



The impact of a history of poor mental health on health care costs in the perinatal period

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Abstract

The perinatal period is a critical time for mental health and is also associated with high health care expenditure. Our previous work has identified a history of poor mental health as the strongest predictor of poor perinatal mental health. This study aims to examine the impact of a history of poor mental health on health care costs during the perinatal period. Data from the 1973–1978 cohort of the Australian Longitudinal Study on Women's Health (ALSWH) were linked with a number of administrative datasets including the NSW Admitted Patient Data Collection and Perinatal Data Collection, the Medicare Benefits Scheme and the Pharmaceuticals Benefits Scheme between 2002 and 2011. Even when taking birth type and private health insurance status into account, a history of poor mental health resulted in an average increase of over 11% per birth across the perinatal period. These findings indicate that an investment in prevention and early treatment of poor mental health prior to child bearing may result in a cost saving in the perinatal period and a reduction of the incidence of women experiencing poor perinatal mental health.

Keywords Perinatal mental health · Health care costs · Depression · Anxiety · women's health

Introduction

Poor mental health has wide-ranging consequences for both individuals and for society as a whole. Good mental health is an essential component of overall health and is interconnected to physical health and general wellbeing (Prince et al. 2007). While social impact of poor mental health has been well acknowledged, the economic impact of poor mental health has only received recent attention (Bauer et al. 2016).

A recent report published by the OECD found that, from a global perspective, the direct and indirect costs of poor mental health are estimated at over 4% of GDP. Further, the global costs of poor mental health were estimated at US\$2.5 trillion in 2010 and estimated to rise to US\$6 trillion by 2030 (OECD 2014). The 2010 Global Burden of Disease (GBD) study found that

mental and substance use disorders were the leading cause of non-fatal disease burden worldwide and reported a 38% increase in the number of disability-adjusted life years (DALYs) since 1990 (Murray et al. 2012). Charlson et al. noted that although the 2010 GBD study found that only 15% of burden of disease arises from mortality for people with mental, neurological and substance use disorders, that study only included *direct* causes of death in their analysis and reported around 840,000 deaths attributable directly to such disorders, yet when all-cause mortality is included, deaths associated with these disorders are estimated to exceed 13 million deaths (Murray et al. 2012; Charlson et al. 2015). Neil et al.'s cost of illness analysis found that in 2010, the costs associated with incidence of psychosis totalled US\$4.91 billion, with US\$2.31 billion attributed to direct costs and US\$2.60 billion to morbidity-related productivity loss (Neil et al. 2014).

From a national perspective, a report commissioned by the Royal Australian and New Zealand College of Psychiatrists estimated the cost of psychosis in Australia in 2014 at AUD\$3.86 billion in terms of government expenditure and AUD\$6.21 billion in terms of broader societal costs, a rise since 2010 estimates (Neil et al. 2014; Victorian Institute of Strategic Economic Studies 2016). These findings demonstrate that mental health remains a major national health challenge, with significant costs associated.

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The perinatal period is a particularly critical period for mental health, with around one in ten women worldwide experiencing poor mental health at this time (WHO 2014). A recent review by Bauer et al. has shown that the present value of total lifetime costs associated with perinatal depression and anxiety are 75,728GBP and 34,811GBP (in 2012/13 GBP), respectively, with the bulk of the costs attributed to the ongoing health care costs of the offspring (Bauer et al. 2016). These costs consisted of public sector costs and productivity loss. In the Australian context, Deloitte Access Economics reported the total costs (including public and private health sector costs and indirect costs including productivity costs) for postnatal depression in 2012 were AUD\$78.66 million, with most costs attributed to those arising from hospital services (Deloitte Access Economics 2012). The perinatal period is already a key area of health service expenditure, with AUD\$3.4 billion spent on reproductive and maternal conditions in 2012/2013 (AIHW 2016). The majority of these costs comprise hospitalisation costs around the time of delivery. As a critical period from both a social and economic perspective, it is imperative to understand the drivers of health service use and expenditure in the perinatal period.

