Patients Routinely Report More Symptoms to Experienced Field Enumerators than Physicians in Rural Côte d'Ivoire

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Abstract. Medical history-taking is among the most powerful diagnostic tools for healthcare professionals. However, its accuracy and reliability are underexplored areas. The present post-hoc study compares medical histories from 463 people in a rural part of Côte d'Ivoire. The medical histories of the same individuals were taken by physicians and experienced field enumerators who were blinded to the results of the others. Kappa (κ) statistics for 14 symptoms revealed only poor-to-moderate agreement between physicians and field enumerators ($\kappa = 0.01$ – 0.54). Participants reported consistently more symptoms to field enumerators than physicians. Only 33 (7.1%) participants gave no discordant statement at all. The average number of discordant statements per participant was 3.7. Poisson regression revealed no significant association between the number of discordant statements and participants' age, sex, educational attainment, occupation, or socioeconomic status. Operational research should further explore best practices to obtain reliable medical histories in resource-constrained settings.

INTRODUCTION

The medical history is a powerful and widely used diagnostic tool that enables clinicians to arrive at a final diagnosis 76–85% of the time compared with physical examination (9–12%) and laboratory tests (9–11%).^{1–3} Indeed, clinicians can extract varying degrees of pertinent information from patients depending on their individual style of conducting a medical history, with open-ended questions and higher degrees of patient education associated with a greater disclosure of medical information.⁴ However, there is considerable interobserver variability in conducting structured medical histories and physical examinations for common medical conditions, such as knee pain or stroke.^{5–8} The accuracy and reliability of clinical examination, particularly in resource-constrained settings, is an underexplored area.

Here, we assess the variability in medical history-taking between physicians and experienced field enumerators during a cross-sectional community-based epidemiological survey in a rural part of southcentral Côte d'Ivoire. The survey was part of an integrated disease control program against malaria, schistosomiasis, soil-transmitted helminthiasis, and other neglected tropical diseases in the Taabo health demographic surveillance system (HDSS). The present post-hoc analysis was spawned from anecdotal evidence that physicians and field enumerators were extracting considerably different medical histories from the same individual. Hence, the purpose of the current study was to investigate and quantify the variability in medical history-taking between field enumerators and physicians in rural Côte d'Ivoire. Depending on the degree of discordance, additional investigations of this issue may be indicated, and the findings may have important ramifications on the most efficient allocation of the scarce health personnel not only in the Taabo HDSS but also in disease control

programs elsewhere. The ultimate goal of all these efforts is to most efficiently provide the best quality care for citizens, and obtaining an accurate medical history is an invaluable first step.

METHODS

Study area and data collection. The analyzed data stem from the third annual cross-sectional epidemiological survey carried out in the Taabo HDSS in June of 2011. These annual cross-sectional surveys constitute a key research operation of the Taabo HDSS, during which a representative sample of the population is invited to participate in a parasitological, clinical, and questionnaire survey.^{9,10} The medical history of the study participants was taken by one of three male Ivorian physicians during their routine clinical examination. Right after the clinical examination, experienced field enumerators of the Taabo HDSS invited the participants to complete a questionnaire interview with them. To not delay the annual survey, the field enumerators were instructed to always invite the next individual coming from the physicians' clinical examination on completion of their previous interview. Hence, the study participants were selected in a two-stage process. First, they had to be selected among participants of the annual epidemiological survey of the Taabo HDSS and consequently subjected to the physicians' clinical examination. Second, they had to be invited for a questionnaire interview by the field enumerators.

The questionnaire applied by the field enumerators was based on previously used questionnaires in Côte d'Ivoire^{9–13} and included, among other topics, a section on medical symptoms. The original questionnaire was in French, and it was thoroughly pre-tested and fine-tuned to the current setting before administration. The questionnaire interviews were conducted in French or one of the local languages (i.e., Baoulé, Dioula, or Senoufo) by 10 experienced, local field enumerators (7 men and 3 women).¹⁴ All field enumerators of the Taabo HDSS have been recruited from this study area and live in the different communities of the Taabo HDSS.

