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1 **Parents' views on artificial intelligence for the daily management of childhood asthma:**
2 **a survey**

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26 **Clinical Implications**

27 The parents surveyed were divided about the implementation of artificial intelligence through
28 an autonomous algorithmic decision system in the management of their child's asthma. Most
29 preferred their physician to keep the control over the care provided to their child.

30

31 **Parents' views on artificial intelligence for the daily management of childhood asthma:**
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33 As asthma is the most common noncommunicable disease in children worldwide, and as data
34 sources (biomarkers, environmental data, connected objects) increase over the years, it
35 becomes possible to create very large datasets (big data) and train algorithms with the most
36 advanced techniques of artificial intelligence (AI) ¹. Soon, it may be possible to propose
37 timely delivery of effective personalised treatments for children with asthma through
38 algorithmic decision systems (ADS) autonomously suggesting changes in asthma treatments
39 and indicating when a medical review is required. The primary aim of this study was to
40 describe parents' perception of AI and to assess if they would accept/prefer an ADS for the
41 management of their child's asthma over current physician-based management. A secondary
42 objective was to identify the factors associated with a preference for using an ADS among the
43 parents surveyed.

44 Methods of this study are described in this article's Online Repository at [www.jaci-](http://www.jaci-inpractice.org)
45 [inpractice.org](http://www.jaci-inpractice.org). Briefly, a cross-sectional survey was conducted in four paediatric hospitals of
46 France with parents of children with asthma during the winter 2019-2020. Participants were
47 asked on their views on AI in the field of medicine, on the place of AI in medical decisions
48 about themselves and their child, and if they would accept/prefer an ADS which would avoid
49 most follow-up medical consultations for the management of their child's asthma over their
50 current physician-based management.

51 From the 321 eligible participants, 295 (92%) provided a complete questionnaire that could
52 be included in the analysis (for characteristics, see Table E1 in this article's Online
53 Repository at www.jaci-inpractice.org).

54 Regarding parents' views on AI in the field of medicine, 158 (63%) and 202 (68%) parents
55 agreed that AI could be useful in assisting physicians in the diagnosis and monitoring of
56 diseases, respectively (See Figure E1 in this article's Online Repository at [www.jaci-
58 inpractice.org](http://www.jaci-
57 inpractice.org)). By contrast, only 44 (15%) and 41 (14%) thought that AI could replace
58 physicians in diagnosing or monitoring diseases, respectively.

59 When asked to determine the respective positions of their doctor (human intelligence) and an
60 AI for medical decisions concerning their child, 60 (23%) parents responded that these
61 decisions should rely on their physician only, 174 (59%) on their physician sometimes
62 assisted by AI, 48 (16%) on their physician often assisted by AI. Only 13 parents (4%) were
63 supporting the idea of medical decisions relying on an AI supervised by their physician, and
64 none supported the idea of medical decisions taken by an AI only.

65 When asked if they would accept to use an ADS for the management of their child's asthma,
66 158 parents (54%) responded positively. To estimate further if they would prefer an ADS-
67 based management, they were asked to choose between a physician-based management
68 allowing to obtain asthma control in 60% of cases, and an ADS-based management with rates
69 of success between 50% and 90% (Figure 1). 134 (45%) parents never chose the ADS-based
70 management even if this system was associated with a rate of success 30% higher than the
71 physician-based management (level 0 of preference). At the opposite 11 parents (4%)
72 preferred the ADS-based management even if it performed worse (by 10%) than the
73 physician-based management (level 5). Between these two extremes, the cumulative number
74 of parents that chose the ADS-based management over the physician-based management
75 were 55 (19%), 96 (33%), 143 (48%) and 161 (55%) when the ADS-based management
76 outperformed the physician-based management by 0% (level 4 of preference), 10% (level 3),
77 20% (level 2) and 30 % (level 1), respectively. In the multivariate analysis, parents were
78 more prone to choose the ADS-based management if they had a professional/intermediate job

79 and owned a higher number of different digital devices, and less prone to choose the ADS-
80 based management if they attached a great importance to the physician-patient relationship
81 (Table 1).

