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Communication Study

A novel analytical strategy for patient–physician communication research: The one-with-many design

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ABSTRACT

Objective: We aimed to demonstrate how a novel analytic strategy – the one-with-many (OWM) design – can provide unique information about patient–physician communication that cannot be obtained using traditional analytic strategies.
Methods: Using an OWM design we conducted a secondary analysis of behavioral (talk time) and self-reported (perceived teamness) data from a study of patient–physician communication, and examined variance decompositions of these variables.
Results: Talk time was largely relational, suggesting that there is no behavioral consistency on the part of physicians across patients or behavioral similarity among patients who see the same physician. In contrast, there was significant actor variance in perceived teamness, suggesting that some physicians consistently reported higher teamness with their patients than others. However, those physicians' positive perceptions of the communication are not necessarily reciprocated by their patients.
Conclusions: OWM design provides researchers with the opportunity to take full advantage of rich non-independent data and explore interesting communication patterns (e.g., behavioral continuity, similarity, reciprocity unique to specific dyads) that have been omitted in prior literature.
Practical implications: OWM can be used to determine the relative differences in how patients and physicians influence communication patterns and identify which aspects of physician–patient communication are relational and which are not.

Patient–physician communication plays a critical role in predicting patients' health-related attitudes and behaviors, and thus ultimately their health outcomes. For instance, communication patterns characterized as patient-centered are associated with greater patient satisfaction, higher rates of adherence, and better medical outcomes [1–6]. Additionally, because many dimensions of patient–physician communication are malleable, findings from patient–physician communication research are important in physician education and training [7,8]. Consequently, numerous studies have examined (and continue to examine) how physicians and patients influence the dynamics of their communication.

In most existing patient–physician communication studies, each physician sees multiple patients. This results in complex non-independent data because patient's outcomes may be related to the outcomes of other patients who see the same physician. However, the traditional analytic strategies used in these studies fail to take full advantage of such rich non-independent data. More specifically, traditional analytic strategies usually treat each patient–physician pair as the unit of analysis, ignoring the fact that the physician in one interaction may be the same physician in several other interactions. Some researchers address such bias by treating physicians as a nuisance parameter in multilevel models (MLM) or generalized estimating equations (GEE) [7–15]. Although this approach corrects for statistical bias, it still does not take full advantage of the richness of non-independent data provided by patient–physician communication. We believe that this complex non-independence in data itself represents important aspects of patient–physician communication. To provide one example, if all patients who see Dr. Smith report higher levels of satisfaction than patients who see Drs. Johnson, Williams, or Brown, this suggests that there is *consensus* among Dr. Smith's patients and that Dr. Smith has some unique characteristics that influence his/her patients' experience. Thus, analytic approaches that explicitly

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model non-independence can provide researchers the opportunity to explore relative differences in how patients vs. physicians influence communication patterns during medical interactions. The goal of this article is to introduce a novel approach, the one-with-many (OWM) design, [16,17] and demonstrate how this design can be used to better understand physician–patient communication. This analytical approach can address important questions (e.g., "*How do patients and physicians mutually influence their communication patterns?*" and "*Which dimension of patient–physician communication is more relational in nature than other dimensions?*") that researchers have been investigating. In addition, the OWM design allows researchers to explore interesting communication patterns (e.g., behavioral continuity, similarity, reciprocity) that have not been systematically examined in prior literature.

1. The one-with-many (OWM) design in patient–physician communication

In the context of medical interactions, the OWM design can take into account the non-independence in communication-related data, both behaviors (e.g., talking, expressing emotion) and perceptions/self-reports (e.g., perceived communality, patient involvement), among multiple patients who see the same physician. In this design, the "one" is the physician, and his or her patients are the "many." Data obtained in the OWM design can be provided by the one, the many, or both. When the data come only from physicians, it is called a *one-perceiver-many-targets* design because one physician provides data on his/her communication with multiple patients. In contrast, when the data come only from patients, it is called a *many-perceivers-one-target* design because every patient who sees the same physician provides data on communication with him/her [18]. Finally, when the data come from both physicians and patients, it is called a *reciprocal* design [18]. The OWM design provides two types of analysis simultaneously: variance decomposition and association.

