Asian Journal of Psychiatry 6 (2013) 460–472

Contents lists available at ScienceDirect

Asian Journal of Psychiatry

journal homepage: www.elsevier.com/locate/ajp

Review

Population impact of depression either as a risk factor or consequence of type 2 diabetes in adults: A meta-analysis of longitudinal studies

Syed Shahzad Hasan [a,*], Alexandra M. Clavarino [a], Abdullah A. Mamun [b], Suhail A.R. Doi [b], Therese Kairuz [a]

[a] The University of Queensland, 20 Cornwall Street, Woolloongabba, 4102 Queensland, Australia
[b] School of Population Health, University of Queensland, Herston Road, Herston, 4006 Queensland, Australia

ARTICLE INFO

Article history:
Received 24 June 2013
Received in revised form 9 September 2013
Accepted 15 September 2013

Keywords:
Depression
Diabetes mellitus
Type 2
Longitudinal
Meta-analysis

ABSTRACT

This meta-analysis examined the reciprocal relationship between depression and diabetes mellitus type 2 (T2DM) by conducting a bias adjusted meta-analysis of longitudinal studies using relative and absolute risk estimates. Specifically, the data were reconstructed to compute relative risk (RR), risk difference (RD), and the number needed to be exposed for one additional person to be harmed (NNEH) or benefited (NNEB). The 25 studies selected for review generated 29 datasets of which 15 examined endpoint A (depression as a risk factor for T2DM), and 14 examined endpoint B (T2DM as a risk factor for depression). For both endpoints, there was a small relative risk increase (for both the RR and hazard ratio (HR)) though with significant heterogeneity between studies. This however translated to a non-significant NNEH of 87 (NNEB 161 to ∞ to NNEH 35) and NNEH of 233 (NNEB 28 to ∞ to NNEH 23) for studies examining endpoint A and endpoint B respectively. This study suggests that the magnitude of the relative risk increase for depression as a risk factor or consequence of T2DM is small without significant impact on absolute risk indices. While these risks may be considered in terms of individual patient management, they are unlikely to have an impact on a population perspective.

Contents

* Corresponding author. Tel.: +61 469378163; fax: +61 073346199.
E-mail addresses: shahzad.syed@uqconnect.edu.au (S.S. Hasan), a.clavarino@sph.uq.edu.au (A.M. Clavarino), mamun@sph.uq.edu.au (A.A. Mamun), s.doi@sph.uq.edu.au (Suhail A.R. Doi), t.kairuz@pharmacy.uq.edu.au (T. Kairuz).

1876-2018/$ – see front matter © 2013 Elsevier B.V. All rights reserved.
http://dx.doi.org/10.1016/j.ajp.2013.09.008

1. Introduction

People with diabetes mellitus type 2 (T2DM) experience a number of complications in the course of the disease, including mental health-related illnesses such as depression. The latter is one of the common co-morbid conditions associated with T2DM (Kessler et al., 1995; WHO, 2000), and is particularly prevalent among such patients (Anderson et al., 2001; Ali et al., 2006). The presence of T2DM doubles the risk for having a diagnosis of depression compared to those without this condition (Eaton et al., 1996), and such patients are also more likely to have deficits in cognitive function (Wandell and Aberg, 1998; Wandell, 1999). Furthermore, the latter are also almost twice as likely to suffer from depression as the general population (Anderson et al., 2001; Egede et al., 2002; Nichols et al., 2007; Bouwman et al., 2010). Once depression develops, it can represent a barrier to glycemic control (Silva et al., 2012) and, sadly, often remains unrecognized and thus untreated (Pouwer, 2009) thus perpetuating the presence of depression among people with T2DM (Bouwman et al., 2010; Pouwer, 2009).

Conversely, depression is quite common itself being responsible for a large proportion of the burden associated with non-fatal health outcomes (WHO, 2005; Murray and Lopez, 1997) and there is some suggestion that it could increase the risk of T2DM. Thomas Willis, a famous physician from Great Britain was the first to report that diabetes was caused by "sadness or long sorrow and other depressions" (Willis, 1971). This relationship was never convincingly demonstrated until Eaton et al. (1996) reported an association that agreed with Willis' hypothesis (Willis, 1971). However the general response from researchers was that given the "modest" relationship, it could be "partially explained by lifestyle" (Golden et al., 2008), or might only exist with severe depression (Eaton et al., 1996; Carnethon et al., 2003; Arroyo et al., 2004; Brown et al., 2005; Kawakami et al., 1999; Palinkas et al., 2004; Golden et al., 2004; Saydah et al., 2003).

