

# An Audit of the Appropriateness of Teletriage Nursing Advice

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## ABSTRACT

This study assessed the appropriateness of advice given by teletriage nurses to patients in northern Ontario. Assessments used audiotapes and printed records of 73 calls, selected from approximately 350 calls based on sound quality, completeness, and consent of caller and teletriage nurse. Audits were conducted independently by one family physician, one nurse practitioner, and one registered nurse with teletriage experience. In 56% of the 73 calls, all three auditors judged the nurse's advice as "appropriate." In 92% of the 73 calls, at least two of the three auditors judged the teletriage nurse's advice as "appropriate." All calls were rated as "appropriate" by at least one auditor. If not "appropriate," then auditors were three times more likely to rate the advice as "overly-cautious" rather than "insufficient." The percentage of calls with the same rating varied from 62% to 86% with an outlier of 33%. Nurse practitioners tended to rate the appropriateness of the advice slightly, but significantly lower than the rating given by family physicians or registered nurses. Interestingly, nurse practitioners tended to rate aspects of the nurse-caller interaction advice as slightly and significantly better than the rating chosen by family physicians or registered nurses. The teletriage service was providing appropriate advice, but the generalizability of these results may be limited because of the selection of calls.

## INTRODUCTION

TELEPHONE HEALTH SERVICES have been used as an integral component of the primary care system in many parts of the world. They are often intended to enhance access to care, to help reduce unnecessary use of more costly services, and to encourage self-care and informal care, especially where health care resources are scarce and access to care is inadequate.

There are three broad and overlapping types of telephone service: (1) health hotlines that provide information only; (2) teletriage services that provide health advice, self-care instruc-

tions, and recommendations as to which types of health care should be accessed; and (3) telephone management services that act as formal gatekeepers to the health care system. Regardless of their nature, assessing the appropriateness of the information provided is necessary to ensure that telephone health services meet acceptable standards. This study assessed the appropriateness of advice given by teletriage nurses to patients in northern Ontario.

A teletriage pilot project, called Direct Health/TéléSanté, ran for 22 months, from June 1, 1999, to March 31, 2001, in northern Ontario, north of, and including, the Districts of Nipissing and

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Parry Sound. It is a geographically vast area (800,000 km<sup>2</sup>) with slightly over 800,000 inhabitants. The teletriage services were pilot-tested in northern Ontario prior to becoming a province-wide program. As part of the pilot testing, a comprehensive evaluation was conducted by researchers at the Centre for Rural and Northern Health Research (CRaNHR), Laurentian University. The audit of the appropriateness of advice provided by the teletriage nurses, as reported in the present study, was one component of a broader evaluation.

The pilot project was conducted by Clinidata Corporation out of a call center in North Bay, Ontario. Offered in English and French and available 24 hours a day, 7 days a week, the teletriage services were accessible through a toll-free telephone line for residents of northern Ontario. The service advised people with nonurgent symptoms who were concerned about a health problem and/or uncertain about what to do about it. Callers spoke with a registered nurse who used computer-assisted and medically approved guidelines and nursing experience to query patients on their symptoms and recommend the most appropriate type of care. Depending on the nature and severity of the patient's symptoms, the nurse provided recommendations for self-care or informal care, visit a family doctor or walk-in clinic, or visit the nearest emergency department (ED). Nurses also provided basic health information and information about prescriptions and over-the-counter medications.

There are several approaches to the evaluation of a teletriage service and the choice of outcomes. Ultimately, one would be interested in whether the service influences the long-term health status or well-being of patients who use it. A systematic review of the literature identified 10 studies that typically reported no differences in deaths, hospital admissions, or number of visits to EDs as compared to other service options.<sup>1</sup> Attribution is an issue here, since several other factors may influence mortality and morbidity.

