

# Comorbidities Between Mental and Physical Health Problems: An Analysis of the New Zealand Health Survey data

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This study used New Zealand Health Survey (NZHS) data to understand the comorbidities between internalising disorders (anxiety, depression, and bipolar disorder) and long-term physical health conditions. The 2015/16 NZHS included 13,719 adults living in the community. Around 20% of participants self-reported having an internalising disorder sometime in their lifetime. Odd ratios (ORs) were adjusted for age, gender, ethnicity, and socioeconomic status. Having an internalising disorder increased the odds of stroke (adjusted OR = 2.26,  $p < .001$ ), cardiovascular disease (adjusted OR = 1.79,  $p < .001$ ), chronic pain (adjusted OR = 2.03,  $p < .001$ ), arthritis (adjusted OR = 1.72,  $p < .001$ ), asthma (adjusted OR = 1.63,  $p < .001$ ), and high cholesterol (adjusted OR = 1.50,  $p < .001$ ). Findings highlight the importance of routine screening and assessment of physical health conditions among people diagnosed with mental health problems, and vice versa.

Keywords: comorbidity; mental health; chronic health conditions; anxiety disorders; depression; bipolar disorder

It is well established that serious mental health problems are associated with a shortened life expectancy and greater likelihood of physical illnesses, such as respiratory diseases, diabetes, and cardiovascular disease (Baxter et al., 2016; Cunningham, Sarfati, Peterson, Stanley, & Collings, 2014; Galletly et al., 2016; Te Pou o te Whakaaro Nui, 2014). This is also the case for mild to moderate mental health problems, such as anxiety, depression, and bipolar disorder, which are commonly referred to as internalising disorders. Around 3 in 5 adults with mental health problems report having one or more long-term physical health problems (Australian Health Policy Collaboration, 2018; Druss & Walker, 2011). Longitudinal research indicates that depression increases the odds of developing cardiovascular disease (Charlson et al., 2013) and diabetes (Mezuk, Eaton, Albrecht, & Golden, 2008). Moreover, the risk of mortality related to cancer and cardiovascular disease is higher among people who have accessed mental health services (Cunningham et al., 2014). The estimated cost of premature mortality associated with comorbidities between serious mental problems and physical health (including opioid dependence) is NZ\$6.2 billion (Royal Australian and New Zealand College of Psychiatrists, 2016).

To address this issue regarding comorbidities and health inequity, New Zealand national policies were introduced in 2012 that identified the need to prioritise the physical health needs of people with experience of mental health problems and addiction. These policies include *Rising to the Challenge: The mental health and addiction service development plan 2012–2017* (Ministry of Health, 2012) and *Blueprint II: How things need to be* (Mental Health Commission, 2012). The analysis of national data is required to better inform clinical practice and monitor progress in addressing the comorbidities between mental and physical health conditions (Liu et al., 2017).

Currently, the availability of up-to-date national data on comorbidities between mental and physical health is limited. The most recent and comprehensive analysis of mental health problems, addiction, and physical health comorbidities in the population is *Te Rau Hinengaro: The New Zealand Mental Health Survey* (Oakley Browne, Wells, & Scott, 2006), which was undertaken more than 10 years ago. Results indicated that meeting the diagnostic criteria for an anxiety or mood disorder was associated with a higher risk of chronic pain, cardiovascular disease, high blood pressure, respiratory conditions, and diabetes compared to having no mental health problems (Oakley Browne et al., 2006). The study also showed around 1 in 4 people with a physical health problem experienced a mental health problem (including substance use problems) (Oakley Browne et al., 2006).

To address the need for up-to-date national data on comorbidities, the New Zealand Health Survey (NZHS) provides a potentially useful dataset worth further examination. The NZHS collects self-reported data each year on the lifetime prevalence of common mental health problems and physical health conditions from approximately 13,000 adults in the general population (Ministry of Health, 2016b). The potential of this dataset for monitoring the comorbidities between mental health and physical health conditions has not been explored to date.

Against this background, this analysis aimed to use data from the NZHS to examine the risk of long-term physical health conditions among adults with mental health problems, whilst taking into account sociodemographic factors. It was hypothesised that the NZHS data would demonstrate comorbidities consistent with the international literature.