82 This study highlights three important points: (1) parents were divided on whether to adopt
83 ADS for the management of their child's asthma; (2) this division was mainly based on
84 socio-economic factors, with parents with higher levels of employment being more likely to
85 use ADS than socially disadvantaged ones; (3) 64% of the parents surveyed would not accept
86 an ADS even if it provided better asthma control than usual care.

87 The development of AI applications divides people. In an online survey of 1183 adult
88 patients with chronic diseases in France (77 with asthma), only 50% of the patients felt that
89 the development of digital tools and AI in healthcare was an important opportunity². Higher
90 levels of education, higher levels of employment and higher household income have
91 frequently been found to be associated with positive views on AI and support for its
92 development³⁻⁶. The reluctance of parents belonging to the least-favored social classes to use
93 an ADS for their child's asthma management remains of great concern for the future
94 development of AI systems. If parents from lower social classes are reluctant to provide data
95 to train ADS, they will be underrepresented in the final ADS developed to guide the
96 management of childhood asthma and will receive suboptimal care compared to higher social
97 classes.

98 Another important finding of this study is that most of the parents surveyed were not ready
99 for an AI-based management of asthma. Loss of human control is a concern that has been
100 expressed by patients in previous studies^{2,7}. Patients think that AI might help physicians in
101 the management of conditions, but that medical decisions should remain the prerogative of
102 physicians. Loss of human contact is another concern expressed by patients. Lack of verbal

103 and nonverbal communication, lack of emotion and lack of empathy with AI were the main
104 limitations that have been reported by patients⁷.

105 This study has some limitations. First, it is a cross-sectional survey, and the opinions
106 reflected in the winter 2019-2020 may change overtime. Second, the opinions expressed by
107 French parents may not reflect those from other countries. Third, a qualitative study would
108 have been more appropriate to assess participants' understanding of AI in general and their
109 vision on how it could be applied in childhood asthma management.

110 In conclusion, the parents surveyed were divided about the implementation of a high level of
111 automation using an ADS for the management of their child's asthma. They preferred their
112 physician to keep the control over the care provided to their child and valued the physician-
113 patient relationship.

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131

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134

135 **Figure legends**

136 Figure 1: Parents' strength of preference for an algorithmic decision system (ADS)-based
137 management over current physician-based management depending on the success rate of the
138 ADS.

Parents' strength of preference for an ADS-based management of childhood asthma, compared to physician-based management, using varying rates of success in achieving asthma control

