PREHOSPITAL CARE

Computer assisted assessment and advice for "non-serious" 999 ambulance service callers: the potential impact on ambulance despatch

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Objective: To investigate the potential impact for ambulance services of telephone assessment and triage for callers who present with non-serious problems (Category C calls) as classified by ambulance service call takers.
Design: Pragmatic controlled trial. Calls identified using priority dispatch protocols as non-serious were allocated to intervention and control groups according to time of call. Ambulance dispatch occurred according to existing procedures. During intervention sessions, nurses or paramedics within the control room used a computerised decision support system to provide telephone assessment, triage and, if appropriate, offer advice to permit estimation of the potential impact on ambulance dispatch.
Setting: Ambulance services in London and the West Midlands.
Subjects: Patients for whom emergency calls were made to the ambulance services between April 1998 and May 1999 during four hour sessions sampled across all days of the week between 0700 and 2300.
Main outcome measures: Triage decision, ambulance cancellation, attendance at an emergency department.
Results: In total, there were 635 intervention calls and 611 controls. Of those in the intervention group, 330 (52.0%) were triaged as not requiring an emergency ambulance, and 119 (36.6%) of these did not attend an emergency department. This compares with 55 (18.1%) of those triaged by a nurse or paramedic as requiring an ambulance (odds ratio 2.62; 95% CI 1.78 to 3.85). Patients triaged as not requiring an emergency ambulance were less likely to be admitted to an inpatient bed (odds ratio 0.55; 95% CI 0.33 to 0.93), but even so 30 (9.2%) were admitted. Nurses were more likely than paramedics to triage calls into the groups classified as not requiring an ambulance. After controlling for age, case mix, time of day, day of week, season, and ambulance service, the results of a logistic regression analysis revealed that this difference was significant with an odds ratio for nurses:paramedics of 1.28 (95% CI 1.12 to 1.47).
Conclusions: The findings indicate that telephone assessment of Category C calls identifies patients who are less likely to require emergency department care and that this could have a significant impact on emergency ambulance dispatch rates. Nurses were more likely than paramedics to assess calls as requiring an alternative response to emergency ambulance despatch, but the extent to which this relates to aspects of training and professional perspective is unclear. However, consideration should be given to the acceptability, reliability, and cost consequences of this intervention before it can be recommended for full evaluation.

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Studies in several countries have shown the rate of unnecessary emergency ambulance call out and subsequent attendance at accident and emergency departments to be between 11% to 52%.[1–15] This contributes to inefficient, clinically inappropriate health care, and may delay the provision of emergency care to those with life threatening needs.[16] However, research evidence is lacking about the potential impact and acceptability of alternatives to immediate emergency ambulance despatch.

To help improve emergency ambulance service performance by targeting resources at the more acutely ill or injured, priority despatch systems have been introduced. These enable control room operators using structured protocols to anticipate the required level of response, but under-prioritisation may occur in as many as 20% of seriously ill patients.[17]

It has been suggested that telephone assessment using computerised decision support could be used to identify whether an alternative to ambulance despatch could be offered to patients who are prioritised by call takers as presenting with non-urgent problems. This role has been proposed for NHS Direct. Although such systems have been piloted and evaluated in the UK in out of hours general practice and accident and emergency settings,[18 19] evidence about their efficacy in ambulance service triage is lacking. The aims of this study were to investigate the efficacy, acceptability, safety, and costs of telephone assessment and advice to such callers. This paper reports on findings from the study concerning the triage decisions made by nurses and paramedics and the potential effects that these might have on emergency ambulance despatch and admission rates.

METHODS

Setting

The study was a pragmatic, controlled trial, conducted across two ambulance service sites covering the whole of Greater London, Birmingham, Coventry, the Black Country, and South Staffordshire; a total population of about 10 million.

Study design

During sessions sampled for inclusion in the study, all 999 calls identified by call takers using priority despatch protocols as presenting with Category C (non-serious) problems were entered into the trial, with the exception of: hoax calls, alarm calls, and calls prioritised as potentially life threatening (Category A) or serious calls (Category B). The exclusions, therefore, included callers with comprehension/language difficulties that prevented adequate assessment by the call taker, as well as children under the age of 2 years, as these would have been automatically assigned the higher Category A or B priority by the call taker.

