Implementation of mental health service recommendations in England and Wales and suicide rates, 1997–2006: a cross-sectional and before-and-after observational study

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Summary

Background Research investigating which aspects of mental health service provision are most effective in prevention of suicide is scarce. We aimed to examine the uptake of key mental health service recommendations over time and to investigate the association between their implementation and suicide rates.

Methods We did a descriptive, cross-sectional, and before-and-after analysis of national suicide data in England and Wales. We collected data for individuals who died by suicide between 1997 and 2006 who were in contact with mental health services in the 12 months before death. Data were obtained as part of the National Confidential Inquiry into Suicide and Homicide by People with Mental Illness. When denominator data were missing, we used information from the Mental Health Minimum Data Set. We compared suicide rates for services implementing most of the recommendations with those implementing fewer recommendations and examined rates before and after implementation. We stratified results for level of socioeconomic deprivation and size of service provider.

Findings The average number of recommendations implemented increased from 0·3 per service in 1998 to 7·2 in 2006. Implementation of recommendations was associated with lower suicide rates in both cross-sectional and before-and-after analyses. The provision of 24 h crisis care was associated with the biggest fall in suicide rates: from 11·44 per 10 000 patient contacts per year (95% CI 11·12–11·77) before to 9·32 (8·99–9·67) after (p<0·0001). Local policies on patients with dual diagnosis (10·55; 10·23–10·89 before *vs* 9·61; 9·18–10·05 after, p=0·0007) and multidisciplinary review after suicide (11·59; 11·31–11·88 before *vs* 10·48; 10·13–10·84 after, p<0·0001) were also associated with falling rates. Services that did not implement recommendations had little reduction in suicide. The biggest falls in suicide seemed to be in services with the most deprived catchment areas (incidence rate ratio 0·90; 95% CI 0·88–0·92) and the most patients (0·86; 0·84–0·88).

Interpretation Our findings suggest that aspects of provision of mental health services can affect suicide rates in clinical populations. Investigation of the relation between new initiatives and suicide could help to inform future suicide prevention efforts and improve safety for patients receiving mental health care.

Funding National Patient Safety Agency, UK.

Lancet 2012; 379: 1005–12

Published Online February 2, 2012 DOI:10.1016/S0140-6736(11)61712-1

See Comment page 981

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Introduction

Prevention of suicide is an international health priority.[1,2] Many people who die by suicide have a psychiatric disorder at the time of death: most commonly mood disorders and alcohol or drug misuse.[3] Mental health services could have an important part to play in reducing the risk of suicide.[4–6] Service-related risk factors for suicide identified in previous studies include poor continuity of care,[7] scarcity of well developed mental health services in the community,[8] short length of inpatient stay,[9] reduction of care at final appointment before death,[10] and missed appointments with services.[11] Most studies of the relation between service interventions and suicide rate are limited by small sample sizes, short follow-up periods after intervention, cross-sectional rather than prospective designs, and infrequent collection of data on service-related variables. Few studies have been national in scope. The aspects of service provision that might be most effective in prevention of suicide are unclear.

Our aim was to examine the relation between provision of mental health services and national suicide rates. We focused on key service recommendations made by the National Confidential Inquiry (NCI) into Suicide and Homicide by People with Mental Illness—a project that aims to monitor suicide and ultimately improve the quality of mental health care in the UK. We had four specific objectives: to examine the implementation of key service recommendations by providers of mental health services in England and Wales with time; to examine the cross-sectional association between the number of recommendations implemented and suicide rate across providers; to measure suicide rates before and after implementation within providers; and to investigate the effect of individual recommendations on suicide risk in specific clinical subgroups.

For more on the **National Confidential Inquiry** see http://www.medicine.manchester.ac.uk/mentalhealth/research/suicide/prevention/nci

Methods

Data collection

The organisation of health care varies across different nations of the UK so for ease and clarity we use the generic term "mental health services" throughout this report. In 2002, 2004, and 2006, all mental health services provided by the National Health Service (NHS) in England and Wales were asked to complete a service provision survey. The few private providers and Regional Secure (Forensic) Units were excluded. The questionnaire was based on previous NCI recommendations;[12] it included items about the availability of aspects of service provision and the implementation of policies in specific areas, and the date of implementation. Our study focused on nine key service recommendations (panel 1) selected a priori from the 12 points to a safer service summary for specialist services, first published in 2001[12] and included in the English Suicide Prevention Strategy. The three excluded recommendations were restriction of the amount of medication prescribed after discharge from hospital, availability of atypical antipsychotic medication (both of which can be affected by prescription in primary care and secondary care), and individuals with the greatest level of need receiving the most intensive treatment (a basic aspect of the Care Programme Approach and likely to be a guiding principle in most services).