1.1. Variance decomposition

Focus on the variance decomposition is what differentiates OWM designs from the standard MLM. Specifically, the model partitions the variance in communication data assessed for the physician, the patient, or both, into distinct components. When the physicians provide data in the one-perceiver-many-target design, the OWM design decomposes variation in physician's behaviors/perceptions into two components: an *actor* effect and a *relationship* effect. The actor effect estimates the degree to which a physician behaves/responds in a similar fashion toward all of his/her patients. Thus, evidence of significant actor effects for physicians suggests that there may be behavioral continuity across patients for the physicians. Additionally, the physician's unique responses to particular patients (along with error variance) are modeled in the OWM design as the relationship effect.

When the patients provide data in the many-perceivers-one-target design, the OWM design also decomposes variation in patient's behaviors/perceptions into two components: a *target* effect and a *relationship* effect. The target effect measures the degree to which all of physician's patients tend to behave/respond in a similar manner when with him/her. Thus, presence of the target effect implies that there is something in the physician's behavior that elicits similar reactions from patients. Additionally, the relationship effect assesses the patient's unique behaviors/perceptions to the physician (plus error).

Finally, when both physicians and patients provide data in the reciprocal design, the OWM design estimates all the actor, target, and relationship effects discussed above. Additionally, this design enables researchers to investigate two types of reciprocity in the responses of patients and physicians [9]. *Generalized reciprocity* measures the degree to which a physician who behaves/responds in a particular way across his/her patients has patients who typically behave/respond in a similar fashion with him/her. *Dyadic reciprocity* measures whether a physician's unique behavior toward an individual patient is reciprocated by the patient.

1.2. Associations between covariates and actor, target, and relationship effects

In addition to the variance decomposition, the OWM design can also estimate fixed effects, which tend to be the focus of the standard MLM and GEE approaches. More specifically, the OWM design can estimate relations between physician-level and patient-level covariates and the actor, target, and relationship effects. Important questions in the context of patient–physician communication that can be addressed at the physician level are associations between physician characteristics (e.g., years in practice, gender, racial bias) and significant actor and/or target effects. For instance, an association between a physician characteristic, such as racial bias, and the actor effect for talk time might show that physicians who have higher racial bias generally tend to talk more with all of their patients. An association between racial bias and the target effect for talk time might show that physicians who have higher racial bias have patients who talk more on average.

Of particular interest to patient–physician communication researchers may be the associations between patient communication outcomes (e.g., satisfaction, adherence, health status) and significant actor, target, and/or relationship effects. For example, an association between the actor effect for talk time and patient health status might show that physicians who talk a great deal to all of their patients tend to, on average, have patients with better health outcomes. An association between the target effect for talk time and patient health status might show that physicians whose patients generally talk more tend to have patients with better health outcomes. Finally, an association between the relationship effect for talk time and patient health status might show that patients who elicit especially high levels of talk from their physician tend to have better outcomes.

2. The present study

In the present study, which was a secondary analysis of self-report data and video-recordings from a larger study of clinical interactions between low-income Black patients and their non-Black primary care physicians, [19,20] we provide examples of how the OWM design can be utilized to assess both behavioral (i.e., talk time) and self-reported (i.e., perceived teamness) measures to examine the quality of patient–physician communication. More specifically, we will first demonstrate what variance decompositions of talk time and perceived teamness can tell researchers about the dynamics of patient–physician communication. Tables 1 and 2 present the specific questions for talk time and perceived teamness, respectively, that can be addressed by the variance decomposition. Next, we will demonstrate how the OWM design can estimate the association between physician characteristics (i.e., implicit racial bias) and talk time/perceived teamness and between patient communication outcomes (i.e., adherence) and talk time/perceived teamness. Table 3 summaries questions that are being addressed by estimating the association between physician bias, patient adherence, and significant actor, target, and relationship effects of talk time/perceived teamness.

We will focus on talk time as an example of behavioral data because it is an important component of patient-centered communication [21] – talk time has been shown to be associated with patient trust, patients' and physicians' racial bias, and patient

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Table 1
The actor, target, and relationship effects in a study examining talk time in patient–physician communication.

