NICE National Institute for Health and Care Excellence

NICE guidelines

Safe staffing for nursing in adult inpatient wards in acute hospitals

Appendix 1: Evidence to recommendations tables

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The following tables summarise the Committee's considerations when making the recommendations.

The references cited in the tables, other than those in section 8 of Safe staffing for nursing in adult inpatient wards in acute hospitals (NICE guideline SG1), are listed in the evidence documents on the NICE website. For more information about the evidence the Committee considered, see section 2 of the guideline.

Organisational strategy

Focus on patient care

1.1.1	**Ensure patients receive the nursing care they need, including specialist nursing, regardless of the ward to which they are allocated, the time of the day or the day of the week. This includes planning to locate patients where their clinical needs can best be met**.
Relative values of different outcomes	The committee considered a range of outcomes such as severe preventable events, never events, missed care and elements of the safety thermometer as well as other outcomes such as patient satisfaction, resource use and cost, and process and organisational factors. All outcomes were considered equally important.
Trade-off between benefits and harms	No evidence that met the inclusion criteria was identified. Therefore the committee developed recommendations based on its knowledge and experience. The Committee agreed that harms could be caused if patients are not cared for in an environment where nursing staff have the appropriate skills and experience to meet their clinical needs. Similarly, the committee felt that benefits would be observed when patients are cared for in an appropriate environment. The Committee emphasised the need for patients to be cared for in an environment where the nursing staff have the appropriate skills and experience to meet the clinical needs of each patient. The Committee felt this would ensure safe care for each patient. The Committee acknowledged that there was currently substantial variation in the provision of nursing care (such as specialist nurse care) at different times of the day and days of the week (such as on the night shift, and shifts at the weekend). If insufficient access to specialist nurses is provided this could lead to poorer patient safety outcomes and potentially additional long-term harms and costs

	associated with managing the harms. Therefore, the Committee agreed that sufficient specialist nursing expertise should be available at any time of the day and any day of week. Such provision might result in higher staffing costs for wards and organisations, but reorganisation of existing nursing staff and management of the nursing teams and also organisation of the care environment could increase efficiency, and contribute to savings in some wards and organisations in the long run. The Committee felt that the net benefits from improved patient safety outcomes outweighed the potential costs from additional staff.
Trade-off between net benefits and resource use	No primary published economic evidence that met the inclusion criteria was identified. Therefore the committee developed recommendations based on its knowledge and experience as outlined above.
Quality of evidence	No evidence that met the inclusion criteria was identified.
Other considerations	The Committee considered Expert paper 2: Patient testimony presented to the Safe Staffing Advisory Committee when making this recommendation. The Committee also considered evidence from the following documents when making this recommendation: Francis R (2013) Report of the Mid Staffordshire NHS Foundation Trust Public Inquiry. London: The Stationery Office National Quality Board (2013) How to ensure the right people, with the right skills, are in the right place at the right time. A guide to nursing, midwifery and care staffing capacity and capability. NHS England

Accountability for ward nursing staff establishments

1.1.2	**Develop procedures to ensure that ward nursing staff establishments (the number of registered nurse and healthcare assistant posts that are funded to work in particular wards) are sufficient to provide safe nursing care to patients at all times.**
1.1.3	**Ensure that the final ward nursing staff establishments are developed with the registered nurses who are responsible for determining nursing staff requirements at a ward level and approved by the chief nurse (or delegated accountable staff). The board should retain organisational responsibility. (See section 1.3 for recommendations on setting nursing staff establishments.) This includes when the ward establishment and budget are set.**
1.1.4	**Ensure senior nursing managers are accountable for the nursing staff roster that is developed from the ward nursing staff establishment.**
1.1.5	**When agreeing the ward nursing staff establishment, ensure it is sufficient to provide planned nursing staff requirements at all times. This should include capacity to deal with planned and predictable variations in nursing staff available, such as annual, maternity, paternity and study leave (commonly known as uplift). Consider adjusting the uplift for individual wards where there is evidence of variation in planned or unplanned absence at a ward level.**
1.1.6	**When agreeing the ward nursing staff establishment, ensure capacity to deal with fluctuations in patients' nursing needs (such as seasonal variations indicated by historical records of nursing staff requirements) and staff unplanned leave or absences.**
Relative values of different outcomes	The committee considered a range of outcomes such as severe preventable events, never events, missed care and elements of the safety thermometer as well as other outcomes such as patient satisfaction, resource use and cost, and process and organisational factors. All outcomes were considered equally important.
Trade-off between benefits and harms	No evidence meeting the inclusion criteria was found in relation to organisational assurance mechanisms. Thus recommendations were developed based on the knowledge and experience of the group. The committee felt that currently there is a lack of clear governance and accountability arrangements in some NHS organisations in relation to the ward nursing staff establishment. This puts patients

	and staff at risk from harm if inadequate numbers of nursing staff are not identified and addressed at the organisational level. Likewise there is potential for misuse of nursing staff resources if some areas are inappropriately over staffed. Since healthcare boards have ultimate responsibility for the overall ward nursing staff establishment, it is crucial that they have mechanisms in place to identify and react to variations in numbers of required nursing staff. The Committee felt that decisions about the ward nursing staff establishment need to be owned by the whole management team involved in that area and signed off by the designated board member such as the chief nurse or equivalent. The Committee also felt that whilst the chief nurse or equivalent should be primarily involved in setting the nursing staff establishment of wards, all directors have responsibility for ensuring that patient needs are met. Thus it was agreed that there is a need to ensure that systems are in place at an organisational level to ensure delivery of the required ward nursing staff establishment. The Committee also highlighted the importance of having additional capacity in the ward nursing staff establishment to deal with planned and predictable variations such as leave entitlement, maternity leave, study leave, and average or expected sickness rate. The amount is not set and can vary dramatically between individual wards. The Committee also wanted to acknowledge that this additional capacity is not the contingency for large variations in demand for nursing care requirement.
Trade-off between net benefits and resource use	The Committee considered the economic evidence identified in Evidence Review 1. The Committee acknowledged that there could be indirect costs to ensure accountability, since additional nursing staff may be required, but that these changes are fundamental to providing safe and effective patient care. The evidence suggested that that increased capacity (nursing staffing) costs may not be offset by savings from better patient or system outcomes (such as reduced hospital stays) although some scenarios suggest additional costs of increased staffing might be more than offset by savings from improved patient outcomes and thus lead to a small net saving. Other studies suggest that increasing nurse staffing has the potential to be cost-effective in terms of cost per life year saved (Twigg et al. 2013), better patient or system outcomes (such as reduced hospital stays) although some scenarios modelled did suggest additional costs of increased staffing might be more than offset by savings from improved patient outcomes and thus lead to a net saving (Needleman et al., 2006). The committee considered the other additional benefits of increased capacity. The Evidence Review identified an association between

	higher nursing hours with lower rates of drug administration errors, missed nursing care, mortality, failure to rescue, hospital acquired infections, falls and pressure ulcers. There was strong evidence to suggest lower length of stay and lower readmission rates with higher numbers of available nursing staffing level. The Committee thought that increasing capacity could lead to long-term savings from preventing costs of management of the harms. However, the Committee acknowledged the limitations of the available evidence and that the evidence did not necessarily mean a causal association between numbers of nursing staffing level and outcomes. Nonetheless, the Committee thought ensuring capacity would be a cost-effective use of NHS resources.
Quality of evidence	The Committee considered the evidence from Evidence review 1: Economic studies of nurse staffing and skill mix: • Studies suggest that increasing nurse staffing has the potential to be cost-effective in terms of cost per life year saved (Twigg et al., 2013) [++ for internal validity and + for external validity] • The costs of increased nurse staffing may not be offset by savings from better patient or system outcomes (such as reduced hospital stays) although some scenarios modelled did suggest additional costs of increased staffing might be more than offset by savings from improved patient outcomes and thus lead to a net saving (Needleman et al., 2006) [++ for internal validity and + for external validity].
Other considerations	The committee also considered the following documents: • Francis R (2013) Report of the Mid Staffordshire NHS Foundation Trust Public Inquiry. London: The Stationery Office. • National Quality Board (2013) How to ensure the right people, with the right skills, are in the right place at the right time. A guide to nursing, midwifery and care staffing capacity and capability. NHS England.

1.1.7	**When agreeing the skill mix of the ward nursing staff establishment, this should be appropriate to patient need and take into account evidence that shows that improved patient outcomes are associated with care delivered by registered nurses (see recommendation 1.3.6).**
Relative values of different outcomes	The committee considered a range of outcomes such as severe preventable events, never events, missed care and elements of the safety thermometer as well as other outcomes such as patient satisfaction, resource use and cost, and process and organisational factors.