## Methods

### Study design and setting

This investigation was carried out using data from the 2015/16 NZHS. The NZHS examined long-term physical health conditions (e.g., diabetes, cardiovascular disease, chronic pain, and high blood pressure), health status, healthcare utilisation, health risk and protective factors, and sociodemographic variables. The survey had a multi-stage, stratified, probability-proportional-to-size sampling design. The questionnaire was administered face-to-face with computer assistance to adults aged 15 years and over living in the community (Ministry of Health, 2016a). Data collection occurred between July 2015 and June 2016.

Ethical approval for the 2015/16 NZHS was granted by the New Zealand Health and Disability Multi-Region Ethics Committee. Te Pou o te Whakaaro Nui (Te Pou) was granted access to the NZHS data through the Statistics New Zealand Confidentialised Unit Record File (CURF) programme.

### Measures

Measures from the 2015/16 NZHS were used in the analysis. The lifetime prevalence of common internalising disorders was indicated by people's self-report of ever being told by their doctor that they had depression, bipolar disorder (sometimes called manic depression), or an anxiety disorder (this includes panic attacks, phobia, post-traumatic stress disorder, and obsessive-compulsive disorder). People who self-reported having one or more of these mental health problems were identified as having an internalising disorder.

A total of eight long-term physical health conditions were examined. People were identified as having diabetes, stroke (excluding mini-strokes and transient ischaemic attacks), other cardiovascular disease (including ischaemic heart disease, heart failure, angina, and/or hospitalisation for heart attack), chronic pain, or arthritis (including rheumatoid arthritis and/or osteoarthritis) if they self-reported being diagnosed by a doctor with these conditions. People were classified as having asthma, high blood pressure (excluding pregnant women), or high blood cholesterol if they self-reported being diagnosed by a doctor and were currently taking medication or treatment for these conditions.

### Statistical methods

In the first stage of the analysis, the number of people with and without internalising disorders was examined, along with weighted proportions (%), and population estimations. Sampling weights were applied in all analyses to account for the NZHS sampling design. This also ensured estimates calculated from the data were representative of the target population (Ministry of Health, 2016a). The sociodemographic characteristics of respondents with and without internalising disorders were examined using chi-square tests of association to determine if the two groups differed with respect to their gender, age, ethnicity, and socioeconomic status.

In the second stage of the analysis, chi-square tests were conducted to determine whether there was a significant association between each long-term physical health condition

and having an internalising disorder. Odds ratios (OR) were calculated through logistic regression analysis to examine the strength of the associations. An OR greater than one suggests a person with an internalising disorder has an increased likelihood of having a long-term physical health condition compared to a person without an internalising disorder.

Multiple logistic regression analyses were conducted to examine the extent to which having an internalising disorder increased the odds of having each long-term physical health condition whilst controlling for sociodemographic covariates. In the multiple logistic regression model, the independent variable was the lifetime prevalence of having an internalising disorder and the dependent variable was each long-term physical health condition. From this model, it was possible to obtain estimates of the covariate adjusted association (adjusted OR) between having an internalising disorder and a long-term physical health condition.

All analyses were performed using Stata version 12, which has appropriate procedures for incorporating the sampling weights used in the analysis.

## Results

### Internalising disorders

Out of the 13,719 NZHS respondents, 2,957 people reported having been diagnosed by a doctor, sometime in their life, as having anxiety, depression, and/or bipolar disorder. As shown in Table 1, people who reported having an internalising disorder sometime in their life were estimated to comprise 18.8% of adults in the general population, representing approximately 702,000 adults in New Zealand.

Table 1. Number of Adults in the 2015/16 New Zealand Health Survey (NZHS) with an Internalising Disorder

Internalising disorder	Number of adults	Weighted (%) <sup>a</sup>	Estimated number of adults in the NZ population
Depression	2,455	15.4	575,000
Anxiety	1,477	9.5	354,000
Bipolar	168	0.9	35,400
Any disorder	2,957 <sup>b</sup>	18.8	702,000
None	10,762	81.2	3,026,000

Note. NZ = New Zealand. <sup>a</sup>Sampling weights were used in the analysis to account for the sampling design of the New Zealand Health Survey. <sup>b</sup>People diagnosed with more than one internalising disorder were only counted

### Sociodemographic characteristics

The sample was categorised into two comparison groups: adults with an internalising disorder and adults without. The sociodemographic characteristics of the groups are summarised in Table 2. The groups significantly differed in the proportion of females ( $p < .001$ ), Europeans ( $p < .001$ ), Pasifika peoples ( $p < .001$ ), Asian peoples ( $p < .001$ ), and mean age ( $p < .001$ ).