All Australian permanent residents have access to Medicare, the Australian national health insurer that provides universal health care. Medicare covers the costs of public hospital stays and subsidises private medical care and pharmaceuticals. Outpatient consultations with physicians (such as general practice doctors (GPs) and specialists) and diagnostic tests (such as radiology and pathology) might be fully covered by Medicare but are more frequently covered by a combination of Medicare rebates and out-of-pocket co-payments made by the patient (which are not recoverable through private health insurance). Patients may also opt to take out private health insurance and to have either their private or public hospitalisation subsidised (Foster and Fleming 2008). GP visits, common tests and routine investigations are also covered under the Medicare Benefits Scheme (MBS), whereas pharmaceuticals are subsidised under the Pharmaceuticals Benefits Scheme (PBS). To further add to this administrative complexity, the federal government funds Medicare, while hospitals receive funding and are administered by state governments. During pregnancy, delivery and the postpartum period, health care costs are therefore attributed to a number of different schemes, both private and public, where costs and subsidies differ (Sutherland et al. 2012). Thus, comprehensive information on health service use and costs in the perinatal period is difficult to obtain.

Our previous work identifying the risk factors for postnatal depression identified that a prior history of poor mental health was a significant risk factor for postnatal depression, where poor mental health was characterised by a history of depressive and anxiety disorders (Chojenta et al. 2016). These findings were the first to demonstrate, in a prospective

longitudinal setting, the importance of previous poor mental health as a risk factor for poor mental health in the perinatal period. In another landmark study, our team has demonstrated that certain factors influence the use of, and therefore the costs associated with, health services during the perinatal period. This study used linked administrative datasets with self-reported health and wellbeing data from a prospective longitudinal cohort, a first of its kind to examine drivers of costs in the perinatal period. For hospital costs, the drivers of costs differed between private and public systems over the antenatal, delivery and postnatal periods. Mode of delivery was found to be the most important driver of hospital costs. For MBS costs, mode of delivery was also important, but poor perinatal mental health had a greater impact, particularly on the postnatal period. Critically, women who indicated they had experienced postnatal depression had significantly higher MBS costs in the perinatal period when compared to women who did not experience postnatal depression (William et al. 2017) [Jananie William Thesis, ANU, 2016, unpublished].

The relationship between a history of poor mental health prior to pregnancy and poor perinatal mental health is known (Chojenta et al. 2016). Logically, therefore, a history of poor mental health seems likely to have an ongoing impact on health care costs in the perinatal period. However, the complexity of health systems in Australia has deterred a comprehensive analysis to provide evidence for this contention. Data collected by the Australian Longitudinal Study on Women's Health (ALSWH) over decades, linked with various administrative datasets (Medicare, hospitals data), offer a unique opportunity to examine more closely the relationship between poor mental health and health service use in the perinatal period. We hypothesise that pre-conception mental health issues will be related to higher health service use and costs in the perinatal period.

Methods

Data

Data were taken from the Australian Longitudinal Study on Women's Health (ALSWH), an ongoing population-based study of health and wellbeing. The study commenced in 1996 with three cohorts born 1973–78, 1946–1951 and 1921–1926, with a fourth cohort born in 1989–1995 added in 2012. The project is conducted by a team of researchers based at the University of Newcastle and the University of Queensland and is funded by the Australian Government Department of Health. Participants complete surveys every 3 years on physical health, mental health, health service use, sociodemographic factors and lifestyle measures. For this analysis, data from six surveys from the 1973–1978 cohort were examined ($N = 14,247$). In order to obtain health service

use information, the ALSWH survey data were linked with a number of administrative datasets including Medicare Benefits Scheme (MBS) data, the Pharmaceutical Benefits Scheme (PBS) data, the NSW Perinatal Data Collection (PDC) and the NSW Admitted Patient Data Collection (APDC). The MBS dataset contains information on eligible services such as GP visits, specialist visits, tests and examinations. The PBS contains information on subsidised medicines. The APDC contains information on all public and private hospital admissions including diagnoses, length of stay and details of any procedures performed. The PDC includes information on births including type of birth, complications and neonatal status. The period of observation for this analysis included all births recorded in the PDC for the decade from 01 Jan. 2002 to 31 Dec. 2011.