	All outcomes were considered equally important.
Trade-off between benefits and harms	The Committee considered the evidence from Evidence review 1. This identified a number of relevant studies that showed a clear association between a higher proportion of registered nurses in the ward nursing staff establishment and positive outcomes. The committee debated whether nursing care activities should be performed by registered nurses only, or whether nursing care activities should be divided between registered nurses and healthcare assistants. There are potential benefits when all care is delivered by registered nurses, since this group is appropriately trained to recognised standards. However, some nursing care activities can be delegated to and undertaken by appropriately trained and experienced healthcare assistants. This could be beneficial if this enables registered nurses time to be released to enable them to provide care to those requiring a registered nurse. The role of the registered nurses is well defined and is consistent across the NHS. The role of the healthcare assistants on the other hand is less well defined since no national standards are currently in place. This means that the skills of the healthcare assistants can be highly variable. Therefore the committee felt that specifying how nursing tasks should be split between registered nurses and healthcare assistants could cause harms. This is because not all healthcare assistants would be appropriately skilled to perform nursing care activities and specifying that they should perform them could put patients and staff at risk of harm. Likewise some healthcare assistants have received appropriate training and can perform some nursing care activities. Specifying that they should not use these skills would not be an appropriate use of NHS resource. Thus the committee agreed that there is no 'safe' skill mix of registered nurses and healthcare assistants that can be recommended. Instead, it was agreed that registered nurses can use their professional judgement to delegate some nursing activities down to healthcare assistants depending on the healthcare assistants individual skills and experience. This evidence and discussion also supported the development of recommendation 1.3.6
Trade-off between net benefits and resource use	The Committee considered the economic evidence included in the Evidence Review 1 alongside the results from the de novo economic analysis report. There was some evidence to showing that increased nursing staffing costs may not be offset by savings from better patient or system outcomes (such as reduced hospital stays). One scenario modelled in a study from the USA did also suggest the additional costs of an increased RN hours as a proportion of the total nursing provision

	might be offset by savings from improved patient outcomes and thus lead to a small net saving (Needleman et al. 2006). Other studies suggest that increasing nurse staffing has the potential to be cost-effective in terms of cost per life year saved (Twigg et al. 2013). Increasing registered nurse staffing (rather than licensed practical nurse staffing (Needleman et al. 2006) on general (medical/surgical) wards (rather than ICU (Shamliyan et al. 2009) may be more cost effective than the alternatives. None of the economic evidence included was conducted in the UK, used an NHS perspective, or adopted evidence of the impact of numbers of nursing staff on outcomes from the NHS. Therefore the results are of limited value in informing decision-making in the NHS context. The Committee therefore relied on the results of the de novo economic analysis produced for the guideline which used data from the UK Audit Commission and also non-UK studies. The de novo economic analyses compared a hypothetical alternation of the skill mix of the nursing staff. Changing the skill mix from 63% registered nurses and 37% healthcare assistants to 73% registered nurses and 27% healthcare assistants identified a plausible incremental cost effective ratio (ICER) of approximately £1400 per fall avoided and £128,000 per drug error avoided. The committee considered the certainty of the ICER estimates by examining the sensitivity analyses. The committee thought the results for each fall avoided were robust to most changes in the parameters of the model investigated in sensitivity analysis. However, the results for the drug errors avoided were considered to be highly uncertain and potentially inaccurate due to non-UK evidence being used as a basis to estimate the effect of the intervention. The Committee considered the limitations of the approach used for the de novo analysis. The model only considered the benefits of reduced falls and drug error. If the economic model had included the additional benefits and outcomes, (such as lower rates of surgical site infection, and pneumonia) identified in the evidence review; then the ICER was likely to become more favourable to a higher registered nurse to healthcare assistant ratio. The Committee considered the data and parameters used in the de novo model. The evidence underpinning the model used data from 10 or more years ago. Changes in the healthcare assistant workforce since then could mean that there are increased skills amongst healthcare assistants, resulting in potentially less difference between registered nurses and healthcare assistants. Therefore, the ICER may also be less favourable to the intervention. The Committee therefore agreed that it did not wish to rely solely on the results of the economic evidence and the de novo economic analysis.

	The Committee thought a higher proportion of registered nurse staff may increase the total cost of the ward nursing staff establishment. The Committee considered the higher salary costs to pay for more registered nurses compared to health care assistants. However, a higher ratio would bring benefits in terms of improved patient and nurse outcomes. Whilst cost savings from improving outcomes are unlikely to offset the higher cost of registered nurse staffing, the committee felt that increasing the proportion of registered nurses in the skill mix was likely to be a cost-effective relationship.
Quality of evidence	The Committee considered the evidence from Evidence review 1: Skill mix and patient outcomes: • Studies [++,++,- for internal validity and +,++,++ for external validity] found that a higher proportion of registered nurses on wards is associated with a significantly lower rate of death (Estabrooks et al. 2005, He et al. 2013) or failure to rescue (Blegen et al. 2011). • Studies of mixed quality [++,-,− for internal validity +,+,++ for external validity] found a significant association between a higher proportion of registered nurses in the nursing workforce and lower rates of pneumonia (Cho et al. 2003), surgical site infection (McGillis Hall et al. 2004) and lower post-operative sepsis (Blegen et al. 2011). However, 1 study Duffield et al 2011(− for internal validity and + for external validity) found that higher rates of pneumonia were associated with a richer skill mix. • Four studies [+,+,-,++ for internal validity and +,++,+ and ++ for external validity] found that a higher proportion of registered nurses in the nursing workforce was associated with significantly fewer falls (Blegen and Vaughn, 1998, Donaldson et al. 2005, Duffield et al. 2011, Patrician et al. 2011). • Three weak studies [++,-,- for internal validity and all +for external validity] found that a higher proportion of registered nurses in the nursing workforce were associated with fewer pressure ulcers (Blegen et al. 2011, Duffield et al. 2011, Ibe et al. 2008). • Two weak studies [both - for internal validity and both + for external validity] provided no evidence of association between skill mix and venous thromboembolism (Duffield et al. 2011, Ibe et al. 2008). • A single moderate study [+ for internal validity and - for external validity] showed significantly fewer complaints with a higher proportion of registered nurses in the nursing workforce (Potter et al. 2003). • Two weak studies [both − for internal validity and - and + for external validity] indicated that a higher proportion of registered

	nurses in the nursing workforce might be associated with lower resource use in terms of hospital stay (Frith et al. 2010) or total nursing hours and overall cost of nursing hours (McGillis Hall et al. 2004). Skill mix and care processes or nurse outcomes: • No studies found significant associations between skill mix and missed care but 1 study [+ for internal validity and ++for external validity] found no significant interaction effect between staff groups, suggesting that the level of registered nurse staffing is the important determinant of the missed care rate. • A single study [+ for internal validity and + for external validity] found that a higher proportion of registered nurses in the nursing workforce was significantly associated with lower turnover (Staggs and Dunton 2012). Healthcare assistant staffing and outcomes: • Studies [-,++,-,+ for internal validity and -,+,+,++ for external validity] found no association with mortality (Unruh et al. 2007), failure to rescue (Park et al. 2012), length of stay (Unruh et al. 2007), venous thromboembolism (Ibe et al. 2008) or missed care (Ball et al. 2013). • Studies [-,+,-,+ for internal validity and -,+,-,- for external validity] found that higher healthcare assistant staffing was associated with higher rates of falls (Hart and Davis, 2011, Lake et al. 2010), pressure ulcers (Seago et al. 2006), readmission rates (Weiss et al. 2011), medication errors (Seago et al. 2006), physical restraints (Hart and Davis 2011) and lower patient satisfaction (Seago et al. 2006). • One weak study [− for internal validity and + for external validity] found that higher healthcare assistant staffing levels were associated with lower rates of pressure ulcers (Ibe et al. 2008). • There were no studies looking at associations of the proportion of healthcare assistants in the nursing workforce with costs, infections or nurse outcomes.
Other considerations	The committee acknowledged that most of evidence reviewed was based on data from 10 or more years ago. Changes in the healthcare assistant workforce since then could mean that there are increased skills amongst healthcare assistants, resulting in potentially less difference between registered nurses and healthcare assistants. Better trained healthcare assistants could lead to some benefits, but there is no evidence that replacing registered nurses with healthcare assistants will be of benefit.

Responsiveness to unplanned changes

1.1.8	**Ensure that there are procedures to identify differences between on-the-day nursing staff requirements and the nursing staff available on a ward.**
1.1.9	**Hospitals need to have a system in place for nursing red flag events (see section 1.4) to be reported by any member of the nursing team, patients, relatives or carers to the registered nurse in charge of the ward or shift.**
1.1.10	**Ensure there are procedures for effective responses to unplanned variations in predicted patients' nursing needs or the availability of nursing staff at any time during the day and night. These procedures should include prompt action to enable an increase or decrease in nursing staff.**
1.1.11	**Action to respond to nursing staff deficits on a ward should not compromise staff nursing on other wards.**
1.1.12	**Ensure there is a separate organisational contingency plan and response for patients who require the continuous presence of a member of the nursing team (often referred to as 'specialing' care).**
1.1.13	**Consider implementing approaches to support flexibility, such as adapting nursing shifts, nursing skill mix, assigned location and employment contract arrangements.**
Relative values of different outcomes	The committee considered a range of outcomes such as severe preventable events, never events, missed care and elements of the safety thermometer as well as other outcomes such as patient satisfaction, resource use and cost, and process and organisational factors. All outcomes were considered equally important.
Trade-off between benefits and harms	No evidence was found that met the inclusion criteria. Therefore recommendations were developed based on the knowledge and experience of the committee. To achieve nursing staff flexibility it is often necessary to use a temporary work force comprising redeployed, bank, or agency nursing staff. Whilst this can offer benefits by facilitating an immediate response to nursing staff variation, it also has the potential for harms. This is because a temporary workforce will usually be unfamiliar with ward layout and care needs of the patients on the ward. Thus temporary nursing staff may be less efficient than usual nursing staff which can result in delays to patients receiving care. Temporary staff who are not directly employed by the organisations are also unlikely to have received the organisations local training,

	which could lead to policies and procedures not being followed, and result in staff using equipment that they are not trained to use, posing a danger to both patients and staff. Bank and agency staff comes at an increased cost to the organisation and so redeployment of existing nursing staff may appear to be more desirable, since they come at zero cost to the organisation and they will have received local training. However, redeploying existing nursing staff may simply result in the original ward becoming unable to respond to its own variations in nursing staff requirement, since its nursing staff flexibility has been reduced due to its staff being redeployed elsewhere. Thus using redeployed nursing staff may simply shift the staffing issue, rather than solve it. The committee felt that often organisations rely on temporary staffing to meet variation in nursing staff requirement. Whilst the use of redeployed, agency, or bank nursing staff have benefits in offering flexibility and responding to immediate staffing needs, the potential for harms were considered to outweigh the benefits gained from this flexible workforce. Instead of using a temporary workforce, the committee agreed that flexibility can be achieved by altering capacity (the number of nursing staff), and by reorganising nursing staff (such as changing shift length, redeployment and contractual arrangement). Additional capacity could also be achieved by changing the skill mix to better suit the activities that are required to meet the care needs of the ward patients. Flexibility can also be achieved by developing a pool of permanent deployable nurses who can be located on different wards in response to variation in staffing requirements, as well as alterations to contracted working patterns and hours. The group highlighted the importance of building additional capacity in nursing staff to deal with unplanned variations.