	What Each Component Tells Us
Components	
Physician actor	Whether some physicians consistently talk a lot with all of his/her patients, whereas other physicians do not talk much with any of their patients
Physician relationship	The extent to which physicians talk a great deal with some patients but not with others
Patient target	Whether some physicians evoke more talking in all of their patients, whereas other physicians evoke less talking with their patients
Patient relationship	The extent to which patients who see the same physician vary in how much they talk
Reciprocity correlations	
General reciprocity	If a physician talks a great deal with all of his/her patients, do those patients in turn talk a great deal with that physician?
Dyadic reciprocity	If a physician talks a lot to a particular patient (over and above how much the physician talks to other patients), does that patient talk a great deal to the physician (more than the physician's other patients talk with him/her)?

Table 2
The actor, target, and relationship effects in a study examining perceived teamness in patient–physician communication.

	What Each Component Tells Us
Components	
Physician actor	Whether some physicians consistently report being on the same team with the majority of his/her patients, whereas other physicians do not report being on the same team with their patients in general
Physician relationship	The extent to which physicians report being on the same team with some patients but not with others
Patient target	Whether patients who see the same physician consistently report high teamness, whereas patients who see another physician consistently report lower teamness
Patient relationship	The extent to which perceived teamness varies from patient to patient after taking their physician's target effect into account
Reciprocity correlations	
General reciprocity	Whether physicians who report being on the same team with his/her patients in general tend to have patients who report being on the same with that physician
Dyadic reciprocity	Whether physicians who report an especially high perceived teamness with particular patients tend to have patients who also report a uniquely high levels of perceived teamness

subsequent adherence [7,22]. We will focus on perceived teamness as an example of self-reported data because a sense of communality between patients and physicians is a critical element of high-quality patient–physician communication and has been found to affect patients' health-related behaviors, such as adherence and healthcare utilization [23,24]. Finally, we will focus on implicit racial bias and adherence as examples of physician characteristics and patient communication outcomes, respectively, because these characteristics have been found to be associated with talk time and perceived teamness in previous research and thus we can explicitly compare the current results to previous studies that used a traditional analytic strategy.

3. Methods

3.1. Participants

Participants in the present demonstration consist of 13 non-Black physicians (11 Asians, 2 Whites, 53.8% women, age $M = 30.50$, $SD = 2.51$, all residents) at a primary care facility in a

Table 3
The associations between physician racial bias, patient adherence, and significant actor, target, and relationship effects of talk time and perceived teamness in patient–physician communication.

Association	What each association tells us
Physician implicit racial bias	
Talk time actor effect	Whether physicians with higher implicit racial bias tend to talk more/less to their patients in general
Talk time target effect	Whether physicians with higher implicit racial bias tend to elicit more/less talk from their patients
Perceived teamness actor effect	Whether physicians with higher implicit racial bias tend to report higher/lower perceived teamness with their patients in general
Perceived teamness target effect	Whether physicians with higher implicit racial bias tend to elicit more/less reported of perceived teamness from their patients
Patient adherence	
Talk time actor effect	Whether physicians who generally talk more to their patients would have patients with higher/lower average levels of adherence
Talk time target effect	Whether physicians whose patients generally talk more would have patients with higher/lower average levels of adherence
Talk time relationship effect for physicians	Whether patients with whom the physician is especially talkative would have uniquely higher/lower levels of adherence
Talk time relationship effect for patient	Whether patients who are especially talkative with their physician have uniquely high/low levels of adherence
Perceived teamness actor effect	Whether physicians who generally report high level of perceived teamness with their patients would, on average, have patients with higher/lower average levels of adherence
Perceived teamness target effect	Whether physicians whose patients generally report high level of perceived teamness would, on average, have patients with higher/lower average levels of adherence outcomes.
Perceived teamness relationship effect for physician	Whether patients with whom the physician reports especially high teamness would have uniquely higher/lower levels of adherence
Perceived teamness relationship effect for patient	Whether patients who report especially high perceived teamness with their physician have uniquely higher/lower levels of adherence

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large Midwestern city, and their 112 patients who self-identified as Black (76.8% women, age $M = 42.83$, $SD = 13.86$). The socio-demographic characteristics of the participants in this demonstration did not differ from those in the parent study [19,20].