Typically, an evaluation of a teletriage service is focused on changes in health status within a few days of the call or differences in nursing assessment or medical diagnosis based on a review of call documentation,<sup>2,3</sup> audio

tapes,<sup>4</sup> or results of a face-to-face encounter with the patient.<sup>5</sup> Alternatively, the evaluation may examine health services use within a few days of the call and whether the advice was consistent with use, with possible adjustments for changes in health status that may have occurred after the call.<sup>6-9</sup> Other evaluation methods have compared the level of agreement between teletriage nurses and other health care practitioners who have seen the same patients face-to-face.<sup>10-12</sup> Standardized patients have been used to assess agreement using teletriage nurses<sup>13,14</sup> or agreement between nurses and other practitioners in providing teletriage services<sup>4</sup> or between teletriage nurses and accepted recommendations for selected case histories.<sup>13,15</sup>

Three main elements were considered in this assessment of teletriage nursing advice: (1) the patients (or those calling on behalf of the patients); (2) the teletriage nurse; and (3) the computer-assisted clinical guidelines. The patients' willingness and ability to comply with the nurses' advice can affect the accuracy of the nursing assessment and influence the nature of the advice. Similarly, the nurses' ability to extract pertinent information on the patient's condition and circumstances will affect the nature of the advice. It is also important to assess the usefulness of the clinical software in facilitating the communication between the teletriage nurse and the patient, and in assisting the nurse's clinical decision-making.

## MATERIALS AND METHODS

The appropriateness of the advice was assessed for 73 tape-recorded calls, supplemented by a print-out of the computerized call record, which included data on: (1) patient demographics, (2) clinical information, and (3) recommendation. The clinical information section contained data on the caller's relationship to patient (i.e., was the caller calling for herself or for someone else?), a brief health history, presenting problem, a set of nursing assessment questions, the care advice given to the patient, and a closing statement. The closing statement advised patients on what to do or how to monitor the situation and how to get help if

things got worse. The recommendation section included the name of clinical guideline used and the recommendation provided by the teletriage nurse.

There were about 350 calls tape-recorded by Clinidata at the North Bay site from May 4 to June 7, 2001. Approximately 300 calls were recorded from the start to the finish of the conversation. The teletriage nurse asked for the caller's consent in 112 calls (37%) and the caller granted consent in 101 calls (90% consent rate for those callers who were asked). These 101 calls were handled by 23 teletriage nurses, and 15 (65%) of these nurses granted consent. At the end of the selection process, there were 73 tape-recorded calls handled by 14 teletriage nurses. There was a range of 1–15 calls per nurse with a mean of approximately 5 calls per nurse. Identifying information was deleted to protect privacy. Patient's age and community of residence, important in the assessment of the appropriateness of advice, were made available to the auditors. The study was approved by Laurentian University's Research Ethics Board.

There were six auditors: two family physicians (FPs), two nurse practitioners (NPs), and two registered nurses (RNs) with teletriage experience, chosen because the teletriage service focused on everyday health problems and enhancing access to primary care. The RN auditors had previous experience in providing teletriage services. All auditors were practicing and licenced by their respective licencing bodies during the audit period.

Audits were conducted independently, and each call was assessed by one FP, one NP, and one RN. Tape-recorded calls were systematically assigned such that each auditor would assess one-half of all calls in the sample. However, seven calls were reassigned from one NP to the other NP due to time constraints. Teletriage nurses with more than three tape-recorded calls were evaluated by both FPs, both NPs, and both RNs. For example, a teletriage nurse with seven tape-recorded calls had three calls audited by one FP and four calls audited by the other FP. Similar arrangements were made for assigning calls to NPs and RNs.

Auditors were unable to assess the entire computerized decision support software package (Sharp Focus, HealthLine Systems Inc. San

Diego, CA) because of copyright restrictions. Auditors, however, assessed certain components of the software that applied directly to the tape-recorded calls. The audit form contained 16 main questions, but the focus in this paper is on the auditors' assessment of the appropriateness of the advice given by the nurse to the patient as well as evaluating aspects of the nurse-patient interaction. The appropriateness of the advice was assessed on a seven-point scale. Aspects of the nurse-patient interaction were rated on a five-point scale. The auditors' responses to open-ended questions were clarified by the research team after discussion with the auditors. The audit process and audit form were pretested by two FPs and two NPs. The analysis was descriptive in nature, using Pearson's Chi-squared statistic for contingency tables, *t*-tests, and percent agreement for estimates of interauditor agreement.

