



























Executive summary

Background

This report presents the findings of the second National Audit of Schizophrenia (NAS2). The audit set out to collect case record data on 100 service users, living in the community, from each of the Mental Health Trusts/Health Boards in England and Wales (hereafter referred to as 'Trusts'), and obtained a final database of 5,608 records (an 88% response rate). Data were also collected from service users and carers.

The first National Audit of Schizophrenia (NAS1; Royal College of Psychiatrists, 2012), provided an in-depth examination of the care of a similarly selected population of 5,091 service users. Among other important findings, it found very significant deficiencies in the monitoring and management of physical health problems in people with schizophrenia, deficiencies in some aspects of medication prescribing practice and deficiencies in some aspects of how clinicians communicate with service users and carers. The report of the independent Schizophrenia Commission, established by the mental health charity Rethink Mental Illness (Schizophrenia Commission, 2012), reported some similar deficiencies but also highlighted lack of access to appropriate psychological interventions and lack of opportunities for employment and training.

NAS2 set out to repeat the exercise conducted in NAS1, to see if improvements had occurred, and to examine service user experience in more depth.

Audit standards

The 16 standards agreed for this audit are based on the NICE guideline for schizophrenia (NICE CG82, 2009). (The more recent guideline [NICE CG178, 2014] was published after the end of data collection for this audit.) Two of the original NAS1 standards were amended and two new ones added in order to simplify the standards and incorporate care planning into these.

The broad aspects of care included in the standards are as below:

- a) Service users' experience of care, treatment and outcomes.
- b) Carers' satisfaction with the support and information they had received.
- c) Information and decision making about medication.
- d) Practice in the prescribing of antipsychotic medications.
- e) Availability and use of psychological therapies.
- f) The extent of monitoring and intervention for physical health problems.
- g) Care planning and crisis planning.

Method

All 64 Mental Health Trusts/Health Boards in England and Wales submitted data for NAS2. Each Trust was asked to submit data on a random sample of 100 adults under their care, with diagnoses of either schizophrenia or schizoaffective disorder, who had been under the care of mental health teams in the community for at least 12 months. Trust clinicians and audit departments collected retrospective information from their case records, supplemented where appropriate with information from primary care services. Trusts distributed the service user survey forms to service users who, in turn, distributed a carer survey form to the individual they considered to be their closest carer. Data collection was from August to November 2013.

Conclusions

Overall, the findings were largely unchanged between NAS1 and NAS2. There are none of the broad areas of care, below, in which Trusts may be regarded as providing an excellent level of service. The major areas of concern are:

- Poor monitoring of, and intervention for, risk factors for diabetes and cardiovascular disease.
- Service users whose illness is poorly responsive to standard antipsychotic medications are waiting too long to be commenced on clozapine.
- Significant gaps in the availability of cognitive behavioural therapy and family interventions.
- Inadequate provision of information and support for carers.
- Inadequacies in information systems (see discussion section).

National findings

A summary of comparisons between NAS2 and NAS1, for some of the indicators for each standard, are shown in Tables 1 and 2 at the end of this section. The main findings are summarised below:

(a) Service users' experience

The service user reference group set a criterion that for a Trust to meet the standards relating to user and carer experience, a threshold of 90% of responses (to key questions in the service user survey) should be 'very satisfied' plus 'fairly satisfied' combined (or their equivalent for different questions).

- With regard to services users' overall experience of care, 44% of Trusts
 met the required threshold. Individually, 88% of all service users
 responding stated that they were 'very' or 'fairly' satisfied with their care
 and 4% were reportedly 'not satisfied at all'.
- In relation to the proportion of service users reporting whether services
 had helped them to achieve good mental health in the previous year, 28%
 of Trusts met the 90% threshold. Individually, 86% of service users
 responding felt that services had helped 'a lot' or 'a little' with this.
- Regarding employment, 90% of service users were reportedly not working and 64% of responders said they were not looking for work. However, of those who were interested in looking for work, less than half reported receiving some help towards this.
- Thirty-four percent of service users were involved in some form of daytime activities but 43% said they were not involved in such and were 'OK with that'.

These findings represent a situation that has changed little since NAS1 two years previously. While service users' views might be stated as moderately satisfied overall, in terms of both experience of care and effect on their outcomes, only 57% actually described themselves as 'very satisfied' with their experience of care and only 61% reported that services have helped them 'a lot'. It is also clear that there are other areas where services can improve, such as in relation to employment.