Panel 1: Key service recommendations

- Ligature points; removal of potential ligature points on inpatient wards, including all non-collapsible curtain rails.
- Assertive outreach; community services include an assertive outreach team that provides intensive support for people with severe mental illness who are difficult to engage in more traditional services.
- 24 h crisis team; community services include a single point of access for people in crisis available 24 h a day. These teams are intended to promptly respond to mental health crisis in the community and so prevent inpatient admission. They provide short-term input until other services are available.
- 7 day follow-up; written policy on follow-up of patients within 7 days of psychiatric inpatient discharge.
- Non-compliance; written policy on response to patients who are non-compliant with treatment.
- Dual diagnosis; written policy on the management of patients with dual diagnosis (patients diagnosed with a psychiatric illness and drug or alcohol dependence or misuse).
- Criminal justice sharing; written policy on sharing information about risk with criminal justice agencies.
- Review; written policy on multidisciplinary review and information sharing with families after a suicide.
- Training; front-line clinical staff receive training in the management of suicide risk at least every 3 years.

Three of the original recommendations were not included in this study. These were: patients with a history of self-harm in the past 3 months to receive supplies of medication covering no more than 2 weeks; atypical antipsychotic medication to be available for all patients with severe mental illness who are non-compliant with typical drugs because of side-effects; all patients with severe mental illness and a history of self-harm or violence to receive the most intensive level of care.

During the study, some services merged and some separated, so we combined responses for relevant services. Full implementation was not achieved until merged services had all implemented the policy. All 91 mental health services returned at least one questionnaire. If implementation was not confirmed, recommendations were recorded as not implemented.

Data were collected as part of the NCI into Suicide and Homicide by People with Mental Illness for individuals aged 10 years and older who died by suicide between Jan 1, 1997, and Dec 31, 2006. The NCI obtain data for people in contact with mental health services by starting with a complete national sample of suicide deaths, establishing which individuals had contact with mental health services within 12 months of death, and then sending the relevant clinicians detailed questionnaires to complete. Further information about methods is available elsewhere.[13] Case ascertainment and completion rates for questionnaires have consistently been high at 95% or more.[13]

Suicides were defined as deaths that received a suicide or open verdict at coroner's inquest (International Statistical Classification of Diseases and Related Health Problems version 10 codes X60–84, Y10–34 [excluding Y33.9], and Y87.0 [excluding Y87.2]). This approach is the conventional way to ascertain suicide deaths for national UK statistics, clinical practice, and research. Most of the open verdict cases described above are suicide deaths, and not including such deaths leads to substantial underestimation of suicide.[14]

Mental health services estimated the number of patients in contact with their service between April 1, 2003, and March 31, 2004 and we used this information as the denominator for calculations. Denominator data were missing for 13 services but for 11 we used denominators provided by the Mental Health Minimum Data Set (MHMDS) for 2004–05.[15] MHMDS data return (derived from routine health care records) has been mandatory since 2003. Overall 97% of data items are in the valid range although data quality might have improved with time; in the early years of MHMDS data collection some definitional and data quality issues were uncovered and some of the methods for deriving some the statistics were new.[16] We decided to use self-reported activity figures and not MHMDS data a priori because of service mergers and reorganisations, known problems with completeness of the MHMDS,[17] and because the dataset does not include Wales. For specific clinical target groups (number of individuals admitted to psychiatric inpatient care and number of individuals treated by mental health services in the community) no self-reported denominator data were available so we used MHMDS denominators.

Socioeconomic deprivation is strongly associated with area-based suicide rates.[18] The effect of service provision on suicide rate might vary with deprivation of catchment populations. Because definitive deprivation scores were unavailable for individual services, we used GeoConvert online 2010 software to derive a deprivation score by linking postcodes of residence of patients included in the NCI to the 2004 Index of Multiple Deprivation score for England. The median deprivation score of individuals within a service was calculated and designated as the score for that mental health service. Services were categorised into tertiles: high (most deprived), middle, and low (least deprived). Wales was not included in this subanalysis because of absence of comparable deprivation data.[19]

All data obtained for this report adhere to UK guidelines for ethical research. The NCI had ethical approval from South Manchester Medical Research Ethics Committee, the North West Research Ethics Committee, the National Information Governance Board for Health and Social Care, the Patient Information Advisory Group and approval under Section 60 (now Section 251) of the Mental Health and Social Care Act.

Statistical analysis

We used STATA version 11.1[20] for all analyses. First, we examined the number of recommendations implemented by mental health services with time. Second, for each year of implementation we compared suicide rates (with exact Poisson 95% CIs) in services implementing zero to six recommendations with those implementing seven to nine recommendations. This cutoff was chosen a priori to identify services that had implemented more than two-thirds of recommendations. We calculated p values by comparing rates with the Stata stir command.

Third, for services that had implemented individual recommendations, we calculated the suicide rate before and after implementation. Some services implemented some recommendations early in the study period and hence had several years of data; for consistency we expressed rates per 10 000 contacts per year.

A fall in suicide rate after implementation of a recommendation might be explained by a falling background rate. We therefore examined reductions in suicide rate in non-implementing services. From implementing services we calculated the median year of implementation for each recommendation. We then worked out the suicide rate in the non-implementing services before and after this date. If the findings were attributable to falling background rates of suicide we would expect to see an equivalent reduction in all mental health services. Since the effects of implementation could vary with deprivation or size of the service, we investigated the effect of these variables on the change in suicide rates by stratifying for them. Services were categorised into tertiles according to their deprivation score and size of clinical population. We examined suicide rates before and after implementation by use of incidence rate ratios (IRRs) and 95% CI. Results are presented separately for each of the three deprivation and size categories.

