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# Effect of Physician Attire on Patient Perceptions of Empathy in Japan

A Quasi-Randomized Controlled Trial in Primary Care

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1 **Title**

2 Effect of Physician Attire on Patient Perceptions of Empathy in Japan: A Quasi-  
3 Randomized Controlled Trial in Primary Care

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2

1 **Abstract**

2 **Background**

3 There is limited quantitative research on the effect of physician attire on patient–  
4 physician relationships. This study aimed to measure the influence of Japanese family  
5 physicians' attire on the “human” aspects of medical care in terms of patient-perceived  
6 relational empathy.

7 **Methods**

8 This was a multicenter, prospective, controlled trial conducted in primary clinics in  
9 Japan. We explored the effects of family physician attire (white coat vs. casual attire)  
10 on patient-perceived empathy. Family physicians were allocated to alternate weeks of  
11 wearing a white coat or casual attire during consultations. Patients' perceptions of  
12 physician empathy were evaluated using the self-rated Japanese Consultation and  
13 Relational Empathy (CARE) Measure. We used a linear mixed model to analyze the  
14 CARE Measure scores, adjusting for cluster effects of patients nested within doctor,  
15 age, and sex of patients, and doctors' sex and years of clinical experience. We used  
16 the same method with Bonferroni adjustment to analyze patient sex differences in  
17 perceived empathy.

18 **Results**

19 A total of 632 patients of seven family physicians were allocated to white coat-wearing  
20 consultations (n = 328), and casual attire-wearing consultations (n = 304). There was  
21 no difference in CARE Measure scores between white coat and casual primary care  
22 consultations overall (p = 0.162). Subgroup analysis of patient sex showed that CARE  
23 Measure scores of male patients were significantly higher in the Casual group than in  
24 the White coat group (adjusted p-value = 0.044). There was no difference in female  
25 patient scores between White coat and Casual groups (adjusted p-value = 1.000).

26 **Conclusions**

1 This study demonstrated that physician attire (white coat or casual attire) in a primary  
2 care setting did not affect patient-perceived relational empathy overall. However, male  
3 patients of physicians wearing casual attire reported higher physician empathy.  
4 Although empathy cannot be reduced to simple variables such as attire, white coats  
5 may have a negative effect on patients, depending on the context. Family physicians  
6 should choose their attire carefully.

### 7 **Trial registration**

8 Japanese University Hospital Medical Information Network (UMIN-ICDR). Clinical Trial  
9 identifier number UMIN000037687 (Registered August 14, 2019,  
10 [https://upload.umin.ac.jp/cgi-open-bin/ctr\\_e/ctr\\_view.cgi?recptno=R000042749](https://upload.umin.ac.jp/cgi-open-bin/ctr_e/ctr_view.cgi?recptno=R000042749)). The  
11 study was prospectively registered.

12

### 13 **Keywords**

14 Empathy, Physician attire, CARE Measure, Primary health care, Patient–physician  
15 relationship, Quality of care

16

## 1 **Background**

2 Most patients report that physician attire is important and associated with their  
3 satisfaction with care [1, 2, 3]. Patient preference for physician attire is influenced by  
4 age, locale, setting, and context of care [1, 3, 4, 5, 6, 7, 8]. Reports from several  
5 countries suggest that patients prefer primary care physicians to wear white coats [4, 5,  
6 6]. However, in some countries, most patients who visit a family physician (FP) no  
7 longer consider white coats a powerful symbol [8]. Previous research in Japan shows  
8 that most patients prefer physicians to wear white coats in a primary care setting [1].  
9 However, one study found that some family medicine specialists certified by the Japan  
10 Primary Care Association (JPCA), which was established in 2010 following the merger  
11 of three primary care academic societies, preferred non-white coat attire, because they  
12 felt that casual attire allowed more empathetic interactions with patients [9]. However,  
13 there are no studies on whether FP attire influences relational empathy as perceived by  
14 patients in primary care settings.

15         Empathy contributes to effective general practice consultations [10] and has  
16 many beneficial effects in terms of health care, such as improved patient satisfaction,  
17 better medication adherence, greater patient enablement, and better clinical outcomes  
18 [11, 12, 13, 14, 15]. The identification of specific nonverbal behaviors that enhance  
19 patient-perceived relational empathy may be important for building efficient therapeutic  
20 relationships and optimizing patient health outcomes [15, 16, 17, 18].

21         One study in a traditional medical clinic in Korea showed that patient-  
22 perceived empathy was substantially higher when physicians wore white coats and  
23 traditional dress than when they wore casual attire and suits [19]. However, a United  
24 States study of a large online sample in an analog medical context that manipulated  
25 physician nonverbal behaviors showed that patient-perceived empathy was affected by  
26 nonverbal communication (e.g., eye contact), not by physician white coat attire [17].