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More detailed descriptions of the Taabo HDSS and the usual procedures during the annual cross-sectional surveys have been published elsewhere.^{9,10}

Statistical analysis. Data were double entered and cross-checked in EpiInfo version 3.5.1 (Centers for Disease Control and Prevention, Atlanta, GA) and analyzed in STATA version 10.1 (STATA Corp., College Station, TX). The medical history data were complemented with individual-level information on age, sex, education, and main occupation and household-level information on certain housing characteristics and asset possession as recorded in the existing Taabo HDSS database. The many different occupations were categorized into being a student, belonging to the primary economic sector (i.e., economic activities making direct use of natural resources), the secondary economic sector (i.e., economic activities producing manufactured and other processed goods), or the tertiary economic sector (i.e., economic activities producing services). Housewives were considered as belonging to the primary sector, because they are usually involved in at least some farming activities. The household-level data on housing characteristics and asset possession were used to calculate an asset-based wealth index and deduce the study participants' socioeconomic status according to a widely and successfully applied approach by the World Bank.¹⁵ κ -statistics were used to check the agreement between symptoms reported to physicians and experienced field enumerators. Ten symptoms were asked in exactly the same way by physicians and field enumerators, and hence, they allowed for direct comparison of the study participants' statements. Another four symptoms were asked in slightly different ways but aimed at the same complex of symptoms, and therefore, they allowed at least for indirect comparison of the answers. The number of discordant statements to physicians and field enumerators with regard to 14 different symptoms was summed up for each patient and further analyzed as the outcome variable of a Poisson regression model with the participants' age, sex, education, occupation, and socioeconomic status used as explanatory variables. Likelihood ratio tests were used to test whether some of the explanatory variables were statistically significantly ($P < 0.05$) related to the number of discordant statements.

Ethical considerations. Approval for our work was granted from the ethics committee of Basel (EKBB; reference no. 316/08) and the Comité National d'Ethique et de la Recherche (CNER) in Côte d'Ivoire (reference no. 1086 MSHP/CNER). Written informed consent was obtained from all individuals aged ≥ 16 years. Parents or legal guardians of younger individuals signed on their behalf. During the annual survey, all inhabitants of the Taabo HDSS aged ≥ 2 years were offered albendazole (400 mg single oral dose), and individuals aged ≥ 5 years were given ivermectin (200 $\mu\text{g}/\text{kg}$ using a dose pole). Six months later, praziquantel (40 mg/kg using a dose pole) was administered to all inhabitants aged ≥ 5 years. All treatments were administered by trained medical personnel irrespective of the individuals' infection status or study participation according to World Health Organization (WHO) guidelines.^{16,17}

RESULTS

Figure 1 shows the study flow chart. Characteristics of the study participants are summarized in Table 1. The final study sample consisted of 463 individuals (208 males [44.9%] and

FIGURE 1. Flow chart illustrating the sample for the present post-hoc analysis. The data for the present study were collected during the third annual cross-sectional epidemiological survey in the Taabo HDSS in southcentral Côte d'Ivoire in June of 2011 and complemented with information from the existing Taabo HDSS database.

255 females) aged 10–82 years, most of whom had no ($N = 191$) or only primary school ($N = 199$) education and worked in the primary sector ($N = 328$).

The κ -statistic revealed an agreement significantly better than chance between the symptoms reported to physicians and field enumerators for all but one symptom (presence of chills; $\kappa = 0.01$; 95% confidence interval [CI] = -0.03 to 0.05) (Table 2). However, the agreement was only poor to moderate with all significant values for κ between 0.14 and 0.54. Furthermore, of 14 symptoms, patients reported, on average, 2.9 more symptoms to field enumerators than physicians. Only 33 (7.1%) participants gave no discordant statement at all to the physicians and field enumerators (Figure 2). The average number of discordant statements per study participant was 3.7. The Poisson regression model and likelihood ratio tests revealed no differences in the number of discordant statements made by the study participants and their age, sex, education, occupation, or socioeconomic status.