Fourth, we examined the relation between implementation and suicide rate in specific subgroups of patients with MHMDS denominator data. Some recommendations might be expected to have specific effects on particular clinical groups. Subgroups examined were inpatients, community patients who had missed their last appointment with services or were not taking drugs as prescribed (non-compliant), those who died shortly after discharge from hospital, those with dual diagnosis (psychiatric illness and drug or alcohol dependence or misuse), or those with a criminal justice history. Crisis teams might be expected to affect patients in the community. However, crisis teams are often intended as an alternative to inpatient admission. We therefore examined the effect of implementation of crisis teams on community and inpatient suicide rates.

Role of the funding source

The study was conceived and developed by the NCI into Suicide and Homicide by People with Mental Illness. The National Patient Safety Agency, UK, was the funder and

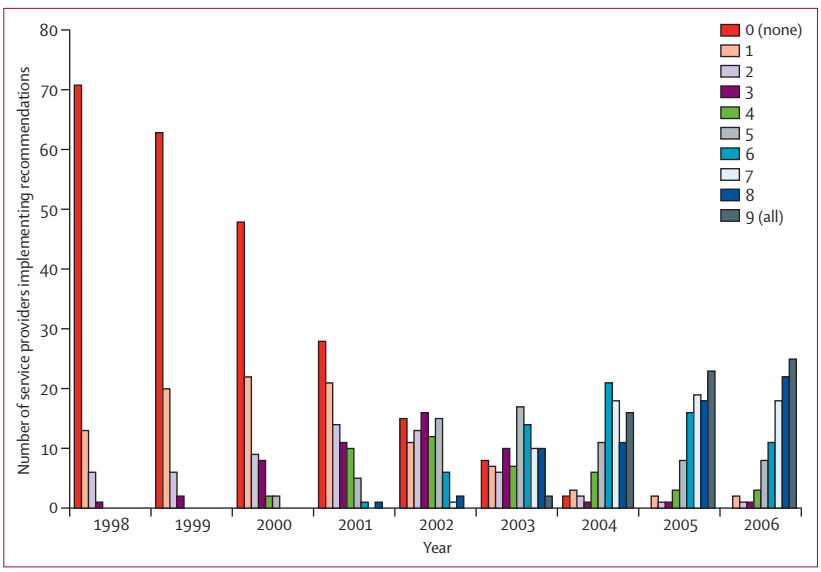

Figure 1: **Number of recommendations implemented by National Health Service mental health services with time**

	Number of services implementing		Suicide rate (95% CI)		p value
	0–6 implementations	7–9 implementations	0–6 implementations	7–9 implementations	
2002	86	3	Not calculated	Not calculated	..
2003	67	22	11·45 (10·73–12·20)	10·52 (9·43–11·71)	0·183
2004	44	45	12·63 (11·70–13·61)	10·80 (9·99–11·65)	0·004
2005	29	60	13·45 (12·27–14·72)	10·50 (9·80–11·23)	<0·0001
2006	24	65	11·03 (9·86–12·31)	9·13 (8·51–9·79)	0·005

Table 1: **Annual suicide rates per 10 000 patients in contact with National Health Service mental health services implementing up to six recommendations compared with those implementing seven to nine recommendations**

