MIXED METHODS PHASED EVALUATION OF HIGH-INTENSITY SPECIALIST-LED ACUTE CARE (HiSLAC) OF EMERGENCY MEDICAL ADMISSIONS TO HOSPITALS IN ENGLAND

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Scientific summary

Background

In 2013 NHS England launched the 7-day services initiative, comprising ten standards designed to ensure that access to, and provision of high quality healthcare was the same at weekends as on weekdays across the English NHS. Six of these standards required front-line consultant involvement for delivery. Four became priority standards to be implemented by 2020.

The drivers for this high-profile initiative included the need to maximise the cost-effective use of hospital facilities, and perceptions that at weekends there was a decrement in quality of emergency hospital care causing an increase in mortality risk – the 'weekend effect'. The weekend effect was attributed to reduced consultant presence in hospitals at weekends, despite the absence of objective evidence demonstrating a causal relationship. Seven-day services therefore provided a unique opportunity to test the hypothesis that increasing consultant input into the care of emergency admissions at weekends would produce better

patient outcomes, and would be cost-effective. The High-intensity Specialist Led Acute Care (HiSLAC) collaboration was established to examine these issues.

Aims

HiSLAC was designed to determine whether increasing the intensity of specialist-led care at weekends improves outcomes for patients admitted to hospital as emergencies at weekends. We quantified specialist input into the care of emergency admissions, mapped changes in provision over time, compared specialist intensity with care quality using mixed methods, determined whether weekend case mix differed from weekdays, and developed a health economics model to estimate costs and outcomes of increased specialist provision.

Study design

HiSLAC was conducted in two phases. *Phase 1* (year 1) focused on developing the methodology for Phase 2. *Phase 2* (years 2-5) was a longitudinal programme of research using quantitative and qualitative methods and health economics to evaluate change in specialist intensity, quality of care, and patient outcomes over the full 5 years, supplemented by a systematic review and a qualitative review of the literature.

Methods

Phase 1 methods

Establishing the HiSLAC collaboration:

NHS England, the NHS Confederation, and the Academy of Medical Royal Colleges endorsed HiSLAC in the form of a joint letter to the chief executives and medical directors of all acute non-specialist hospital Trusts in England inviting their participation. Of 141 Trusts, 127 agreed to participate, appointing a local HiSLAC project lead, and 115 Trusts subsequently contributed data to the surveys.

Hospital Episode Statistics:

We obtained data from NHS Digital on all acute admissions to English hospitals from 1st April 2007 until 31st March 2018, and analysed in-hospital mortality in financial years 2013/14 to 2017/18 during the introduction of the 7-day services policy for those Trusts participating in the point prevalence survey. Because of long delays in obtaining data from NHS Digital, for the case record review study we used patient administration (PAS) data from each of the 20 participating Trusts (from which HES data is derived).

Specialist Intensity Metric:

In the absence of a national or local metric for the number of consultants and associate specialists (henceforth 'specialists') on duty and providing direct patient care each day of the week, we therefore established a Nominal Group (professionals and patient/public representatives) to evaluate options. Following a plenary meeting with subsequent rounds by email, the group prioritised the ratio between the self-reported number of specialist hours of direct patient care delivered on a Sunday and on a Wednesday, expressed as a rate per ten emergency admissions derived from HES data for all Sundays and Wednesdays over the financial year. A web-based survey was established to permit easy data entry by all hospital specialists in England. Trust email distribution lists provided the denominator for response rates. Sunday and Wednesday in June were considered affected by seasonal or social factors. To account for variable response rates, estimates of total specialist hours from the survey were scaled up using the reciprocals of the response rates in each Trust.

For comparison, we also surveyed the directors of four acute medical specialities in each Trust, seeking their estimates of the number of specialists on duty and the number of hours devoted to caring for emergency admissions.

The overall response rate to the first point prevalence survey was 45%, and to the directorate level questionnaire 31%. There was a moderate correlation between these two

estimates of specialist intensity (r = 0.58). We therefore chose the point prevalence survey as being the most authentic method with the highest response rate.

Phase 2 methods

The Magnitude and Mechanisms of the Weekend Effect in Hospital Admissions: A Mixed Methods Review

Systematic Review: MEDLINE, CINAHL, HMIC, EMBASE, EthOS, CPCI and the Cochrane Library were searched from January 2000 to April 2015, updated to November 2017, including studies reporting predominantly unselected emergency and elective hospital admissions. The primary outcome was the weekend effect on mortality. Data were meta-analysed using a Bayesian random effects model.