Trade-off between net benefits and resource use	No primary published economic evidence that met the inclusion criteria was identified. Therefore the committee developed recommendations based on its knowledge and experience. The Committee considered the potential implication of changing the flexibility within the workforce as outlined above. If safe nursing staff requirements can be successful established on each ward, then improvement in patient outcomes are likely. Increasing the use of bank and agency nursing staff could result in increased costs for organisations. A pool of permanent bank staff was considered to be the least costly of available options to increase capacity and flexibility. The Committee noted that renegotiating all contracts to ensure flexibility might be time consuming and costly for organisations to undertake. It recognised that it might result in lower nurse satisfaction and happiness in the short-term. However, the Committee wished to emphasise the need for any future contracts to consider methods which ensure flexibility in the working patterns of nursing staff.
Quality of evidence	No evidence meeting the inclusion criteria was identified.
Other considerations	The Committee considered 'Expert paper 1: Expert testimony presented to the Safe Staffing Advisory Committee' when making this recommendation.

Monitor adequacy of ward nursing staff establishments

1.1.14 **1.1.15**	**Ensure that there are procedures for systematic ongoing monitoring of safe nursing indicators (see section 1.5) and formal review of nursing staff establishments of individual wards at a board level at least twice a year (and more often if there are significant changes such as ward patient characteristics). These procedures should include periodic analysis of reported nursing red flag events and the safe nursing indicators (see section 1.5).** **Make appropriate changes to the ward nursing staff establishment in response to the outcome of the review.**
Relative values of different outcomes	The committee considered a range of outcomes such as severe preventable events, never events, missed care and elements of the safety thermometer as well as other outcomes such as patient satisfaction, resource use and cost, and process and organisational factors. All outcomes were considered equally important.
Trade-off between benefits and harms	No evidence was available that met the inclusion criteria was identified. Therefore the committee made recommendations based on its knowledge and experience. The committee agreed that assessing whether the available nursing staff can adequately meet the nursing care needs of patient is of utmost importance, since being unable to meet care needs could be a safety risk. The Committee agreed that it was important to recommend procedures to ensure that nursing staff establishments of individual wards are regularly reviewed and monitored. They also agreed to recommend procedures that ensure effective responses to any unplanned variations can subsequently be made. See recommendation 1.5.1 and 1.5.2 for further discussion of the evidence and committee deliberations linked to this area.
Trade-off between net benefits and resource use	No primary published economic evidence that met the inclusion criteria was identified. Therefore the committee developed recommendations based on its knowledge and experience. Systematic monitoring and reviewing ward nursing staff establishment at least twice a year may require additional resources and the time of the board. This is likely to be a small added cost for organisations, depending on the frequency of the review. The Committee also considered the additional time needed and expense of the board meeting discussing the indicators for safe staffing requirements. Although this recommendation had potential cost implications, the Committee thought that the board has the overall responsibility to

	ensure staffing levels requirements are adequate to ensure safe patient and nursing outcomes.
Quality of evidence	No evidence that met the inclusion criteria was found.
Other considerations	None

Promote staff training and education

1.1.16	**Enable nursing staff to have the appropriate training for the care they are required to provide.**
1.1.17	**Ensure that there are sufficient designated registered nurses who are experienced and trained to determine on-the-day nursing staff requirements over a 24-hour period.**
1.1.18	**The organisation should encourage and enable nursing staff to take part in programmes that assure the quality of nursing care and nursing standards to maximise the effectiveness of the nursing care provided and the productivity of the nursing team.**
1.1.19	**Involve nursing staff in developing and maintaining hospital policies and governance about nursing staff requirements, such as escalation policies and contingency plans.**
Relative values of different outcomes	The committee considered a range of outcomes such as severe preventable events, never events, missed care and elements of the safety thermometer as well as other outcomes such as patient satisfaction, resource use and cost, and process and organisational factors. All outcomes were considered equally important.
Trade-off between benefits and harms	The Committee considered the evidence from Evidence review 2 when making this recommendation. The committee felt that it was of utmost importance for nursing staff to have relevant and appropriate training in estimating total nursing requirements, although evidence specifically addressing this issue was not found. In spite of the lack of evidence, the committee agreed that without such training, it is likely that registered nurses will be less able to make accurate judgements, and this could compromise patient and staff safety. The Committee felt that it was important to emphasise that identifying and meeting the required numbers of nursing staff alone does not deliver improvements in nurse sensitive outcomes. Evidence was available that showed that the impact of having safe nursing staff available could be increased by using a specific organisational programme such as the Magnet approach.

	Health care organizations assessed as achieving Magnet status are recognized for their quality patient care, nursing excellence and innovations in professional practice and are evaluated on five elements: transformational leadership; structural empowerment; exemplary professional practice; new knowledge, innovations, and improvements; and empirical outcomes. Structural and organisational characteristics associated with Magnet recognition include active involvement (at the hospital level) in nursing sensitive outcome benchmarking, active programmes of quality assurance and structures to actively promote the involvement of registered nurses in the setting of hospital policies and governance. The recognition process consists of a comprehensive and rigorous assessment and takes about two years. The award is given for a period of four years. The Committee also commented that Magnet research involves safe numbers of nursing staff and requirement of a certain proportion of registered nurses in the ward nurse staffing establishment and so felt it was hard to disaggregate the effects of these from the overall benefits of the Magnet approach.
Trade-off between net benefits and resource use	No primary published economic evidence that met the inclusion criteria was identified. Therefore the committee developed recommendations based on its knowledge and experience and studies from evidence review 2 that are detailed above.. The Committee agreed that training of staff increased staff retention within the organisation. This could potentially reduce staff turnover, and retain skilled and experienced nursing staff. It would also save long-term costs of recruitment of new staff to replace those who left the organisation. To estimate the on-the-day nursing requirements over a 24-hour period accurately, a registered nurse of appropriate experience and training is needed. The Committee agreed that not all registered nurses on the ward need to be trained in estimating the staff requirement, and only the designated nurses responsible for estimating nursing staff requirements would require training. The Committee agreed that training had potential cost implications, for example in requiring additional training and education. This cost would vary depending on the experience and familiarity with the method used (such as a decision support toolkit) to estimate nursing staff requirements of the ward. Although there may not be any direct patient or nursing outcome benefits, setting the appropriate nursing staff requirements will result in improved patient and nursing outcomes, and potential fewer longer-term costs and consequences.
Quality of evidence	**Organisational policies and procedures, including staff training:** • One US study (Kooker and Kamikawa, 2011 [- for internal validity and - for external validity] assessed the effect of a staff

	training intervention focused on nurse retention and found improved staff retention (no test of significance) and job satisfaction (no test of significance) after the introduction of the programme. • McGillis Hall et al. [2008, - for internal validity and + for external validity] tested a workplace change programme to improve resource availability only finding improved nurse ratings for the quality of work (p=0.02), but not for four patient reported outcomes including patient perceived hospital quality and five nurse-reported outcomes including job satisfaction. • Kalisch et al. [2013, - for internal validity and - for external validity] investigated crew resource management training and found decreased nurse reported missed care (p=0.029) and improved teamwork (p= 0.001). **Management structures/procedures and organisational culture:** Seven studies investigated the association between American Nurses Credentialing Center Magnet recognition and nurse and patient outcomes, six in US hospitals (Goode et al. 2011, Hess et al. 2011, Kalisch and Lee, 2012, Kelly et al. 2011, Lacey et al. 2007, Lake et al. 2010) and one in England (Aiken et al. 2008). • Three studies (Aiken et al. 2008 [- for internal validity and - for external validity]; Kelly et al. 2011 [- for internal validity and ++ for external validity] and Lacey et al. 2007 [- for internal validity and + for external validity]) found nurses were more satisfied with their job in Magnet hospitals, which are recognised for nursing excellence and innovations in professional practice, while one study (Hess et al. 2011 [- for internal validity and – for external validity]) did not confirm this difference. • Two studies (Kelly et al. 2011 [- for internal validity and ++ for external validity]Lacey et al. 2007 [- for internal validity and + for external validity]) found lower nurse burnout in Magnet hospitals than in non-Magnet organisations, but this was not confirmed by the study of Aiken et al. (2008 [- for internal validity and + external validity]) which found no association. The same three studies found nurses were less likely to intend to leave in Magnet hospitals than non-recognised hospitals. Of these studies, only one (Kelly et al. 2011 [- for internal validity and ++ for external validity]) presented an analysis that controlled for the possible confounding effect of overall staffing levels. • Three studies compared Magnet vs. Non-Magnet hospitals and nurse sensitive patient care outcomes after controlling for staffing levels. Lake et al. (2010 [- for internal validity and ++ for external validity]) found lower rates of falls (p<0.01), Goode et al. (2011 [- for internal validity and + for external validity]) found lower rates of pressure ulcers (p<.10), and Kalisch and Lee (2012 [- for internal validity and + for external validity]) found lower amounts of nurse reported missed care (p<0.05) in Magnet hospitals compared to

	non-Magnet hospitals. • Goode et al. (2011 [- for internal validity and + for external validity]) found no significant differences for heart failure mortality and failure to rescue, and higher rates of postoperative sepsis and metabolic derangement ($p<0.05$) in Magnet hospitals.
Other considerations	The group acknowledged that some of the recommendations in this guideline describe a different approach to estimating nursing staff requirements than is currently used. Therefore the committee felt that it was essential that additional training to facilitate the implementation of this guideline may also be required.