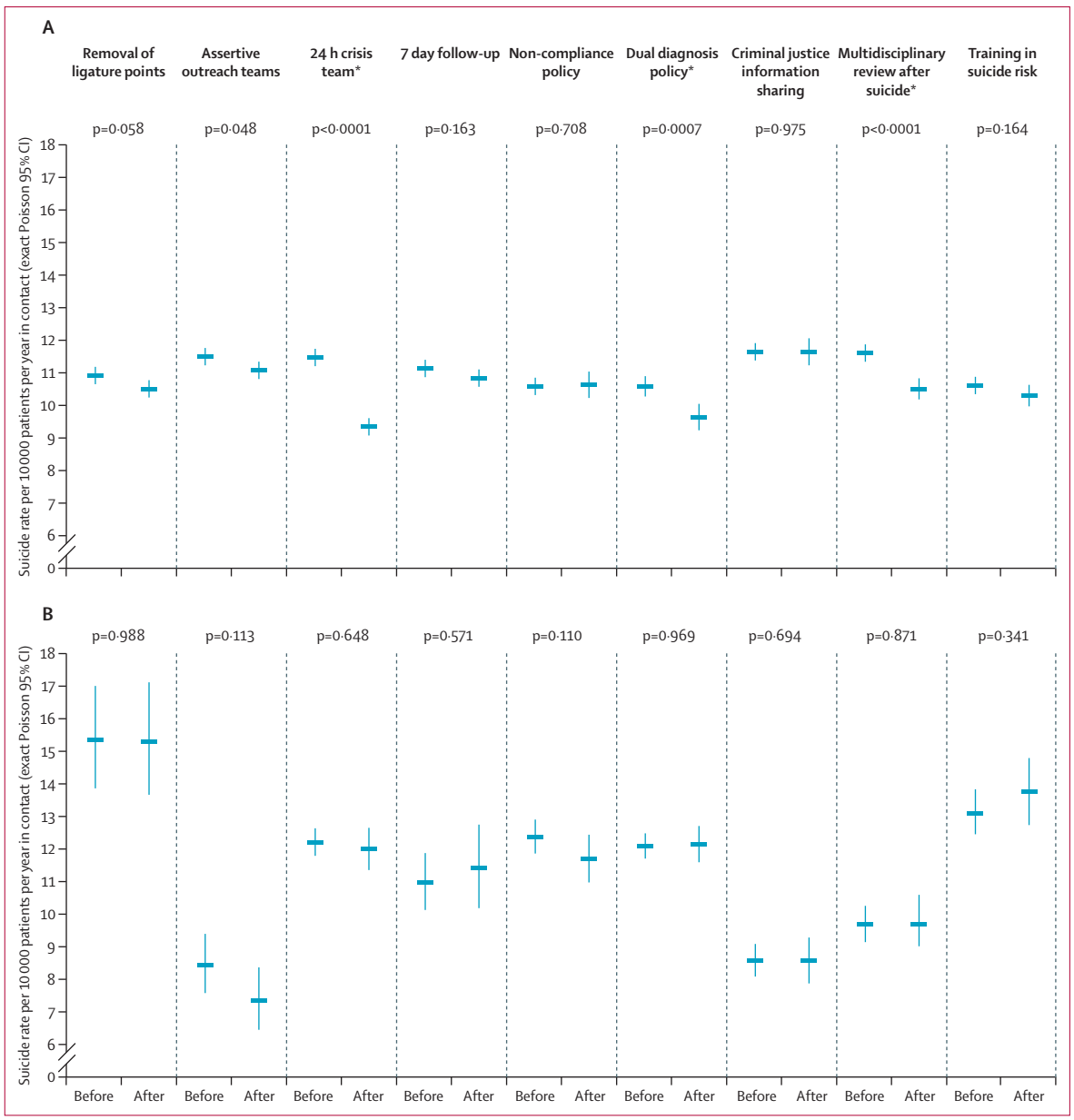

Figure 2: **Annual suicide rates per 10 000 patients before and after implementation of individual recommendations**
(A) NHS mental health services implementing recommendations. (B) NHS mental health services not implementing recommendations. *Statistically significant. NHS=National Health Service.

the University of Manchester was the sponsor. Neither the funder nor the sponsor had any role in study design, data collection, data analysis, data interpretation, or writing of the report. All authors had full access to the data, but DW did most of the data manipulation and analysis. NK and LA made the final decision to submit for publication.

Results

From 1997 to 2006, the NCI recorded 12 881 suicides (12 098 in England, 783 in Wales) within 91 mental health services accounting for 26% of 50 437 suicides in England and Wales during this period. Two services did not have suitable NCI or MHMDS denominator data; we therefore calculated suicide rates for 89 mental health services.

Most services had not introduced any key recommendations in 1998 (figure 1). The average number of recommendations implemented increased gradually from 0·3 per service in 1998 to 7·2 in 2006. The median year of implementation was 2002 for the recommendations for ligature points and assertive outreach team and 2003 for the others. The annual number of new implementations peaked in 2004 (157). By 2006,

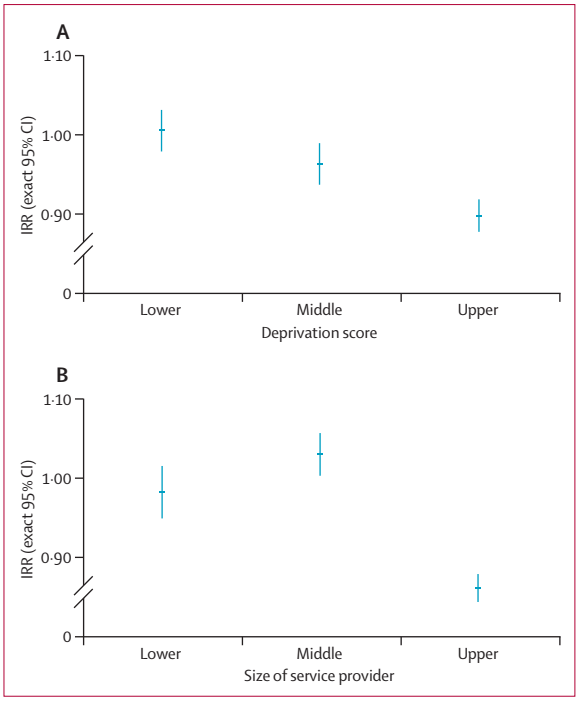

Figure 3: **Incidence rate ratios (and exact 95% CI) comparing suicide rates before and after implementation**
(A) By deprivation score of mental health service. (B) By size of mental health service. IRR=incidence rate ratio.