DISCUSSION

Our results indicate that physicians and experienced field enumerators extracted significantly different data from study participants while taking focused and structured medical histories as part of a yearly cross-sectional survey carried out in an HDSS of a primarily rural setting of West Africa. Interestingly, participants consistently reported more symptoms to field enumerators compared with physicians. People were evaluated by physicians and field enumerators within 1 hour, and hence, it is unlikely that symptoms would develop or dissipate over such a short time frame. Moreover, physicians and field enumerators were blinded to the results of each other. Unfortunately, we lack a 'gold' standard for obtaining the most reliable and accurate medical history, and therefore, it is impossible to know whether the physicians or field enumerators are closer to the truth.

What are possible explanations for why participants report symptoms more frequently to field enumerators compared with physicians? Do participants underreport symptoms to

TABLE 1
Characteristics of 463 study participants

Age (years)	Sex	Total number of people	Educational attainment			Main occupation			
			No education	Primary school	Secondary or higher education	Student*	Primary sector†	Secondary sector‡	Tertiary sector§
10–16	Male	57	12	38	7	40	15	1	1
10–16	Female	66	8	52	6	51	13	1	1
17–30	Male	43	5	28	10	0	34	3	6
17–30	Female	68	40	19	9	1	55	3	9
31–45	Male	51	16	18	17	0	48	0	3
31–45	Female	72	38	26	8	0	64	0	8
> 45	Male	57	28	13	16	0	53	0	4
> 45	Female	49	44	5	0	0	46	0	3
All	Male	208	61	97	50	40	150	4	14
All	Female	255	130	102	23	52	178	4	21
All	Both	463	191	199	73	92	328	8	35

Age, sex, educational attainment and main occupation among 463 individuals included in the present post-hoc analysis. The data for the present study were collected during the third annual cross-sectional epidemiological survey in the Taabo HDSS in southcentral Côte d'Ivoire in June of 2011 and complemented with information from the existing Taabo HDSS database.

*Participant is a student.

†Participant is a farmer, fisher, hunter, or housewife.

‡Participant is an artisan, builder, or mechanic.

§Participant is a merchant, trader, gastronome, hairdresser, office worker, or housekeeper.

physicians, or do they overreport to field enumerators? Of note, all physicians and field enumerators were local Ivorians, and all physicians were male, whereas 3 of 10 field enumerators were female. However, the study participants' sex was not associated with the number of discordant statements, and hence, we presume that sex did not influence our results. Several other reasons may explain why patients underreported symptoms to physicians. Few people in this region would have regular interaction with physicians and may have regarded them as authority figures and possibly intimidating. Alternatively, physicians may have spent less time with participants or conducted the focused history in a style where less patient information was acquired, such as using closed-ended questions or acting impatiently.⁴ Participants may also be overreporting symptoms to field enumerators, because they may have mutual trust and familiarity; therefore, every medical issue, no matter how minor or severe, was reported. In this connection, it is important to note that field enumerators in an established HDSS regularly visit households, and hence, there is a climate of shared ownership and more equity among the different parties.¹⁸ Because of this familiarity, field enumerators may be willing to take more time to ask questions and verify

answers. However, there might also be a perceived potential for secondary gain on behalf of many participants by over-reporting symptoms. Redelmeier and Cialdini¹⁹ describe the psychological interplay between clinicians and patients that, either consciously or subconsciously, affects patient behavior, including what information is transmitted during a medical history. Concepts such as reciprocity (e.g., patients provide a more or less detailed history depending of the positive or negative atmosphere created by clinicians), consistency (e.g., routinely answering questions in a consistent manner), and authority (e.g., more reserved behavior around figures of authority based on cultural norms) may account for our results. It is also possible that participants reported more symptoms to field enumerators, because the interviews with the field enumerators were always conducted after the physicians' examinations. Physicians may have primed participants by taking an initial medical history, and when questioned again shortly after by field enumerators, participants may have reported more frequent positive symptoms. In addition, because this investigation was a cross-sectional study, participants were not necessarily overtly ill at the time of questioning, which may have affected our results. However, with regard to helminth infections, subtle

TABLE 2
Comparison of medical history-taking by physicians and experienced field enumerators