(b) Carers'satisfaction

The experience of carers also remains much as before. Only 9% of Trusts met the 90% threshold for carers feeling either 'very' or 'somewhat' satisfied with the information and support they were receiving. Individually, 20% of carers responding were 'dissatisfied' on this measure. The fact that only 9% of Trusts met the threshold is disappointing.

In particular, carers said they were dissatisfied with information about the service user's prognosis, about their involvement in decisions made about care, and ease of access for support for themselves. These are aspects of care in which most Trusts need to improve.

(c) Information and decision making about medication

There has been some deterioration in communication of information about medication. This is another aspect of care where Trusts need to improve.

• Between NAS1 and NAS2, service users reporting receiving any information about medication reduced from 52% to 48%, with only 39% receiving this in a format they could easily understand. Trusts reported a reduction in giving information about medication from 42% to 37% of service users. The proportion of service users who 'definitely' felt involved in decisions about medication is unchanged (41%) but the extent to which Trusts say they involved service users has reduced from 62% to 54%.

(d) Prescribing of antipsychotic medications

Appropriate guidelines are being followed for the majority of prescribing for the majority of service users. However, some deficiencies remain. For these particular areas there are quite wide variations between Trusts in their level of performance against guidelines.

 For service users not on clozapine, the prescribing of more than one antipsychotic medication at a time (polypharmacy), which is only appropriate in a few circumstances, remains at an average of 11%, with a range from 1% of service users in two Trusts to 24% at the other extreme.

- The prescribing of doses of medication above those recommended in the British National Formulary (BNF; BMJ Group and RPS Publishing, 2013) was occurring for 10% of service users overall, with a range of 1% in one Trust to 22% at the other extreme. However, the frequency of recording of a rationale for this has improved from 25% of instances in NAS1 to 37% in NAS2.
- A trial of clozapine is recommended for service users who have had a poor response to trials of two other antipsychotics. We found that 28% of service users whose illness was not in remission, and who were probably appropriate for a trial of clozapine, had not yet been commenced on clozapine an improvement from 40% in NAS1. However, 57% of service users currently receiving clozapine had been prescribed three or more antipsychotic medications prior to commencing clozapine, which means that their progress, to a medication more likely to be effective for them, was slower than it should have been. This problem is further highlighted by the finding that 93% of service users who were on their very first antipsychotic medication, and who were not in remission, had been on this first medication for at least six months. (If a medication is not effective it is usually not continued for more than 8 weeks.)

Thus, there are areas where prescribing practice can be further improved. This should be prioritised by psychiatrists, mental health pharmacists and their respective professional bodies.

(e) Psychological therapies

In this audit, where reference is made to cognitive behavioural therapy (CBT) and family interventions, these are applied in a rather more generic sense than would be envisaged in some other reports.

• The percentage of service users whom Trusts reported had been offered CBT was 39%, though not all took up such offers. Trusts reported that 19% of service users had been offered and had taken up CBT and 18% of service users reported that they had received CBT. These proportions remain low. The only data from NAS2 that can be directly compared with NAS1 relate to the percentage of service users whose illness was not in

- remission. For service users whose illness was not in remission, 29% had been offered CBT in NAS1, which increased to 45% in NAS2.
- Twelve percent of service users said they had received a family intervention, compared with 8% that Trusts said had taken up an offer of this treatment. For service users whose illness was not in remission, 10% had been offered a family intervention in NAS1 but 23% in NAS2.

It is clear that the numbers of service users having access to, and actually receiving, these types of intervention remain very low. This needs to be addressed and has significant funding implications.

(f) Monitoring and intervention for physical health problems

Diabetes and cardiovascular disease are more prevalent in people with schizophrenia and are significant contributors to the premature mortality suffered by this population. It is important that service users are monitored for six important risk factors for these disorders. Clinicians should enquire about family history of diabetes and cardiovascular disease as well as assessing five other factors: smoking, elevated body mass index (BMI), blood glucose control, blood lipids and blood pressure. This monitoring should be carried out on at least an annual basis. Yet reports such as NAS1 have demonstrated that such monitoring frequently does not occur.