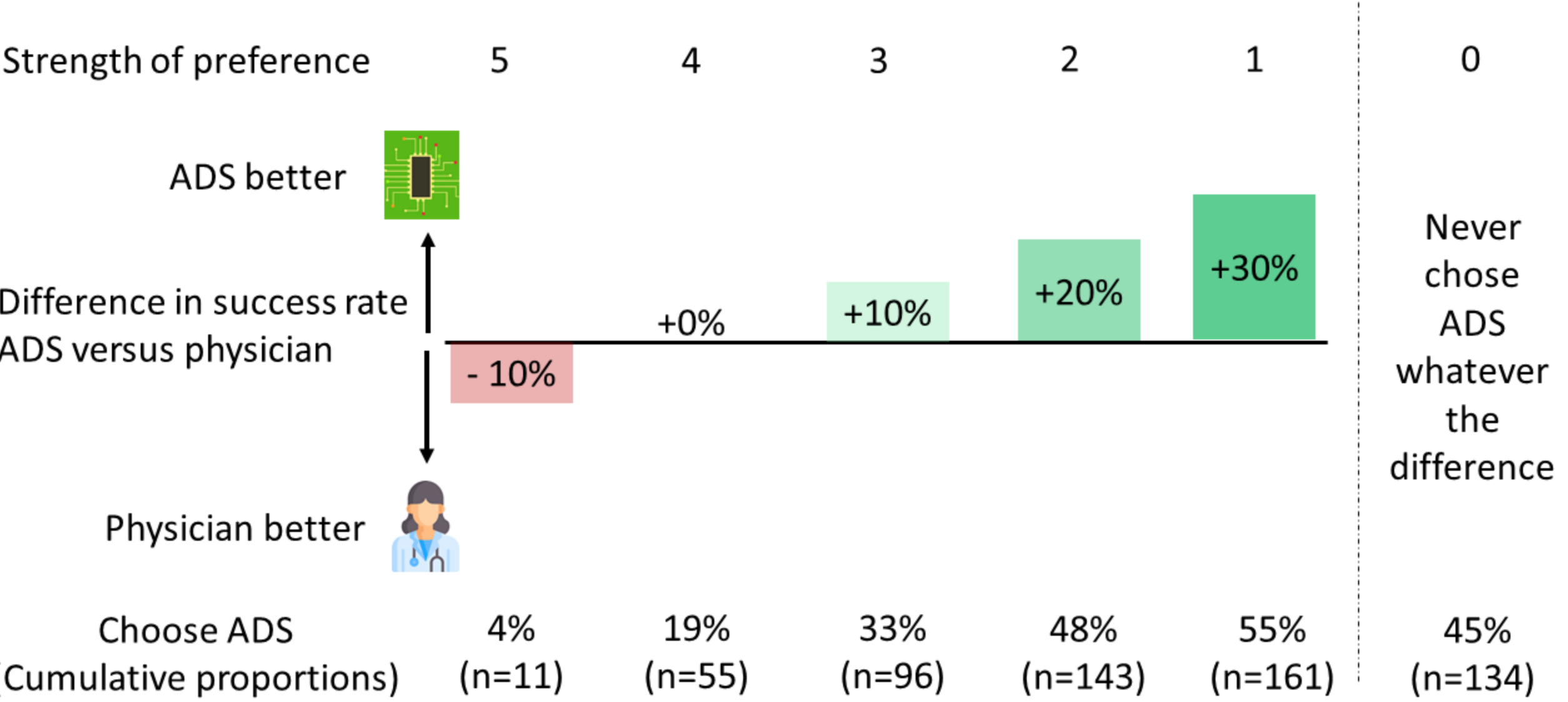


Table 1: Univariate and multivariate analysis of factors associated with preference for adoption of an algorithmic decision system for the management of childhood asthma over current physician management.

Variable	Univariate analysis		Multivariate analysis	
	Odds Ratio (95% CI)	p-value	Odds Ratio (95% CI)	p-value
Age (years)				
• ≥ 45 years	0.82 (0.46-1.46)	0.51	-	-
• < 45 years (reference)	1.00			
Sex of participant				
• Female	1.16 (0.69-1.94)	0.58	-	-
• Male (reference)	1.00			
Educational level				
• Undergraduate or graduate degree	6.54 (2.50-17.08)	<0.01	2.73 (0.96-7.76)	0.06
• High school	2.73 (1.01-7.38)	0.048	1.90 (0.68-5.33)	0.22
• Middle school (reference)	1.00		1.00	
Job				
• Professional/intermediate	2.96 (1.91-4.60)	<0.01	2.06 (1.24-3.42)	<0.01
• Others (reference)	1.00		1.00	
Child's asthma				
• Hospital admission for asthma in the previous 12 months				
○ Yes	0.82 (0.46-1.48)	0.51	-	-
○ No (reference)	1.00			
• Emergency department visit for asthma in the previous 12 months				
○ Yes	0.75 (0.47-1.19)	0.22	-	-
○ No (reference)	1.00			
• Controller treatment				
○ Yes	0.91 (0.49-1.70)	0.77	-	-
○ No (reference)	1.00			
Self-efficacy score	1.34 (0.85-2.11)	0.21	-	-

Equipment in digital devices	1.44 (1.17-1.79)	<0.01	1.29 (1.02-1.62)	0.03
Digital literacy	1.55 (1.21-1.99)	<0.01	1.22 (0.92-1.61)	0.18
Need for humanity in the physician-patient relationship	0.66 (0.40-1.06)	0.08	0.56 (0.34-0.93)	0.02
Knowledge of AI	1.40 (1.18-1.66)	<0.01	1.10 (0.90-1.34)	0.36
Data concerns (linked to data collection, privacy, misuse)	1.08 (0.82-1.43)	0.58	-	-