Symptom	Positive (%)		κ	95% CI
	Physicians	Field enumerators		
Headache	46.2	70.0	0.35	0.26, 0.43*
Abdominal pain	33.7	48.4	0.46	0.38, 0.55*
Fever†	28.3	58.1	0.21	0.13, 0.28*
Vertigo	23.3	39.7	0.47	0.39, 0.56*
Itch, nodules, papules, or skin spots†	17.7	30.7	0.41	0.33, 0.50*
Blood in the stool	14.5	22.3	0.43	0.34, 0.52*
Constipation	12.1	41.5	0.14	0.07, 0.20*
Visual impairment	10.2	41.9	0.16	0.10, 0.22*
Vomiting	9.3	13.4	0.37	0.28, 0.46*
Cough	8.4	29.6	0.25	0.18, 0.32*
Blood in the urine	6.1	9.5	0.54	0.45, 0.63*
Chill†	5.4	52.1	0.01	–0.03, 0.05
Diarrhea	3.0	24.6	0.16	0.11, 0.21*
Inflammation or ulceration†	1.7	13.6	0.14	0.09, 0.20*

Symptoms among 463 individuals included in the present post-hoc analysis as assessed first by physicians during the anamnesis of a clinical examination and second by trained field enumerators during a questionnaire interview. The data for the present study were collected during the third annual cross-sectional epidemiological survey in the Taabo HDSS in southcentral Côte d'Ivoire in June of 2011 and complemented with information from the existing Taabo HDSS database. CI = confidence interval.

*Statistically significant ($P < 0.05$).

†The physicians and field enumerators did not use the exact same wording but asked questions pertaining to the same syndrome, allowing for indirect comparison.

FIGURE 2. Histogram displaying the discordance in medical history-taking between physicians and experienced field enumerators. Each study participant ($N = 463$) was asked to report the presence or absence of a host of different symptoms to a physician and a trained field enumerator (14 symptoms asked by both investigators). The number of discordant statements to physicians and field enumerators was summed up for each patient. The data for the present study were collected during the third annual cross-sectional epidemiological survey in the Taabo HDSS in southcentral Côte d'Ivoire in June of 2011 and complemented with information from the existing Taabo HDSS database.

morbidity may be more frequent than overt morbidity. Additional studies should evaluate the variability of medical history-taking for patients presenting to medical attention with and without specific syndromes in resource-limited settings. In addition, future studies should compare the medical history with related, objectively measured clinical or laboratory data to better delineate the history that is closer to the truth.

Data from other resource-constrained settings show both accurate and inaccurate medical histories provided to clinicians. For example, investigators were retrospectively able to validate the accuracy of Bangladeshi mothers' medical histories for their ill infants. These women could consistently identify such conditions as tetanus, malnutrition, pre-term delivery, and pneumonia in their children.²⁰ In contrast, standardized health questionnaires in Uganda were used as verbal autopsies for malaria-related deaths and found to be useful in regions of high and moderate malaria transmission, whereas accuracy was jeopardized in low-transmission settings.²¹

Our findings—if confirmed in other settings—have important ramifications for healthcare delivery, because the medical history is a vital component in reaching a diagnosis and frequently cited as being more important than the physical examination or laboratory investigations.^{1–3} Unreliable medical history-gathering has direct implications for how care is provided in resource-constrained settings. More emphasis will need to be placed on physical examination and laboratory data, but in deprived rural settings, there is frequently no specialized clinician or sophisticated laboratory support available.²² Often, non-physicians have to take over a multitude of duties and responsibilities and are understandably not as adept at performing physical examinations and laboratory investigations, because they may lack the necessary training. It follows that diagnostic and treatment algorithms in many parts of the developing world are imprecise. Recognizing this issue, NIDIAG—a recently established international research

consortium funded under the European Commission's Seventh Framework Program—pursues a patient-centered approach and aims to improve clinical treatment algorithms in resource-constrained settings (see www.NIDIAG.org). Emphasis is placed on three clinical syndromes: digestive syndromes, persistent fever, and neurological disorders.^{23–25}