Principles for determining nursing staff requirements

1.2.1	**Use a systematic approach that takes into account the patient, ward and staffing factors in box 1 to determine nursing staff requirements both when setting the ward nursing staff establishment and when making on-the-day assessments.**
1.2.2	**Use a decision support toolkit endorsed by NICE to facilitate the systematic approach to determining the nursing staff requirements (see the NICE endorsement programme webpages for full details).**
1.2.3	**Use informed professional judgement to make a final assessment of nursing staff requirements. This should take account of the local circumstances, variability of patients' nursing needs, and previously reported nursing red flag events (see section 1.4).**
1.2.4	**Consider using the nursing care activities summarised in tables 1 and 2 as a prompt to help inform professional judgement of the nursing staff requirements. Tables 1 and 2 may help to identify where patients' nursing needs are not fully accounted for by any decision support toolkit that is being used.**
Relative value of different outcomes	The committee considered a range of outcomes such as severe preventable events, never events, missed care and elements of the safety thermometer as well as other outcomes such as patient satisfaction, resource use and cost, and process and organisational factors. All outcomes were considered equally important.
Trade-off between benefits and harms	The committee considered evidence review 1 and 2 in making their decisions. The committee considered the benefits and harms of making decisions about safe nursing staff requirements. Decision making can be variable depending on who is making the judgements and what factors are being considered. This is because different factors could be considered or different 'weight' given to the same factors depending on the approach taken. This can lead to inconsistent and inappropriate decision making on safe nursing staff requirements on wards and throughout the NHS. This could pose serious patient and staff harms if decision making leads to underestimation of nursing staff requirements, and is an inefficient use of nursing staff time and resource if decision making leads to over estimations. The committee agreed that making staffing decisions using professional judgement alone could lead to harms, since it is likely that a single, experienced individual would normally be responsible for this task and if that person is not available, decisions may not be

	made, or they may get made by inexperienced individuals. This could lead to potentially serious under- or over- estimations of nursing staff requirements, which could cause harms to patients and to staff. Thus the use of decision support toolkits were felt to offer some protection against these risks, since having a systematic approach to determining nursing staff requirements should enable appropriate and consistent decisions to be made by different members of the nursing team. Most of the evidence on decision support toolkits was descriptive in nature, meaning that the effectiveness of the tools are unknown. However a small amount of evidence was available on the Nursing Hours Per Patient Day (NHPPD) method which assigns different NHPPD to different ward types, depending patient complexity, intervention levels, the presence of high dependency beds, the emergency/elective patient mix and patient turnover. This method was associated with improved patient outcomes, but no evidence was available about other methods for supporting decision making. The committee agreed that there was insufficient evidence to recommend a particular decision support toolkit. The group also acknowledged that there is a compromise between subjectivity of professional judgement compared to the objectivity of decision support toolkits and agreed that it would be inappropriate to rely on professional judgement alone or decision support toolkits alone. Therefore, the Committee decided to recommend a framework to support decision making to be used in conjunction with professional judgement that is based on consideration of patient, ward and staffing factors. Consideration was given to the evidence where available, but much of the evidence was confounded and poorly conducted meaning that the committee were uncertain in the conclusions drawn in the evidence. Where this occurred the committee used its knowledge and experience to further develop the recommendations. In estimating direct care that needs to be provided to patients, the Committee agreed that explicit consideration needs to be given to the patient and their relatives and/or carers. This should include (but is not limited to) consideration of age, patient comorbidities, learning difficulties, mental health issues, communication requirements, emotional needs, and spiritual needs. The evidence suggests and is congruent with the experience of the Committee that there are functions that are required of nursing staff over and above direct clinical care that contributes to the provision of coherent, quality nursing service. These include for example communication, supervision (of team, professional), clinical support, mentorship, education, patient flow, team organisation, delegation. This needs to be accounted for in the assessment of the total nursing

	care requirement of the service. The committee highlighted that senior registered nurses are often required to admit, transfer and discharge patients in and out of the wards are a significant factor on nursing workload and this also needs to be explicitly considered in determining nursing staff requirement. The committee also stressed the importance of accounting for care required by all of the patients who are under the responsibility of the ward nursing team, since there may be some patients who are not physically on the ward but still require care from the nursing team.
Trade-off between net benefits and resource use	No primary published economic evidence that met the inclusion criteria was identified. Therefore the committee developed recommendations based on its knowledge and experience and studies from evidence reviews that are detailed above. The Committee recognised that there may be a cost associated with using a decision support toolkit because some toolkits may have procurement and licensing costs. A small amount of additional nursing time would also be required to use a decision support toolkit to determine nursing staff requirements. The committee also recognised that additional nursing resources may be required on wards that are small, have high patient turn over, or which care for patients with complex needs, in comparison to larger wards, lower turnover wards, and wards where patients have less complex needs. The Committee felt that hospital wards which consider patient factors (such as cognition and specialist needs of patients) as the main driver for setting staffing levels would likely require additional nursing time compared to those that do not. The Committee considered these costs as unavoidable because it is essential in determining safe nursing staff requirements. The Committee considered the net benefits and resource use implication of taking patient turnover rate into account when determining the ward requirement. The Committee felt there were that additional costs associated with more staff for high patient turn-over wards, but considered these costs as unavoidable because it considering patient turnover as essential in determining safe nurse staffing requirements as it was significantly associated with patient outcomes. Nursing staff factors should be considered when calculating the nursing staffing requirements. The Committee considered that these costs would unavoidable, because nursing staff factors were critically important to patient outcomes and should be one of the main drivers of patients' nursing care requirements is essential in determining safe nursing staff requirements. The economic analysis found that total whole time equivalent nursing

	staff per adjusted bed day was dependant on ward size. Larger wards required fewer staff per bed with a substantial increase in the number of staff per bed for the smallest wards; 10-12 beds or fewer. The Committee acknowledged that staffing requirements should consider layout and size. The Committee agreed that all these elements should be considered when determining nursing staff requirements and ward nursing staff establishment. This may result in a net increase in costs due to increase nursing staff. On the whole, the Committee felt it was a cost-effective use of NHS resources because it would result in improved safety of patients and improved patient outcomes.
Quality of evidence	The Committee considered evidence review 1 and 2 in making their decisions. • Limited evidence was available on decision support tools, and the evidence that was available was primarily descriptive in nature (Fasoli and Haddock, 2010). This includes studies on well-known approaches like the AUKUH / Safer Nursing Care tool (Smith et al. 2009), Patient Intensity Nursing Index (Prescott et al. 1991, Prescott et al. 1989, Soeken and Prescott, 1991) or RAFAELA (Rainio and Ohinmaa, 2005, Rauhala and Fagerstrom, 2007), which have been described and tested for their reliability and validity (albeit to a limited extent), but ultimately not for their effect on patient outcomes. In addition to these organizational level tools, a small body of literature exists which explores the effectiveness of governmental initiatives such as mandated staffing ratios in California (e.g. Mark et al. 2013, McHugh et al. 2012, McHugh et al. 2011), which were beyond the scope of the evidence review. • However, a single observational study conducted in Australia (Twigg et al. 2011 [- for internal validity and + for external validity]) was identified, which assessed the effectiveness of the Nursing Hours Per Patient Day (NHPPD) method which assigns different NHPPD to different ward types, depending patient complexity, intervention levels, the presence of high dependency beds, the emergency/elective patient mix and patient turnover. The study found that three nursing sensitive outcomes improved after the introduction of the NHPPD method in surgical wards: CNS complications, pneumonia and ulcer/gastritis/upper gastrointestinal bleeds. Mortality decreased for medical and surgical patients. • No evidence was found about the effectiveness of other methods for supporting decision making. ***Nursing care need of patients*** • Eleven studies were identified supporting the association of

