horse air transport.

148

149 **Conflict of interest statement**

150           None of the authors of this paper has a financial or personal relationship with other  
151 people or organizations that could inappropriately influence or bias the paper's content.

152

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155 agreed to share their data: BBA Shipping & Transport Ltd, Cargolux Airlines Intl S.A., Etihad  
156 Cargo, European Horse Services, FedEx, Hobday Equestrian Enterprises, IRT, New Zealand  
157 Bloodstock Ltd, Overseas Horse Services Ltd, Qatar Airways Cargo, and T&T Corporation.

158

159 **Ethical Animal Research**

160           This research study has been approved by the University of Bologna Animal Ethics  
161 Committee (approval n° 118016).

162

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165

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230 **Table 1.** Regions, sub-regions, and countries involved in the ISCs' horse air movements during  
 231 the study period.  
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<b>Regions</b>	<b>Subregions</b>	<b>Countries</b>
Europe	Northern Europe, Western Europe, Eastern Europe	UK, France, Belgium, The Netherlands, Luxemburg, Germany, Russia
Middle East/Africa	Middle East, Northern Africa, Western Africa, Middle Africa, Eastern Africa, Southern Africa	Tunisia, Libya, Egypt, Senegal, Burkina Faso, Congo, Democratic Republic of Congo, Kenia, South Africa, Madagascar, Turkey, Israel, Jordan, Lebanon, Syria, Saudi Arabia, Kuwait, Bahrain, Qatar, United Arab Emirates, Georgia, Azerbaijan
Asia Pacific	Central Asia, Eastern Asia, Southern Asia, Southeast Asia, Eastern Asia, Australia, and New Zealand	Uzbekistan, India, Pakistan, Sri Lanka, Thailandia, Singapore, Indonesia, Taiwan, China, South Korea, Japan, Malaysia, Macau
Americas	North America, Central America, South America	Canada, USA, Mexico, Cuba, Guatemala, Costa Rica, Venezuela, Colombia, Ecuador, Perù, Brazil, Chile, Argentina

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241 **Table 2.** Descriptive statistics of the number of horse movement events reported by seven  
242 international shipping companies (ISCs) and five airlines from 2018 to 2021.

243

	ISCs				Airlines			
Year	Total	Median	IQR	Min-max	Total	Median	IQR	Min-Max
2018	12048	1045	390-2489	88-5159	8868	1900	748-2500	748-2700
2019	11584	1046	447-2219	50-5157	12147	2500	1264-2913	1264-3000
2020	9217	961	86-2003	34-4044	9165	1041	430-1400	430-5500
2021	8399	636	198-1635	59-4039	14596	1418	850-2928	850-8500