The Australian Institute of Health and Welfare (AIHW) acted as the integrating authority for the national datasets (MBS and PBS) and the Centre for Health Record Linkage (CHeReL) for the NSW-based datasets (APDC and PDC). Data was obtained for all participants in the 1973–1978 cohort excluding those who had explicitly opted-out of data linkage ($N = 829$).

Sample

Eligible participants were those from the 1973–1978 cohort who had completed at least one survey, resided in NSW during the observation period and who had at least one birth recorded in the PDC between 2002 and 2011. The period of observation for each baby included the beginning of the antenatal period (baby date of birth (DOB)-gestational age at birth) to the end of the postnatal period (baby DOB + 366 days). If two babies were born to one mother within a 12-month period, overlapping episodes of care were attributed to the younger baby only, to avoid duplication of costs. Those participants with no costs attributed across the entire perinatal period were excluded from the analysis ($n = 11$); however, those participants with no costs in at least one period (antenatal, delivery, postnatal) were included in the analysis.

Ethics approvals

The ALSWH has human research ethics approval from the University of Newcastle (H-076-0795) and the University of Queensland (2004000224).

Measures

Costs were examined from a number of sources. From the APDC, costs of all maternal hospitalisations in the perinatal period were calculated. For each hospitalisation, an Australian Refined Diagnosis Related Group (AR-DRG) patient classification code was attributed (Ellis et al. 2013). Cost were allocated to each AR-DRG (and hence each hospitalisation) with national

cost-weight tables as these tables differentiate costs between public and private hospitals. As multiple versions of AR-DRG codes exist, AR-DRG v6.x was used, and any v6.0 codes were recoded. The MBS costs comprised of the government rebates paid for each service claimed in the perinatal period per baby. The PBS costs were obtained only for those medications above the co-payment threshold, as those below co-payment were not recorded in the PBS prior to 2012 (Paige et al. 2015). All costs were inflated to 2016 rates for comparability across time.

History of poor mental health was derived from a series of self-reported items from the ALSWH surveys. Since Survey 2 (2000), participants were asked if they had been diagnosed with or treated for ‘depression’, ‘anxiety disorder’ or ‘other major mental illness’. Since Survey 5 (2009), participants have also been asked to indicate whether they were diagnosed with or treated for ‘antenatal anxiety’, ‘antenatal depression’, ‘postnatal anxiety’ or ‘postnatal depression’ for the birth of each of their children. If the participant had responded positively to any of these variables in a survey prior to the birth of the index baby, they were considered to have experienced a history of poor mental health.

Birth type was recorded in the PDC using two different variables over time—for consistency, these variables were recoded to ‘vaginal’, ‘assisted vaginal/instrumental’ and ‘caesarean’ within our analysis.

As the public/private hospital flag variable was not explicitly available in this version of the APDC, a proxy indicator of hospital type was employed for this analysis. The payment status on separation variable was used and recoded to indicate whether the patient had been a private or public patient.

Analysis

All analyses were conducted in SPSS version 24 (IBM Corp 2015). In the first instance, descriptive analyses were conducted to broadly characterise the sample. The analysis proceeded by regarding individual babies as the experimental unit, rather than individual women, so each row in the data represented one birth. Children born to the same mother were therefore addressed using multilevel models to account for correlation. A series of linear mixed models was constructed by first analysing the impact of a history of poor mental health on perinatal health care costs, adding birth type and patient payment status as additional covariates. Multilevel modelling has become common in epidemiological applications over recent years and is most appropriate when longitudinal data is nested, and includes repeated measures (Greenland 2000). To account for positive and skewed data, a gamma distribution with log link was used. Health care costs were considered as a continuous measure, summed across the entire perinatal period per baby. Analyses were weighted for area of residence reported at Survey 1 to account for deliberate over-sampling within ALSWH in rural and remote areas.