	dependency/acuity and patient outcomes in staffing adjusted analyses (Duffield et al. 2011, Frith et al. 2010, Frith et al. 2012, He et al. 2013, McGillis Hall et al. 2004, O'Brien-Pallas et al. 2010b, Park et al. 2012, Patrician et al. 2011, Potter et al. 2003, Sales et al. 2008, Unruh et al. 2007). The results were drawn from studies with mixed validity but including 4 studies rated as high for internal validity (4 rated as ++) and external validity (3 rated as ++). • Three reviews support this association (Edwardson and Giovannetti, 1994, Fasoli and Haddock, 2010, O'Brien-Pallas et al. 2005) although Fasoli and Haddock (2010) emphasise the lack of any clear validated measures that accurately link dependency and acuity to staffing requirements with the precision required for workforce planning. ***Patient turnover*** • Five studies were identified showing a significant association between patient turnover and patient outcomes in staffing adjusted analyses (Donaldson et al. 2005, Duffield et al. 2011, Needleman et al. 2011, Park et al. 2012, Patrician et al. 2011) with ratings for internal validity of ++, ++,++,+,- and ++,++,+,+,+ for external validity. One study specifically analysed the interaction of patient turnover and RN hours per patient day on failure to rescue in 42 hospitals in the US finding a diminishing association of RN hours per patient day with failure to rescue with increasing levels of patient turnover (Park et al. 2012). • Two recent reviews (Fasoli and Haddock, 2010, Myny et al. 2011) identified turnover as a factor associated with increased nursing workload. ***Ward layout and size*** • A single study (Hurst, 2008 [- for internal validity and - for external validity]) explored the association of different ward layouts and whole time equivalent nurses per occupied bed. The study found lowest staffing levels on racetrack wards compared to other designs including nightingale wards, other bay designs and hub and spoke wards and other designs (including wards with all single room accommodation)13 . Although the study reports acuity levels per ward layout, staffing variables are unadjusted for differences in patient acuity, ward specialty or clustering of wards in hospitals and therefore results are likely to be confounded. It is clear that there is confounding by ward speciality as some ward types (e.g. 'other') are identified as containing high numbers of high dependency beds and therefore have disproportionately high staffing requirements. Furthermore while quality of care was measured and reported as broadly equivalent it was not controlled

	for in analyses. We identified one review investigating the effects of physical environment factors of hospital wards (Huisman et al. 2012). This did not find evidence for the association of ward layout and staffing requirements, patient or staff outcomes. • One primary study found [- for internal validity and ++ for external validity] found less total RN hours and lower proportion of RNs with increasing ward size (Blegen et al. 2008) although the absolute differences were small (1.6. minutes less care per patient per additional bed on the unit). The relationship between ward size and staffing requirements is not fully understood, but it is hypothesised that with increased ward size economies of scale may influence care hours and skill mix, with more opportunity for delegation in a larger team (Blegen et al. 2008). However, there was no control for quality of care and so no indication of equivalent outcomes. Two reviews (Fasoli and Haddock, 2010, Myny et al. 2011) also identified ward size as a relevant factor for staffing requirements, although the implications of their findings were unclear. In each case this conclusion was based on one primary study, different in each review. Myny (2011) presented results indicating that larger units were associated with "higher role overload" which appeared to be associated with lower staffing levels. While Fasoli and Haddock identified 'volume' as a key variable in the literature, its significance was unclear in the sense that it could be referring to efficiencies associated with specialism or the self-evident need to consider total patient load rather than ward size per-se. ***Case mix*** • Eight studies [+,-,+,-,+,++,-,- for internal validity and +,++,-,-,+,++,-,- for external validity] found differences in outcomes between wards with different ward types (case mix) (Blegen and Vaughn, 1998, Duffield et al. 2011, Frith et al. 2012, Hart and Davis, 2011, Lake et al. 2010, Sales et al. 2008, Seago et al. 2006, Unruh et al. 2007) and four studies (Duffield et al. 2011, Frith et al. 2010, Sales et al. 2008, Unruh et al. 2007) identified case mix as a factor independent of acuity. • Two reviews (Fasoli and Haddock, 2010, Myny et al. 2011) supported this by identifying case mix / ward type as a factor affecting staffing requirements but no studies give clear evidence of specific differences in staffing requirements between ward types (e.g. medical vs surgical or care of older people). ***Staff factors*** • Two studies that explored models of nursing care delivery (Barkell et al. 2002 [- for internal validity and - for external validity], Wells et al. 2011 [- for internal validity and - for external validity]) that changed from a team nursing model (where a team of nurses with

	different skill levels care for a group of patients) to one that incorporated a total patient care model (where a group of patients is assigned to a nurse who delivers all necessary care) found no significant differences in patient satisfaction, urinary tract infections, pneumonia or levels of job satisfaction. • Two studies explored a change from a total patient care model to a team based approach (Fairbrother et al. 2010 [- for internal validity and - for external validity], Tran et al. 2010 [- internal validity and - for external validity]). Fairbrother et al. (2010) reported significantly higher levels of extrinsic job satisfaction of the • Team based approach to care over a total patient care approach (F 5.4, p<0.005); however Tran et al. (2010 [- for internal validity and - for external validity]) reported no statistically significant difference between a team based approach to the delivery of nursing care and job satisfaction. • One study (Dubois et al. 2013 [- for internal validity and + for external validity]), found that the risk of experiencing any event with consequences (medication administration errors, falls, pneumonia, urinary tract infection, unjustified restraints and pressure ulcers) was significantly lower (OR=0.477, 95 -CI 0.25-0.91) in clinical areas with professional models of care characterised by higher nurse skill levels and staffing levels to those with functional models. - • One study (Kovner et al. 1994 [- for internal validity and + for external validity]) that explored mixed interventions (reorganisations, case management, shared governance, computerisation, education) on the delivery of care, reported that the interventions, taken as a whole, improved the job satisfaction with professional interaction (p<0.05) but not other aspects of job satisfaction.
Other considerations	The Committee wanted to stress that decisions about staffing requirements should be made using both decision support toolkits and professional judgement. The Committee emphasised the need to ensure safety day to day and that there is a need to assess nursing staff requirements on a daily basis. However, it was acknowledged that in some cases it may not be practical to do this on a daily basis.

Setting the ward nursing staff establishment

1.3.1	**Set ward nursing staff establishments using the stages outlined in recommendations 1.3.2-1.3.8. This should involve the designated senior registered nurses at a ward level who are experienced and trained in determining nursing staff requirements. This process could be facilitated by the use of a NICE-endorsed decision support toolkit.**
1.3.2	**Routinely measure the average amount of nursing time required throughout a 24-hour period for each of the ward's patients. The measurement should take into account the patient factors and nursing care activities outlined in section 1.2. It could be expressed as nursing hours per patient to ensure ward nursing staff establishments are derived from individual patient's needs. (A measurement of nursing hours per patient enables the nursing needs of individual patients and different shift durations of the nursing staff to be more easily taken into account than with a nurse-to-patient ratio. See the glossary for more information.)**
1.3.3	**Formally analyse the average nursing hours required per patient at least twice a year when reviewing the ward nursing staff establishment.**
1.3.4	**Multiply the average number of nursing hours per patient by the average daily bed utilisation (the number of patients that a ward nursing team is responsible for during each 24-hour period). Using bed utilisation rather than bed occupancy will ensure that the nursing care needs of patients who are discharged or transferred to another ward during a 24-hour period are also accounted for.**
1.3.5	**Add an allowance for additional nursing workload based on the relevant ward factors such as average patient turnover, layout and size, and staff factors such as nursing activities and responsibilities other than direct patient care (see recommendations section 1.2, box 1).**
1.3.6	**Identify the appropriate knowledge and nursing skill mix required in the team to meet the nursing needs of the ward's patients, with registered nurses remaining accountable for the overall care of patients. Base the nursing staff requirements on registered nurse hours, and consider which activities can safely be delegated to trained and competent healthcare assistants. Take into account:** - **the level of knowledge, skill and competence of the healthcare assistants in relation to the care that needs to be given** - **the requirement for registered nurses to support and**

	supervise healthcare assistants - **that improved patient outcomes are associated with a higher proportion of registered nurses in the ward nursing staff establishment.**
1.3.7	**Use average patients' nursing need and the estimated time of day or night when care will be required to:** - **design the staffing roster** - **allocate nursing staff to care for specific patients during shifts.**
1.3.8	**Take account of the following factors (commonly known as 'uplift' and likely to be set at an organisational level, see recommendation 1.1.5):** - **planned absence (for example, for professional development, mandatory training, entitlement for annual, maternity or paternity leave)** - **unplanned absence (such as sickness absence).**
Relative value of different outcomes	The committee considered a range of outcomes such as severe preventable events, never events, missed care and elements of the safety thermometer as well as other outcomes such as patient satisfaction, resource use and cost, and process and organisational factors. All outcomes were considered equally important.
Trade-off between benefits and harms	The committee considered evidence review 1 and 2 in making their decisions. Currently there are many different approaches to calculating nursing staff requirements. Usually this would include a calculation based on bed occupancy whereby predicted or average numbers of beds occupied at a certain time point are used to calculate staffing requirements. The committee felt that this does not account for all nursing requirements because it doesn't take into account the needs of discharged and newly admitted patients, and therefore leads to inaccurate estimation of nursing staff requirement. For example, a ward with 10 beds may only have 8 occupied at the time of counting. However, the ward may have previously had 10 patients that day and discharged 2 of them, then received 2 more patients. At the time of counting, occupancy was 8 patients (occupancy rate of 80%), but 12 patients utilised the beds (utilisation rate of 120%) in the same time period. Thus, the committee agreed that bed utilisation is a better method to use as part of the calculations to determine nurse staffing requirement, although no evidence was found to support this. The committee also considered the way in which the number of nurses required to deliver care is determined. Often the number of nurses required is expressed as a ratio of nurses to beds. This