1 There is also evidence that, compared with male participants, female participants  
2 perceive doctors who express brusque nonverbal behavior as having low empathy.  
3 Empathy is a complex, multidimensional phenomenon that includes several functional  
4 processes, such as emotion recognition, emotional contagion, and emotion priming  
5 [20]. Empathy is also context-sensitive in patient–physician relationships [21]. Japan  
6 has a very unique culture that relies heavily on nonverbal and implicit communication  
7 [1, 22, 23]; thus, physician attire may play a more important role in patient–physician  
8 relationships in Japan than in other countries. In Japan, most patients prefer physicians  
9 to wear a white coat because it is considered professional or hygienic [24]. Conversely,  
10 white coat attire, with its connotations of professionalism, can be a symbol of a doctor's  
11 paternalism, which may negatively influence the “human” aspects of medical care [25,  
12 26]. It remains to be established whether FP dress style is associated with the  
13 perception of empathy in patient–physician relationships in Japan.

14 In this study, we investigated the use of alternating dress styles (casual attire  
15 vs. white coats) in FP practice to compare patient-perceived empathy, assessed using  
16 the Consultation and Relational Empathy (CARE) Measure. In addition, we tested  
17 previous findings [17] of a difference in perceived empathy between male and female  
18 patients.

19

## 20 **Methods**

### 21 *Setting and study design*

22 This trial was a multicenter, prospective, non-blind, controlled study conducted at  
23 primary clinics in Japan. We contacted 10 primary care clinics in the Tokai region of  
24 Japan and seven FPs in five clinics (four private clinics and one public clinic) agreed to  
25 participate in the study. The five clinics that declined to participate were all private  
26 clinics; the main reason given for declining was that staff expected to be very busy

1 because of the high care demand over the winter period. The experience of the seven  
2 FPs who participated in the study ranged from 8 to 46 years. One FP was female. Five  
3 FPs were JPCA certified. The FPs' usual attire was white coats (3), casuals (3), or  
4 scrubs (1).

5         Of the five clinics that participated, three had an appointment system. Patients  
6 made appointments by visiting the clinic in person, through the Internet, or by phone.  
7 Patients were not informed about the study at this stage. We recruited consecutive new  
8 patients (aged  $\geq 20$  years) in the clinics immediately after their consultation. New  
9 patients were defined as those who had not visited the clinic for 6 months or more. We  
10 excluded patients with conditions that may have been affected by a request for  
11 participation (e.g., anxiety disorder, serious infection, terminal illness) and those who  
12 could not complete the assessment independently because of their condition (e.g.,  
13 dementia, blindness, deafness). We also excluded patients who visited the clinics for  
14 routine health checks or vaccinations, because the CARE Measure was originally  
15 developed in the context of the therapeutic relationship during one-on-one patient–  
16 clinician consultations [27].

17         The study period was from October 2019 to April 2020. Each FP was asked to  
18 conduct their consultations wearing a white coat (White coat condition) or casual attire  
19 (Casual condition) on alternate weeks. FPs in the White coat group wore a white coat  
20 (Figure 1); the wearing of undershirts, scrubs, and ties was not regulated. FPs in the  
21 Casual group wore a collared shirt without a white coat or a tie. We did not regulate the  
22 wearing of trousers, skirts, or shoes. The wearing of a facemask was fixed for each FP  
23 during the study period (two FPs wore facemasks; five FPs did not wear facemasks),  
24 because it has a negative effect on patient-perceived empathy [28]. At the end of each  
25 consultation, the FP invited the patient to fill out a questionnaire. If the patient agreed to  
26 participate, the reception staff gave them a questionnaire and explained it to them as



1 required. Completed questionnaires were either mailed to the researchers or handed in  
2 to the reception staff in a sealed envelope. Survey participants were compensated for  
3 their time.

#### 4 *Outcome*

6 The primary outcome was the difference in scores on the Japanese CARE Measure  
7 between the White coat and Casual conditions. The CARE Measure is a widely used  
8 patient-reported measure of empathy that has demonstrated validity and reliability [29].  
9 The CARE Measure was first developed in English [27] and has been translated into  
10 Japanese and validated in that language. The Japanese CARE Measure can  
11 effectively differentiate between doctors in terms of patient-rated empathy [30, 31].  
12 Patients rated the 10 questions on the CARE Measure from 1 (“poor”) to 5 (“excellent”);  
13 there was also a “not applicable” option. In the case of missing or “not applicable”  
14 responses, the total CARE value was calculated by multiplying the average score for  
15 each item by 10. The total possible score range was 10 to 50. The questionnaire also  
16 recorded demographic and social information, including age, sex, marital status,  
17 education level, employment status, nature of the problem, and presence of chronic  
18 diseases.