The main data collection was conducted between April 1998 and May 1999. The week was divided into weekdays and weekends and by four hour time sessions between 0700 to 2300 hours, across the entire data collection period; the Category C workload was too low during the early hours of the morning to merit inclusion in the study.

The intention was that time sessions would be selected and allocated randomly to nurse assessment, paramedic assessment, or control using computer generated random numbers. However, because of external constraints, session times had to be modified to accommodate the hours of availability of the nurses, paramedics, and the availability of call takers trained in priority despatch. Other work and family commitments particularly limited the availability of the nurses, but as far as possible the timings of control and intervention sessions were matched and allocated evenly across the entire data collection period.

Ambulances were dispatched to all calls at the commencement of prioritisation by the call taker, in accordance with existing ambulance service procedure at the time. Once identified, Category C calls received a type of response dependent on the session to which they were allocated, either control or intervention. During control sessions the calls received the usual ambulance response with no additional telephone assessment and advice.

During intervention sessions, following ambulance despatch Category C calls were passed to a nurse or paramedic, if available, for assessment, triage and advice. Computerised decision support was used to assist this process, and to determine whether or not despatch of an emergency ambulance was indicated. If the patient was triaged as not requiring an ambulance, the caller was offered advice and asked whether they still wished an ambulance to attend. If the caller stated that they were happy to follow the advice, ambulance despatch was cancelled. The decision to cancel was never made without the patient's agreement.

Nurses and paramedics

A total of 16 nurses and 10 paramedics participated in the study. Nurses were recruited from NHS services in London and the West Midlands that at the time of the study used the clinical decision support system for the assessment and triage of out of hours or NHS Direct calls. Paramedics were only available for the study in London, and they were recruited using the ambulance service's internal vacancy bulletin.

All participating staff attended an induction day that included an orientation to the study and the call centre environment, and training on a version of the decision support system that had been modified to support the needs of data collection. In addition, the paramedics received in depth training in the use of the system, followed by at least 14 hours practice using role play scenarios. The nurses' and paramedics' skills and competencies were evaluated during a 90 minute session that involved simulated Category C calls role played over the telephone with an actor. Nurses then completed a four hour "live" practice session, while paramedics completed at least eight hours of "live" practice sessions.

Data collection and analysis

After each sampled session, all calls prioritised as Category C (non-serious) were identified, and data were collected from ambulance service records (patient name, contact address, age, ambulance attendance, ambulance arrival time), and from accident and emergency department records (diagnosis, treatment, investigations, and referrals). For patients assessed by a nurse or paramedic, the computerised call record provided information on the content of the nurse/paramedic telephone assessment including the questions and responses, length of assessment, patient's symptoms, advice given and the nurse/paramedic assessment of need for an ambulance. Patients triaged using the decision support system as not requiring care within four hours (that is "homecare", "routine", or "moderately urgent" categories) were classified as not requiring an emergency ambulance, while those requiring an ambulance comprised of those who needed "urgent" (within two to four hours) or "immediate care" (within two hours).

In the week after the initial 999 call, all subjects in both the intervention and control groups were sent a set of questionnaires by post and a Freepost reply envelope. Intervention group patients received an additional questionnaire relating to their experiences of the telephone assessment and advice. Where patients were children, the parent/guardian of the child was asked to complete the questionnaires. A Care Pathway questionnaire was also included that asked subjects to report the care that they had received from community and hospital based services in the week subsequent to the call. This was particularly important for identifying the care received by patients who had declined an ambulance.

Based on the results of an initial pilot study, the intention was to recruit 400 subjects who had been triaged by nurses, 300 by paramedics and 600 controls, and it was estimated that around 150 intervention sessions would need to be sampled for this purpose (average of five completed Category C call assessments/session).

All data were coded, input, and analysed using the statistical package SPSS. For the purpose of analysis, the priority despatch classifications were recoded into five categories:

- neurological/head injury (including headache, fits/convulsions, and unconsciousness/fainting)
- falls/accidents (including animal bite, overdose/poisoning, assault/trauma, burns, and road traffic accident)
- sick unknown (as priority despatch classification)
- back pain/abdominal pain (as priority despatch classification)
- other (including allergic reaction, bleeding, breathing difficulty, chest pain, diabetic, environmental emergency, gynaecological/miscarriage, and pregnancy/childbirth)

Ethical approval

Ethical approval was granted by the Multi-Centre Regional Ethics Committee for South Thames, and a total of 39 local research ethics committees responsible for the populations covered by the two ambulance services.