3.2. Procedure

When approached by an experimenter, the majority of the physicians (83%) agreed to participate in the study. Physicians completed a baseline questionnaire that included measures of basic demographic characteristics and racial attitudes shortly after they granted consent. Then, they interacted with their patients, and their medical interactions were video-recorded. Finally, after each medical interaction, they completed a questionnaire that included measures of perceived teamness, patient involvement, and shared decision making. They received a gift card in exchange for their participation.

Patients whose physicians signed a consent form to be in the study were approached by a Black female clinic staff member during their appointment. Approximately 75% of the patients approached agreed to participate and signed informed consent and HIPAA release forms. Once granting consent, patients completed a baseline questionnaire that included measures such as demographic characteristics, general adherence, and perceived past discrimination. Next, they were video-recorded during their appointment with a physician. Immediately after the interaction, patients completed another questionnaire that included measures such as perceived teamness, physician warmth, participation in decision making. Four and 16 weeks later, participants were mailed a follow-up questionnaire about their health and adherence to the physicians' treatment recommendations. Of the 112 patients who completed the baseline measure, 80 (71.4%) completed the 4-week follow-up questionnaire and 71 (63.4%) completed the 16-week follow-up questionnaire. They received gift cards each time they completed a specific part of the study.

3.3. Measures

3.3.1. Talk time

Using the video-recorded medical interactions, a coder recorded how many seconds the physician and patient each talked during a given interaction. In general, physicians talked more ($M = 8$ min 43 s, $SD = 4$ min 2 s) than patients ($M = 5$ min 26 s, $SD = 3$ min 20 s).

3.3.2. Perceived teamness

Immediately after the video-recorded medical interactions, both physicians and patients answered two questions assessing their sense of being on the same team. These items were: "*The doctor/patient and I worked well together as a team to solve my/their medical problems*," and "*I felt like the doctor/patient and I were like members of the same team trying to solve my/their medical problems*." Scores on these two items were averaged to compute a single "perceived teamness" score (inter-item correlation = .88 for physicians and .83 for patients). Higher numbers indicate greater teamness.

3.3.3. Physician implicit racial bias

The computer-based race implicit association test (IAT) [25] was used to assess physicians' implicit racial bias toward Blacks. IAT responses were scored to produce a D measure [26]. Higher numbers indicate more implicit pro-White bias and thus greater negative bias toward Blacks.

3.3.4. Patient adherence

Three positively worded items from the 5-item adherence subscale of the RAND Health's Medical Outcomes Study [27] were used to assess participants' subsequent adherence to the recommendations of the physicians whom they saw four weeks after the interaction ($\alpha = .75$). Higher numbers indicate greater adherence.

3.4. Statistical analysis

The OWM design can be estimated using a MLM framework, in which physicians are treated as the upper-level units and patients are treated as the lower-level units. In the current demonstration, both physicians and patients provide the outcome scores – talk time and perceived teamness – for each lower-level unit. Thus, it was a reciprocal OWM design. The MLM analysis for the OWM design with reciprocal data uses what has been called the two-intercept approach [28]. This analysis requires a unique data structure if computer software, such as SPSS, SAS PROC MIXED, and HLM, is used. However, such data restructuring is not required in some other computer software, such as Mplus [29]. In the current demonstration, SPSS was used to analyze the OWN design data. Due to the limited space, we do not provide the step-by-step instructions for how to analyze the OWM design data using MLM. We refer readers to Marcus, et al. [17] who provide a detailed discussion of how the data are structured and analyzed for an OWM analysis using SPSS. However, the SPSS syntax from the current analysis is provided in the Appendix.

4. Results

4.1. Variance partitioning of talk time

Table 4 shows the OWM variance estimates and correlations for talk time. To facilitate interpretation, we report the proportion of variance for each effect. For physicians, 18.7% of the variance in talk time [physician actor variance divided by the sum of physician actor and physician relationship (plus error) variance; 2.91/(2.91 + 12.63)] can be attributed to the actor effect, which tells us whether some physicians consistently talked more with patients than others. However, as shown in table, the actor variance did not attain statistical significance. The majority of the variance in the physicians' talk time (81.3%) fell at the patient or relationship (plus error) level, suggesting that physicians talked more with some patients, but less with others.