#### 19 *Sample size*

21 A previous study found an average score on the Japanese CARE Measure for general  
22 practitioners of 38.41 (standard deviation 8.60) [30]. We estimated that 676 patients  
23 would be needed to detect a 2-point difference in CARE score, which is sufficient to  
24 detect a small to moderate standardized effect size using a two-tailed significance test  
25 with a power of 90% and an alpha level of 0.05. At least 38 consultations per doctor  
26 were required for the Japanese CARE Measure to differentiate between individual FPs

1 on CARE score [31]. To detect significant CARE score differences in wearing a white  
2 coat or wearing casual attire, it was calculated that 100 consultations per FP (a total of  
3 700) were needed.

#### 4 *Statistical analysis*

5 To test the effect on CARE Measure scores of wearing a white coat or casual attire  
6 during clinical consultations, we used a linear mixed model. This allowed us to adjust  
7 for cluster effects in patients nested within doctor, as well as potential confounding  
8 effects from patient demographic variables, such as age and sex of patients, and  
9 doctors' sex and years of clinical experience. We also used a linear mixed model with  
10 Bonferroni adjustment to analyze the CARE score difference between the sexes, as  
11 previous research indicates a gender difference in empathy [17]. To examine the effect  
12 of sex on the primary outcome, we conducted a subgroup analysis of multiple  
13 comparisons by sex. Only nominal p-values less than 0.025 (= 0.05 divided by 2) were  
14 judged to be statistically significant. Statistical analyses were performed using SPSS  
15 software (version 26.0, IBM Corporation, Armonk, NY, USA).

17

## 18 **Results**

### 19 *Study subjects*

20 A total of 731 patients were consecutively recruited to the study; 637 patients (87.1%)  
21 submitted questionnaires (mailed: 94; handed in: 543). Data for five patients were  
22 excluded from the analysis because of the patients' age, leaving 632 questionnaires  
23 (86.5%) (Figure 2). Four doctors from two clinics terminated the study early because of  
24 the COVID-19 pandemic [32]. The number of participating patients per doctor ranged  
25 from 49 to 113 (median: 100, mean: 91) for the seven doctors. Mean CARE Measure  
26 scores for each doctor ranged from 31.8 to 41.6.

1

2 *Primary outcome*

3 Patient characteristics are shown in Table 1. The two groups were evenly matched for  
 4 most variables, although there was a higher percentage of females in the Casual group  
 5 than in the White coat group ( $p = 0.012$ ). Of 632 patients, the mean CARE score for the  
 6 White coat group was 37.67 (95% confidence interval [CI]: 33.64–41.69) and that for  
 7 the Casual group was 38.60 (95% CI: 34.60–42.60) ( $p = 0.162$ ).

8

9 Table 1. Patient demographic characteristics.

	WHITE COAT No. (%)	CASUAL No. (%)	p-value
Total	328	304	
Age (years)			
≤39	157 (47.9)	142 (46.7)	
40–69	152 (46.3)	133 (43.8)	
≥70	15 (4.6)	21 (6.9)	
Missing	4 (1.2)	8 (2.6)	
Sex			
Men	129 (39.3)	148 (48.7)	<0.05
Women	196 (59.8)	148 (48.7)	<0.05
Missing	3 (0.9)	8 (2.6)	
Marital status			
Single	97 (29.6)	79 (26.0)	
Married	205 (62.5)	203 (66.8)	
Separated	17 (5.2)	11 (3.6)	
Divorced	4 (1.2)	5 (1.6)	
Missing	5 (1.5)	6 (2.0)	
Education level			
Junior high school	20 (6.1)	13 (4.3)	
High school	107 (32.6)	86 (28.3)	
Vocational college	50 (15.2)	42 (13.8)	
Junior college	35 (10.7)	34 (11.2)	
University	100 (30.5)	108 (35.5)	
Graduate school	11 (3.4)	15 (4.9)	
Missing	5 (1.5)	6 (2.0)	
Employment status			
Employed (full- or part-time, including self-employed)	259 (79.0)	237 (78.0)	
Unemployed or looking for work	4 (1.2)	6 (2.0)	

Retired from paid work	11 (3.4)	13 (4.3)
Unable to work owing to long-term sickness or disability	3 (0.9)	2 (0.7)
Looks after the home/family	37 (11.3)	22 (7.2)
At school or in full-time education	9 (2.7)	14 (4.6)
Missing	5 (1.5)	10 (3.3)
Nature of the problem		
New (acute) illness	269 (82.0)	244 (80.3)
Old (chronic) illness	46 (14.0)	41 (13.5)
Missing	13 (4.0)	19 (6.3)
Presence of chronic diseases		
None	221 (67.4)	203 (66.8)
All	107 (32.6)	101 (33.2)