RESULTS

Subjects

During the study period 102 four hour data collection sessions were sampled in London and 56 in the West Midlands. During sessions in London 16% of all emergency calls received were prioritised as Category C, while in the West Midlands the proportion was 18%.

In all, 635 calls were recruited to the intervention group (360 assessed by nurses, 275 by paramedics), and 611 controls were recruited. The distribution and characteristics of these calls is shown in table 1. Patients in the intervention and control groups did not differ by sex, but there was a significant

Table 1 Patient characteristics and call times for intervention (triage decision recorded) and control groups

Demographics	Nurse group (n=360)	Paramedic group (n=275)	Control group (n=611)
Age, mean, range (SD)	(n=358) 44.5 y, 0.08–98 (27.7)	(n=275) 44.4 y, 0.5–96 (29.4)	(n=608) 49.1 y, 0.04–99 (28.5)
Men	146 (41%)	107 (39 %)	265 (43%)
Women	214 (59%)	168 (61 %)	346 (57%)
Ethnicity:	(n=170)	(n=160)	(n=295)
White (UK)	94 (55.3%)	90 (56.3%)	204 (69.2%)
White (other)	15 (8.8%)	9 (5.6%)	20 (6.8%)
Black Caribbean	12 (7.1%)	10 (6.3%)	12 (4.1%)
Black African	14 (8.2%)	14 (8.8%)	11 (3.7%)
Black (other)	2 (1.2%)	3 (1.9%)	5 (1.7%)
Indian	13 (7.6%)	14 (8.8%)	20 (6.8%)
Pakistani	5 (2.9%)	3 (1.9%)	8 (2.7%)
Bangladeshi	3 (1.8%)	4 (2.5%)	3 (1.0%)
Chinese	1 (0.6%)	0	1 (0.3%)
Other	11 (6.5%)	13 (8.1%)	11 (3.7%)
Details of call			
Day of week:			
Monday–Friday	188 (52.2%)	219 (79.6%)	380 (62.2%)
Saturday–Sunday	172 (47.8%)	56 (20.4%)	231 (37.8%)
Time of day:			
0700–1100	53 (14.7%)	106 (38.5%)	98 (16.0%)
1100–1500	112 (31.1%)	47 (17.1%)	204 (33.4%)
1500–1900	123 (34.2%)	76 (27.6%)	160 (26.2%)
1900–2300	72 (20.0%)	46 (16.7%)	149 (24.4%)
Season:			
Spring	113 (31.4%)	65 (23.6%)	166 (27.2%)
Summer	58 (16.1%)	98 (35.6%)	168 (27.5%)
Autumn	92 (25.6%)	63 (22.9%)	130 (21.3%)
Winter	97 (26.9%)	49 (17.8%)	147 (24.1%)
Problem presented:	(n=324)	(n=253)	(n=600)
Neurological/head injury	30 (9.3%)	16 (6.3%)	43 (7.2%)
Falls/accidents	139 (42.9%)	98 (38.7%)	353 (58.8%)
Sick/unknown	79 (24.4%)	76 (30.0%)	59 (9.8%)
Back pain/abdominal pain	57 (17.6%)	44 (17.4%)	86 (14.3%)
Other	19 (5.9%)	19 (7.5%)	59 (9.8%)
Triage outcome:	(n=360)	(n=275)	
Ambulance required	151 (41.9%)	154 (56.0%)	–
Immediate	80 (22.2%)	81 (29.5%)	–
Urgent	71 (19.7%)	73 (26.5%)	–
Ambulance not required	209 (58.1%)	121 (44.0%)	–
Moderately urgent	104 (28.9%)	51 (18.5%)	–
Routine	60 (16.7%)	28 (10.2%)	–
Home care	45 (12.5%)	42 (15.3%)	–
Ambulance despatch cancelled	36 (10.0%)	26 (9.5%)	1 (0.2%)

"n" totals indicate numbers of patients for whom data were available for this particular feature.

difference between groups for age; controls being on average about five years older ($F=3.43$, df=2, p=0.033). There were some differences in the distribution of calls over time of day, day of week and season (table 1), reflecting the constraints on the availability of the nurses and paramedics.