	Rate before implementation (95% CI)	Rate after implementation (95% CI)	p value
Ligature points			
Inpatients*†	15·66 (14·65–16·73)	11·98 (10·92–13·11)	<0·0001
Inpatients on the ward†	3·20 (2·75–3·70)	2·21 (1·77–2·72)	0·004
Assertive outreach			
Non-compliant community patients‡	1·77 (1·65–1·89)	1·26 (1·16–1·37)	<0·0001
Community patients who missed their last appointment with services‡	2·98 (2·83–3·14)	2·64 (2·49–2·80)	0·002
24 h crisis team			
Community patients‡	9·26 (8·97–9·56)	8·91 (8·56–9·27)	0·137
Inpatients*†	16·39 (15·15–17·71)	11·68 (10·53–12·92)	<0·0001
7 day follow-up			
Community patients discharged <7 days before‡	0·36 (0·31–0·42)§	0·31 (0·25–0·37)§	0·161
Community patients discharged <3 months before‡	2·48 (2·35–2·62)§	1·95 (1·80–2·10)§	<0·0001
Non-compliant			
Community patients who were non-compliant‡	1·51 (1·40–1·62)	1·23 (1·09–1·39)	0·003
Dual diagnosis			
Patients with a dual diagnosis¶	2·35 (2·20–2·50)	2·27 (2·06–2·49)	0·569
Criminal justice sharing			
Patients with a forensic history¶	2·48 (2·35–2·62)	2·54 (2·36–2·73)	0·640

*Inpatient suicides included patients who died on the ward and those who were under inpatient care but died at a distance from the ward (when off the ward with or without staff permission). †Denominator data is number of inpatients from Mental Health Minimum Data Set (MHMDS). ‡Denominator data is number of community patients from MHMDS. §The rates of suicide within 7 days and 3 months of discharge are not intended for direct comparison—the key analyses are the rates before and after implementation. The denominators for both the 7 day and 3 month suicide deaths are number of community patients from the MHMDS. Therefore the greater number of deaths within 3 months generates a higher rate whereas it is generally accepted that the early post-discharge period is the time of highest suicide risk. MHMDS data reused with the permission of The Information Centre for Health and Social Care, Allocated Permission Reference Number 14040108. ¶Denominator data is number of patients from MHMDS.

Table 2: **Rates of suicide per 10 000 per year in target groups before and after implementation of individual recommendations**

25 services (27%) were implementing nine recommendations. The most common months for implementations to occur were April (116 [25%] recommendations implemented), March (60 [13%]), and January (55 [12%]).

We compared the suicide rates for services implementing at least seven recommendations with those implementing fewer (table 1). Before 2003, few services were implementing seven or more recommendations, hence statistical comparisons were not possible. In 2003, differences in suicide rates between services that had implemented seven to nine recommendations and services that had implemented zero to six were not significant (table 1). From 2004 onwards, services that had implemented seven to nine recommendations had a significantly lower suicide rate than those implementing fewer (table 1).

In the before-and-after analysis, implementation of seven recommendations was associated with a fall in the suicide rate (figure 2). For three recommendations this was statistically significant: 24 h crisis team included in community services, dual diagnosis policy, and post-suicide multidisciplinary review policy (figure 2). To assess whether rates had significantly changed with time in non-implementing services, we used median year of implementation in implementer services as the comparison date. For three recommendations (assertive outreach, 24 h crisis team, and non-compliance) rates declined, but these changes were not significant (figure 2).

We obtained deprivation scores for 79 mental health services in England, which included 99% (11 981) of the deaths. The IRRs compare mean rates of suicide before and after implementation. Data are aggregated so that all recommendations are assessed together. The relation between suicide rate and deprivation seemed to be stepwise, with the largest falls in rates in the most deprived services (figure 3A). With respect to size, the greatest falls were recorded in large services (those with the greatest number of contacts with patients) but with no evidence of a stepwise relation (figure 3B). For completeness we examined the effect of deprivation and service size on the cross-sectional analyses (table 1) by stratifying for these variables (English services only). Rates of suicide were significantly lower in the most deprived services implementing seven to nine recommendations (*vs* those implementing six or fewer) in 2003 ([rate; 95% CI] 11·41; 10·29–12·61 *vs* 7·85; 6·16–9·85), 2005 (15·08; 12·17–18·48 *vs* 9·87; 8·88–10·94), and 2006 (11·52; 8·99–14·53 *vs* 8·01; 7·12–8·98), but not in 2004 (12·52; 10·89–14·32 *vs* 10·88; 9·65–12·24).

When we stratified the cross-sectional data by service size we recorded no consistent relation between service size and rate.

Several recommendations were particularly relevant to specific clinical target groups. Suicide rates were calculated and compared for these subgroups before and after implementation (table 2). The removal of ligature points was associated with significant reductions in the overall psychiatric inpatient suicide rate, and in the rate of inpatient suicide by hanging (table 2). Implementation of an assertive outreach policy was associated with significant decreases in the suicide rate in those who were non-compliant with medication or who missed their last appointment (table 2). Crisis-team implementation did not seem to be associated with a significant fall in the community suicide rate but was associated with a fall in the rate among inpatients (table 2). The implementation of a policy for 7 day follow-up after discharge was associated with a significant decrease in the suicide rate within 3 months of discharge, but did not have a significant effect on risk in the first 7 days after discharge (table 2). Implementation of a policy on non-compliance in community patients was associated with a reduction in the suicide rate in the appropriate target group (table 2).