1

## 2 *Sex subgroup analysis*

3 In the linear mixed model analysis (adjusting for cluster effects of patients nested within  
4 doctor, age, sex of patients, and years of clinical experience and sex of doctors, and  
5 sex nested within attire), the p-value of the interaction between sex and attire was  
6 0.072. The regression coefficient for sex was 0.027. We conducted a linear mixed  
7 model analysis for sex using the Bonferroni adjustment for 619 patients who provided  
8 full sociodemographic information, including sex and age. Figure 3 shows the sex  
9 difference between the White coat and Casual groups. The mean CARE score for  
10 males in the Casual group was significantly higher than that for males in the White coat  
11 group (40.34 vs. 38.03, adjusted p-value = 0.044). We found no difference between the  
12 mean CARE scores for females in the Casual group (38.17) and females in the White  
13 coat group (38.30) (adjusted p-value = 1.000). To explore the effect of age, we  
14 analyzed two groups of patients, one above and one below the average age, but there  
15 was no statistically significant difference between the two groups (adjusted p-value =  
16 1.000).

17

## 18 **Discussion**

19 This is the first multicenter, quasi-randomized controlled trial to examine the effect of

1 physician attire (a white coat or casual attire) on patient-perceived relational empathy.  
2 We found no difference in empathy between the White coat and Casual attire  
3 conditions overall. However, the wearing of a white coat during FP consultations had a  
4 significant negative effect on male patients' perceived empathy.

5           Previous studies in Japan [1, 24] have shown that most patients prefer  
6 Japanese FPs to wear white coats. It is likely that patients whose expectations are met  
7 in terms of their physician's attire will experience more empathy in the therapeutic  
8 relationship. However, we found no difference in patient-perceived relational empathy  
9 between the White coat and Casual attire conditions. There are several possible  
10 patient-related reasons for this result. First, previous research indicates that FP  
11 clothing is a nonverbal cue that is perceived less frequently by patients compared with  
12 tone of voice, eye contact, and facial expressions [33]. Therefore, FPs' choice of dress  
13 did not contribute substantially to empathy as perceived by patients. Second, a  
14 previous study [34] found that more tenseness was reported by new patients in a White  
15 coat group than in a Casual group, which suggests that the use of non-white coat attire  
16 in patient consultations may help to establish smoother patient-physician relationships.  
17 Third, modern patients have become more accustomed to physicians not wearing white  
18 coats, as increasing numbers of doctors do not wear white coats owing to concerns  
19 about contamination [9, 35, 36, 37]. From the physician's perspective, a white coat  
20 confers professional identity at the expense of personhood, and so is not necessarily  
21 empathetic [35]. Our results differed from previous research in Korea which showed  
22 that patients' perception of empathy was substantially higher when a traditional Korean  
23 medicine doctor wore a white coat or traditional attire than when they wore casual attire  
24 or suits [19]. Patient-perceived empathy may differ according to cultural differences and  
25 type of medical professional.

1           We also found that male patients were significantly more affected than female  
2 patients by perceived physician empathy when their physicians wore casual attire.  
3 There was a 2-point difference in the CARE Measure score, which is greater than the  
4 difference observed in previous studies with and without facemasks [28]. In a previous  
5 study that investigated gender differences in an emotion attribution task using  
6 functional magnetic resonance imaging, women and men relied on different strategies  
7 when assessing their own emotions in response to other people [38]. Previous  
8 research using the CARE Measure has also shown that female patients are more  
9 attuned than male patients to empathy signals such as lack of eye contact and unequal  
10 eye-levels [17]. Women are generally more sensitive than men to empathy and the  
11 feelings of others [21, 39]. Women are faster and more accurate at recognizing facial  
12 expressions than men [20], better at recognizing emotions, and express themselves  
13 more easily [39]. Female patients may be affected by features that are more salient  
14 than physician attire, such as tone of voice, eye contact, and facial expression [33].  
15 However, the empathetic responses of male patients tend to be more influenced by  
16 contextual cues than those of female patients [20]. Men are also more responsive to  
17 threatening cues (dominant, violent, or aggressive cues) [39]. A white coat may be  
18 perceived as indicating medical paternalism [40], and so may affect the perceived  
19 empathy of male patients more than that of females. Although intriguing, further  
20 research is needed to explore such differences between male and female patients, as  
21 this was a secondary analysis in the present study.