- In NAS2, 33% had five of these factors (excluding family history)
 monitored, compared to 29% in NAS1, demonstrating some improvement
 but also the considerable ground that secondary care and primary care
 services need to make up to reach an acceptable provision of care.
- Only 9% of service users in NAS2 had all six of the above risk factors, including family history, assessed in the previous year. For 6% there was no evidence that any of these had been monitored. This is not adequate.
- Even monitoring of something as basic as a service user's BMI was only recorded for 52% in NAS2, and 51% in NAS1.
- The provision of interventions when evidence of health risks is found is also poor. For example, in NAS2 only 36% of service users with evidence of impaired control of blood glucose (suggesting diabetes or a pre-diabetic state) had evidence of intervention. This was 53% in NAS1.

Clearly the provision of such monitoring and appropriate intervention needs to be improved. Three barriers in this area are: (i) availability of staff time, appropriate facilities and equipment; (ii) the need for formal systems to review physical health data and interventions required on at least an annual basis; and (iii) the need for more formal arrangements regarding collaboration between primary and secondary care in relation to physical health. The new NICE guideline (NICE CG178, 2014) gives clear guidance regarding this last issue.

(g) Care planning and crisis planning

This relates to a new standard so comparisons with NAS1 are not possible. Ninety-five percent of case records included details of a care plan, though this varied from 68% to 100% across the Trusts. Seventy-five percent of service users who responded said they had a care plan and 74% reported that they had a telephone number for use in a crisis.

Comparisons between NAS2 and NAS1

Tables 1 and 2, on the next two pages, provide a summary of some key comparisons between the findings in NAS2 and the findings in NAS1. In these Tables the standards are listed in order by standard number. A full list of NAS standards is provided on page 41 of the National Report. The list below indicates which Table relates to each of the broad aspects of care (a-g) described above:

Table 1: (a) Service user's experience

(b) Carers' satisfaction

- (f) Monitoring and intervention for physical health problems
- (c) Information and decision making about medication

Table 2: (d) Prescribing of antipsychotic medications

- (e) Psychological therapies
- (g) Care planning and crisis planning

Table 1: Key comparisons between NAS2 and NAS1 for each of the standards set for this audit (standards 1 to 7)

set for this audit (standards 1 to 7) Standard / Indicator	NAS2	NAS1
	(%)	(%)
Standards 1 & 2 – service users' experience & report	of positive ou	ıtcomes
Direct comparison not possible as the service user survey w	as modified	
Standard 3 – carers' satisfaction		
Carers report being 'somewhat' or 'very' satisfied with the	80%	81%
information and support received		
Range across Trusts	56- 100%	55 – 100%
Standard 4 – monitoring of physical health risk factor	S	
Monitoring of five risk factors (family history excluded)	33%	29%
Monitoring of smoking	89%	88%
Monitoring of BMI	52%	51%
Range across Trusts for monitoring of BMI	5 – 92%	27 – 87%
Monitoring of glucose control	57%	50%
Range across Trusts for monitoring of glucose control	16 – 99%	25 – 83%
Monitoring of lipids	57%	47%
Monitoring of blood pressure	61%	56%
Monitoring of five risk factors in those with established	37%	37%
cardiovascular disease		
Monitoring of alcohol consumption	70%	69%
Standard 5 – intervention offered for identified physic	al health risk	(S
Intervention for smoking	59%	57%
Intervention for BMI $>$ or $= 25 \text{kg/m}^2$	71%	76%
Intervention for abnormal glucose control	36%	53%
Intervention for elevated blood pressure	25%	25%
Intervention for alcohol misuse	74%	72%
Standard 6 – provision of information about medication	on	1
Service users said they received information	48%	52%
Trusts said they provided information	37%	42%
Standard 7 – involvement in prescribing decision		•
Service users felt involved	71%	74%
Trusts said they involved the service user	54%	62%