Results

After removing records with incomplete key variables (1.5%) and one outlier with total health care costs over \$200,000, the final dataset for analysis included 3668 babies from 2106 mothers, with up to 5 children per mother. Of the sample of babies, 18.9% ($N = 697$) had a mother with a history of poor mental health prior to the birth, 29.5% ($N = 1089$) were born via caesarean section, 11.3% by instrumental birth ($N = 416$) and 59.2% by vaginal birth ($N = 2183$). Births attributed to public payment status accounted for 41.3% ($N = 1523$) of births, with 58.7% ($N = 2165$) therefore attributed to private payment status.

Table 1 shows the mean, range and interquartile range for health care costs across the perinatal period. The majority of costs were associated with the delivery period, while the postnatal period had a wide range. For modelling, all periods were aggregated to calculate a total perinatal period cost.

Table 2 shows the results of the linear mixed models. For each GLMM, a gamma distribution with log link was used (Gamma distribution variance = 46,265,812). Data were nested by mother so that all births were examined, and multicollinearity between family groups was taken into account. Each of the key covariates was entered successively into each model as fixed effects and models 1–3 compared for performance. When only a history of poor mental health is taken into account (model 1), a 12% increase in total health care costs was predicted ($p < .01$). When type of birth is included in the model for costs, this predicted increase is reduced to 9% ($p < .01$) but with significantly increased costs for Caesarean and Instrumental births. Further including patient payment status in the modelling (model 3), there is an average baseline increase of 11% per birth in health care costs attributed to a history of poor mental health ($p < .01$), increased costs for non-vaginal births and a premium for private payment status. The AIC and BIC measures of model fit both suggest that model 3 is the better performing of the three models.

Discussion and conclusions

Our results indicate that there is a significant predicted increase in health care costs in the perinatal period for women who have a prior history of poor mental health prior to birth,

Table 1 Untransformed mean (SD) and range for health care costs across the perinatal period

	Mean (SD)	Range	Q1	Q3
Antenatal	2509 (2812)	0–31,956	848	3321
Delivery	8388 (3390)	0–21,976	5598	11,371
Postnatal	1792 (4081)	0–76,518	233	1304
Whole perinatal period	12,689 (6809)	3113–94,081	7516	15,539

even when key factors such as birth type and payment status are taken into account. Critically, this analysis was based on linking together distinct data sources so that (a) multiple cost sources could be considered together, (b) costs could be allocated to distinct birth events, (c) health costs in the linked datasets could be appropriately attributed to the perinatal period for each birth, and (d) multiple important factors could be considered together.

Our findings are consistent with previous evidence that has suggested that poor mental health has a long-term impact on health care costs and quality of life (Murray et al. 2012; OECD 2014). Notably, however, this was the first study to examine the impact of poor mental health specifically for costs incurred during the perinatal period, a life stage for which engagement with health services are already high and during which mental health is at greater risk.