Table 2. Sociodemographic Characteristics of Adults in the 2015/16 New Zealand Health Survey (N=13,719)

Sociodemographic characteristic	Adults with an internalising disorder <sup>a</sup>	Adults without an internalising disorder <sup>a</sup>	p <sup>b</sup>
<i>Proportion (%)</i>			
Female	64.3	48.4	<.001
Māori	13.6	12.8	.273 ns
Pasifika	2.9	6.7	<.001
Asian	3.9	14.0	<.001
European/Other	89.3	74.0	<.001
<i>Means</i>			
NZDep2013 <sup>c</sup>	5.6	5.5	.251 ns
Age (years)	46.9	44.9	<.001

Note. <sup>a</sup>These columns presents the weighted proportion of adults with the sociodemographic characteristics in the two groups. <sup>b</sup>Chi-square tests were used to assess if there was a significant association between the sociodemographic measure and the internalising disorder group. <sup>c</sup>NZDep2013 refers to the New Zealand Index of Deprivation 2013.

Long-term physical health conditions

Internalising disorders were associated with higher odds of each long-term physical health condition, with the exception of diabetes and high blood pressure. The findings show people with a lifetime prevalence of an internalising disorder were twice as likely to experience chronic pain compared to people without an internalising disorder, OR = 2.09, 95% CI [1.87, 2.34], p < .001 (see Figure 1). The odds of having asthma, OR = 1.83, 95% CI [1.59, 2.11], p < .001, or a stroke, OR = 1.83, 95% CI [1.30, 2.57], p < .001, were almost twice as high in relation to lifetime prevalence of an internalising disorder.

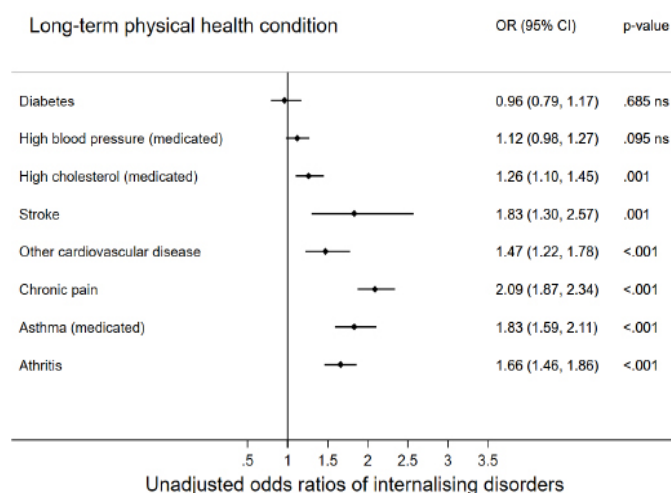


Figure 1. Unadjusted associations between internalising disorders and long-term physical health conditions (N=13,719).

Note. OR = an odd ratio greater than one suggests that a person with an internalising disorder is more likely to experience the long-term physical health condition compared to a person without an internalising disorder; CI: confidence interval. Other cardiovascular diseases included ischaemic heart disease, heart failure, heart attack or angina. Arthritis included rheumatoid arthritis and osteoarthritis.

Adjustment for sociodemographic characteristics

The main finding from the multiple logistic regression analyses showed that, whilst controlling for gender, age, ethnicity, and socioeconomic status, the association between internalising disorders and long-term physical health conditions remained significant and largely unchanged (see Figure 2). Diabetes and high blood pressure remained not significant. The highest odds were for stroke, where people with an internalising disorder were more than twice as likely to have experienced a stroke compared to those without an internalising disorder, adjusted OR = 2.26, 95% CI [1.57, 3.27], p < .001. Similarly, the odds of chronic pain remained twice as high in relation to lifetime prevalence of an internalising disorder, adjusted OR = 2.03, 95% CI [1.80, 2.29], p < .001. The adjusted association for asthma was slightly lower, adjusted OR = 1.63, 95% CI [1.41, 1.88], p < .001.