Qualitative Review: Screening of papers from 2000 to 2015 for mechanisms of the weekend effect did not identify any high quality studies. We therefore used the available literature to guide focus groups of healthcare staff and patients on how the quality and safety of hospital care differed between weekend and weekday, and how this could contribute to the weekend effect. Participants were recruited through existing acute care Patient and Public Involvement (PPI) groups, and during observations in the acute medical wards. Focus group moderators, scribes and interviewers were trained qualitative researchers. Data analysis employed thematic analysis.

Cross-sectional and Longitudinal Five Year Study of Weekend-Weekday Specialist Intensity and Emergency Admission Mortality

The point prevalence survey was conducted on a Sunday and a Wednesday in June each year. Local project leads emailed invitations to every specialist in each participating Trust to complete the web-based survey, from which we calculated the specialist intensity metric for the Trust (hours of direct patient care per ten emergency admissions for the Sunday and the Wednesday). Raw estimates were scaled up by the reciprocal of the response rate to

correct for data incompleteness. The Sunday:Wednesday intensity ratio was used to quantify the weekend deficit at Trust level: this is unaffected by the scaling correction for intensity. The weekend:weekday mortality ratio compensates for case mix differences. We used logistic regression to analyse in-hospital mortality with adjustment for diagnosis, age, comorbidity and income deprivation; and meta-regression to analyse Trust-specific weekend effects.

Case Mix Differences Between Weekend and Weekday Emergency Admissions to a Large Hospital Trust

We analysed prospectively collected clinical data for adult emergency admissions between January 2012 and December 2015 from a large hospital Trust. In addition to age, sex, ethnicity, deprivation, principal diagnosis, comorbidities and outcome (hospital discharge and 30 days post-admission), we calculated National Early Warning Scores (NEWS) from physiological vital signs and documented transfers to the intensive care unit. We used multivariable logistic regression to estimate the weekend:weekday mortality odds ratio.

Safety and Quality of Weekend Care in Hospital: A Mixed Methods Evaluation

We examined quality of care of emergency admissions to 20 Trusts selected from the national cohort of HiSLAC Trusts, ten with low and ten with high specialist intensity on Sundays, by performing two qualitative research studies and a case record review.

The first qualitative research (interviews, and observations employing elements of an ethnographic approach) involved site visits during 2016-17 by a team of six qualitative researchers to all 20 Trusts, conducting structured observations of the acute admitting pathway and interviews with staff over 4 days including a weekend. The aim was to describe the role of specialists in quality of care delivery, contextual factors influencing care at weekends, and how hospitals responded to the 7-day services policy. Team debriefings, thematic analysis and detailed case study reports permitted comparative analyses of

weekend care quality between sites, summarised as severe problems or limitations (red), some limitations (amber) or satisfactory (green) to allow derivation of a semiquantitative 'RAG' score. The second qualitative research study involved interviews during 2017-18 with senior clinical and managerial staff in a subset of eight of the 20 Trusts to examine local culture and organisational responses to the 7-day services policy.

Case record reviews examined errors, error-related adverse events and global care quality of 4000 emergency admissions to the 20 Trusts (200 from each), equally divided between weekend and weekday admission and between two epochs representing before (2012-13) and after (2016-17) implementation of the 7-day services policy. Case records were anonymised, scanned and transmitted to a central repository for randomised allocation to 79 reviewers, senior registrars or consultants in acute medical specialities who had undergone a half-day training session in performing structured judgement reviews to identify errors, error-related adverse events, and global care quality assessments. Eight hundred records underwent randomised duplicate review, providing a total of 4800 reviews for analysis.

Health Economics Evaluation of Increasing the Weekend to Weekday Specialist Intensity Ratio in Hospitals in England

Data for assessing quality or care and patient outcomes were obtained from the 4000 case record reviews of emergency admissions to the 20 hospital Trusts. Salary costs were obtained from published pay scales. The primary outcome was the expected net benefits (cost per quality adjusted life years (QALYs)) of shifting from a low level of specialist intensity to a higher level. A distribution of possible QALY losses associated with the observed outcomes, and counterfactual life expectancies associated with adverse events, were derived from published studies. Three models by which specialists might influence patient outcomes and risk estimates were developed from an expert elicitation workshop

and focus group. A Bayesian approach was employed to determine posterior distributions from the study data and the prior distributions obtained from the elicitation workshop.