	approach does not take into account the individual needs of patients and so can be very imprecise, especially when the ward may be occupied by patients with very different nursing needs. A small amount of evidence was found that showed improved outcomes following the introduction of a systematic approach which measure nursing hours per patient day. This approach considers the individual patient care needs and expresses them in hours. The committee agreed that this was a more appropriate and accurate method for helping to determine nurse staffing requirements. This approach was considered to provide a more accurate prediction of the number of nurses needed to deliver nursing care to all patients on the ward. The Committee emphasised the need for responsibility of nursing care should be with registered nurses, and certain tasks could be delegated to trained and competent healthcare assistants on each ward. For further discussion on skill mix see the evidence to recommendations table for recommendation 1.1.7.
Trade-off between net benefits and resource use	No primary published economic evidence that met the inclusion criteria was identified. Therefore the committee developed recommendations based on its knowledge and experience and studies from evidence review 1 that are detailed above. The Committee agreed that a senior registered nurse should be designated the responsibility to set the ward nursing staff establishment and agreed that this was already routinely done in many hospitals and would have minimal additional costs. To ensure that day to day requirements can be achieved, the ward nursing staff establishment should also be able to account for planned and unplanned absence using an 'uplift'. The Committee acknowledged the fact that adding an 'uplift' may result in increased staffing costs. The Committee discussed the potential efficiency loss from occasional over-staffing due to up-lift; however it thought the benefits from over-staffing (increased flexibility) would outweigh the risks (including increased costs).
Quality of evidence	The Committee considered evidence from Evidence review 1 and 2 when making this recommendation: • One study (Twigg et al. 2011 [- for internal validity and + for external validity]) demonstrated that the introduction of a nursing hours per patient day staffing method reduced some adverse patient outcomes (CNS complications on surgical wards RR 0.46 (95 -CI: 0.23, 0.92), pneumonia on surgical wards RR 0.83 (95 -CI: 0.70, 0.99), gastrointestinal bleeds on surgical wards RR 0.63 (95 -CI: 0.43, 0.92), and mortality). There is no evidence on how frequently the method should be used. We found no evidence about the effectiveness of other methods. • Studies [++ for internal validity and + for external validity] found

	that a higher proportion of registered nurses on wards is associated with a significantly lower rate of death (Estabrooks et al. 2005, He et al. 2013) or failure to rescue (Blegen et al. 2011). • Studies of mixed quality [++,++,- for internal validity and +,+,+ for external validity] found a significant associations between a higher proportion of RNs in the nursing workforce) and lower rates of pneumonia (Cho et al. 2003) surgical site infection (McGillis Hall et al. 2004) lower post-operative sepsis (Blegen et al. 2011) but one study (Duffield et al 20011 [- for internal validity and + for external validity]) found that higher rates of pneumonia were associated with a richer skill mix. • Four studies [++,+,+, - for internal validity and +,++,+,++ for external validity] found that a richer RN skill mix was associated with significantly fewer falls (Blegen and Vaughn 1998, Donaldson et al. 2005, Duffield et al. 2011, Patrician et al. 2011). • Three studies [+,-,- for internal validity and +,+,+ for external validity] found that a richer RN skill mix was associated with fewer pressure ulcers (Blegen et al. 2011, Duffield et al. 2011, Ibe et al. 2008). • Two weak studies [both - for internal validity and both + for external validity] provided no evidence of association between skill mix and VTE (Duffield et al. 2011, Ibe et al. 2008). • A single moderate study [+ for internal validity and - for external validity] showed significantly fewer complaints with a richer RN skill mix (Potter et al. 2003). • Two weak studies [both - for internal validity and -,+ for external validity] indicated that a richer RN skill mix might be associated with lower resource use in terms of hospital stay (Frith et al. 2010) or total nursing hours and overall cost of nursing hours (McGillis Hall et al. 2004).
Other considerations	The Committee also considered the following documents: • Expert paper 1: Expert testimony presented to the Safe Staffing Advisory Committee • Francis R (2013) Report of the Mid Staffordshire NHS Foundation Trust Public Inquiry. London: The Stationery Office • National Quality Board (2013) How to ensure the right people, with the right skills, are in the right place at the right time. A guide to nursing, midwifery and care staffing capacity and capability. NHS England.

Assessing if nursing staff available on the day meet patients' nursing needs

1.4.1	**Systematically assess that the available nursing staff for each shift or at least each 24-hour period is adequate to meet the actual nursing needs of patients currently on the ward. The nurse in charge on individual shifts should make the on-the-day assessments of nursing staff requirements, which could be facilitated by using a NICE-endorsed decision support toolkit. Also take into account the patient factors outlined in section 1.2, box 1 and tables 1 and 2.**
1.4.2	**Monitor the occurrence of the nursing red flag events shown in box 2 throughout each 24-hour period. Monitoring of other events may be agreed locally.**
1.4.3	**If a nursing red flag event occurs, it should prompt an immediate escalation response by the registered nurse in charge. An appropriate response may be to allocate additional nursing staff to the ward.**
1.4.4	**Keep records of the on-the-day assessments of actual nursing staff requirements and reported red flag events so that they can be used to inform future planning of ward nursing staff establishments or other appropriate action.**
Relative value of different outcomes	The committee considered a range of outcomes such as severe preventable events, never events, missed care and elements of the safety thermometer as well as other outcomes such as patient satisfaction, resource use and cost, and process and organisational factors. All outcomes were considered equally important.
Trade-off between benefits and harms	The Committee considered evidence from Evidence review 1. For discussions about recommendation 1.4.1 see the discussion for recommendation 1.2.1 The committee agreed that it was imperative that nursing staff should be able to alert the organisation to potential harms so that escalation responses can be actioned. To do this requires monitoring of events that can indicate whether harm to patients is occurring, or is likely to occur because the number of available nursing staff may be dangerously low. The committee felt that events to be monitored should be closely related to the number of available nursing staff, as opposed to the wider care team; be able to be measured immediately and therefore addressed rapidly if required; high prevalence of events and therefore on a sufficient scale to detect deviation from the

	expected levels; not dependent on case mix. The committee developed a list of red flag events that was based on both evidence and knowledge and experience of the group and using the rationale described above. The following nursing red flags were developed as the committee felt they were most important and meaningful to patients: • Unplanned omission in providing patient medications • Delay of more than 30 minutes in providing pain relief. • Patient vital signs not assessed or recorded as outlined in the care plan. • Regular checks on patients to ensure that their fundamental care needs are met as outlined in the care plan The following nursing red flags were also developed as the committee felt they represented a threshold where the number of available staff would be potentially dangerously low: • Less than 2 registered nurses present on a ward during any shift • A shortfall of more than 8 hours or 25% (whichever is reached first) of registered nursing staff present compared with the actual requirement for the shift. The committee discussed that avoiding a nursing red flag event of having less than 2 registered nurses present on a ward during any shift would be more difficult for smaller wards. However they discussed that one of the ways of addressing this could be to adapt staff rostering to allow cover for breaks or other reasons to be provided by wards who have more than two registered nurses available.
Trade-off between net benefits and resource use	No primary published economic evidence that met the inclusion criteria was identified. Therefore the committee developed recommendations based on its knowledge and experience and studies from evidence review 1 that are detailed above. Immediate escalation to a red flag (Box 2) may have a small added administrative burden for data collection; monitoring and escalation methods (i.e. alerting the designated nurse in charge). The Committee considered the implication of using red flags as a negligible added cost to the organisation. The Committee discussed the potential actions as a result of nursing red flag event following escalation. It emphases the need for a more flexible workforce within the organisation (see recommendations 1.1.8 onwards). It noted that it may not always be an immediate action for the occurrence of a red flag. On occasion, the organisation may want to increase nursing staff on the wards (by redeploying staff, or using bank or agency staff. This may result in an increase in costs, particularly if bank or agency staff are used to temporary increase nursing staff on wards. The Committee felt that there might be long-term net benefits and

	potential savings associated with preventing adverse patient and nursing outcomes (such as mortality, drug administration errors). The committee therefore, felt that using red flags may be a cost-effective means to ensure safe staffing numbers in acute wards. The Committee emphasised the benefits of storing and recording red flag events for longer-term monitoring, it felt that these could be used to change requirements and ward nursing staff establishments in the future. This data storage should be in an electronic format, so it should be of negligible additional cost to organisations.
Quality of evidence	The Committee considered evidence from Evidence review 1: • The study by Needleman (Needleman et al. 2011 [++ for internal validity and + for external validity], provides evidence of an association between variation in staffing at the level of a nursing shift and subsequent adverse outcomes - Mortality and exposure to below-target shifts. Risk of death increased with exposure to increased number of below-target shifts. Hazard ratio per below-target shift, 1.02 95% CI, 1.01 to 1.03 p<0.001. When number of below-target shifts restricted to in ≤5 days after admission, hazard ratio increased to 1.03 95% CI, 1.02 to 1.05 p<0.001. When exposure specified in a window of previous 6 shifts, hazard ratio was 1.05 95% CI, 1.02 to 1.07 p=0.001. High-turnover shifts and increased risk of death. Analyses that included all hospital admissions and cumulative exposure during ≤30 days, hazard ration per high-turnover shift was 1.04 95% CI, 1.02 to 1.06 p<0.001. When restricted to those in ≤5 days, hazard ratio increased to 1.07 95% CI, 1.03 to 1.10 p<0.001. • There is some strong evidence that a lower level of nurse staffing is associated with higher rates of drug administration errors (Frith et al. 2012, O'Brien-Pallas et al. 2010a, Patrician et al. 2011) [++,+,- for internal validity and ++ for external validity] and missed nursing care (Ball et al. 2013, Tschannen et al. 2010, Weiss et al. 2011) [++,++,- for internal validity and ++,++,-for external validity] including paperwork (Ball et al. 2013).
Other considerations	The Committee also considered the following documents: • Expert paper 1: Expert testimony presented to the Safe Staffing Advisory Committee • Francis R (2013) Report of the Mid Staffordshire NHS Foundation Trust Public Inquiry. London: The Stationery Office • National Quality Board (2013) How to ensure the right people, with the right skills, are in the right place at the right time. A guide to nursing, midwifery and care staffing capacity and capability. NHS England.