## RESULTS

### *Description of calls, callers, and patients*

The teletriage nurses recommended self-care (including informal care to others) in 34% of the 73 calls, and advised 29% of the patients to see a physician within 4 hours (urgent physician referral category) (Table 1). A comparison to recommendations for all calls logged during

TABLE 1. RECOMMENDATION SUGGESTED BY CLINICAL GUIDELINE

<i>Recommendation</i>	<i>Audited calls</i> n = (%)	<i>All calls</i> <sup>a</sup> n = (%)
Priority (911)	1 (1%)	2,307 (2%)
Emergent (ED)	21 (29%)	22,811 (23%)
Urgent physician referral	14 (19%)	26,066 (26%)
Physician referral	3 (4%)	8,018 (8%)
Interim care (self-care)	25 (34%)	38,727 (28%)
Information only	8 (11%)	<sup>b</sup>
Other recommendation	0 (0%)	3,288 (3%)
No recommendation	1 (1%)	0 (0%)
Total	73 (100%) <sup>c</sup>	101,217 (100%)

<sup>a</sup>Clinidata Corporation (2001).<sup>16</sup>

<sup>b</sup>Included in self-care.

<sup>c</sup> $\chi^2 = 5.017, df = 4, p = 0.276$ , for 911 + ED, Urgent physician referral, Physician referral, interim care + information only, and other + no recommendation.

the pilot project by the service provider (Clinidata Corporation) did not find a statistically significant difference ( $\chi^2 = 5.107$ ,  $df = 4$ ,  $p = 0.276$ ). The triage nurses accessed 41 guidelines. Approximately 63% of the guidelines were accessed once, 15% were accessed twice, and 22% were accessed three times. There were 15 pediatric guidelines used in 30 calls and these were the most frequently used guidelines. Guidelines for trauma and genitourinary symptoms were also frequently accessed. Different health information topics were accessed in 14 calls. Guidelines and health topics used in the audited calls were representative of those used during the pilot project.

Most callers were female (86%) and most (60%) had called for another person, typically a young child. The proportion of female callers in the audit sample was not statistically significantly different from that obtained from a survey of callers (2389 questionnaires returned, 5475 mailed) conducted by the research team as part of the evaluation ( $\chi^2 = 0.001$ ,  $df = 1$ ,  $p = 0.980$ ). Most patients were female (67%), and the proportion was not statistically significantly different from that obtained by the survey ( $\chi^2 = 0.875$ ,  $df = 1$ ,  $p = 0.350$ ) or from a larger sample of 27,302 call records ( $\chi^2 = 0.443$ ,  $df = 1$ ,  $p = 0.505$ ). There were, however, significantly ( $p < 0.001$ ) more female callers or female patients in the audit sample as compared to the population of northern Ontario, where approximately 50% of the population are female.

The average age of patients was 19 years. The majority were 17 years of age or younger (56%), while 21% were aged 17–34 years (Table 2). The

age distribution of audited patients was not statistically significantly different from that obtained by the survey ( $\chi^2 = 2.748$ ,  $df = 3$ ,  $p = 0.432$ ) or from the call records ( $\chi^2 = 3.373$ ,  $df = 3$ ,  $p = 0.338$ ). There were, however, significantly more audited patients in the 17 or younger age group as compared to the population of northern Ontario ( $\chi^2 = 44.128$ ,  $df = 3$ ,  $p < 0.001$ ).

#### *Appropriateness of advice*

In 56% of the 73 calls, all three auditors judged the nurse's advice as "appropriate." In 92% of the 73 calls, at least two of the three auditors judged the triage nurse's advice as "appropriate." All calls were rated as "appropriate" by at least one auditor. If the auditors did not rate the triage nurse's advice as "appropriate," then they were approximately three times more likely to rate it as "overly-cautious" (23 calls) rather than "insufficient" or "inappropriate" (8 calls).

The overall mean rating of the 73 calls was 4.1 (1 = "inappropriate," 4 = "appropriate," 7 = "unnecessarily overly cautious") (Table 3). Mean rating given by NPs (3.8) was statistically significantly different ( $p < 0.001$ ) from that given by the RNs (4.2) or FPs (4.3) (paired *t*-tests). Mean ratings given by RNs and FPs were not significantly different ( $p = 0.109$ ) from one another.