Table 2: Key comparisons between NAS2 and NAS1 for each of the standards set for this audit (standards 8 to 16)

set for this audit (standards 8 to 16) Standard / Indicator	NAS2	NAS1
	(%)	(%)
Standard 8 – antipsychotic monotherapy		
Frequency of polypharmacy	11%	11%
Range across Trusts	1-24%	3-30%
Standard 9 – dose within BNF maximum		
Frequency of high dose (>100% BNF)	10%	10%
Range across Trusts	1-22%	1-24%
Rationale documented for high dose	37%	25%
Standard 10 – investigation of alcohol and substance	e misuse in the	ose with poor
symptom response		
Frequency in cases not on clozapine	62%	78%
Frequency in cases on clozapine	56%	81%
Standard 11 – medication changed if poor response		
Direct comparison not possible as standard was amended		
Standard 12 – pathway to clozapine		
Service users not in remission and not on clozapine	28%	40%
without a reason normally considered as appropriate		
Standard 13 – augmentation of clozapine		•
Frequency of use of augmentation strategy in service	26%	22%
users on clozapine		
Standard 14a - CBT offered		
Those not in remission offered CBT	45%	29%
Standard 14b – Family intervention offered	-1	•
Those not in remission offered family intervention	23%	10%
Standards 15 & 16 – care planning and crisis planning	ng	
Comparison not possible as these are new standards		

Recommendations

There are a number of areas in which the care of service users with schizophrenia falls significantly below the standards expected. Our recommendations relate to these aspects of care and the issue of poor information systems.

Since this audit commenced, NICE published a new clinical guideline: "Psychosis and schizophrenia in adults: treatment and management" (NICE CG178, 2014). Where appropriate we refer to the relevant recommendation by paragraph number in CG178, e.g. (*NICE 1.3.6.5*).

1. Recommendations for the Department of Health

- 1.1 Develop information systems that can properly support a modern mental health service. These should be developed in partnership with CCGs, Trusts, Chief Clinical Informatics Officers and the Royal College of Psychiatrists. These systems need to enable estimations of local prevalence and incidence of different diagnoses, support sharing of information with primary care (NICE 1.5.3.2) and include decision support menus for clinicians.
- 1.2 Improve the minimum Mental Health and Learning Disability Data Set (formerly MHMDS) to enable the collection of data regarding all NICErecommended effective interventions, including physical health assessments and interventions, within a timescale of six months. This would help to inform the development of national outcomes frameworks.
- 1.3 Develop a new primary care framework for supporting the physical and mental health of people with schizophrenia in light of the reduction in Quality Outcomes Framework (QOF) indicators for schizophrenia.
- 1.4 Ensure the Increasing Access to Psychological Therapies (IAPT) for severe mental illness programme has the same level of support as the existing IAPT for anxiety and depression. This should include a national data set, indicators in national frameworks and plans for how this could develop.

2. Recommendations for NHS England

2.1 Given the slow pace of change indicated by NAS2, NHS England should commission future audits looking at the care of people with psychosis and schizophrenia. These should complement national CQUIN data collection.

3. Recommendations for Professional Bodies

- 3.1 The Royal College of Psychiatrists, in collaboration with the British Association for Psychopharmacology, should ensure that postgraduate education and continuing professional development for psychiatrists includes modern competency based teaching on psychopharmacology and the physical health risks faced by people with schizophrenia.
- 3.2 The General Medical Council should ensure that medical schools include in curricula the necessary teaching about psychopharmacology and the physical health risks faced by people with schizophrenia.
- 3.3 The Royal College of General Practitioners should highlight and promote awareness among general practitioners of the new NICE Guideline and the requirement for primary care to carry out monitoring of physical health risk factors for service users with schizophrenia (*NICE 1.3.6.5*).
- 3.4 The Royal Colleges of Psychiatrists and General Practitioners should work together to improve the education of general practitioners in respect of mental illness.
- 3.5 The Royal College of Nursing should ensure that undergraduate and postgraduate education, and continuing professional development for nurses in mental health settings and primary care, include adequate teaching on psychopharmacology and the physical health risks faced by people with schizophrenia.
- 3.6 Health Education England should review the emphasis placed on mental health in their various programmes and, in particular, knowledge about psychopharmacology and the physical health issues facing people with schizophrenia.

4. Recommendations for Commissioners (Clinical Commissioning Groups [CCGs] and Health Boards)

- 4.1 Must work with the Department of Health and NHS England to improve the information systems available to mental health services.
- 4.2 Be aware of the important recommendation in the new NICE Guideline regarding lead accountability for the monitoring of service users' physical health (NICE 1.3.6.5):
 - a) Specialist mental health teams to assume lead responsibility for the first 12 months or until the service user's condition has stabilised.
 - b) Thereafter primary care to assume lead responsibility, unless there are well developed local agreements.