Our findings indicate that by addressing and preventing or adequately treating poor mental health in women of reproductive age, the health system is likely to experience significant cost savings during a critical period such as the perinatal period. To date, a significant amount of funding has been provided in Australia for the early detection and prevention of perinatal mental health conditions via the National Action Plan for Perinatal Mental Health (Perinatal Mental Health Consortium 2008). The action plan called for the implementation of routine psychosocial assessment of perinatal patients, training for staff and the establishment of appropriate care pathways. The National Perinatal Depression Initiative (NPDI) was established by the Federal Government in 2008 and saw the commitment of \$85 million over 5 years to facilitate the National Action Plan. In addition to these national initiatives, a number of state-based health policies were developed. Austin et al. acknowledge the need for evaluation of such initiatives in order to determine the impact of such funding and policy reforms (Austin et al. 2012). In a follow-up paper, the research team indicates that a non-significant trend was detected when examining the impact of routine psychosocial assessment on access to GPs, psychologist and psychiatrists during the perinatal period (Chambers et al. 2016). Further data are required to explore any potential impacts of such policy reforms, and these initial findings are inconclusive as to the impact of the National Action Plan and subsequent NPDI.

Indeed, our findings indicate that strategic investments in the early detection, treatment and prevention of poor mental health in the pre-adulthood phase and certainly *before* pregnancy may yield cost savings in terms of health care costs at specific, high-risk times such as the perinatal period and possibly even over the life-course of individuals affected. Evidence of this relationship strengthened by a future cost-benefit analysis of key interventions is targeted at young people.

While conducted in the Australian health system context, it is expected that these findings are generally applicable at a global level, with indications that mental health and maternity expenditure in other OECD countries follow similar trends.

Table 2 Generalised linear mixed model (with gamma log transformation) results for model 1 (history of poor mental health), model 2 (history of poor mental health + birth type) and model 3 (history of poor mental health + birth type + patient payment status)

	Model 1 (N = 3684)					Model 2 (N = 3684)					Model 3 (N = 3684)				
	B	Std. error	Exp (B)	Exp (95% CIs)	p	B	Std. error	Exp (B)	Exp (95% CIs)	p	B	Std. error	Exp (B)	Exp (95% CIs)	p
Intercept	9.43	0.01	12,404	12,129–12,686	.00-001	9.20	0.01	9844	9607–10,086	.00-001	9.07	0.01	8698	8470–8933	.00001
History of poor mental health															
Yes	0.11	0.03	1.12	1.06–1.17	.00-002	0.08	0.02	1.09	1.04–1.14	.00-001	0.10	0.02	1.11	1.06–1.15	.00001
No (ref)															
Birth Type															
Caesarean						0.61	0.02	1.83	1.77–1.90	.00-001	0.57	0.02	1.78	1.72–1.83	.00002
Instrumental						0.15	0.02	1.16	1.10–1.21	.00-001	0.08	0.02	1.09	1.04–1.14	.00001
Vaginal (ref)															
Patient payment status															
Private															
Public (ref)															
Alkaike corrected	5836					4662					4397				
Bayesian	5861					4687					4422				

Importantly, this study demonstrates a clear cost-saving strategy by investing in prevention and treatment strategies in early life in order to reduce costs in an already high period of health care expenditure. In particular, universal prevention programs that focus on children's mental health should be implemented (Costello 2016). Strategies may include integration of mental health awareness into schools and provision of counselling services specifically for young people. With the addition of a future full cost-benefit analysis, we anticipate the benefits to early intervention to be clear.

Limitations

While this analysis was comprehensive in scope, some limitations need to be acknowledged. There are several costs that were not captured in this analysis including outpatient services not covered under the MBS, cost of over-the-counter medications and any out-of-pocket costs attributed to the patient. In addition, in only capturing those PBS medications that over the co-payment amount, about half of prescribed medications may not have been included in our analyses. Our results comparing public and private hospitals should be interpreted with caution as a Productivity Commission report has identified a consistent over-costing of common types of hospital admissions in private hospitals compared to public hospitals (Productivity Commission 2009). However, the commission concluded that while there are differences in the systems, the similarities still warrant comparisons being made. Additionally, we have not tracked any ongoing costs to the infant including neonatal intensive care stays or other health care costs in the perinatal period. While not all of these costs will be attributed to prior mental health, our results may still reflect an underestimate of the actual impact of poor mental health on costs in the perinatal period. We also note that there may be other important confounding factors that could not be included in the model as they were not measured in the survey. Nonetheless, the findings do indicate a significant relationship between prior poor mental health and health care costs in the perinatal period.