For patients, the target effect shows that physicians accounted for only 7.0% of the variance in the patients' talk time [patient target variance divided by the sum of patient target and patient relationship (plus error) variance; .70/(.70 + 9.28)]. The small target variance provides little evidence that some physicians consistently elicit longer talk time from their patients than others. As with physician's talk time, patient talk time varied more at the patient or relationship (plus error) level, accounting for 93.0% of the variance. This suggests, perhaps not surprisingly, that after

Table 4
OWM variance estimates and correlations for talk time (measured in minutes).

	Estimate	*SE*	*Wald Z*
Actor variance – Physician talk time	2.91	2.13	1.36
Target variance – Patient talk time	.70	.76	.92
Generalized reciprocity correlation	.57	.42	1.36
Physician talk time relationship variance[a]	12.63	1.88	6.73**
Patient talk time relationship variance[a]	9.28	1.34	6.94**
Dyadic reciprocity correlation	.56	.07	7.94**

[a] Relationship variance estimates include error variance. Coefficients for generalized reciprocity correlation and dyadic reciprocity correlation are provided in the SPSS output as "Corr(2,1)" for repeated measures and for physician + patient, respectively, in the covariance parameters table.
** $p < .001$.

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taking physician into account, some patients talked more than did other patients.

Turning to two types of reciprocity correlations, generalized reciprocity measures the tendency for a physician who talks a great deal to his/her patients in general to have patients who talk a great deal to him/her. The evidence of generalized reciprocity was strong but non-significant ($r = .57$, $p = .18$). Note that generalized reciprocity is based on the covariance between small, non-significant actor and target variances, and as a result what might normally be considered a large correlation did not approach statistical significance with generalized reciprocity. In contrast, there was evidence of dyadic reciprocity ($r = .56$, $p < .001$), suggesting that if a physician talked more with a particular patient (more than with his/her other patients), then that patient also talked more with that physician (more than the physician's other patients). Overall, the variance partitioning and the dyadic reciprocity correlation strongly suggest the relational nature of talk time.

4.2. Variance partitioning of perceived teamness

Table 5 shows the OWM variance estimates and correlations for self-reported perceived teamness. Results indicate significant actor variance in perceived teamness [.16/(.16 + .21) = 43.3%], such that some physicians consistently reported being on the same team with each of their patients, and others did not. About 56.7% of the variance in the physicians' perceived teamness was at the patient or relationship level, suggesting that even though some physicians generally report higher perceived teamness with their patients than other physicians, there is still variability in their reports of teamness across patients.

As with talk time, there was little evidence of target variance in patients' reports of teamness [.04/(.04 + .46) = 8.6%]. Thus, among patients seeing the same physician, there was not much consensus that some physicians create an atmosphere of teamness and others do not. Patient perceived teamness varied primarily at the patient level, such that 91.4.0% of the variance was due to relationship effects (plus error). This suggests that patients who saw the same physician varied in their reports of perceived teamness with that physician.

Turning to the two types of reciprocity, neither the generalized reciprocity ($r = .45$, $p = .32$) nor the dyadic reciprocity correlations ($r = .01$, $p = .93$) was significant. Thus, a physician who reported high level of perceived teamness with his/her patients in general did not have patients who reported similarly high level of perceived teamness with him/her. Moreover, and somewhat surprisingly, even if a physician reported especially high perceived teamness with a particular patient, that patient did not agree. Taken together, some physicians seem to perceive having better communication with his/her patients than other physicians; however, those physicians' positive perceptions of the communication are not necessarily reciprocated by their patients.

Table 5
OWM variance estimates and correlations for perceived teamness.