Ultimately, the goal is to provide the highest quality of medical care to the local population, and obtaining an accurate medical history is a major early step for both physicians and field enumerators, because management decisions for the individual patient as well as the whole population depend on the gathered information. Clearly, the potential to provide appropriate medical care based on the obtained medical histories is different between physicians and non-physicians because of differences in training, but studies from both resource-rich²⁶ and resource-constrained settings²⁷ indicate that quality of primary care is not necessarily and under all circumstances better if provided by physicians. Hence, additional operational research is urgently needed to further elucidate the most accurate methods to obtain reliable medical histories—particularly in deprived rural settings where other diagnostic means are often not available—and how the essential information obtained during medical history-taking is best used for decision-making and action-taking not only in individual case management but also population-based health interventions.

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REFERENCES

- Hampton JR, Harrison MJ, Mitchell JR, Prichard JS, Seymour C, 1975. Relative contributions of history-taking, physical examination, and laboratory investigation to diagnosis and management of medical outpatients. *BMJ* 2: 486–489.
- Peterson MC, Holbrook JH, Von Hales D, Smith NL, Staker LV, 1992. Contributions of the history, physical examination, and laboratory investigation in making medical diagnoses. *West J Med* 156: 163–165.
- Sapira JD, Orient JM, 2010. The history. Sapira JD, Orient JM, eds. *Sapira's Art and Science of Bedside Diagnosis*. Philadelphia, PA: Lippincott, Williams & Wilkins, 33–46.
- Roter DL, Hall JA, 1987. Physician's interviewing styles and medical information obtained from patients. *J Gen Intern Med* 2: 325–329.
- Koran LM, 1975. The reliability of clinical methods, data and judgments (first of two parts). *N Engl J Med* 293: 642–646.
- Shinar D, Gross CR, Mohr JP, Caplan LR, Price TR, Wolf PA, Hier DB, Kase CS, Fishman IG, Wolf CL, Kunitz SC, 1985. Interobserver variability in the assessment of neurologic history and examination in the Stroke Data Bank. *Arch Neurol* 42: 557–565.
- Wipf JE, Lipsky BA, Hirschmann JV, Boyko EJ, Takasugi J, Peugeot RL, Davis CL, 1999. Diagnosing pneumonia by physical examination: relevant or relic? *Arch Intern Med* 159: 1082–1087.
- Peat G, Wood L, Wilkie R, Thomas E, 2003. How reliable is structured clinical history-taking in older adults with knee problems? Inter- and intraobserver variability of the KNE-SCI. *J Clin Epidemiol* 56: 1030–1037.
- Fürst T, Silué KD, Ouattara M, N'Goran DN, Adiossan LG, N'Guessan Y, Zouzou F, Koné S, N'Goran EK, Utzinger J, 2012. Schistosomiasis, soil-transmitted helminthiasis, and sociodemographic factors influence quality of life of adults in Côte d'Ivoire. *PLoS Negl Trop Dis* 6: e1855.
- Fürst T, Ouattara M, Silué KD, N'Goran DN, Adiossan LG, Bogoch II, Yao AJA, Koné S, Utzinger J, N'Goran EK, 2013. Scope and limits of an anamnestic questionnaire in a control-induced low-endemicity helminthiasis setting in south-central Côte d'Ivoire. *PLoS One* 8: e64380.
- Utzinger J, N'Goran EK, Ossey YA, Booth M, Traoré M, Lohourignon KL, Allangba A, Ahiba LA, Tanner M, Lengeler C, 2000. Rapid screening for *Schistosoma mansoni* in western Côte d'Ivoire using a simple school questionnaire. *Bull World Health Organ* 78: 389–398.