Interrater agreement, calculated as the percentage of calls rated exactly the same by each pair of auditors, ranged from 33% to 86% (Table 4). Including audits in which one auditor was within one rating category of the other auditor

TABLE 2. AGE OF PATIENT BY DATA SOURCE

Age of patient (years)	Audit patients	Survey patients	Call records	1996 Population <sup>a</sup>
Under 17	41 (56%) <sup>b</sup>	1162 (49%)	12,975 (46%)	197,005 (24%)
17–34	15 (21%)	477 (20%)	8091 (29%)	207,605 (25%)
35–49	10 (14%)	353 (15%)	3825 (14%)	193,180 (23%)
50 or older	7 (10%)	384 (16%)	3041 (11%)	228,485 (27%)
Subtotal	73	2376 <sup>c</sup>	27,932 <sup>d</sup>	826,275 <sup>e</sup>
Missing	0	13	104	0
Total	73	2389	28,036	826,275

<sup>a</sup>Source: Statistics Canada 1996 Census.

<sup>b</sup>Percentages were calculated separately for each column based on subtotals.

<sup>c</sup> $\chi^2 = 2.748$ ,  $df = 3$ ,  $p = 0.432$  (comparison of audit and survey).

<sup>d</sup> $\chi^2 = 3.373$ ,  $df = 3$ ,  $p = 0.338$  (comparison of audit and call records).

<sup>e</sup> $\chi^2 = 44.128$ ,  $df = 3$ ,  $p < 0.001$  (comparison of audit and 1996 population).

TABLE 3. AUDITORS' RATING OF THE TELETRIAGE NURSES' ADVICE TO PATIENTS<sup>a</sup>

Appropriateness of the teletriage nurse's advice to the patient	Auditor			
	FP n (%)	NP n (%)	RN n (%)	Total n (%)
Inappropriate (1) <sup>b</sup>		3 (4%)		3 (1%)
Insufficient, no mitigating circumstances		3 (4%)	1 (1%)	4 (2%)
Insufficient but with mitigating circumstances	1 (1%) <sup>c</sup>		1 (1%)	2 (1%)
Appropriate	55 (76%)	67 (92%)	59 (82%)	181 (83%)
Overly cautious but with mitigating circumstances	8 (11%)		8 (11%)	16 (7%)
Overly cautious, no mitigating circumstances	6 (8%)		2 (3%)	8 (4%)
Unnecessarily overly cautious	2 (3%)		1 (1%)	3 (1%)
Total	72 <sup>d</sup>	73	72 <sup>d</sup>	217
Mean rating (7 point scale)	4.3	3.8	4.2	4.1
(SD)	(0.772)	(0.706)	(0.628)	(0.469)

<sup>a</sup>Zeros were removed from the table to aid interpretation.

<sup>b</sup>Value on 7-point scale.

<sup>c</sup>Percent of audits were calculated down columns.

<sup>d</sup>One call was not rated.

yielded a modified overall agreement of 76–94%. An examination of how auditors rated the teletriage nurse's advice (Table 3) and percent agreement between auditors (Table 4) suggests that ratings were reasonably robust. Paradoxically, the high level of agreement in one category (as opposed to high level of agreement in several categories) resulted in low values for correlation coefficients (Pearson's or Spearman's) as well as low values for Cohen's kappa.<sup>17</sup> Cohen's kappa (a measure of interrater agreement) ranged from -0.19 to 0.23 (data not presented), which is considered to be poor to slight agreement.<sup>18</sup>

There were 22 calls for which one of the auditors suggested a level of care that differed from that of the teletriage nurse. These include the 18 calls for which advice was not appropriate or did not have mitigating circumstances, and four calls with mitigating circumstances for which the auditor still suggested an alternative level of care. In 73% of these 22 calls, the auditor suggested a level of care that was less urgent than what the teletriage nurse had advised. For example, the auditor recommended that the patient should see their physician within 24 hours whereas the teletriage nurse had recommended a visit to the ED or to the physician within 4 hours (six calls). In another four calls, the auditor suggested that self-care would suffice, whereas the teletriage nurse had suggested a visit to a physician within 24 hours.

In the remaining 27% of the 22 calls, the auditor suggested a level of care that was more urgent. Four calls for which the teletriage nurse advised self-care or provided information were upgraded to a physician visit. The advice for another four calls was upgraded to an ED visit. In 82% of these 22 calls, it was only one auditor who disagreed with the level of urgency suggested by the teletriage nurse.