	Estimate	*SE*	*Wald Z*
Actor Variance – Physician reported teamness	.16	.08	2.09*
Target variance – Patient reported teamness	.04	.06	.78
Generalized reciprocity correlation	.45	.45	1.00
Physician teamness relationship variance[a]	.21	.03	7.03**
Patient teamness relationship variance[a]	.46	.07	6.81**
Dyadic reciprocity correlation	.01	.10	.09

[a] Relationship variance estimates include error variance. Coefficients for generalized reciprocity correlation and dyadic reciprocity correlation are provided in the SPSS output as "Corr(2,1)" for repeated measures and for physician + patient, respectively, in the covariance parameters table.
* $p < .05$.
** $p < .001$.

4.3. Physician implicit racial bias, talk time, and perceived teamness

When there is evidence of actor and/or target variance, we can examine associations between physician characteristics (e.g., implicit racial bias) and those effects. In the present demonstration, the only significant physician-level effect was the actor effect of physicians' perceived teamness. The analysis revealed a marginally significant negative association between physician implicit racial bias and their tendency to report higher levels of perceived teamness with their patients, $b = -.56$, $SE = .32$, $t(12) = -1.76$, $p = .10$. Thus, there is a tendency for non-Black physicians with more negative racial attitudes to report lower perceived teamness with their Black patients.

4.4. Patient adherence, talk time, and perceived teamness

If there is evidence of actor, target, and/or relationship variance, we can estimate associations between patient communication outcomes (e.g., adherence) and those effects. For talk time, there was evidence of significant relationship variance for both physician talk time and patient talk time. The association between the relationship component of physician talk time and patient adherence was marginally significant, $\beta = .197$, $t(61) = 1.77$, $p = .08$. Thus, there was a pattern such that patients whose physicians talked more with them tended to adhere more than other patients who saw the same physician. In contrast, there was no significant association between the relationship component of patient talk time and their adherence, $\beta = .03$, $t(65) = .42$, $p = .67$; patients who talked more with their physician did not adhere more/less than other patients seeing the same physician.

Turning to perceived teamness, there was significant actor variance as well as significant relationship variance for both physician perceived teamness and patient perceived teamness. There was no significant association between the actor effect of physicians' perceived teamness and patient adherence, $\beta = -.14$, $t(14) = 1.00$, $p = .33$, suggesting that there is no evidence that physicians who typically report high level of perceived teamness with their patients have higher average patient adherence four weeks after the interactions. The association between the relationship component of physicians' perceived teamness and patient adherence was significant, $\beta = .16$, $t(65) = 2.38$, $p = .02$; patients whose physicians reported higher perceived teamness with them had higher adherence than other patients who saw the same physician. Finally, there was no association between the relationship components of patients' perceived teamness and their adherence, $\beta = .11$, $t(61) = 1.05$, $p = .30$, indicating that patients who reported high teamness did not adhere more/less than other patients seeing that physician.

5. Discussion and conclusion

5.1. Discussion

The primary aim of the present study was to use an existing patient–physician communication data set to demonstrate that a novel analytic strategy, the one-with-many design, is a useful approach for analyzing rich, unique data often obtained in patient–physician communication research. Even with a small sample in the present demonstration, the OWM design revealed interesting new findings about patient–physician communication. Specifically, talk time was rather relational, and there was no behavioral consistency on the part of physicians or behavioral similarity among patients who see the same physician. In contrast, about 45% of variance in physicians' perceived teamness was accounted for by actor effects, suggesting there was consistency in the physicians' perceptions of teamness across patients. However, there was no

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consensus in perceived teamness among patients who saw the same physician. These results, together with lack of generalized and dyadic reciprocity in perceived teamness, indicate that even when physicians saw themselves having positive communication with their patients, their patients did not necessarily feel this way. This finding is consistent with research examining client–therapist communication in clinical interactions [30,31] and interracial interactions in general [32–34], suggesting that the findings from other fields of research can also be applied to patient–physician communication research. Taken together, these findings suggest that behavioral dimensions of patient–physician communication (e.g., talk time) may be more relational in nature than perceptual dimensions of such communication (e.g., perceived teamness). This difference could not have been detected by traditional analytical approaches.

The OWM design also revealed interesting findings that both physicians' talk time and perceived teamness were associated with patient adherence when we looked at the dyadic or relationship level. That is, patients whose physicians talked more or reported higher perceived teamness with them, relative to other patients seeing that same physician, were more likely to adhere four weeks after the interactions. Interestingly, however, patients who talked more or reported higher perceived teamness with their physician were no more likely to adhere than other patients. These findings suggest that physicians' communication patterns may play a more critical role in determining patients' subsequent health-related behaviors than patients' own communication patterns.

