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# Lifetime prevalence estimates of major depression: An indirect estimation method and a quantification of recall bias

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**Abstract.** The measurement of lifetime prevalence of depression in cross-sectional surveys is biased by recall problems. We estimated it indirectly for two countries using modelling, and quantified the underestimation in the empirical estimate for one. A microsimulation model was used to generate population-based epidemiological measures of depression. We fitted the model to 1-and 12-month prevalence data from the Netherlands Mental Health Survey and Incidence Study (NEMESIS) and the Australian Adult Mental Health and Wellbeing Survey. The lowest proportion of cases ever having an episode in their life is 30% of men and 40% of women, for both countries. This corresponds to a lifetime prevalence of 20 and 30%, respectively, in a cross-sectional setting (aged 15–65). The NEMESIS data were 38% lower than these estimates. We conclude that modelling enabled us to estimate lifetime prevalence of depression indirectly. This method is useful in the absence of direct measurement, but also showed that direct estimates are underestimated by recall bias and by the cross-sectional setting.

**Key words:** Major Depression, Models (theoretical), Prevalence, Unipolar Depression

**Abbreviations:** NEMESIS = The Netherlands Mental Health Survey and Incidence Study; MD = Major Depression; CIDI = The Composite International Diagnostic Interview; DSM = The Diagnostic and Statistical Manual of Psychiatric Disorders; ICD = The International Classification of Diseases; RR = Relative Risk; 95% CI = 95% Confidence Interval; ECA = Epidemiologic Catchment Area; NCS = National Comorbidity Survey

## Introduction

Major depression (MD) is a debilitating [1–6] and prevalent disease, which is among the top five leading causes of burden of disease worldwide [7, 8]. In recent community surveys, 4 to 10% of the general population was shown to experience an episode of MD within a year [9–13]. Another way to express the prevalence of MD is lifetime prevalence, which is defined as the proportion of people ever having experienced at least one episode. Ideally this would be measured based on completed life courses, but since community studies have to rely on self-report, this is not possible. In practice, studies measure a cross-sectional lifetime prevalence, ignoring incident cases that appear after the survey takes place. Two recent surveys reported lifetime prevalences of over 15% [10, 11].

These recent surveys rely on structured diagnostic interviews that use the respondents' reporting of depressive symptoms to diagnose MD. To collect lifetime prevalence data, respondents have to recall the presence and co-occurrence of symptoms retrospectively over their past lifetime, possibly many years after they occurred. In such an assessment, problems with recall are not uncommon [14–19]. A comparison of cross-sectional and longitudinal data suggested that lifetime prevalence based on recall may be severely underestimated [20]. Furthermore, one study found that 25 years after admission for MD, 50% of the patients were not detected by the Composite International Diagnostic Interview (CIDI), the interview used in the recent surveys [21]. This recall problem was an important reason to refrain from measuring lifetime prevalence in the Australian Mental Health and Wellbeing Survey (personal communication).

Instead of collecting lifetime prevalence empirically, it can also be estimated indirectly, using a modelling approach. It can be reconstructed from survey data, which are less prone to recall bias, such as 1- and 12-month prevalence. This approach enables us to check the extent to which existing measures of lifetime prevalence are underestimated by recall bias, but also provides an estimate in the absence of data.

In this study we indirectly estimate the lifetime prevalence of MD on data from the Australian Adult Mental Health and Wellbeing Survey [9] and the Netherlands Mental Health Survey and Incidence Study (NEMESIS) [10]. In addition to providing an estimate for Australia, where empirical data is missing, a comparison of the indirect estimate with the empirical NEMESIS data provides a quantification of recall bias.

## Methods

### *The data*

The three-wave longitudinal NEMESIS survey was based on a random sample drawn from the Dutch general adult population, aged 18–64 [10, 22]. Using the CIDI [23, 24] version 1.1, diagnoses were derived according to third revised version of the Diagnostic and Statistical Manual of Psychiatric Disorders (DSM-III-R) [25]. We used 1- and 12-month prevalence data from wave I (1996). Total incidence (of both first and recurrent cases) in the 12 months between waves I and II were used to check the model outcome. For consistency with the incidence data, prevalence data were derived from the sample that participated in both waves I and II (5018 people) and exclusion criteria were not applied.

The cross-sectional Australian Mental Health and Wellbeing survey was based on a household sample of adults 18 years and older. Using the CIDI version 2.1, 1- and 12-month prevalence was assessed for 1997. Both DSM-IV and ICD-10 diagnoses were available. To be consistent with the Dutch data, we used the DSM diagnoses, without application of exclusion criteria, and excluding subjects older than 65.

The weighted data of the surveys were used. For more information on the methods, sampling and response we refer to Bijl et al. [22] and Andrews et al. [9]. For both studies 95% confidence intervals around the prevalence data were calculated assuming a binomial distribution, using:

$$\mathrm{CI95}_a = \sin\left[\arcsin\sqrt{P_a} \pm 1.96\sqrt{1/(4N_a)}\right]^2,$$

where $p_a$ is the prevalence at age-group $a$ and $N_a$ the total number of persons at that age-group [26].

### *The model*

To allow for the large degree of heterogeneity that is seen in MD, we used a microsimulation approach. This technique describes the disease process of an individual in terms of probabilities and their distributions [27]. Individual life histories are generated by random drawings from these distributions. Adding a large number of life histories creates a population from which population based epidemiological measures, such as lifetime prevalence and number of episodes, can be derived.

We assumed appropriate distributions for all the relevant transitions. The following algorithm creates a life history for each person in the population:

(1) First an age at death is drawn from the observed survival curve (Statistics Netherlands and Australian Bureau of Statistics).
(2) A second random draw from a uniform distribution determines whether the person may develop depression or not (parameter p). If so we continue with point 3, else all years are lived free of MD.
(3) From a Weibull distribution, a standard distribution to model 'time to failure', age at first incidence is drawn (parameters: $\alpha_1$ and $\beta_1$). If this age is lower than the age at death, we continue with point 4, else all years are lived free of MD.
(4) We assumed the duration of a depressive episode to be lognormally distributed [28] (parameters: $\mu$ and $\sigma$). Random draws are made until the episode lasts at least two weeks. If age at death is higher than age at incidence increased with duration, we continue with point 5, else the duration of the episode is reduced to last until death. If it becomes shorter than two weeks, it is dropped.
(5) From a second Weibull, time until a repeat episode is drawn (parameters: $\alpha_2$ and $\beta_2$). Eight weeks, by definition the minimum period between episodes is added to the randomly drawn time to the next episode. If the age of incidence is lower than age at death, we continue with point 6, else all remaining years are lived free of MD.
(6) Points 4 and 5 are repeated until the age at death is reached.

The model is thus defined by seven parameters. The choice of the Lognormal distribution to describe duration, and the Weibull distributions to describe time to next episode and age at first incidence, are assumptions that the model makes. Another assumption made is that the parameters for duration and time to next episode are independent of age.

### *Fitting the model to survey data*

First we fitted the parameters of the lognormal distribution to sex-specific mean duration of episodes