Mitigating circumstances were cited for 21 calls. These include the 18 calls that had "mitigating circumstances," and three additional

TABLE 4. EXACT AGREEMENT BETWEEN PAIRS OF AUDITORS

Auditors	NP1	NP2	RN1	RN2
FP1	10 of 13 (77%)	16 of 22 (73%)	13 of 18 (72%)	13 of 17 (76%)
FP2	11 of 16 (69%)	13 of 21 (62%)	6 of 18 (33%)	15 of 18 (83%)
NP1	<sup>a</sup>	<sup>b</sup>	11 of 14 (79%)	9 of 14 (64%)
NP2			15 of 23 (65%)	18 of 21 (86%)

<sup>a</sup>Self-agreement statistics were not presented.

<sup>b</sup>Agreement statistics could not be calculated for (1) FP1 and FP2, (2) NP1 and NP2, or (3) RN1 and RN2 because there was no overlap.

calls in which the auditor judged the advice as "appropriate." The most frequently cited mitigating circumstance was that the patient did not have a physician (seven calls) followed by the absence of an after-hours or walk-in clinic (AHC) (six calls) in the patient's community. Overall, access-related mitigating circumstances (e.g., no physician, ED, or AHC) were cited in 13 of the 21 calls while patient-related mitigating circumstances (e.g., difficulty understanding, unwilling or unable to comply) were cited in eight calls. Two calls had both access and patient-related mitigating circumstances.

#### *Evaluation of the teletriage nurse–caller interaction*

The auditors rated five aspects of the teletriage nurse–caller interaction. Mean rating of the: (1) teletriage nurse's ability to establish a relationship with the caller; (2) nurse's ability to extract pertinent information; (3) caller's ability or willingness to describe the problem, and (4) the caller's level of literacy or under-

standing was 3.5–3.7 (1 = "poor," 5 = "excellent") (Table 5). Most ratings occurred in the categories of "good to excellent" (46–48%) and "good" (33–36%). Mean rating of the change in the caller's anxiety level was 3.6 (1 = "more anxious," 3 = "no change," 5 = "less anxious"). Most of the ratings occurred in the category of "slightly less anxious" (42%) or "no change" (34%). NPs gave the highest mean rating (3.8–4.1) in all five aspects of the nurse–caller interaction, whereas RNs typically gave the lowest mean rating (3.0–3.6). There were statistically significant differences ( $p < 0.05$ ) for all pair-wise comparisons of auditors (e.g., NP vs. FP, NP vs. RN, FP vs. RN) with the exception of the change in anxiety, where NPs (mean = 3.8) gave significantly higher ratings than FPs (3.5) but not RNs (3.6).

## DISCUSSION

Each of the 73 calls was audited by one FP, one NP, and one RN. In 92% of the 73 calls, at

TABLE 5. AUDITOR'S OVERALL IMPRESSION OF THE TELETRIAGE NURSE-CALLER INTERACTION

	Rating Scale					Total n	Mean rating (5-point scale) (SD)
	Poor (1) <sup>a</sup> n (%)	Poor to good n (%)	Good n (%)	Good to excellent n (%)	Excellent n (%)		
Teletriage nurses's ability to							
Establish a relationship with the caller/patient	3 <sup>b</sup> (1%) <sup>c</sup>	5 (2%)	79 (36%)	104 (48%)	27 (12%)	218	3.7 (0.470)
Extract pertinent information	3 (1%)	15 (7%)	71 (33%)	102 (48%)	23 (11%)	214	3.6 (0.537)
Caller's							
Ability or willingness to describe the problem	3 (1%)	15 (7%)	70 (33%)	98 (46%)	29 (13%)	215	3.6 (0.590)
Literacy level or level of understanding	5 (2%)	19 (9%)	73 (33%)	105 (48%)	16 (7%)	218	3.5 (0.602)
	<i>Caller became more anxious (1)<sup>a</sup></i>	<i>Caller became slightly more anxious</i>	<i>No change in caller's anxiety level</i>	<i>Caller became slightly less anxious</i>	<i>Caller became less anxious</i>	Total	Mean rating (5-point scale) (SD)
Caller's anxiety							
Overall change in caller's level of anxiety	1 (1%)	17 (8%)	73 (34%)	90 (42%)	31 (15%)	212	3.6 (0.628)

<sup>a</sup>Value on 5-point scale.

