Translating neuroimaging findings into psychiatric practice

Thomas J. Reilly and Philip K. McGuire

Summary
Although translational medicine has become a priority for medical science, advances in neuroscience have failed to be translated for the benefit of patients. In populations at high risk of psychosis, neuroimaging could stratify those mostly likely to develop psychosis. This is an example of potentially translatable psychiatry.

Declaration of interest
None.

Translational medicine
In theory, the goal of basic medical science is to improve the health of patients. In recent years, the effort to quickly shift scientific discoveries “from the bench to the bedside” has become formalised in translational medicine. This is now a fashionable term; there are new journals, Masters degrees, university departments and governmental initiatives devoted to translational medicine. The thrust of translational research is to gain clinical benefit from discovery, fast. Unfortunately, examples of translational psychiatry are conspicuous by their absence. All the major advances in psychiatric treatment, such as the use of antipsychotic drugs, have been serendipitous rather than hypothesis driven. Nevertheless, there is no good reason why psychiatry cannot exploit advances in neuroscience to inform clinical practice. Neuroimaging is one promising form of basic science which could help translate research findings into benefits for patients with mental illnesses, and is a useful exemplar for translational psychiatry.

Neuroimaging the transition to psychosis
One of the most promising clinical applications of neuroimaging in psychiatry is in predicting the later development of psychosis. The onset of psychotic disorders such as schizophrenia is preceded by a high-risk phase, a clinical syndrome characterised by psychotic symptoms and a decline in overall function. Up to a third of people with this syndrome will develop a psychotic disorder within 2 years. However, it is impossible to predict who later develop psychosis and the majority who do not.

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subsequently develop psychosis have less grey matter in the prefrontal, cingulate and temporal cortex,4,5 altered function in these regions,6 and elevated subcortical dopamine synthesis capacity.7 As these individuals make the transition to psychosis, there is a longitudinal progression in baseline abnormalities.4,7

Neuroimaging has thus shown that alterations in brain structure, function, chemistry and connectivity pre-date the onset of psychosis. However, if these discoveries are to have more than just academic importance, they must be translated for clinical benefit.

Translating neuroimaging science

A key challenge for translating neuroimaging findings into clinical practice is that research has identified differences between groups of patients but clinical decisions have to be made on the basis of data from an individual. Statistical methods have the potential to overcome this problem. Machine learning is a statistical approach that can be used to estimate the likelihood that a given individual belongs to one clinical group or another; for example, high-risk patients who later develop psychosis, or high-risk patients who will not.8 This approach has already been used with some success in predicting the individual risk of transition to psychosis,9 and the course of illness after the onset of psychosis.8 To date, it has mainly been applied using a single type of imaging data, but its accuracy may be improved by combining data from different imaging modalities, and incorporating neurocognitive and genetic measures in the analysis.10

In the future, psychiatrists may thus be able to use quantitatively analysed brain scans and other biomarkers as well as their own clinical judgement to stratify patients in terms of clinically meaningful outcomes. This would allow psychiatrists to tailor the form of treatment to the needs of each individual patient.

Delivering on promise

Translational psychiatry requires psychiatrists to operate outwith their comfort zone in embracing research developments. We owe it to our patients to deliver on the promises which modern neuroscience offers. Unravelling the intricacies of the human brain is meaningless if we continue to employ 20th-century clinical practice in the 21st century. The inherent complexity and uncertainty of mental illness make this task more difficult than in other fields of medicine, so it requires a concerted effort from individuals, institutions and governments. Time and money need to be invested to translate basic research into clinical practice, but the reward of transforming the lives of those living with psychiatric disorders makes it well worth the expense.

References

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