Monitor and evaluate ward nursing staff establishment

1.5.1	**Monitor whether the ward nursing staff establishment adequately meets patients' nursing needs using the safe nursing indicators in box 3. These are indicators that evidence shows to be sensitive to the number of available nursing staff and skill mix. Consider continuous data collection of these safe nursing indicators (using data already routinely collected locally where available) and regularly analyse the results. (Appendix 2 gives further guidance on data collection for the safe nursing indicators).**
1.5.2	**Compare the results of the safe nursing indicators with previous results from the same ward at least every 6 months. The comparisons should also take into account the specific ward and patient characteristics (such as patient risk factors and ward speciality). Reported nursing red flag events (see section 1.4, box 2) should also be reviewed when undertaking this monitoring and prompt an earlier examination of the adequacy of the ward nursing staff establishment.**
Relative value of different outcomes	The committee considered a range of outcomes such as severe preventable events, never events, missed care and elements of the safety thermometer as well as other outcomes such as patient satisfaction, resource use and cost, and process and organisational factors. All outcomes were considered equally important.
Trade-off between benefits and harms	The Committee considered evidence from Evidence review 1. The Committee were keen to emphasise that providing the number of nursing staff that were deemed to be required would not alone necessarily result in improved outcomes for patients. They therefore felt that it was important to recommend that the quality of the delivery of patient care should be monitored and used to drive improvements. There was evidence (but not necessarily a causal association) between a number of outcomes and the numbers of registered nurses– mortality, hospital acquired infections, falls, completed/missed care and medication errors. None of the studies were undertaken in the UK and few were rated highly, however the Committee agreed they were able to make recommendations based on this evidence as it was derived from a diverse range of settings including from studies which were drawn on nationally representative samples of hospitals in developed countries. The Committee wished to acknowledge that outcomes like mortality and hospital acquired infection, despite having good evidence were not felt to be a suitable indicator as significantly confounded by many

	other factors. Falls also has reasonable evidence, but should not be used as indicator to measure between wards or hospitals due to the large variation in incidence that is largely driven by the demographics of the population that is being treated, but could be used as an improvement measure. Other outcomes collected as part of the Care Thermometer were discussed. It was noted that the Care Thermometer records the prevalence and not the incidence of events. There was strong consensus decision that infections, VTE (no evidence to support) and catheter associated UTI, like mortality are too greatly influenced by the wider healthcare team and should therefore not be used as indicators.
Trade-off between net benefits and resource use	No primary published economic evidence was found that met the inclusion criteria. Therefore recommendations were developed based on the knowledge and experience of the committee and studies from evidence review 1 that are detailed above. The Committee agreed that regularly monitoring of outcomes related to the ward nursing staff establishment may result in a small cost increase (such as the cost of data collection). It also considered the costs and net benefits of continuous data collection. The Committee thought there may be a substantial increase in costs to organisations to continually monitor outcomes because it may require complex electronic data systems. However, it highlighted the benefits of swifter response to changes in staffing and outcomes, and the potential benefits of reduces adverse patient and nursing outcomes. The committee emphasised the need to monitor and prevent the patient, staff and safety outcomes listed in the indicators (Box 3). This may reduce long-term cost of management (such as the management of the patient after the fall, or pressure ulcer) and give health and process benefits. But the Committee acknowledged that the guideline does not investigate if prevention of adverse outcomes (patient, safety, staff) are themselves cost-effective use of resources. The Committee felt they were appropriate markers of safe staffing numbers in wards. The Committee felt that effective monitoring and evaluation was fundamental to providing safe and effective care that in implemented in practice and so was a cost-effective use of resources.
Quality of evidence	The Committee considered evidence from Evidence review 1: Registered / all nurse staffing levels and patient outcomes: • There is evidence from large observational studies, of good quality [all ++ for internal validity and +,+,++,+ for external validity] that hospitals / units with higher nurse staffing have lower rates of mortality (Blegen et al. 2011, Needleman et al. 2011, Sales et al. 2008, Sochalski et al. 2008) and failure to rescue (Park et al.

	2012, Twigg et al. 2013) . • There is mixed evidence on the association between nurse staffing levels and hospital acquired infections. No studies showed a significant association with catheter associated UTI. One weak study [- for internal validity and + for external validity] showed a significant association between low staffing and higher rates of pneumonia (Duffield et al. 2011) but 1 strong study [++ for internal validity and + for external validity] showed a significant association in the opposite direction (Twigg et al. 2013). One study [++ for internal validity and + for external validity] showed higher rates of surgical site infection to be associated with lower staffing (Twigg et al. 2013). Two studies [both - for internal validity and ++,+], showed significant negative associations between staffing and other infections (Blegen et al. 2008, Duffield et al. 2011). • There is evidence of an association between staffing levels and falls from 3 [+,++,+ for internal validity and ++,++,- for external validity] studies (Donaldson et al. 2005, Patrician et al. 2011, Potter et al. 2003). Evidence from non-significant studies supports this direction of association. • Evidence is mixed for an association with pressure ulcers. Three studies [+,-,- for internal validity and ++,+- for external validity] found significant negative associations between staffing levels and pressure ulcers with lower staffing associated with lower rates of ulcers (Donaldson et al. 2005, Duffield et al. 2011, Hart and Davis, 2011) but two studies, [both ++ for internal validity and both + for external validity], found a significant association in the opposite direction (Cho et al. 2003, Twigg et al. 2013). • Evidence from three studies [-,-,++ for internal validity and +,+,++ for external validity] found no association between nurse staffing levels and venous thromboembolism (Duffield et al. 2011, Ibe et al. 2008, Spetz et al. 2013). • Three small studies with low / moderate [-,+,- for internal validity and ++,-,- for external validity] gave no significant association with satisfaction (Ausserhofer et al. 2013, Potter et al. 2003, Seago et al. 2006). • There is strong evidence showing lower hospital use in terms of length of stay (Blegen et al. 2008, Frith et al. 2010, O'Brien-Pallas et al. 2010b, Spetz et al. 2013) or readmission (Weiss et al. 2011) is associated with higher levels of nurse staffing [-,-,-++,+ for internal validity and ++,-,-,++,- for external validity]. Registered / all nurse staffing levels and care processes / nurse outcomes: • There is some strong evidence that a lower level of nurse staffing is associated with higher rates of drug administration errors (Frith

	et al. 2012, O'Brien-Pallas et al. 2010a, Patrician et al. 2011) [+,+,++ for internal validity and -,-,++ for external validity] and missed nursing care (Ball et al. 2013, Tschannen et al. 2010, Weiss et al. 2011) [all + for internal validity and ++,++,- for external validity] including paperwork (Ball et al. 2013). • There is also some contradictory evidence on drug administration errors with one study (Blegen and Vaughn, 1998) of moderate quality [+ for internal validity and + for external validity] finding that wards with more nursing staff had significantly higher error rates. • No significant relationships were found from five studies that reported nurse outcomes (Ausserhofer et al. 2013, O'Brien-Pallas et al. 2010a, O'Brien-Pallas et al. 2010b, Staggs and Dunton 2012) but the overall quality of this evidence was moderate to low (-,+,-,+for internal validity and ++,-,-,+ for external validity]. Health care assistant staffing and outcomes: • Studies of moderate and low quality [-,++ for internal validity and -,+ for external validity] found no association with mortality (Unruh et al. 2007), failure to rescue (Park et al. 2012), length of stay (Unruh et al. 2007), VTE (Ibe et al. 2008) or missed care (Ball et al. 2013). • Studies with moderate to low quality [-,+,-,- for internal validity and -,+,-,- for external validity] found that higher HCA staffing was associated with higher rates of falls (Hart and Davis 2011, Lake et al. 2010) pressure ulcers (Seago et al. 2006), readmission rates (Weiss et al. 2011), medication errors (Seago et al. 2006), physical restraints (Hart and Davis 2011) and lower patient satisfaction (Seago et al. 2006). • One weak study [- for internal validity and + for external validity] found that higher HCA staffing levels were associated with lower rates of pressure ulcers (Ibe et al. 2008). • There we no studies looking at associations with costs, infections or nurse outcomes. The Committee used their professional and personal experiences to inform the other indicators that have been suggested to be monitored from this recommendation and also considered evidence from the following when making this recommendation: • Expert paper 1: Expert testimony presented to the Safe Staffing Advisory Committee • Francis R (2013) Report of the Mid Staffordshire NHS Foundation Trust Public Inquiry. London: The Stationery Office • National Quality Board (2013) How to ensure the right people, with the right skills, are in the right place at the right time. A guide to

	nursing, midwifery and care staffing capacity and capability. NHS England.
Other considerations	None.