Recommendations

In addition to a focus on improved mental health education and awareness for young people, additional approaches should be considered to improve mental health outcomes in the perinatal period. These approaches should include adequate training of health professionals in order to best detect and treat poor mental health, and a holistic approach to mental health care, where it is integrated into usual perinatal health care. This could be achieved through local mother/baby clinics and parenting education initiatives for all stages of parenting.

Conclusion

By focused attention on the detection and prevention of prior mental health disorders, cost savings can be made across the life-course, particularly in the perinatal period. Any cost savings should not further marginalise those groups with additional needs for support but would naturally occur with a reduction of poor mental health across the life-course. A future follow-up study could further identify the items that inflated the overall health care costs for women who had a history of poor mental health. Targeted policies and strategies for appropriate referral in earlier life should contribute to a later cost saving, but importantly, they should also reduce the incidence of poor perinatal mental health in particular, since a history of poor mental health is a leading risk factor for postnatal depression (Chojenta et al. 2016).

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Compliance with ethical standards

Ethical approval All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

Informed consent Informed consent was obtained from all individual participants included in the study.

Conflict of interest The authors declare that they have no conflict of interest.

References

- AIHW (2016) Australia's health 2016. Australia's health series no. 15. cat. no. AUS 199. Australian Institute of Health and Welfare, Canberra
- Austin MP, Reilly N, Sullivan E (2012) The need to evaluate public health reforms: Australian perinatal mental health initiatives. *Aust N Z J Public Health* 36(3):208–211
- Bauer A, Knapp M, Parsonage M (2016) Lifetime costs of perinatal anxiety and depression. *J Affect Disord* 192:83–90
- Chambers GM, Randall S, Hoang VP, Sullivan EA, Highet N, Croft M, Mihalopoulos C, Morgan VA, Reilly N, Austin MP (2016) The National Perinatal Depression Initiative: an evaluation of access to