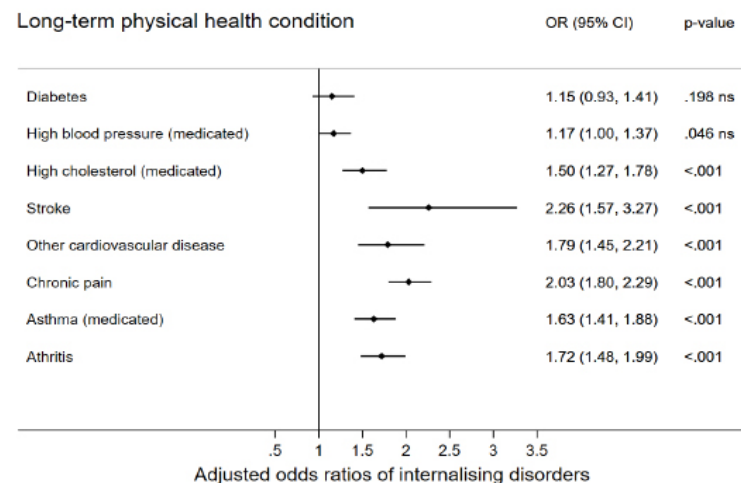


Figure 2. Adjusted associations between internalising disorders and long-term physical health conditions (N= 13,719).

Note. OR = an odd ratio greater than one suggests that a person with an internalising disorder is more likely to experience the long-term physical health condition compared to a person without an internalising disorder; CI: confidence interval. Other cardiovascular disease included ischaemic heart disease, heart failure, heart attack or angina. Arthritis included rheumatoid arthritis and osteoarthritis.

Sensitivity analysis

To address the possibility that the risk of long-term physical health conditions differed between anxiety, depression, and bipolar disorders, each internalising disorder was examined individually. Overall, the sensitivity analysis indicated the results were similar for each individual internalising disorder. The main difference was that anxiety was significantly associated with high blood pressure, adjusted OR = 1.39, 95% CI [1.14, 1.70], p = .001. While many of the associations between bipolar disorder and long-term physical health conditions were approaching significance, bipolar disorder was only significantly associated with chronic pain, adjusted OR = 2.30, 95% CI [1.49, 3.55], p < .001. However, only 1% of people reported having bipolar disorder, meaning the study had insufficient power to detect associations that exist for this particular internalising disorder.

## Discussion

Using data from the 2015/16 NZHS, the associations between internalising disorders and long-term physical health conditions were examined whilst controlling for sociodemographic factors that included age, gender, ethnicity and socioeconomic status. Findings demonstrated that the lifetime prevalence of internalising disorders was associated with an increased risk of long-term physical health conditions, particularly stroke, other cardiovascular disease, chronic pain, arthritis, and asthma. These associations are discussed below in relation to current New Zealand and international literature.

### Stroke and other cardiovascular disease

People with an internalising disorder had an increased risk of stroke and cardiovascular disease compared to those without an internalising disorder. Similarly, *Te Rau Hinengaro* (Oakley Browne et al., 2006) showed a higher prevalence of stroke and other cardiovascular disease among people who had experienced mental health problems in the past 12 months (10.2% compared to 7.5% respectively).

The current study indicated the risk of stroke was two times higher in relation to lifetime prevalence of an internalising disorder, after controlling for sociodemographic factors. This finding is higher than that reported in systematic reviews of longitudinal cohort studies that controlled for a history of stroke at baseline, in which the risk of stroke was 24–64% higher for people with anxiety or depression when compared to those without (Barlinn et al., 2015; Dong, Zhang, Tong, & Qin, 2012; Pérez-Piñar et al., 2017); and higher (74%) for bipolar disorder (Prieto et al., 2014). Given the cross-sectional study design of the NZHS, it is possible the odds ratios identified overestimate the risk compared to longitudinal studies, since the baseline prevalence of mental health problems in people diagnosed with stroke was not controlled for.

The risk of other cardiovascular disease was 79% higher (OR = 1.79) among people with experience of an internalising disorder compared to those without. Earlier systematic reviews of longitudinal studies found the risk of cardiovascular disease was 26% higher among people with anxiety (Roest, Martens, de Jonge, & Denollet, 2010), and 56–64% higher among people with depression after taking into account a history of cardiovascular disease and other risk factors (Charlson et al., 2013; Wulsin & Singal, 2003). There appears to be a dose response relationship with a higher risk associated with clinically diagnosed depression. For example, Van der Kooy et al. (2007) found the risk of cardiovascular disease was more than twice as high for major depression.