22           This is the first multicenter, prospective controlled trial in primary care clinics to  
23 explore the differential effect of wearing a white coat or casual attire on empathy. One  
24 strength of the present study is that, to reduce information bias (and with the  
25 permission of our ethics committee), we explained to patients that the research was  
26 about empathy, but did not reveal that we were investigating the effect of physician

1 attire. Our study has several limitations. First, for pragmatic reasons, patients were  
2 allocated on a weekly basis and there was no randomization. Second, the study design  
3 meant that the study was non-blind. Third, we did not reach the target sample size  
4 because we had to terminate the study early owing to the COVID-19 pandemic. This  
5 makes it difficult to draw firm conclusions from the findings. Fourth, a previous study  
6 identified a weak positive association between CARE score and consultation length,  
7 satisfaction with consultation length, and how well the patient knew the doctor [30]. We  
8 did not evaluate consultation length and satisfaction with the length, so we could not  
9 adjust the results. However, as our study targeted new patients, it was unlikely that the  
10 findings were affected by how well the patient knew the doctor. Fifth, the FPs in this  
11 study may not necessarily be representative of all Japanese FPs. Certification of FPs is  
12 changing in Japan. The JPCA began to certify FPs as “JPCA-certified family  
13 physicians” in 2010 [41] and the number of JPCA-certified FPs was only 900 as of  
14 September 30, 2020 [42]. From 2018, the certification changed to be a specialty based  
15 on the acquisition of general practitioner board certification [43, 44]. Therefore, most  
16 physicians currently working as FPs are not well-trained certified FPs and do not  
17 necessarily follow the global standard of primary care physicians [45]. For these  
18 reasons, statistical data for physicians working as FPs are not available. However, the  
19 participants of this study currently work as FPs, and we believe that they are fairly  
20 representative of FPs in Japan. Of the seven FP participants, six work in private clinics;  
21 this is close to the national situation, as more than 95% of medical clinics in Japan are  
22 private clinics [46]. Sixth, we did not regulate clothing worn under the white coat. This  
23 may have been a confounding variable, because a patient's impression of a physician  
24 changes according to what the physician wears under his or her white coat [1].  
25 Seventh, the effect of physician sex was not assessed because only one female  
26 physician participated in this study (below our target number for females). As perceived

1 changes in facial expression are affected by the gender of both the source and  
2 recipient [47], more research is needed on this topic.

3         The present results suggest that physicians should be advised that wearing a  
4 white coat or casual attire does not have an overall effect on the establishment of  
5 patient–physician relationships in Japan, but that casual attire may have a positive  
6 effect on male patients. Additionally, white coat attire is associated with several  
7 problems, such as white coat hypertension [48, 49] and bacterial dissemination [36,  
8 37]. Given these findings, it is perhaps time for physicians to consider alternatives to  
9 white coat attire.

10

## 11 **Conclusion**

12 We found no difference overall in the effect of white coats and casual attire on patient-  
13 perceived relational empathy in primary care consultations, but male patients of  
14 physicians who wore casual attire reported higher physician empathy. Empathy is a  
15 complex, multidimensional phenomenon that is context-sensitive in patient–physician  
16 relationships and cannot be reduced to simple variables such as attire. White coats  
17 may have a negative effect on patients, depending on the context. FPs should choose  
18 their attire carefully.

19

## 20 **List of abbreviations**

21 CARE: Consultation and Relational Empathy

22 FP: Family physician

23 JPCA: Japan Primary Care Association

24

## 25 **Declarations**

26 **Ethics approval and consent to participate**



1 The protocol was approved by Nagoya University (approval number 2019-0302).  
2 Patients gave their verbal informed consent to participate in the study as described in  
3 the Methods section and this was approved by the ethics committee.

#### 4 **Consent for publication**

5 Not applicable.

#### 6 **Availability of data and material**

7 The datasets generated and analyzed during the current study are not publicly  
8 available due to confidentiality but are available from the corresponding author on  
9 reasonable request.

#### 10 **Competing interests**

11 The authors declare that they have no competing interests.

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14 funding body had no role in the design of the study, collection, analysis, and  
15 interpretation of the data, or in the writing of the manuscript.

#### 16 **Authors' contributions**

17 TM, NT, KT, MA, JS, SM, and NB designed the study. TM, YY, and JS worked on the  
18 data collection. TM and KT carried out the data analysis. TM wrote the first version of  
19 the article, which was then revised by all the authors. All authors read and approved  
20 the final manuscript.