Commissioners must also ensure that information systems are in place which support rapid sharing of the results of routine monitoring of physical health of service users between primary and secondary care practitioners (NICE 1.5.3.2).

Commissioners and senior clinical provider leaders must ensure that local agreements are in place between primary and secondary care to achieve the necessary collaboration.

- 4.3 Ensure that services are able to provide cognitive behavioural therapy (NICE 1.4.4.1) and family interventions for all those wanting to receive them (NICE 1.4.4.2). CCGs and mental health clinical leaders should map the prevalence and incidence of schizophrenia and review how spending can support this in order to reduce repeat admissions to hospital.
- 4.4 Commission services that support service users to stay in work or access new employment (*NICE 1.5.8.1*).

5. Recommendations for Mental Health Trusts (Trust Boards and Chief Executive Officers)

5.1 Mental Health Trusts and Chief Executive Officers, in collaboration with their medical director, director of nursing and lead psychologist, need to put in place robust governance processes which provide clear accountability for the implementation of NICE guidelines.

Trusts should have a named member of the Trust Board who:

- a) Ensures regular audit of, and compliance with, quality standards on the monitoring and treatment of cardiovascular and metabolic disease in people with schizophrenia through board-level performance indicators (*NICE 1.1.3.7*).
- b) Ensures that regular audit of, and compliance with, standards for the prescribing of antipsychotic medications occurs.
- Be aware of, and support, implementation of the NICE Guideline regarding lead accountability for monitoring service users' physical health (*NICE* 1.3.6.5). This will require clear agreements to be reached with local primary care services.
 - This requires supporting the rapid sharing of the results of routine physical health monitoring between primary and secondary care (*NICE 1.5.3.2*).
- 5.3 Work with CCGs to ensure services are able to provide cognitive behavioural therapy (*NICE 1.4.4.1*) and family interventions for all those wanting to receive them (*NICE 1.4.4.2*).
- 5.4 Enable mental health services to support service users to stay in work or access new employment (*NICE 1.5.8.2*).
- 5.5 Be aware of, and ensure implementation of, NICE guidelines to provide support for carers (*NICE 1.1.5*). Develop protocols to support proper carer involvement and support.
- 5.6 Ensure that this report of the second National Audit of Schizophrenia, and the related individual local Trust Report, are disseminated to the appropriate managers, members of their mental health teams and others as appropriate, and that action is taken regarding the recommendations.
- 5.7 Ensure that where mental health team members require additional training to meet the requirements, above, that this is made available.

6. Recommendations for Medical Directors and Directors of Nursing

- 6.1 Ensure that staff in Mental Health Teams have the resources, equipment and facilities to follow the recommendations that they are expected to meet, as described in the section "Mental Health Teams".
- 6.2 Work to change a culture which often regards physical health care and mental health care as separate. This can often be related to staff fears about areas they feel unfamiliar with. The Lester Resource provides a focus around which to base local education programmes.
- 6.3 Recognise the importance of regular activities for service users and enable specialist mental health services to support service users to stay in work or access new employment (*NICE 1.5.8.2*).
- 6.4 Be aware of, and ensure implementation of, NICE guidelines to provide support for carers (*NICE 1.1.5*) and assist Trusts in developing protocols.

7. Recommendations for Mental Health Teams and their Managers

- 7.1 Be aware of, and implement, the recommendation in the new NICE Guideline regarding lead accountability for the monitoring of service users' physical health (NICE 1.3.6.5):
 - a) Specialist mental health teams to assume lead responsibility for the first 12 months or until the service user's condition has stabilised.
 - b) Thereafter primary care to assume lead responsibility, unless there are particular reasons for this remaining with secondary care.

This also requires supporting the rapid sharing of the results of routine physical health monitoring between primary and secondary care (*NICE* 1.5.3.2).

They should ensure that Chief Executive Officers, and other managers, are aware of the need for the Trust to develop agreements with primary care to enable this.