It is clear therefore that the relationship between depression and T2DM, while not conclusive (Brown et al., 2006), could be bidirectional (Golden et al., 2008; Engum, 2007). Biologically both hypotheses have some support. For example, depression as a consequence of T2DM could be explained by the burden of chronic disease or biochemical changes that occur as a result of T2DM (Kinder et al., 2002; Knol et al., 2007). Depression however may also be a co-morbid condition that results from the daily burden of having T2DM and/or its complications. Conversely, depression as a risk factor for the development of T2DM could be the consequence of a decline in health-maintenance behaviors among depressed persons (Golden et al., 2008; Kinder et al., 2002; Katon et al., 2004; Barbour and Blumenthal, 2005), or biochemical changes associated with depression (Bjorntorp, 2001; Knol et al., 2006).

While previous meta-analyses exist on this topic which support somewhat the bidirectional hypotheses (Knol et al., 2006; Mezuk et al., 2008; Nouwen et al., 2010; Rotella and Mannucci, 2012), they are far from conclusive because of several deficiencies. For example, absolute risk measures were not computed because most of the longitudinal studies neither presented data in a four-fold table form nor supplied adequate information to calculate cumulative incidence proportions (i.e. raw numbers of incident diabetes or depression by risk category). They also mainly focused on relative measures (the binary point estimates relative risk; RR and odds ratio; OR) or the time-to-event estimate (hazard ratio; HR). Also, there was no examination of bias risks. The aim of this review was therefore to use more rigorous methodology to examine the reciprocal relationship between depression and DM by conducting a meta-analysis of longitudinal studies using bias adjusted models, and extensive review and synthesis of the data. The advantage this provides is to reduce the variance of the final estimator thus precluding results that could be unrealistically far from true estimates. In addition to bias adjustment we also separated binary point estimates (OR, RR) and time-to-event estimates (HR), which we think were inappropriately combined in previous reviews (Knol et al., 2006; Mezuk et al., 2008; Nouwen et al., 2010). We also converted all odds ratios (ORs) to relative risks (RRs) (see Section 2) so that risks are uniform. Finally, and most importantly, we also imputed (from four-fold table reconstruction) both the Cumulative Incident Proportion (CIP) and then the absolute effect measure (risk difference) which was then pooled and compared against the relative pooled estimates, thus allowing us to judge the impact of any excess risk on the real world.

2. Methods

2.1. Data sources

Search terms included combinations of the following: incident diabetes, diabetes mellitus, type 2 diabetes mellitus, direction, co-morbid, relationship, risk factor, depression, and/or depressive reaction and/or symptomatology, incident depression. Studies using longitudinal design and probable type 2 diabetes to generate a risk estimate were included, whereas we excluded existing cases of either depression (for diabetes predicting incident depression) or diabetes (for depression predicting incident diabetes). Various electronic databases were searched: MEDLINE (1950 to December, 2012); EMBASE (1980 to December, 2012); CINAHL (1982 to December 2012); PsycINFO (1880 to December 2012). In the final stage Google Scholar was also carefully scanned to find any missed or additional studies.

After possible studies were identified, titles and abstracts were screened to remove studies that were clearly irrelevant to the aim of this review. The full texts of the remaining studies were then examined to determine whether the studies met our inclusion criteria. The references cited in identified relevant original research and review articles were then scanned for any additional articles that would possibly be relevant to our review; moreover, the reference lists of previous reviews and included studies were also examined. Studies were excluded if the authors did not explicitly exclude subjects with prevalent diabetes at baseline and if there were insufficient data to estimate a relative risk, an odds ratio, risk ratio or hazard ratio. When multiple publications from the same study population were available, we only included the most recent publication.

2.2. Eligibility criteria

Only studies relevant to the scope of the review were included. The eligibility criteria were based on study type and population attributes. Regarding study type, studies that investigated the association, unidirectional or bidirectional, comorbidity and/or