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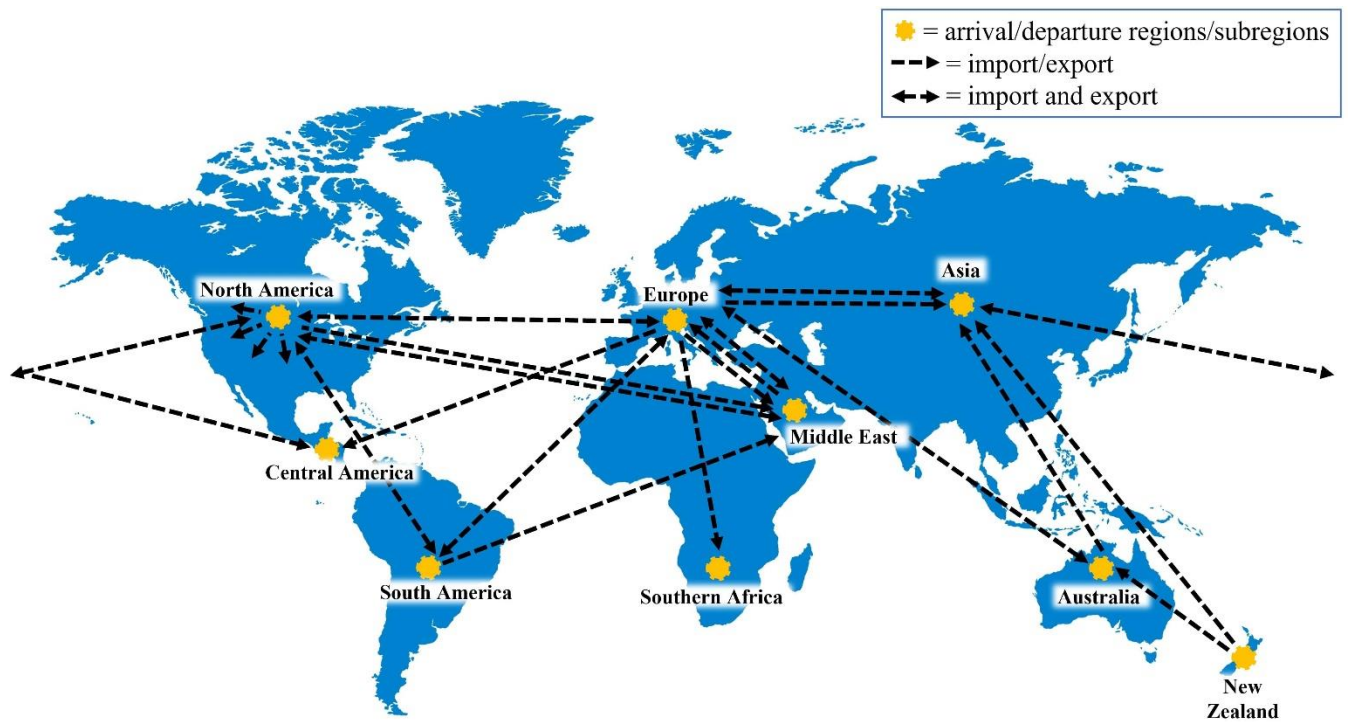
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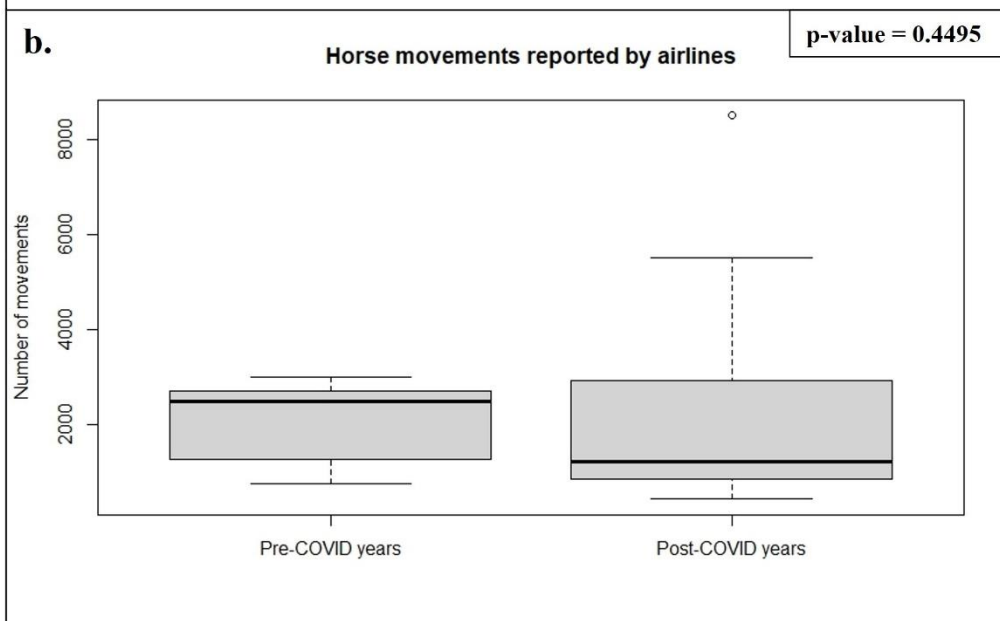
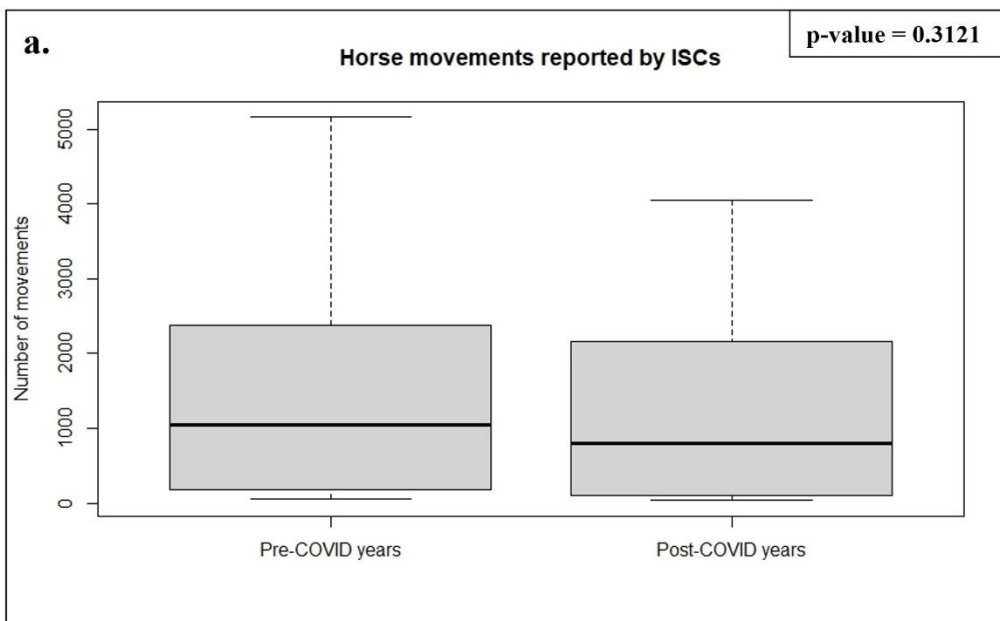
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260 **Figure legend**

261  
262 Fig 1. Routes of horse movements by air. Yellow dots indicate the regions of arrival and  
263 departure of horse air travel from 2018 to 2021. Dashed lines with one arrow indicate that the  
264 route is unidirectional. Dashed lines with two arrows indicate that the route is bidirectional, to  
265 and from that region.



266  
267  
268 Fig 2. Box plot showing the effect of pre-COVID years (2018-2019) *versus* post-COVID years  
269 (2020-2021) on the horse movements reported by seven International Shipping Companies  
270 (ISCs) (a.) and five airlines (b.). The black line within the boxplots represents the median value  
271 of horse movements recorded respectively for pre-COVID (left) and post-COVID years (right).  
272 The two vertical lines represent the first (lower line) and third (upper line) quartiles.



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