- Raso G, Luginbühl A, Adjoua CA, Tian-Bi NT, Silué KD, Matthys B, Vounatsou P, Wang Y, Dumas ME, Holmes E, Singer BH, Tanner M, N'Goran EK, Utzinger J, 2004. Multiple parasite infections and their relationship to self-reported morbidity in a community of rural Côte d'Ivoire. *Int J Epidemiol* 33: 1092–1102.
- Raso G, Utzinger J, Silué KD, Ouattara M, Yapi A, Toty A, Matthys B, Vounatsou P, Tanner M, N'Goran EK, 2005. Disparities in parasitic infections, perceived ill health and access to health care among poorer and less poor schoolchildren of rural Côte d'Ivoire. *Trop Med Int Health* 10: 42–57.
- Kouadio MKD, Righetti AA, Abé NN, Wegmüller R, Weiss MG, N'Goran EK, Utzinger J, 2013. Local concepts of anemia-related illnesses and public health implications in the Taabo health demographic surveillance system, Côte d'Ivoire. *BMC Hematol* 13: 5.
- O'Donnell O, van Doorslaer E, Wagstaff A, Lindelow M, 2008. *Analyzing Health Equity Using Household Survey Data. A Guide to Techniques and their Implementation*. Washington, DC: World Bank.
- World Health Organization, 2002. Prevention and control of schistosomiasis and soil-transmitted helminthiasis: report of a WHO expert committee. *WHO Tech Rep Ser* 912: 1–57.
- World Health Organization, 2008. *Preventive Chemotherapy Newsletter. Action Against Worms. Issue 11*. Available at: http://www.who.int/neglected_diseases/preventive_chemotherapy/pctnewsletter11.pdf. Accessed January 23, 2013.
- INDEPTH Network, 2002. *Population and Health in Developing Countries*. Ottawa, Canada: International Development Research Centre.
- Redelmeier DA, Cialdini RB, 2002. Problems for clinical judgement: 5. Principles of influence in medical practice. *CMAJ* 166: 1680–1684.
- Kalter HD, Hossain M, Burnham G, Khan NZ, Saha SK, Ali MA, Black RE, 1999. Validation of caregiver interviews to diagnose common causes of severe neonatal illness. *Paediatr Perinat Epidemiol* 13: 99–113.
- Mpimbaza A, Filler S, Katureebe A, Kinara SO, Nzabandora E, Quick L, Ratcliffe A, Wabwire-Mangen F, Chandramohan D, Staedke SG, 2011. Validity of verbal autopsy procedures for determining malaria deaths in different epidemiological settings in Uganda. *PLoS One* 6: e26892.
- Anyangwe SC, Mtonga C, 2007. Inequities in the global health workforce: the greatest impediment to health in sub-Saharan Africa. *Int J Environ Res Public Health* 4: 93–100.
- Yansouni CP, Bottieau E, Chappuis F, Phoba MF, Lunguya O, Ifeka BB, Jacobs J, 2012. Rapid diagnostic tests for a coordinated approach to fever syndromes in low-resource settings. *Clin Infect Dis* 55: 610–611.
- Becker SL, Vogt J, Knopp S, Panning M, Warhurst DC, Polman K, Marti H, von Müller L, Yansouni CP, Jacobs J, Bottieau E, Sacko M, Rijal S, Meyanti F, Miles MA, Boelaert M, Lutumba P, van Lieshout L, N'Goran EK, Chappuis F, Utzinger J, 2013. Persistent digestive disorders in the tropics: causative infectious pathogens and reference diagnostic tests. *BMC Infect Dis* 13: 37.
- Yansouni CP, Bottieau E, Lutumba P, Winkler AS, Lynen L, Büscher P, Jacobs J, Gillet P, Lejon V, Alirol E, Polman K, Utzinger J, Miles MA, Peeling RW, Muyembe JJ, Chappuis F, Boelaert M, 2013. Rapid diagnostic tests for neurological infections in central Africa. *Lancet Infect Dis* 13: 546–558.
- Horrocks S, Anderson E, Salisbury C, 2002. Systematic review of whether nurse practitioners working in primary care can provide equivalent care to doctors. *BMJ* 324: 819–823.
- Vasan A, Kenya-Mugisha N, Seung KJ, Achieng M, Banura P, Lule F, Beems M, Todd J, Madraa E, 2009. Agreement between physicians and non-physician clinicians in starting antiretroviral therapy in rural Uganda. *Hum Resour Health* 7: 75.