1.5.3	**There is no single nursing staff-to-patient ratio that can be applied across all acute adult inpatient wards. However, take into account that there is evidence of increased risk of harm associated with a registered nurse caring for more than 8 patients during the day shifts. Therefore if the available registered nurses for a particular ward (excluding the nurse in charge) are caring for more than 8 patients during the day shifts, the senior management and nursing managers or matrons should:** • **closely monitor nursing red flag events (section 1.4, box 2)** • **perform early analysis of safe nursing indicator results (see section 1.5, box 3)** • **take action to ensure staffing is adequate to meet the patients' nursing needs if indicated by the analysis of nursing red flag events and safe nursing indicators.** **In many cases, patient's nursing needs, as determined by following the recommendations in this guideline, will require registered nurses to care for fewer than 8 patients.**
Relative value of different outcomes	The committee considered a range of outcomes such as mortality, failure to rescue, severe preventable events, missed care, never events, and elements of the safety thermometer as well as other outcomes such as patient satisfaction, resource use and cost, and process and organisational factors. The adverse outcomes of mortality and failure to rescue were considered to be more important in developing this recommendation.
Trade-off between benefits and harms	The Committee considered evidence review 1, the economic analysis and report of field testing of draft guideline when making this recommendation Evidence was identified that supported the association between nursing staff caring for fewer patients and better outcomes for patients and staff. The committee agreed that the relationship between number of nurses and outcomes is unlikely to be linear. Rather, this relationship is likely to be curved, whereby as the number of nursing staff increases, the number of positive outcomes also increases until a point is reached where the addition of additional nursing staff doesn't

	result in any further increase in positive outcomes. However, no evidence was available to enable the committee to state what the shape of the curve actually is, and at what point the addition of nursing staff leads to no increase in outcomes. Thus the committee debated whether it could make a recommendation on the point at which numbers of nursing staff are at their optimum based on its knowledge and experience. The committee considered the data from a number of different sources that were examined in the economic analysis. This included data from the United Kingdom Nursing Database, the Audit Commission Ward Data and NHS Foundation Trust Data. These all demonstrated that there was a large range in the number of patients nursing staff were caring for across different wards in the country and even amongst different wards of the same organisation. The data from the report of field testing of draft guideline also showed that when experienced registered nurses applied their professional judgement, they felt it was appropriate to have a wide range in the number of patients each registered nurse should be caring for. After deliberating, the committee felt that it would be impractical and potentially harmful to define an optimum or minimum 'safe' nurssing staff to patient ratio, since there are a wide variety of factors that influence the amount of care that is required for an individual patient, ward, and on an organisational level. To recommend a minimum 'safe' ratio for all acute wards could also lead people to disregard these important factors in favour of adhering to an arbitrary number. Instead the committee wanted to emphasise that following the recommendations of this guideline will determine an appropriate nursing staff requirement for each shift on each ward. However, evidence was available that showed that harms were associated with low registered nurse to patient ratios. In particular, evidence from Rafferty (2007) indicated that there increased risk of mortality and failure to rescue when registered nurses cared for 8.6 patients or more, than when they cared for less than 8.3 patients. Because of the seriousness of this finding, the committee felt it could not be ignored. The Committee felt the evidence was strong enough to suggest that when registered nurses care for more than 8 patients on a regular basis, this could lead to significant harm, with the risk of harm likely to disproportionally increase as the number of patients each registered nurse is caring for increases. The committee wanted to stress that this is not a minimum safe staffing ratio, but should be used to prompt close monitoring of red flag events (see recommendation 1.4.2) and safe nursing indicators. Evidence also showed that nursing staff satisfaction and missed care was also negatively affected by the number of patients they care for. Thus the committee felt justified in stating that harms are likely to occur when registered nurses care for more than 8 patients during

	the day shifts, and that if this occurs, it should trigger close monitoring of red flag events and nursing care indicators as a prompt to reviewing if further action is required.
Trade-off between net benefits and resource use	No primary published economic evidence was found that met the inclusion criteria. Therefore recommendations were developed based on the knowledge and experience of the committee and studies from evidence detailed above. The Committee felt that on some wards a registered nurse caring for over 8 patients may not necessarily be unsafe (for example, the ward may have low patient turnover and nursing needs of the patients). However, the evidence review suggested an increased risk of mortality for wards with each registered nurse caring for greater than 8 patients. The Committee strongly emphasised the importance of reducing the risk of death and improve patient outcomes. They also considered that wards with higher mortality rates and poor patient outcomes would create additional nursing activities related to poor care. The Committee acknowledged the potential costs of these increase activities as well as potential litigation costs. The Committee considered evidence showing that a higher patient to registered nurse ratio resulted in higher burnout and job dissatisfaction. The Committee felt that this might increase staff absence and turnover requiring a greater 'uplift' for the ward nursing staff establishment and therefore higher nursing staff costs. The Committee discussed the implications of registered nurses caring for fewer patients. There could be a lower risk of mortality and adverse patient safety events, plus potentially fewer litigation costs. There is likely to additional cost of increased total nursing staff, however, there are also likely to be savings from preventing serious adverse events and that these costs can be substantial. Overall, the Committee's conclusion was that following the recommendations in this guideline should result in safe staffing and the net benefits to patients from improved patient safety outcomes and reduced litigation costs outweigh the potential costs from additional resource required to implement the guideline recommendations.
Quality of evidence	The Committee considered evidence from Evidence review 1: Rafferty AM, Clarke SP, Coles J, Ball, J, James P, McKee M and Aiken LH 2007. Outcomes of variation in hospital nurse staffing in English hospitals: Cross-sectional analysis of survey data and discharge records. International Journal of Nursing Studies, 44, 175-182. • This cross-sectional analysis [- for internal validity and ++ for external validity] combined nurse survey data (N = 3984) with discharge abstracts of general, orthopaedic, and vascular surgery patients (N = 118 752) in 30 English acute trusts. Patients and

	nurses in the quartile of hospitals with the most favourable staffing levels (the lowest patient-to-nurse ratios) had consistently better outcomes than those in hospitals with less favourable staffing. • Patients in the hospitals with the highest patient to nurse ratios (12.4–14.3) had 26% higher mortality (95% CI: 12–49%) than patients in those with the lowest ratios (6.9–8.3 patients per nurse); the nurses in those hospitals were approximately twice as likely to be dissatisfied with their jobs, to show high burnout levels, and to report low or deteriorating quality of care on their wards and hospitals. • Most of the increased risk in mortality occurred between the best staffed hospitals compared to any hospital with lower staffing. Ball JE, Murrells T, Rafferty AM, Morrow E and Griffiths P 2014. 'Care left undone' during nursing shifts: associations with workload and perceived quality of care. BMJ Qual Saf, 23, 116-25. • This study [+ for internal validity and ++ for external validity] examined the nature and prevalence of care left undone by nurses in English National Health Service hospitals and assessed whether the number of missed care episodes reported by nurses is associated with nurse staffing levels and nurse ratings of the quality of nursing care and patient safety environment. Data were derived from a cross-sectional survey of 2917 registered nurses working in 401 general medical/surgical wards in 46 general acute National Health Service hospitals in England. • Most nurses (86%) reported that one or more care activity had been left undone due to lack of time on their last shift. Most frequently left undone were: comforting or talking with patients (66%), educating patients (52%) and developing/updating nursing care plans (47%). The number of patients per registered nurse was significantly associated with the incidence of 'missed care' ($p<0.001$). • When registered nurses cared for 6.13 or fewer patients the odds of missing any care and the rate of care missed were significantly reduced (OR 0.343 $p<0.001$, beta -1.087, $p<0.001$) compared to the lowest staffed wards (11.67 patient per nurse or worse).. • This study found no significant association with HCA staffing and no significant interaction between RN and HCA staffing. While we assessed this study as having high external validity (++) because it included a random sample of wards from a random sample of English hospitals, there are potential limitations in internal validity (+). The most significant of this is that the measure is nurses' reports of care left undone on the last shift. While this subjective measure has been shown to relate to other measures of quality its validity as an objective measure of 'missed care' is uncertain. This

	and similar studies suggest a line of development for quality measures rather than providing a solution. Sheward L, Hunt J, Hagen S, Macleod M and Ball J 2005. The relationship between UK hospital nurse staffing and emotional exhaustion and job dissatisfaction. Journal of Nursing Management, 13, 51-60. • This study [- internal validity and ++ for external validity] explored the relationship between nurse workload, nurse characteristics, and hospital variables and nurse outcomes, specifically job dissatisfaction and burnout. Fifty nine adult, acute, multi-speciality hospitals employing 100 nurses minimum in England and Scotland formed the sample. Data derived from a 1999 survey of 19 454 registered nurses in Scotland and England (50% response rate). • The study showed statistically significant relationships between nurse patient ratios and emotional exhaustion and dissatisfaction with current job. Compared to nurses reporting the worst staffing (patient to nurse ratio 13 or more patients per nurse) nurses reporting better staffing were significantly less likely to report emotional exhaustion (adjusted odds ratios 0–4 Patients 0.57 [95% CI 0.46–0.71] 5–8 Patients 0.67 [0.55–0.81] 9–12 Patients 0.80 [0.71–0.92]) and job dissatisfaction (OR 0–4 Patients 0.70 [95% CI 0.58–0.83], 5–8 Patients 0.75 [0.66–0.85], 9–12 Patients 0.84 [0.72–0.99]).
Other considerations	The Committee considered the potential harms of this recommendation being misinterpreted to mean that if a registered nurse is caring for 8 patients, then this is represents a safe number of registered nurses. The Committee wished to emphasise that there is no floor or ceiling in the number of registered nurses and healthcare assistants that are required to care for the patients in a particular ward. Rather the required number of nursing staff should be determined by individual wards according to the recommendations stated in this guideline.

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