The problem presented by callers was only recorded for 1177 (94.5%) calls (table 1). There were significant differences between nurse and control groups ($\chi^2=46.4$, df=4, $p<0.001$) and between paramedic and control groups ($\chi^2=61.4$, df=4, $p<0.001$) for case mix. Patients in the intervention groups were less likely to have problems related to falls and accidents, but had a greater proportion in the "sick unknown" category.

Telephone triage

In total, 330 (52%) calls were triaged as not requiring an emergency ambulance, of whom 47% were triaged as having problems of moderate urgency (that is, the decision support system recorded that care was needed within 24 hours), 26% needing a routine appointment with a general practitioner and 27% for whom self care advice would suffice. Patients triaged as requiring an ambulance included 144 (47%) classified as "urgent" and 161 (53%) as needing "immediate care".

Nurses were more likely than paramedics to triage calls into the groups who were classified as not requiring an ambulance (table 1). After controlling for age, case mix, time of day, day of week, season and ambulance service, the results of a logistic regression analysis revealed that this difference was significant with an odds ratio for nurses:paramedics of 1.28 (95% CI 1.12 to 1.47).

Table 2 compares the characteristics of patients triaged as requiring and not requiring an ambulance. Although most were women in both groups, those requiring an ambulance comprised of a greater proportion of men. They were also significantly older, and/or presenting with falls or accidents.

Callers in the intervention group were offered, when considered appropriate, the opportunity to decline the ambulance, and as a result 62 (9.8%) ambulances were cancelled

Table 2 Characteristics of Category C patients in the intervention group for whom a triage decision was recorded

Variable	Patients triaged as requiring an ambulance (n=305)	Patients triaged as not requiring an ambulance (n=330)	Significance of difference
Age, mean, range (SD)	(n=303) 48.6 y, 0.5–98 (29.3)	(n=330) 40.7 y, 0.08–94 (27.1)	
0–15 y	48 (15.8%)	60 (18.2%)	χ^2=13.3, p<0.01
16–60 y	133 (43.9%)	182 (55.2%)	
60+ y	122 (40.3%)	88 (26.7%)	
Men	141 (46%)	112 (34%)	χ^2=9.9, p<0.01
Women	164 (54%)	218 (66%)	
Problem presented:	(n=278)	(n=299)	χ^2=22.1, p<0.001
Neurological/head injury	24 (8.6%)	22 (7.4%)	
Falls/accidents	140 (50.4%)	97 (32.4%)	
Sick/unknown	60 (21.6%)	95 (31.8%)	
Back pain/abdominal pain	40 (14.4%)	61 (20.4%)	
Other	14 (5%)	24 (8%)	
Care received:	(n=304)	(n=325)	
Not conveyed to A&E:	55 (%)	119 (%)	
Assistance at scene only	41 (13.5%)	43 (13.2%)	
Seen by GP	9 (3.0%)	47 (14.5%)	
Self care	3 (1.0%)	25 (7.7%)	
Other	2 (0.7%)	4 (1.2%)	
Attended A&E:	249 (81.9%)	206 (63.4%)	χ^2=26.9, p<0.001
A&E outcome:			χ^2=7.1, df=2, p<0.05
Admitted to inpatient bed	47 (15.5%)	30 (9.2%)	
Discharged	118 (38.8%)	117 (36.0%)	
Referred to outpatient clinic	30 (9.9%)	13 (4.0%)	
Outcome not recorded	13 (4.3%)	17 (5.2%)	
Notes missing	35 (11.5%)	23 (7.1%)	
Other	6 (2.0%)	6 (1.8%)	

after telephone assessment (table 1). This included 58 in the group triaged as not requiring an ambulance, and four in the group triaged as requiring an ambulance.

In total, it seemed that 119 (36.6%) of those triaged as not requiring an ambulance were not attended to in an accident and emergency department compared with only 55 (18.1%) of those who had been triaged as requiring an ambulance (odds ratio 2.62; 95% CI 1.78 to 3.85). As table 2 shows, this comprised of patients who followed self care advice after ambulance despatch had cancelled, those that only required assistance at the scene of the incident with no further care from any other service, and those that were identified as having visited their GP after either cancellation of the ambulance or assistance at scene.