Ethics

HiSLAC was approved by the Health Research Authority (IRAS project ID 139089) and by the Welsh Research Ethics Committee (ref 13/WA/0372) as service evaluation of an existing form of health care delivery without collecting patient-identifiable data. Informed consent was not required for accessing anonymised patient records.

Findings

Emergency admissions and mortality rates, 2007/8 to 2018/19:

Emergency department attendances and hospital admissions continued to increase each year and the number of hospital beds diminished; length of stay therefore declined. The annual increase in the proportion of delayed discharges from hospital reversed after 2016/17. Hospital mortality rates fell progressively between 2007/8 and 2013/4, but the rate of reduction slowed thereafter. The crude mortality rate associated with weekend admission increased in 2017/18, but not the adjusted weekend:weekday admission mortality ratio, indicating that the increase in crude mortality is therefore attributable to case mix differences (e.g. sicker patients or those with multimorbidity). A progressive widening of the difference between hospital mortality and 30-day mortality suggests that efforts to reduce length of stay may have transferred mortality risk from hospital to the community.

Hospital specialist availability is not the cause of the weekend effect:

Although specialist input into the care of emergency admissions at weekends was on average half that of weekdays, there was no evidence that this was inadequate or that the weekend:weekday specialist intensity difference causes the weekend effect. There was an increase in the weekend:weekday specialist intensity ratio which is attributable to a modest

increase in specialist hours throughout the 7 days, masked by the proportionately greater increase in emergency admissions particularly on weekdays.

Contextual factors influence local adoption of the 7-day services policy:

Trusts with more resources and fewer infrastructure challenges were better able to respond to policy imperatives. A collaborative Trust culture promoted engagement with the policy, whereas 'clan' cultures inhibited clinician engagement. If community services were poorly integrated with secondary care, this was a barrier to introducing 7-day services.

Increasing specialist intensity at weekends may be cost-effective by promoting timely patient discharge from hospital:

Health economics modelling suggests that 7-day services would be cost-effective if specialist intensity at weekends were to achieve parity with that currently provided on weekdays, but the mechanism of benefit is through reducing length of hospital stay by promoting earlier discharge, not by influencing care quality of emergency admissions at weekends.

Care quality of emergency admissions in hospital has improved over time, but may be deteriorating in the community:

Patients and staff identified deficiencies in weekend care processes and quality for patients already admitted to hospital, but considered that new admissions were likely to receive more timely care than those admitted on weekdays. This was supported by the case record review: hospital care processes for emergency admissions were more reliable at weekends than on weekdays and error and adverse event rates and global care quality were similar for weekend and weekday admissions. We found a positive association between case record reviewer judgements of care quality aggregated by Trust, and the on-site observations by the qualitative researchers. In-hospital quality improved during the period of implementation of 7-day services, but indicators of community care quality (sicker patients,

more chronic disease, more palliative care, fewer GP referrals preceding admission) were worse at weekends and deteriorated further with time.

The causal pathway for the weekend effect includes community healthcare preceding hospital admission:

Admission to hospital at a weekend was consistently associated with a surplus mortality of around 16 per cent in the UK and internationally. We have shown that in England this is attributable to case mix differences. Patients admitted as emergencies to hospital at weekends were more severely ill, had more comorbid conditions, are more likely to be candidates for palliative care, and less likely to be discharged to the community before midnight on the day of admission. These adverse features of weekend case mix deteriorated further by 2016/17. Although the same numbers of patients presented to Emergency Departments at weekends as on weekdays, fewer are admitted at weekends. This contributed to the weekend effect by reducing the denominator for the weekend mortality rate. The reduction in admissions was partly attributable to a reduction of two thirds in the proportion of patients referred directly to hospital at weekends by their family doctor (general practitioners (GPs)). The reduction in GP referrals at weekends became more marked over time.

Conclusions

The weekend effect is not caused by a lack of consultants in hospital at weekends, but by differences in case mix probably attributable to a decrement in community services at weekends. Policy makers should focus their efforts to improve acute and emergency care on a 'whole system' 7-day approach which integrates social, community and secondary healthcare resources, organisation and delivery.

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