<sup>b</sup>Number of audits.

<sup>c</sup>Percent of audits calculated across rows.

least two of three auditors rated the teletriage nurse's advice as "appropriate." This is comparable with an evaluation of teletriage referrals to a children's hospital ED in Alabama, where Barber *et al.* reported that two of three physician auditors had agreed that 80% of the recommended visits were appropriate.<sup>9</sup> The variation among auditors in the assessment of the appropriateness of the teletriage nurse's advice may be due to the different perspective that the family physicians, nurse practitioners, and registered nurses brought to the audit process. A certain amount of variability is also to be expected among teletriage nurses. For example, Belman and colleagues found a mean agreement of 83% (range 64–100%) among 15 teletriage nurses in Colorado based on 15 different case scenarios from standardized (mock) patients.<sup>13</sup> In our study, the percentage of calls that were rated exactly the same by each pair of auditors varied from 62–86% with an outlier of 33%.

In the calls in which at least one auditor did not rate the teletriage nurse's advice as "appropriate," the auditor was three times more likely to rate it as "overly cautious" rather than "insufficient" or "inappropriate." These results were consistent with Clinidata's policy and with the Canadian Nurses Association's recommendations to err on the side of caution.<sup>19–21</sup>

Access-related mitigating circumstances (e.g., no FP or ED or AHC) were most frequently cited followed by patient-related circumstances (e.g., difficulty understanding, unwilling or unable to comply). Patient understanding and willingness or ability to comply are crucial to the process.<sup>22–24</sup> In over 80% of the audits, the auditors rated the teletriage nurse's ability to establish a relationship with the caller and extract pertinent information as "good to excellent" or "good." The caller's ability or willingness to describe the problem and the caller's level of literacy or understanding was also rated as "good to excellent" or as "good" in approximately 80% of the audits. The auditors also judged that the caller became slightly less anxious in 42% of the audits. No change in the caller's level of anxiety was recorded for 34% of the audits.

The major limitation to the generalizability of results was the fact that the audited calls

were not randomly selected due to practical limitations and informed consent requirements. However, the characteristics of the calls, callers, and patients were comparable to those of the pilot project in terms of call disposition, guidelines, and information topics used, as well as caller's or patient's demographic characteristics such as age and gender. However, more callers and patients are female and are younger than the population of northern Ontario. This study did not specifically address issues of accuracy of the nursing assessment as determined by subsequent changes in patient's health status or use of health services. Nor did the study examine all aspects of safety and quality, unless directly related to appropriateness of advice. However, Clinidata Corporation has a training program and a quality improvement program that seeks to address these concerns.<sup>25</sup>

Overall, the teletriage nurse's advice was rated as "appropriate" by at least two of three auditors in over 90% of the audited calls. In approximately three-quarters of the 31 calls in which the teletriage nurse and auditor disagreed on the level of urgency, the teletriage nurse erred on the side of caution by advising a level of care that was, in the auditors opinion, overly cautious. The "overly cautious" nature of the advice given should be understood in the broader context of the Canadian health care system. Unlike some teletriage programs in managed care settings in the United States or in the National Health System of the United Kingdom, teletriage programs in Canada are not gatekeepers. Thus, there was no pressure on teletriage nurses to direct patients away from more costly services such as physician or ED visits. As a matter of fact, in Ontario and some other provinces, teletriage programs, physician services, and emergency services are run and funded separately. Over utilization of, for instance, ED services has no adverse financial implications for a teletriage program. On the other hand, if a patient's situation deteriorates after he has been told by a teletriage nurse that there is no need to see a doctor, the teletriage program could be blamed for the consequence. Thus, there appears to be some incentive for teletriage nurses to err on the side of caution when in doubt.