Discussion

Service providers reported increasing implementation of key service recommendations with time. Implementation of these recommendations was associated with a lower suicide rate in a cross-sectional analysis. In a national before-and-after analysis, reductions in suicide rate were associated with the implementation of a total of seven of the nine recommendations, and these reductions were statistically significant for three recommendations. The provision of 24 h crisis care was associated with the biggest fall in suicide rates, but policies for dual diagnosis patients and multidisciplinary review and information sharing with families after suicide were also associated with falling rates. Services that did not implement recommendations saw little reduction in suicide. Particular recommendations were associated with falls in suicide rates in specific clinical subgroups. For example, removal of ligature points was associated with large reductions in inpatient suicides particularly inpatient hanging on the ward, and assertive outreach teams seemed to reduce suicide in those with a history of missed contact with services. The biggest falls in suicide were recorded in the services with the most deprived catchment areas and the largest clinical population.

Although our study was national in scope and one of the largest so far, our findings need to be interpreted in the context of several methodological limitations. First, this was an observational study and we cannot infer a causal relation between service provision and suicide rates. Unmeasured confounding factors could bring about some of the associations we recorded in both our cross-sectional and longitudinal analyses. Possibilities might include differences in or changes to individual-level characteristics of at-risk populations under the care of services (sociodemographic factors, diagnostic case-mix, the numbers of individuals with a history of previous suicidal behaviour). Other confounders might relate to service-level factors such as overall resources, staffing, or organisational changes. However, the longitudinal design of this study is a strength compared with studies with only cross-sectional or ecological approaches.

Second, implementation was based on self-report by services and referred (in part) to implementation of policies rather than structures or services. However, since the examination of policies rather than services could result in an over-reporting of implementation, our findings might underestimate the strength of association between implementation and reductions in rates. Third, our main denominator to calculate rates (ie, contacts with patients) was based on data from 2003–05 and remained constant during the study period. Last, we used rate of suicide of patients in mental health services rather than general population suicide rate as our main outcome. Our focus in this study was the effect of service provision on suicide rates in those who accessed services. However, services might also be an important driver of general population suicide rates.[4,14]

We are confident that we used an appropriate definition of suicide, which (as is convention in the UK) included deaths that received either a suicide or undetermined verdict at coroner's inquest. A post-hoc analysis restricted to the two-thirds of deaths with a suicide verdict left the findings of our cross-sectional analysis essentially unchanged—with statistically significant differences between implementing and non-implementing services for each of the years 2003–06 (2003 p=0·041, 2004 p=0·004, 2005 p<0·0001, 2006 p=0·014, compared with 2004–06 for our main analysis). In the before-and-after analysis, 24 h crisis teams, dual diagnosis services, and multidisciplinary review were still associated with falls in the suicide rate, but the falls were statistically significant for 24 h crisis teams only: 7·9 before (95% CI 7·6–8·2) versus 6·4 (6·2–6·7) after implementation. Some researchers have expressed concerns about the effect of narrative verdicts (verdicts that describe the cause and circumstances of death) on national suicide rates.[21] We think narrative verdicts are unlikely to have affected our findings because these verdicts should not have a greater effect in implementing services than in non-implementing services. Additionally, the increase in the number of narrative verdicts has been particularly evident in the past 4 years—after our study period.

Our study is one of the few to report robust associations between suicide rates and aspects of service provision (panel 2).[2,8,22–25] We believe our findings have implications for mental health services internationally, particularly those in the USA, Europe, and Australasia, which have also had an increased emphasis on community compared

with inpatient treatment.[26] Some researchers have suggested that mental health services might have less of a part to play in suicide prevention in developing countries, where the contribution of psychiatric disorder to suicide is not as prominent and mental health budgets are very small.[27] However, research in these settings has been scarce and improvement in the accessibility and delivery of mental health services could well reduce suicide rates.

We recorded that the implementation of certain NCI recommendations was associated with reduced risk of suicide. The large-scale introduction of crisis resolution and home treatment teams began in 2001 and was achieved nationally by 2005.[28] These teams are intended as an alternative to inpatient admission for adults with severe mental illness who have an acute mental health crisis and are at risk to themselves or others. In practice, they also see patients with less severe mental illness. Our data suggest that these teams might have helped to prevent deaths. Alcohol and drug misuse increases suicide risk,[29] and in our study the implementation of policies to facilitate management of dual diagnosis patients seemed to reduce suicide rates. The association between multidisciplinary reviews and falling suicide rates could be indicative of a learning or training effect[30] or be a marker for other aspects of service provision.