- general practitioners, psychologists and psychiatrists through the Medicare benefits schedule. *Aust N Z J Psychiatry* 50(3):264–274
- Charlson FJ, Baxter AJ, Dua T, Degenhardt L, Whiteford HA, Vos T (2015) Excess mortality from mental, neurological and substance use disorders in the global burden of disease study 2010. *Epidemiology Psychiatric Sci* 24(2):121–140
- Chojenta CL, Lucke JC, Forder PM, Loxton DJ (2016) Maternal health factors as risks for postnatal depression: a prospective longitudinal study. *PLoS One* 11(1):e0147246
- Costello EJ (2016) Early detection and prevention of mental health problems: developmental epidemiology and systems of support. *J Clin Child Adolesc Psychol* 45(6):710–717
- Deloitte Access Economics (2012) The cost of perinatal depression in Australia final report. Post and Antenatal Depression Association, Barton
- Ellis RP, Fiebig DG, Johar M, Jones G, Savage E (2013) Explaining health care expenditure variation: large-sample evidence using linked survey and health administrative data. *Health Econ* 22(9):1093–1110
- Foster M, Fleming J (2008) The health care system in Australia. Health care practice in Australia. Oxford University Press, Melbourne
- Greenland S (2000) Principles of multilevel modelling. *Int J Epidemiol* 29(1):158–167
- IBM Corp (2015) IBM SPSS Statistics for Windows, version 24.0. IBM Corp, Armonk
- Murray CJL, Vos T, Lozano R, Naghavi M, Flaxman AD, Michaud C, Ezzati M, Shibuya K, Salomon JA, Abdalla S, Aboyans V, Abraham J, Ackerman I, Aggarwal R, Ahn SY, Ali MK, AlMazroa MA, Alvarado M, Anderson HR, Anderson LM, Andrews KG, Atkinson C, Baddour LM, Bahalim AN, Barker-Collo S, Barrero LH, Bartels DH, Basáñez MG, Baxter A, Bell ML, Benjamin EJ, Bennett D, Bernabé E, Bhalla K, Bhandari B, Bikbov B, Abdulhak AB, Birbeck G, Black JA, Blencowe H, Blore JD, Blyth F, Bolliger I, Bonaventure A, Boufous S, Bourne R, Boussinesq M, Braithwaite T, Brayne C, Bridgett L, Brooker S, Brooks P, Brugha TS, Bryan-Hancock C, Bucello C, Buchbinder R, Buckle G, Budke CM, Burch M, Burney P, Burstein R, Calabria B, Campbell B, Canter CE, Carabin H, Carapetis J, Carmona L, Cella C, Charlson F, Chen H, Cheng ATA, Chou D, Chugh SS, Coffeng LE, Colan SD, Colquhoun S, Colson KE, Condon J, Connor MD, Cooper LT, Corriere M, Cortinovis M, de Vaccaro KC, Couser W, Cowie BC, Criqui MH, Cross M, Dabhadkar KC, Dahiya M, Dahodwala N, Damsere-Derry J, Danaei G, Davis A, Leo DD, Degenhardt L, Dellavalle R, Delossantos A, Denenberg J, Derrett S, Des Jarlais DC, Dharmaratne SD, Dherani M, Diaz-Torne C, Dolk H, Dorsey ER, Driscoll T, Duber H, Ebel B, Edmond K, Elbaz A, Ali SE, Erskine H, Erwin PJ, Espindola P, Ewoigbokhan SE, Farzadfar F, Feigin V, Felson DT, Ferrari A, Ferri CP, Fèvre EM, Finucane MM, Flaxman S, Flood L, Foreman K, Forouzanfar MH, Fowkes FGR, Fransen M, Freeman MK, Gabbe BJ, Gabriel SE, Gakidou E, Ganatra HA, Garcia B, Gaspari F, Gillum RF, Gmel G, Gonzalez-Medina D, Gosselin R, Grainger R, Grant B, Groeger J, Guillemin F, Gunnell D, Gupta R, Haagsma J, Hagan H, Halasa YA, Hall W, Haring D, Haro JM, Harrison JE, Havmoeller R, Hay RJ, Higashi H, Hill C, Hoen B, Hoffman H, Hotez PJ, Hoy D, Huang JJ, Ibeanusi SE, Jacobsen KH, James SL, Jarvis D, Jasrasaria R, Jayaraman S, Johns N, Jonas JB, Karthikeyan G, Kassebaum N, Kawakami N, Keren A, Khoo JP, King CH, Knowlton LM, Kobusingye O, Koranteng A, Krishnamurthi R, Laden F, Lalloo R, Laslett LL, Lathlean T, Leasher JL, Lee YY, Leigh J, Levinson D, Lim SS, Limb E, Lin JK, Lipnick M, Lipshultz SE, Liu W, Loane M, Ohno SL, Lyons R, Mabweijano J, MacIntyre MF, Malekzadeh R, Mallinger L, Manivannan S, Marcenes W, March