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23

#### 24 **References**

- 1 1. Kamata K, Kuriyama A, Chopra V, Saint S, Houchens N, Petrilli CM, et al.  
2 Patient preferences for physician attire: a multicenter study in Japan. *J Hosp*  
3 *Med.* 2020;15:e1-7. <https://doi.org/10.12788/jhm.3350>
- 4 2. Petrilli CM, Mack M, Petrilli JJ, Hickner A, Saint S, Chopra V. Understanding the  
5 role of physician attire on patient perceptions: a systematic review of the  
6 literature--targeting attire to improve likelihood of rapport (TAILOR)  
7 investigators. *BMJ Open.* 2015;5:e006578. [https://doi.org/10.1136/bmjopen-](https://doi.org/10.1136/bmjopen-2014-006578)  
8 [2014-006578](https://doi.org/10.1136/bmjopen-2014-006578)
- 9 3. Zollinger M, Houchens N, Chopra V, Clack L, Schreiber PW, Kuhn L, et al.  
10 Understanding patient preference for physician attire in ambulatory clinics: a  
11 cross-sectional observational study. *BMJ Open.* 2019;9:e026009.  
12 <https://doi.org/10.1136/bmjopen-2018-026009>
- 13 4. Petrilli CM, Saint S, Jennings JJ, Caruso A, Kuhn L, Snyder A, et al.  
14 Understanding patient preference for physician attire: a cross-sectional  
15 observational study of 10 academic medical centres in the USA. *BMJ Open.*  
16 2018;8:e021239. <https://doi.org/10.1136/bmjopen-2017-021239>
- 17 5. Zahrina AZ, Haymond P, Rosanna P, Ho R, Rajini AR, Low BT, et al. Does the  
18 attire of a primary care physician affect patients' perceptions and their levels of  
19 trust in the doctor? *Malays Fam Physician.* 2018;13:3-11.
- 20 6. Batais MA. Patients' attitudes toward the attire of male physicians: a single-  
21 center study in Saudi Arabia. *Ann Saudi Med.* 2014;34:383-9.  
22 <https://doi.org/10.5144/0256-4947.2014.383>
- 23 7. Palazzo S, Hocken DB. Patients' perspectives on how doctors dress. *J Hosp*  
24 *Infect.* 2010;74:30-4. <https://doi.org/10.1016/j.jhin.2009.08.021>
- 25 8. Sebo P, Herrmann FR, Haller DM. White coat in primary care: what do patients  
26 think today? Cross-sectional study. *Swiss Med Wkly.* 2014;144:w14072.  
27 <https://doi.org/10.4414/smw.2014.14072>
- 28 9. Yoshikawa Y, Matsuhisa T, Takahashi N, Sato J, Ban N. A survey of Japanese  
29 physician preference for attire: what to wear and why. *Nagoya J Med Sci.*  
30 2020;82. (in press)
- 31 10. Mercer SW, Reynolds WJ. Empathy and quality of care. *Br J Gen Pract.*  
32 2002;52 Suppl: S9-12.
- 33 11. Derksen F, Bensing J, Lagro-Janssen A. Effectiveness of empathy in general  
34 practice: a systematic review. *Br J Gen Pract.* 2013;63:e76-84.  
35 <https://doi.org/10.3399/bjgp13X660814>
- 36 12. Mercer SW, Jani BD, Maxwell M, Wong SY, Watt GC. Patient enablement  
37 requires physician empathy: a cross-sectional study of general practice  
38 consultations in areas of high and low socioeconomic deprivation in Scotland.  
39 *BMC Fam Pract.* 2012;13:6. <https://doi.org/10.1186/1471-2296-13-6>
- 40 13. Kim SS, Kaplowitz S, Johnston MV. The effects of physician empathy on patient  
41 satisfaction and compliance. *Eval Health Prof.* 2004;27:237-51.  
42 <https://doi.org/10.1177/0163278704267037>
- 43 14. Hojat M, Louis DZ, Markham FW, Wender R, Rabinowitz C, Gonnella JS.  
44 Physicians' empathy and clinical outcomes for diabetic patients. *Acad Med.*  
45 2011;86:359-64. <https://doi.org/10.1097/ACM.0b013e3182086fe1>
- 46 15. Mercer SW, Higgins M, Bikker AM, Fitzpatrick B, McConnachie A, Lloyd SM, et  
47 al. General practitioners' empathy and health outcomes: a prospective  
48 observational study of consultations in areas of high and low deprivation. *Ann*  
49 *Fam Med.* 2016;14:117-24. <https://doi.org/10.1370/afm.1910>