### Chronic pain

The odds of experiencing chronic pain was two times higher among people with internalising disorders. *Te Rau Hinengaro* (Oakley Browne et al., 2006) also showed a higher prevalence of chronic pain (which included arthritis) among people with mental health problems compared to those without (52% and 35% respectively). The risk of chronic pain appears to be particularly high for people diagnosed with bipolar disorder. A large-scale meta-analysis provided some

evidence to suggest people with bipolar disorder are more than twice as likely to experience chronic pain compared to the general population (Stubbs et al., 2015). However, prospective longitudinal studies are lacking and the relationship between mental health and chronic pain appears to be bi-directional. For depression this may partly reflect shared biological pathways and neurotransmitters (Bair, Robinson, Katon, & Kroenke, 2003).

### Arthritis

Internalising disorders were associated with 72% higher odds of arthritis (OR = 1.72; including rheumatoid arthritis and/or osteoarthritis). This finding corroborates with a previous population-based longitudinal study that found people with depression were 65% more likely to have rheumatoid arthritis compared to people without depression (Lu et al., 2016). The study also found there was a 69% increased risk of depression among people with arthritis.

### Asthma

People with an internalising disorder were found to have 63% higher odds of asthma compared to those without an internalising disorder (OR = 1.63). *Te Rau Hinengaro* (Oakley Browne et al., 2006) also found a higher prevalence of respiratory conditions (including asthma) among people with mental health problems in the general population compared to those without (23% and 17% respectively). An earlier systematic review of prospective studies (Gao et al., 2015) found depression increased the risk of asthma by 43%, and a smaller risk (23%) of asthma associated with depression based on the findings of two studies (after controlling for depression at baseline).

### Diabetes

Finding that internalising disorders were not significantly associated with diabetes was not expected based on previous research. A prior systematic review of longitudinal studies provided evidence to suggest depression increases the risk of type 2 diabetes by 60% (Mezuk et al., 2008). In addition, a systematic review of studies with various designs by Vancampfort et al. (2015) found bipolar disorder was associated with a 98% increased risk of type 2 diabetes. The results of this analysis of the NZHS did not differ when anxiety, depression, and bipolar disorder were examined separately. To further investigate this finding, the previous three years of NZHS data were examined in post hoc analyses. The analyses indicated a significantly higher risk of diabetes among adults with internalising disorders in each of the previous three years, adjusted OR = 1.37–1.68,  $p < .01$ . This highlights the limitation of using only one year of data and suggests the comorbidity between diabetes and internalising disorders needs further examination and monitoring.

### Implications

The findings of the current study are in line with those of *Te Rau Hinengaro* (Oakley Browne et al., 2006) and the wider international literature in which mental health problems are associated with higher risks of cardiovascular disease (Charlson et al., 2013), stroke (Barlinn et al., 2015; Pérez-Piñar et al.,

2017), arthritis (Lu et al., 2016), chronic pain (Stubbs et al., 2015), and asthma (Gao et al., 2015). The findings are also comparable to the higher risk of physical health conditions reported in *Australia's Mental and Physical Health Tracker 2018* (Australian Health Policy Collaboration, 2018). Therefore, the NZHS may be a useful source of routinely collected data for monitoring the comorbidity of mental health problems and physical health conditions over time to inform clinical practice.

These comorbidities highlight the importance of assessing and responding to both the physical and mental health needs of people (De Hert et al., 2011). Routine screening and assessment is important given the risk of poorer health outcomes and premature mortality associated with mental health problems. This is important for people accessing primary health care as well as those accessing specialist mental health and addiction services. For example, a recent large-scale New Zealand study indicated a higher risk of premature mortality among people accessing specialist mental health and addiction services compared to the general population (Cunningham et al., 2014). In particular, the risk of cardiovascular causes of death was 69% higher among people accessing specialist mental health and addiction services compared to the general population (Cunningham et al., 2014). A higher risk of premature death from cancer amongst people with mental health problems has also been shown in New Zealand (Cunningham et al., 2014). Previous research suggests comorbidities may reflect the effect of depression on inflammatory mediators, neuroendocrine and neurotransmitter systems, and oxidative stress, as well as the mediating effects of individual-level risk factors, such as smoking, poor nutrition, and lack of physical activity (Barlinn et al., 2015; Cunningham et al., 2014; Gao et al., 2015; Maes, Kubera, Obuchowiczwa, Goehler, & Brzeszcz, 2011). It is also important to consider the cardiometabolic effects of psychotropic medications, and for clinicians to explain, monitor, and help people manage these physical health side-effects (Cunningham et al., 2014).