L, Margolis DJ, Marks GB, Marks R, Matsumori A, Matzopoulos R, Mayosi BM, McAnulty JH, McDermott MM, McGill N, McGrath J, Medina-Mora ME, Meltzer M, Memish ZA, Mensah GA, Merriman TR, Meyer AC, Miglioli V, Miller M, Miller TR, Mitchell PB, Mock C, Mocumbi AO, Moffitt TE, Mokdad AA, Monasta L, Montico M, Moradi-Lakeh M, Moran A, Morawska L, Mori R, Murdoch ME, Mwaniki MK, Naidoo K, Nair MN, Naldi L, Narayan KMV, Nelson PK, Nelson RG, Nevitt MC, Newton CR, Nolte S, Norman P, Norman R, O'Donnell M, O'Hanlon S, Olives C, Omer SB, Ortblad K, Osborne R, Ozgediz D, Page A, Pahari B, Pandian JD, Rivero AP, Patten SB, Pearce N, Padilla RP, Perez-Ruiz F, Perico N, Pesudovs K, Phillips D, Phillips MR, Pierce K, Pion S, Polanczyk GV, Polinder S, Pope CA III, Popova S, Porrini E, Pourmalek F, Prince M, Pullan RL, Ramaiah KD, Ranganathan D, Ravavi H, Regan M, Rehm JT, Rein DB, Remuzzi G, Richardson K, Rivara FP, Roberts T, Robinson C, de León FR, Ronfani L, Room R, Rosenfeld LC, Rushton L, Sacco RL, Saha S, Sampson U, Sanchez-Riera L, Sanman E, Schwebel DC, Scott JG, Segui-Gomez M, Shahraz S, Shepard DS, Shin H, Shivakoti R, Silberberg D, Singh D, Singh GM, Singh JA, Singleton J, Sleet DA, Sliwa K, Smith E, Smith JL, Stapelberg NJC, Steer A, Steiner T, Stolk WA, Stovner LJ, Sudfeld C, Syed S, Tamburlini G, Tavakkoli M, Taylor HR, Taylor JA, Taylor WJ, Thomas B, Thomson WM, Thurston GD, Tleyeh IM, Tonelli M, Towbin JA, Truelsen T, Tsilimbaris MK, Ubeda C, Undurraga EA, van der Werf MJ, van Os J, Vavilala MS, Venketasubramanian N, Wang M, Wang W, Watt K, Weatherall DJ, Weinstock MA, Weintraub R, Weisskopf MG, Weissman MM, White RA, Whiteford H, Wiebe N, Wiersma ST, Wilkinson JD, Williams HC, Williams SRM, Witt E, Wolfe F, Woolf AD, Wulf S, Yeh PH, Zaidi AKM, Zheng ZJ, Zonies D, Lopez AD (2012) Disability-adjusted life years (DALYs) for 291 diseases and injuries in 21 regions, 1990–2010: a systematic analysis for the global burden of disease study 2010. *Lancet* 380(9859):2197–2223
- Neil AL, Carr VJ, Mihalopoulos C, Mackinnon A, Morgan VA (2014) Costs of psychosis in 2010: findings from the second Australian National Survey of psychosis. *Aust N Z J Psychiatry* 48(2):169–182
- OECD (2014). Making mental health count: the social and economic costs of neglecting mental health care. OECD Health Policy Studies, OECD Publishing
- Paige, E., A. Kemp-Casey, R. Korda, E. Banks (2015). Using Australian pharmaceutical benefits scheme data for pharmacoepidemiological research: challenges and approaches. *Public Health Research & Practice* 25(4)
- Perinatal Mental Health Consortium (2008) Perinatal mental health, National Action Plan 2008–2010, full report. beyondblue, Melbourne
- Prince M, Patel V, Saxena S, Maj M, Maselko J, Phillips MR, Rahman A (2007) No health without mental health. *Lancet* 370(9590):859–877
- Productivity Commission (2009) Public and private hospitals: research report. Productivity Commission, Canberra
- Sutherland G, Yelland J, Brown S (2012) Social inequalities in the Organization of Pregnancy Care in a universally funded public health care system. *Matern Child Health J* 16(2):288–296
- Victorian Institute of Strategic Economic Studies (2016) The economic cost of serious mental illness and comorbidities in Australia and New Zealand. The Royal Australian and New Zealand College of Psychiatrists, Melbourne
- WHO (2014) Social determinants of mental health. World Health Organization and Calouste Gulbenkian Foundation, Geneva
- William J, Chojenta CL et al (2017) An actuarial investigation into maternal hospital cost risk factors for public patients. *Annals of Actuarial Science* Accepted June 2017