- 1 16. Riess H, Kraft-Todd G. Empathy: a tool to enhance nonverbal communication  
2 between clinicians and their patients. *Acad Med.* 2014;89:1108-12.  
3 <https://doi.org/10.1097/ACM.0000000000000287>
- 4 17. Kraft-Todd GT, Reiner DA, Kelley JM, Heberlein AS, Baer L, Riess H.  
5 Empathic nonverbal behavior increases ratings of both warmth and competence  
6 in a medical context. *PLoS One.* 2017;12:e0177758.  
7 <https://doi.org/10.1371/journal.pone.0177758>
- 8 18. Little P, White P, Kelly J, Everitt H, Gashi S, Bikker A, et al. Verbal and non-  
9 verbal behaviour and patient perception of communication in primary care: an  
10 observational study. *Br J Gen Pract.* 2015;65:e357-65.  
11 <https://doi.org/10.3399/bjgp15X685249>
- 12 19. Chung H, Lee H, Chang DS, Kim HS, Lee H, Park HJ, et al. Doctor's attire  
13 influences perceived empathy in the patient-doctor relationship. *Patient Educ*  
14 *Couns.* 2012;89:387-91. <https://doi.org/10.1016/j.pec.2012.02.017>
- 15 20. Christov-Moore L, Simpson EA, Coude G, Grigaityte K, Iacoboni M, Ferrari PF.  
16 Empathy: gender effects in brain and behavior. *Neurosci Biobehav Rev.*  
17 2014;46 Pt 4:604-27. <https://doi.org/10.1016/j.neubiorev.2014.09.001>
- 18 21. Hojat M. Empathy in health professions, education, and patient care.  
19 Switzerland: Springer International Publishing; 2016.
- 20 22. Nishimura S, Nevgi A, Tella S. Communication style and cultural features in  
21 high/low context communication cultures: a case study of Finland, Japan and  
22 India. *Teoksessa A Kallioniemi (toim), Uudistuva ja kehittyvä ainedidaktiikka*  
23 *Ainedidaktinen symposium.* 2008;8:783-96.  
24 <https://doi.org/10.13140/RG.2.2.31338.06084>
- 25 23. Richardson RM, Smith SW. The influence of high/low-context culture and power  
26 distance on choice of communication media: students' media choice to  
27 communicate with professors in Japan and America. *Int J Intercult Relat.*  
28 2007;31:479-501. <https://doi.org/10.1016/j.ijintrel.2007.01.002>
- 29 24. Yamada Y, Takahashi O, Ohde S, Deshpande GA, Fukui T. Patients'  
30 preferences for doctors' attire in Japan. *Intern Med.* 2010;49:1521-6.  
31 <https://doi.org/10.2169/internalmedicine.49.3572>
- 32 25. Goldberg JL. Humanism or professionalism? The White Coat Ceremony and  
33 medical education. *Acad Med.* 2008;83:715-22.  
34 <https://doi.org/10.1097/ACM.0b013e31817eba30>
- 35 26. Lill MM, Wilkinson TJ. Judging a book by its cover: descriptive survey of  
36 patients' preferences for doctors' appearance and mode of address. *BMJ.*  
37 2005;331:1524-7. <https://doi.org/10.1136/bmj.331.7531.1524>
- 38 27. Mercer SW, Maxwell M, Heaney D, Watt GC. The consultation and relational  
39 empathy (CARE) measure: development and preliminary validation and  
40 reliability of an empathy-based consultation process measure. *Fam Pract.*  
41 2004;21:699-705. <https://doi.org/10.1093/fampra/cmh621>
- 42 28. Wong CK, Yip BH, Mercer S, Griffiths S, Kung K, Wong MC, et al. Effect of  
43 facemasks on empathy and relational continuity: a randomised controlled trial in  
44 primary care. *BMC Fam Pract.* 2013;14:200. <https://doi.org/10.1186/1471-2296-14-200>
- 45 29. Stepien KA, Baernstein A. Educating for empathy. A review. *J Gen Intern Med.*  
46 2006;21:524-30. <https://doi.org/10.1111/j.1525-1497.2006.00443.x>
- 47 30. Aomatsu M, Abe H, Abe K, Yasui H, Suzuki T, Sato J, et al. Validity and  
48 reliability of the Japanese version of the CARE measure in a general medicine  
49 outpatient setting. *Fam Pract.* 2014;31:118-26.  
50 <https://doi.org/10.1093/fampra/cmt053>
- 51