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## REFERENCES

1. Stacey D, Noorani HZ, Fisher A, Robinson D, Joyce J & Pong RW. *Telephone triage services: systematic review and survey of Canadian call centre programs*. Ottawa, Ontario: Canadian Coordinating Office for Health Technology Assessment. Technical report no. 43. November, 2003.
2. Gaffney P, Crane S, Johnson G, Playforth M. An analysis of calls referred to the emergency 999 service by NHS Direct. *Emerg Med J* 2001;18:302-304.
3. Poole SR, Schmitt BD, Carruth T, Peterson-Smith A, Slusarski M. After-hours telephone coverage: the application of an area-wide telephone triage and advice system for pediatric practices. *Pediatrics* 1993;92:670-679.
4. Perrin EC and Goodman HC. Telephone management of acute pediatric illnesses. *NEJM* 1978;298:130-135.
5. Allen-Davies JT, Beck A, Parker R, Ellis JL, Polley P. Assessment of vulvovaginal complaints: Accuracy of telephone triage and in-office diagnosis. *Obstet Gynecol* 2002;99:18-22.
6. Marsden J. An evaluation of the safety and effectiveness of telephone triage as a method of patient prioritization in an ophthalmic accident and emergency service. *J Adv Nurs* 2000;31:401-409.
7. Lee TJ, Baraf LJ, Guzy JJD, Woo, H. Does telephone triage delay significant medical treatment. *Arch Pediatr Adolesc Med* 2003;157:635-641.
8. Frisbee SJ, Malloy M, Meurer JR, Kuhagen KA & Kini NM. Urban Wisconsin pediatric patients using an after-hours telephone triage service: Outcomes and compliance. *WMJ* 2001;100:55-58.
9. Barber JW, King WD, Monroe KW, Nichols MH. Evaluation of emergency department referrals by telephone triage. *Pediatrics* 2000;105:819-821.
10. Kempe A, Dempsey C, Hegarty T, Frei N, Chandramouli V, Poole SR. Reducing after-hours referrals by an after-hours call center with second-level physician triage. *Pediatrics* 2000;106:226-230.
11. Kempe A, Dempsey C, Whitefield J, Bothner J, MacKenzie T, Poole S. Appropriateness of Urgent Referrals by Nurses at a Hospital-Based Pediatric Call Center. *Arch Pediatr Adolesc Med* 2000;154:355-360.
12. Kempe A, Luberti A, Belman S, Hertz A, Sherman H, Amin D, Dempsey C, Chandramouli U, MacKenzie T. Outcomes associated with pediatric after-hours care by call centers: a multicenter study. *Ambulat Pediatr* 2003;3:211-217.
13. Belman S, Murphy J, Steiner JF, Kempe A. Consistency of triage decisions by call center nurses. *Ambulat Pediatr* 2002;2:396-400.
14. Wachter DA, Brillman JC, Lewis J, Sapien RE. Pediatric telephone triage protocols: standardized decisionmaking or a false sense of security? *Ann Emerg Med* 1999;33:388-394.
15. Rupp RE, Ramsey KP, Foley JD. Telephone triage: results of adolescent clinic responses to a mock patient with pelvic pain. *J Adolesc Health* 1994;15:249-253.
16. Clinidata Corporation. Direct Health Report for the City of North Bay. June 1999-March 2001 Report. Clinidata Corporation, 2001.
17. Uebersax, JS. Kappa coefficients: A critical appraisal. In *Statistical methods for rater agreement*. Downloaded July 18, 2002 from <http://ourworld.compuserve.com/homepages/jsuebersax/agree.htm>.
18. Landis JR, Koch GG. The measurement of observer agreement for categorical data. *Biometrics* 1977;33:159-174.
19. Clinidata Corporation. Guidelines and Procedures Manual. #3.1.1.5 Scope of Practice v2. Clinidata Corporation. June, 2001.
20. Clinidata Corporation. Guidelines and Procedures Manual. #3.3.2 Transfer to Call to 911 Ambulance Dispatch—Ontario. Clinidata Corporation. June, 2001.
21. Canadian Nurses Association. Telehealth: Great potential or risky terrain? *Nursing Now* 2000;9:5-8.
22. Leclerc BS, Dunnigan L, Cote H, Zunzunegui MV, Hagan L, Morin D. Callers' ability to understand advice received from a telephone health-line service: comparison of self-reported and registered data. *Health Serv Res* 2003;38:697-710.
23. Cooke MW, Wilson S, Cox P, Roalfe A. Public understanding of medical terminology: non-English speakers may not receive optimal care. *J Accident Emerg Med* 2000;17:119-121.
24. Larson-Dahn ML. Tel-eNurse practice—quality of care and patient outcomes. *JONA* 2001;31:145-152.
25. Clinidata Corporation. Guidelines and Procedures Manual. Clinidata Corporation, 2001.

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