Although the OWM design is a valuable statistical tool for health communication researchers, it is not without limitations. One major limitation of the OWM design is that its ability to estimate and test physician-level effects is dependent upon the number of physicians enrolled in a study. In many physician–patient interaction studies, the number of physicians is relatively low (e.g., in the current study, it was only 13). However, when the number of physicians is small it is difficult to know whether the absence of statistically significant effects is because no such effects exist or because statistical power is low. We suggest that researchers who plan to apply the OWM design should try to recruit a relatively large number of physicians ($N = 30$), each of whom is tied to between 4 and 8 patients, to ensure adequate power. Alternatively, researchers can assess sample sizes required for unbiased estimates using simulation-based methods, such as Monte Carlo techniques and/or bootstrapping [35,36] because it has been documented that small sample sizes yield accurate estimates of regression coefficients, the variance components, and the standard errors of the regression coefficients, and that the only biased estimates associated with small samples are the standard errors of the second-level (in the current demonstration the physician-level) variances [37].

In addition to the methodological limitations, there are also possible limitations to the specific findings because of the nature of the sample in the current demonstration. This was a secondary data analysis, and the choice of the sample was primarily driven by the availability of the patient–physician communication data. It should be noted that the sample was rather homogeneous (i.e., low-income, middle-aged Black women), so the specific findings from the current demonstration should be interpreted with caution before generalizing to patient–physician communication in other contexts (e.g., racially concordant interactions involving White patients)

5.2. Conclusion

The OWM design is a useful data analytic tool for patient–physician communication researchers. This novel approach can be used to analyze a wide range of measures that patient–physician communication researchers generally examine (e.g., word/utterance, affective impressions, nonverbal behavior coding) [38–41]. The OWM design provides researchers with the opportunity to take advantage of their rich data and ask unique questions to better understand patient–physician communication.

5.3. Practical implications

As discussed in the introduction, knowing the relative differences in how patients and physicians influence communication patterns during medical interactions can have direct implications on physician education and training. For example, knowing that physician talk time varies from patient to patient can encourage future research that explores unique dyadic characteristics that increase/decrease physician talk time (e.g., when a physician with characteristic A interacts with a patient with characteristic B, he/she talks more, but when he/she interacts with a patient with characteristics C, he/she talks less). That information could be used to inform physician education and training programs on patient empowerment and involvement during medical interactions (e.g., when a physician with characteristic A interacts with a patient with characteristic B, he/she should pay particularly more attention to how much he/she encourages his/her patient to talk during the medical interactions). In contrast, knowing that there is not much consensus in perceived teamness among patients who see the same physician can encourage and facilitate future research that investigates what communication patterns are perceived as positive by most patients, and those findings can be used to train physicians to utilize such communication approaches. For instance, findings such as patient adherence is more strongly associated with physicians' communication patterns than patients' communication would suggest that physician training focusing on how to improve physicians' communication patterns that are relatively malleable (e.g., talk time) may be more effective than interventions trying to change patient behaviors or perceptions during patient–physician communication. Taken together, findings unique to the OWM design can not only facilitate future research that addresses novel research questions but also be used to inform future physician education and training.

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Appendix

SPSS syntax used in the current demonstration of variance decomposition

Talk time

```
MIXED rawtalktime WITH physician patient
  /FIXED=physician patient | NOINT
  /PRINT=SOLUTION TESTCOV
  /RANDOM=physician patient | SUBJECT(focal_id) COVTYPE(UNR)
  /REPEATED=role | SUBJECT(focal_id*partner_id) COVTYPE(UNR).
```

Perceived teamness

```
MIXED avePerceivedTeam WITH physician patient
  /FIXED=physician patient | NOINT
  /PRINT=SOLUTION TESTCOV
  /RANDOM=physician patient | SUBJECT(focal_id) COVTYPE(UNR)
  /REPEATED=role | SUBJECT(focal_id*partner_id) COVTYPE(UNR).
```

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