7.2 Ensure that service users' physical health is managed actively, as described in the Lester Resource. This includes the following:

- a) Monitor physical health risk factors and offer intervention when necessary (*NICE 1.1.3.2* and 1.1.3.6).
- b) Offer support for healthier eating and increased physical activity (*NICE* 1.3.1.1) and, if the service user smokes, help to stop smoking(*NICE* 1.3.1.3).
- c) At the earliest opportunity, identify those at high risk of cardiovascular and metabolic disorders (*NICE 1.5.3.3*).
- d) Offer appropriate interventions to prevent the development of obesity, type 2 diabetes and cardiovascular disease (*NICE 1.5.3.3*).
- 7.3 Institute a regular review process, at least annually, to ensure service users' physical health status and medication are updated and that interventions take place "Don't just screen, intervene".
- 7.4 Support people with schizophrenia to stay in work, or access new employment, education or volunteering opportunities. (*NICE 1.5.8.2*).
- 7.5 Be aware of, and implement, NICE guidelines to provide support for carers (NICE 1.1.5).
- 7.6 Ensure that the care plan is an active document, which is regularly reviewed, with a copy given to the service user.

8. Recommendations for General Practitioners (and where relevant their primary care teams)

- 8.1 Be aware of, and implement, the recommendation in the new NICE Guideline regarding lead accountability for the monitoring of service users' physical health (NICE 1.3.6.5):
 - a) Specialist mental health teams to assume lead responsibility for the first 12 months or until the service user's condition has stabilised.
 - b) Thereafter primary care to assume lead responsibility, unless there are particular reasons for this remaining with secondary care.

This also requires supporting the rapid sharing of the results of routine physical health monitoring between primary and secondary care (*NICE* 1.5.3.2).

- 8.2 Ensure that service users' physical health is managed actively, as described in the Lester Resource, to cover the following:
 - Monitor physical health risk factors and offer intervention when necessary.
 - b) Offer support for healthier eating and increased physical activity (*NICE* 1.3.1.1) and, if the service user smokes, help to stop smoking(*NICE* 1.3.1.3).
 - c) At the earliest opportunity identify those at high risk of cardiovascular and metabolic disorders (*NICE 1.5.3.3*).
 - d) Offer appropriate interventions to prevent the development of obesity, type 2 diabetes and cardiovascular disease (*NICE 1.5.3.3*).
- 8.3 Review the care of people with schizophrenia who have established diabetes or cardiovascular disease and who wish to have a review (*NICE* 1.5.3.4).

9. Recommendations for Psychiatrists

- 9.1 Ensure that they adhere to the prescribing standards set out in the NICE guideline (*NICE 1.3.6*).
- 9.2 In situations where antipsychotic drugs are prescribed outside the recommendations of the BNF (British National Formulary), which is only rarely appropriate, a clear rationale <u>must</u> be provided to the service user and documented in the case record by the prescribing psychiatrist. This rationale should be reviewed and updated at least annually. This will most commonly be when:
 - a) Use of more than one antipsychotic drug at the same time is being considered; or
 - b) The dose of medication may exceed BNF dose recommendations.
- 9.3 Service users whose symptoms do not respond well to adequate trials of two standard antipsychotic medications (i.e. are regarded as 'treatment unresponsive') should have a treatment trial of clozapine, unless contraindicated. This should not be delayed by inappropriately long trials of the first two antipsychotic medications (*NICE 1.5.7.2*).

- 9.4 In collaboration with a Mental Health Pharmacist and service users, psychiatrists should review the written and/or online information about medication they provide to people affected by schizophrenia and their carers, and check that it is clear and easy to understand.
- 9.5 Ensure that prescribers are trained to work in a collaborative way with service users regarding decisions about medication (*NICE 1.3.5.1*).

10. Recommendations for Mental Health Pharmacists

- 10.1 Review prescribing practices for antipsychotic medications in their Trusts and, where appropriate, develop educational programmes for members of Mental Health Teams.
- 10.2 Collaborate with psychiatrists and service users to review the written and/or online information they provide about medication to service users and their carers. Check that it is clear and easy to understand.

In these recommendations, reference is made to the Lester Resource¹ (see Appendix F of the National Report), which provides advice regarding the monitoring of risks for cardiometabolic disease in service users taking antipsychotic medication. This resource is endorsed by many professional bodies and NHS England. It is included in the list of resources that NICE consider appropriate to support the new guideline

(http://www.nice.org.uk/Guidance/CG178/Resources).

.

¹Lester UK Adaptation: Positive Cardiometabolic Health Resource: an intervention framework for patients with psychosis and schizophrenia. 2014 update (Shiers et al, 2014)