As shown in table 2, patients triaged as not requiring an ambulance were less likely to be admitted or referred to an outpatient clinic and more likely to be discharged from the department, although this difference between the groups was only marginally significant (χ^2=9.52, df=5, p<0.01). In all, 77 (12.1%) patients were admitted to an inpatient bed (table 3). Patients triaged as not requiring an emergency ambulance were less likely to be admitted to an inpatient bed (odds ratio 0.55; 95% CI 0.33 to 0.93).

As table 3 shows, few significant differences were identified between the characteristics of admitted patients triaged as requiring an ambulance and those who had been triaged as not requiring one. The former subgroup included a greater proportion of men, and there was a trend towards a greater proportion of medical admissions being included.

DISCUSSION

This is the first study to demonstrate the feasibility of using nurse or paramedic provided telephone assessment and triage to identify whether patients who present to the emergency ambulance service with non-serious problems need an emergency ambulance. Overall, the findings indicate that 58% (95% CI 53% to 63%) of Category C calls assessed by nurses and 44% (95% CI 38% to 50%) of those assessed by paramedics were triaged as not requiring immediate attendance of an emergency ambulance, suggesting that such assessment could lead to a significant reduction in emergency ambulance despatch. After controlling for confounding factors, nurses were found to triage a significantly higher proportion of calls as not requiring an emergency ambulance when compared with paramedics.

However, the actual numbers of ambulances declined by callers were only around one in five of those for whom the nurse or paramedic triaged the emergency ambulance as being unnecessary. This reflected constraints within the study design that intentionally limited the impact of the intervention pending evidence about its safety. Furthermore, because at the time of data collection ambulance despatch could not be delayed because of the requirements placed on ambulances services to achieve national performance standards, ambulances often arrived at the scene before assessment or advice giving had been completed or before ambulance control had been able to cancel them for patients who felt, after telephone assessment, that an ambulance was no longer required. It is unlikely, therefore, that call takers, nurses and paramedics behaved in the same way as if the intervention were to be fully implemented, with ambulance despatch delayed until the further assessment of each Category C call had been completed. Delaying despatch would permit time for more in depth appraisal of each patient's needs, which, in turn, might permit a greater proportion to be triaged as not requiring an emergency ambulance. This warrants further study.

Table 3 Characteristics of Category C patients admitted to an inpatient bed

Variable	Patients triaged as requiring an ambulance (n=305)	Patients triaged as not requiring an ambulance (n=330)	Significance of difference
Admitted	n=47	n=30	
Age, mean, range (SD)	58.1 y, 0.5–91.5 (26.4)	61.2 y, 2–92 (28.9)	p>0.05
0–15 y	3 (6.4%)	2 (6.7%)	
16–60 y	16 (34.0%)	10 (33.3%)	
60+ y	28 (59.6%)	18 (60.0%)	
Men	27 (57.4%)	7 (23.3%)	χ^2=8.6, df=1, p<0.005
Women	20 (42.6%)	23 (76.7%)	
Problem presented:			
Neurological/head injury	4 (9.3%)	2 (7.1%)	p>0.05
Falls/accidents	18 (14.9%)	8 (28.6%)	
Sick/unknown	13 (30.2%)	12 (42.9%)	
Back pain/abdominal pain	3 (7.0%)	5 (17.9%)	
Other	5 (11.6%)	1 (3.6%)	
Admission to:			
Medicine	17 (36.2%)	16 (53.3%)	p>0.05
Surgery	6 (12.8%)	1 (3.3%)	
Urology	1 (2.1%)	1 (3.3%)	
Orthopaedic	8 (17.0%)	4 (13.3%)	
Paediatric	3 (6.4%)	2 (6.7%)	
Psychiatric	1 (2.1%)	0	
Geriatric	6 (12.8%)	2 (6.7%)	
ENT	1 (2.1%)	0	
Gynaecology	0	4 (13.3%)	
Obstetric	1 (2.1%)	0	
A&E observation	3 (6.4%)	0	

Significant associations were found between the care patients received at accident and emergency departments and whether they had been triaged as requiring or not requiring an emergency ambulance. Even so, almost 10% of those triaged as not requiring an ambulance were admitted, and from the hospital data that were retrieved there seemed to be little difference between their characteristics and those of patients admitted who had been triaged as requiring an ambulance. This is an important finding raising questions about the safety of the intervention. Admission in itself does not mean that the triage decision was incorrect; the triage decision related to an assessment of the patient's need to be attended by and/or travel to hospital in an emergency ambulance (that is, a lights and sirens response) rather than whether or not hospital admission in itself might subsequently be needed. As described in another, which considers the safety of the triage decisions made, a detailed analysis of these cases is presented (submitted data).