Implementation of recommendations seemed to have the greatest effect in the largest services in this study. The effect of patient volume on outcome has been reviewed with respect to particular medical specialties[31] although not for psychiatry. The data suggest an association between large organisations (high volume) and positive outcomes, presumably because of development and dissemination of expertise. However, implementation of service change in large diffuse organisations can be very challenging.[32] The findings for deprivation should be treated cautiously because our measure of deprivation was a compositional measure based on the postcode of residence of individuals who died and had had contact with services. Nevertheless, our findings suggest that the effect of service changes might vary with the socioeconomic context in which people live—the biggest effects were recorded in individuals from the most deprived areas. This effect could be indicative of a baseline of greater morbidity and unmet health need in individuals in these areas than in less deprived regions, or a comparative lack of protective or resiliency factors.

The physical ward environment has been suggested as an important factor in inpatient suicide[33] and our findings were consistent with this notion. Previous researchers have drawn attention to the potential role of assertive follow-up in suicide prevention,[34] although other investigators recorded little evidence of benefit.[35] Early follow-up after inpatient discharge and good continuity of care could help reduce suicide after discharge.[7]

Service developments in mental health occur on a continual basis. Services should ideally obtain data on the timing of new interventions, the extent and quality of implementation, and their effect on other important outcomes such as self-harm or readmission. When possible this information should be embedded in routine data-collection systems to enable a preliminary examination of the cost of new services and potential benefits. Such data will show not only which innovations might be most helpful in prevention of suicide but should help to inform safer service provision for all patients under the care of mental health services.

Panel 2: Research in context

Systematic review

We searched Medline, PsychINFO, and Embase with a combination of keyword and subject heading searches (with the terms "suicide", "suicide, attempted", and "suicidal", combined with "prevention", "treatment", "reduction", "public policy", and "health policy") to identify systematic reviews about suicide prevention published in the past 10 years. We identified four reviews.[2,22–24] Although mental disorder was consistently cited as an important risk factor for suicide, few studies examined the effect of treatment or service-related factors on suicide risk. Some evidence exists for the antisuicidal effects of pharmacological treatments (lithium, antidepressants, clozapine), physician education in depression recognition and management, removing barriers to accessing treatment, and contact by letter after discharge from hospital. Additionally we identified two ecological studies based on national samples.[8,25] Results of a Finnish study showed that areas where outpatient services were over-represented compared with inpatient services and areas with 24 h emergency services had lower rates of suicide than areas without such services.[8] A Norwegian study showed no association between any mental health service variables and suicide rate.[25]

Interpretation

We surveyed mental health care providers in England and Wales and linked service data to individual level suicide data. We recorded an association between the implementation of service changes and a reduced incidence of suicide. Our findings suggest that aspects of mental health service provision might have a positive effect on suicide rates in clinical populations. Investigation of the relation between new initiatives and suicide will help to inform future suicide prevention efforts and improve mental health care.

Contributors

LA, NK, and JS were responsible for obtaining funding. NK and LA designed the study with input from DW, HB, and other authors. HB took a lead on devising the service monitoring survey, and HB and AR did questionnaire dispatch and return. HB, AR, DW, KW, and SR were involved in aspects of individual level data collection, with input from all authors. DW took a lead on statistical analysis. NK and DW led interpretation of the findings with additional input from HB, AR and LA. HB did the initial reference search. NK, HB, and DW were principally responsible for the writing of the paper. NK and DW led subsequent revisions with all authors contributing to successive drafts.

Conflicts of interest
LA is the National Director for Health and Criminal Justice and was formerly the National Director for Mental Health (2000–2010). The other authors declare that they have no conflicts of interest.

Acknowledgments
This study was funded by the National Patient Safety Agency, UK, and was done as part of the NCI into Suicide and Homicide by People with Mental Illness. We thank the district directors of public health, health authority, and mental health service contacts, and all respondents for completing the questionnaires. We thank Nicola Swinson and Hetal Mehta for assistance with data collection.