Improving the physical health of people with mental health problems requires integrated health service delivery and interventions at multiple levels (Liu et al., 2017; World Health Organization, 2017). To support this approach, Equally Well is a collaboration of New Zealand organisations working together to take action at multiple levels of the service delivery system (Te Pou o te Whakaaro Nui, 2014). Equally Well collaboratives have also been established in Australia and the UK. The collaboratives include mental health and addiction organisations, as well as, primary health organisations, which have a key role in offering routine screening and assessments. It is also important to ensure people with mental health problems have good access to primary health services. In an earlier NZHS analysis, Lockett, Lai, Tuason, Jury, and Fergusson (2018) showed that despite having greater health needs, people with mental health problems experience greater challenges accessing primary health services due to transport and costs.

Regarding workforce development, all health workers should be aware of the comorbidities between mental and physical health problems, and have the knowledge and skills to respond effectively to people (World Health Organization,

2017). The mental health services workforce should have the knowledge and skills needed to screen for physical health problems, identify deterioration in physical health, and ensure people have access to appropriate care (World Health Organization, 2017). The World Health Organization (WHO) noted that “whatever model is used, the outcome must be the same: care for both physical and mental health is available for each individual” (WHO, 2017 p. 24).

### *Limitations*

Several limitations need to be considered when interpreting the findings. The diagnoses of internalising disorders and physical health conditions were based on self-reported data. It is likely some people had undiagnosed mental health problems within the sample, as many people do not seek treatment for mental health problems, particularly Māori and Pasifika peoples (Horwood & Fergusson, 1998). Therefore, the prevalence of internalising disorders in the general population may have been underestimated, as well as the risk associated with physical health conditions. In comparison, *Te Rau Hinengaro* (Oakley Browne et al., 2006) assessed mental health problems using the Composite International Diagnostic Interview (CIDI 3.0), a diagnostic screening tool. The lifetime prevalence of anxiety disorders was 25%, and mood disorders was 20%, which is higher than in the current study. Despite this limitation, data from the NZHS was able to detect a significant association between mental health problems and most physical health conditions in line with previous research.

The NZHS is a cross-sectional survey and therefore the direction of relationship between variables cannot be determined. The WHO highlights the relationship between mental health and physical health problems is often bi-directional and complex (WHO, 2017). As a result, the odds ratios reported in the current study may have been overestimated. In addition, the study only examined one year of NZHS data. This may have contributed to the lack of relationship between internalising disorders and diabetes being detected, which was present in previous years. The use of multiple years of data would assist in addressing variation between individual years.

The mental health problems examined in the current study included anxiety, depression, and bipolar disorder. Other serious mental health problems are also of interest, including psychosis and schizophrenia. However, the NZHS does not routinely gather this information. Nevertheless, previous research has shown people diagnosed with schizophrenia have high levels of physical health comorbidities (Te Pou o te Whakaaro Nui, 2014), in particular an increased risk of cardiovascular morbidity and mortality compared to the general population (Cunningham et al., 2014; De Hert et al., 2011). The inclusion of psychosis or schizophrenia in future surveys of this type may therefore be beneficial.

Other factors such as childhood sexual abuse and trauma may also increase the risk of both internalising disorders and physical health conditions, however these were not examined (Afifi et al., 2016; Fergusson, McLeod, & Horwood, 2013). It will also be useful to control for smoking and other health behaviours in future research.

## Conclusion

This analysis of NZHS data shows the utility of using routinely collected data for examining comorbidities between mental health and physical health conditions. The results indicate people who experience anxiety, depression, and/or bipolar disorders often have co-occurring physical health conditions. Continued examination of national data can help monitor the prevalence of comorbidities and progress in addressing these health equity issues. This information should also be of interest to clinicians working across primary and specialist health services. Findings highlight the importance of screening and assessment of physical health conditions among people diagnosed with mental health problems, and routinely screening for mental health problems in people with long-term physical health conditions.

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## Declaration of interests

The authors report no conflicts of interest. The authors alone are responsible for the content and writing of the paper.

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