Applicability

The paramedics recruited for the study were volunteers, selected because they seemed to demonstrate the greatest suitability to the task of telephone consultation. The extent to which they were representative of the wider population of paramedics is unknown. While they had comparatively little time to develop their telephone consulting skills or gain experience of the decision support system, the nurses were all experienced providers of telephone assessment and advice to out of hours general practice callers. Some of the differences in triage decision making between the nurses and paramedics may have reflected overall experience of telephone consultation rather than differences in professional background.

The results relate to findings using one particular decision support system that had been designed for use by nurses and had not previously been used by paramedics. Use of a different decision support system, or a modification of the system used in this study, might be expected to influence the differences observed between the nurses' and paramedics' decision making. In addition, the paramedics were all employed in London, and it might be that those employed in other services might behave differently.

The characteristics of the patient sample studied reflected those of the populations who had called the 999 service during sampled sessions together with the effectiveness of the priority despatch triage process used by call takers. For example, increasing the specificity of priority despatch decisions to the most serious calls may have led to greater numbers of calls being classified as Category C, while increasing the sensitivity to the less serious calls might have resulted in a greater proportion of these calls being amenable to telephone advice. Increased sensitivity does not necessarily, however, equate to increased numbers suitable for telephone advice as the criteria for Category C classification and suitability for telephone advice are not the same. There was also evidence that call takers at times transferred some patients who did not meet the inclusion criteria for telephone assessment; for example, there were some patients who were referred to a nurse or paramedic who were under 2 years old. This seemed to occur when call takers felt that the caller would benefit from telephone assessment and advice.

Randomisation and methods used to control the study environment

A rigorously controlled trial was precluded by the need to keep ambulance service response times to a minimum, unpredictable variations in workload, and at the time of data collection, the limited number of call takers trained in the use of priority despatch in one of the participating services. In addition, the hours of availability of the nurses and paramedics were restricted. The loss of randomisation was allowed for by including confounding factors in the analysis of the data.

Not all Category C callers during intervention sessions were transferred to the allocated nurse or paramedic. Firstly, calls were not transferred at times when the nurse or paramedic

was already occupied. Secondly, some call takers seem to have been reluctant to transfer calls even at times when a nurse or paramedic was available despite the efforts invested in call taker training throughout the study. It was beyond the scope of the study to determine the extent to which call takers varied in their use of the priority despatch protocols, although the differences in case mix and age between the control and intervention groups seem to be as a result of call takers' selection of calls to pass over for further assessment and advice.

Conclusion

The findings from the study suggest that it is feasible to use telephone assessment of Category C calls to identify patients who are less likely to require accident and emergency department care or hospital admission. Within the constraints of this study, nurses were more likely than paramedics to assess calls as requiring an alternative response to emergency ambulance despatch, but issues around A&E attendance rates and admission remain. In particular, the finding that almost 10% of those triaged as not requiring ambulance dispatch subsequently required hospital admission raises concerns about the safety of this intervention that need to be resolved before a trial to undertake full evaluation of this intervention can be recommended. This is the subject of the another paper.[20]

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Contributors

All the authors were part of the project team. JD initiated the study with HS, Kathy Jones and RC, and with SW, RC, HS, EG and SG drafted the grant application and designed the study protocol. SW, TF, and JH were responsible for the development and piloting of data collection tools, the recruitment of patients and nurses, and for the collection, coding and analysis of all data. HS, CHS and trainers at the London Ambulance Service recruited and trained the paramedics. The Plain Software Company trained nurses and paramedics in the use of the decision support system. RH provided statistical advice. JD wrote the paper, and all authors contributed to its drafting and the interpretation of findings. SW, TF and JH are guarantors of the data.

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