References

1 World Health Organisation. Mental health. Suicide prevention (SUPRE). www.who.int/mental_health/prevention/suicide/suicideprevent/en/ (accessed Oct 20, 2011).
2 Mann JJ, Apter A, Bertolote J, et al. Suicide prevention strategies: a systematic review. *JAMA* 2005; **294:** 2064–74.
3 Bertolotte JM, Fleischmann A. Suicide and a psychiatric diagnosis: a world-wide perspective. *World Psychiatry* 2002; **1:** 181–85.
4 Kapur N. Health services and suicide prevention. *J Ment Health* 2009; **18:** 1–5.
5 Gunnell D, Frankel S. Education and debate: prevention of suicide: aspirations and evidence. *BMJ* 1994; **308:** 1227–33.
6 Kapur N, Hunt IM, Webb R, et al. Suicide in psychiatric in-patients in England, 1997 to 2003. *Psychol Med* 2006; **36:** 1485–92.
7 King EA, Baldwin DS, Sinclair JM, Baker NG, Campbell MJ, Thompson C. The Wessex recent in-patient suicide study, 1. Case-control study of 234 recently discharged psychiatric patient suicides. *Br J Psychiatry* 2001; **178:** 531–36.
8 Pirkola S, Sund R, Salias E, Wahlbeck K. Community mental-health services and suicide rate in Finland: a nationwide small-area analysis. *Lancet* 2009; **373:** 147–53.
9 Bassett D, Tsourtos G. In-patient suicide in a general hospital psychiatric unit: a consequence of inadequate resources? *Gen Hosp Psychiatry* 1993; **15:** 301–06.
10 Appleby L, Dennehy JA, Thomas CS, Faragher EB, Lewis G. Aftercare and clinical characteristics of people with mental illness who commit suicide: a case-control study. *Lancet* 1999; **353:** 1397–1400.
11 Hunt IM, Kapur N, Webb R, et al. Suicide in recently discharged psychiatric patients: a case-control study. *Psychol Med* 2009; **39:** 443–49.
12 Appleby L, Shaw J, Sherratt J, et al. Safety first. London: Stationery Office, 2001.
13 Windfuhr K, While D, Hunt IM, et al. Suicide in juveniles and adolescents in the United Kingdom. *J Child Psychol Psychiatry* 2008; **49:** 1155–65.
14 Linsley KR, Schapira K, Kelly TP. Open verdict v. suicide—importance to research. *Br J Psychiatry* 2001; **178:** 465–68.
15 The Information Centre for Health and Social Care. The Mental Health Minimum Data Set (MHMDS) 2008. Table A —the number of patients receiving care from mental health specialist services by ethnicity, provider and number of patients with CPA Review, 2004–5. www.ic.nhs.uk (accessed April 7, 2008).
16 The Information Centre for Health and Social Care. The Mental Health Minimum Data Set (MHMDS). Online statistics 2003–10. Why were these statistics labelled as experimental? http://www.mhmdsonline.ic.nhs.uk/includes/experimental_note.asp (accessed Dec 19, 2011).
17 The Information Centre for Health and Social Care. The Mental Health Minimum Data Set (MHMDS). Online statistics 2003–10. www.mhmdsonline.ic.nhs.uk/index.asp (accessed Oct 6, 2011).
18 Rehkopf DH, Buka SL. The association between suicide and the socio-economic characteristics of geographical areas: a systematic review. *Psychol Med* 2005; **36:** 145–157.
19 Office for National Statistics. Regional trends, No. 41, 2009 edition. Understanding patterns of deprivation. http://www.ons.gov.uk/ons/rel/regional-trends/regional-trends/no--41--2009-edition/index.html (accessed Dec 19, 2011).
20 StataCorp. 2010. Stata Statistical Software: Release 11·1 College Station, Texas USA. StataCorp LP.
21 Gunnell D, Hawton K, Kapur N. Coroners' verdicts and suicide statistics in England and Wales. *BMJ* 2011; **343:** d6030.
22 Goldney RD. Suicide prevention: a pragmatic review of recent studies. *Crisis* 2005; **26:** 128–40.
23 Nordentoft M. Crucial elements in suicide prevention strategies. *Prog Neuropsychopharmacol Biol Psychiatry* 2010; **35:** 848–53.
24 Hawton K, van Heeringen K. Suicide. *Lancet* 2009; **373:** 1372–81.
25 Johannessen HA, Dieserud G, Claussen B, Zahl P. Changes in mental health services and suicide mortality in Norway: an ecological study. *BMC Health Serv Res* 2011; **11:** 68.
26 Currier GW. Datapoints: psychiatric bed reductions and mortality among persons with mental disorders *Psychiatr Serv* 2000; **51:** 851.
27 Khan MM, Syed EU. Suicide in Asia: epidemiology, risk factors and prevention. In: O'Connor RC, Platt S, Gordon J, eds. International handbook of suicide prevention – research, policy and practice. Chichester: John Wiley & Sons, 2011: 487–506.
28 Glover G, Arts G, Suresh Babu K. Crisis resolution/home treatment teams and psychiatric admission rates in England. *Br J Psychiatry* 2006; **189:** 441–45.
29 Stack S. Work and the economy. In: Maris RW, Berman AL, Silverman MM, eds. Comprehensive textbook of suicidology. New York: The Guildford Press, 2000: 193–221.
30 Links PS, Hoffman B. Review paper: preventing suicidal behaviour in a general hospital psychiatric service: priorities for programming. *Can J Psychiatry* 2005; **50:** 490–96.
31 Halm EA, Lee C, Chassin MR. Is volume related to outcome in health care? A systematic review and methodologic critique of the literature. *Ann Intern Med* 2002; **137:** 511–20.
32 Iles V, Sutherland K. Managing change in the NHS. Organisational change. A review for health care managers, professionals and researchers. National co-ordinating centre for NHS service delivery and organization R & D, 2001; http://www.sdo.nihr.ac.uk/files/adhoc/change-management-review.pdf (accessed Oct 6, 2011).
33 Leiberman DZ, Resnik HLP, Holder-Perkins V. Environmental risk factors in hospital suicide. *Suicide Life Threat Behav* 2004; **34:** 448–53.
34 De Leo D, Dello Buono M, Dwyer J. Suicide among the elderly: the long-term impact of a telephone support and assessment intervention in northern Italy. *Br J Psychiatry* 2002; **181:** 226–29.
35 Dekker J, Wijdenes W, Koning YA, Gardien R, Hermandes-Willenborg L, Nusselder H. Assertive community treatment in Amsterdam. *Community Ment Health J* 2002; **38:** 425–34.