- 1 31. Matsuhisa T, Takahashi N, Aomatsu M, Takahashi K, Nishino J, Ban N, et al.  
2 How many patients are required to provide a high level of reliability in the  
3 Japanese version of the CARE Measure? A secondary analysis. *BMC Fam*  
4 *Pract.* 2018;19:138. <https://doi.org/10.1186/s12875-018-0826-2>
- 5 32. Looi MK. Covid-19: Japan declares state of emergency as Tokyo cases soar.  
6 *BMJ.* 2020;369:m1447. <https://doi.org/10.1136/bmj.m1447>
- 7 33. Marcinowicz L, Konstantynowicz J, Godlewski C. Patients' perceptions of GP  
8 non-verbal communication: a qualitative study. *Br J Gen Pract.* 2010;60:83-7.  
9 <https://doi.org/10.3399/bjgp10X483111>
- 10 34. Ikusaka M, Kamegai M, Sunaga T, Narita N, Kobayashi H, Yonenami K, et al.  
11 Patients' attitude toward consultations by a physician without a white coat in  
12 Japan. *Intern Med.* 1999;38:533-6.  
13 <https://doi.org/10.2169/internalmedicine.38.533>
- 14 35. Wellbery C, Chan M. White coat, patient gown. *Med Humanit.* 2014;40:90-6.  
15 <https://doi.org/10.1136/medhum-2013-010463>
- 16 36. Fernandes E. Doctors and medical students in India should stop wearing white  
17 coats. *BMJ.* 2015;351:h3855. <https://doi.org/10.1136/bmj.h3855>
- 18 37. Banu A, Anand M, Nagi N. White coats as a vehicle for bacterial dissemination.  
19 *J Clin Diagn Res.* 2012;6:1381-4.  
20 <https://doi.org/10.7860/JCDR/2012/4286.2364>
- 21 38. Schulte-Ruther M, Markowitsch HJ, Shah NJ, Fink GR, Piefke M. Gender  
22 differences in brain networks supporting empathy. *Neuroimage.* 2008;42:393-  
23 403. <https://doi.org/10.1016/j.neuroimage.2008.04.180>
- 24 39. Kret ME, De Gelder B. A review on sex differences in processing emotional  
25 signals. *Neuropsychologia.* 2012;50:1211-21.  
26 <https://doi.org/10.1016/j.neuropsychologia.2011.12.022>
- 27 40. Russell PC. The White Coat Ceremony: turning trust into entitlement. *Teach*  
28 *Learn Med.* 2002;14:56-9. [https://doi.org/10.1207/S15328015TLM1401\\_13](https://doi.org/10.1207/S15328015TLM1401_13)
- 29 41. Japan Primary Care Association. History of JPCA. [https://www.primary-](https://www.primary-care.or.jp/jpca_eng/history.html)  
30 [care.or.jp/jpca\\_eng/history.html](https://www.primary-care.or.jp/jpca_eng/history.html). Accessed 17 Feb 2021.
- 31 42. Japan Primary Care Association. Membership. [http://www.primary-](http://www.primary-care.or.jp/jpca_eng/membership.html)  
32 [care.or.jp/jpca\\_eng/membership.html](http://www.primary-care.or.jp/jpca_eng/membership.html). Accessed 17 Feb 2021.
- 33 43. Kaneko M, Matsushima M. Current trends in Japanese health care: establishing  
34 a system for board-certificated GPs. *Br J Gen Pract.* 2017;67:29.  
35 <https://doi.org/10.3399/bjgp17X688669>
- 36 44. Japanese Medical Specialty Board. <https://jmsb.or.jp/sogo/>. (in Japanese)  
37 Accessed 17 Feb 2021.
- 38 45. Ban N, Fetters MD. Education for health professionals in Japan: time to change.  
39 *Lancet.* 2011;378:1206-7.  
40 [https://doi.org/10.1016/S0140-6736\(11\)61189-6](https://doi.org/10.1016/S0140-6736(11)61189-6)
- 41 46. Ministry of Health, Labor and Welfare. Survey of medical institutions of 2019.  
42 <https://www.mhlw.go.jp/toukei/saikin/hw/iryosd/19/>. Accessed 17 Feb 2021.
- 43 47. Seidel EM, Habel U, Kirschner M, Gur RC, Derntl B. The impact of facial  
44 emotional expressions on behavioral tendencies in women and men. *J Exp*  
45 *Psychol Hum Percept Perform.* 2010;36:500-7.  
46 <https://doi.org/10.1037/a0018169>
- 47 48. Mancía G, Bombelli M, Seravalle G, Grassi G. Diagnosis and management of  
48 patients with white-coat and masked hypertension. *Nat Rev Cardiol.*  
49 2011;8:686-93. <https://doi.org/10.1038/nrcardio.2011.115>

1 49. Cobos B, Haskard-Zolnierrek K, Howard K. White coat hypertension: improving  
2 the patient-health care practitioner relationship. Psychol Res Behav Manag.  
3 2015;8:133-41. <https://doi.org/10.2147/PRBM.S61192>  
4  
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6 **Figure 1 title**

7 Photographs of model male and female physicians in white coats and casual attire.

8 **Figure 2 title**

9 Flow diagram for trial participants.

10 **Figure 3 title**

11 Graph showing the effect of attire and sex on CARE scores.

12 **Figure 3 legend**

13 Male patients in the Casual group (40.34) had a significantly higher CARE score than  
14 male patients in the White coat group (38.03) (adjusted p-value = 0.044). There was no  
15 difference in CARE score for female patients in the Casual (38.17) and White coat  
16 (38.30) groups (adjusted p-value = 1.000). CARE: Consultation and Relational  
17 Empathy Measure.

18