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Economic costs of minor depression: a population-based study

Cuijpers P, Smit F, Oostenbrink J, de Graaf R, ten Have M, Beekman A. Economic costs of minor depression: a population-based study.

Objective: Although the clinical relevance of minor depression has been demonstrated in many studies, the economic costs are not well explored. In this study, we examine the economic costs of minor depression.
Method: In a large-scale, population-based study in the Netherlands ($n = 5504$) the costs of minor depression were compared with the costs of major depression and dysthymia. Excess costs, i.e. the costs of a disorder over and above the costs attributable to other illnesses, were estimated with help of regression analysis. The direct medical costs, the direct non-medical costs and the indirect non-medical costs were calculated. The year 2003 was used as the reference year.
Results: The annual per capita excess costs of minor depression were US$ 2141 (95% CI = 753–3529) higher than the base rate costs of US$ 1023, while the costs of major depression were US$ 3313 (95% CI = 1234–5390) higher than the base rate. The costs of minor depression per 1 million inhabitants were 160 million dollars per year, which is somewhat less than the costs of major depression (192 million dollars per year).
Conclusion: The economic costs associated with minor depression are considerable and approach those of major depression.

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Key words: depressive disorder; cost of illness; economics; population characteristics

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Significant outcomes

- The annual excess per capita costs of minor depression are about two-thirds of the per capita costs of major depression.
- Per million inhabitants the excess costs of minor depression (US$ 160 million) approach those of major depression (US$ 192 million).
- Virtually all excess costs of minor depression are indirect non-medical costs (costs for treatment are not significantly higher than the base rate).

Limitations

- The definition of minor depression was not exactly the same as the DSM-IV definition.
- Although the number of subjects was large, it is relatively small for economic studies.
- Data from the second measurement point of the study were used, at which point some attrition had already taken place.

Introduction

Minor depression is a highly prevalent condition (1, 2), with a considerable impact on the quality of life of patients (3, 4), and resulting in an increased utilization of medical services (5). Minor depression is also associated with an increased mortality rate (6, 7) and carries a high risk of developing

major depressive disorder on both the short (2) and the long term (8, 9).

Despite these indications of clinical relevance, it is less clear whether minor depression is associated with increased economic costs. Although major depressive disorder is associated with considerable economic costs (10, 11), as are other mental disorders (12–14), the costs of minor depression remain unclear.

The few studies that have examined the economic burden of minor depression have reported increased service utilization and high medical costs in adults (5, 15–17) and among elderly (18–20). However, most of these studies focused exclusively on direct medical costs, thereby ignoring patients' out-of-pocket and time costs, and ignoring the often very substantial costs of production losses. Furthermore, several of these studies do not define minor depression according to diagnostic criteria but are based on self-reported symptoms. Most studies have focused on patients with minor depression who sought help for their problems, thereby ignoring those subjects who do not seek treatment. Finally, none of the studies has used a random sample of community residents with minor depression.

Aims of the study

To examine in a large, representative sample of the Dutch population whether minor depression is associated with significantly increased medical and non-medical costs. Furthermore, it was hypothesized that the costs of minor depression would be substantially smaller than those of major depression and dysthymia, which are generally considered to be more disabling. The study also examined whether there is a dose–response relationship between the number of depressive symptoms and economic costs and whether specific symptoms are associated with excess costs.

Material and methods

Subjects and procedure

This cost-of-illness study was conducted using the data of the Netherlands Mental Health Survey and Incidence Study (NEMESIS) which has been described in detail elsewhere (21), and is part of a series of studies on the costs of mental disorders. In brief, a random, stratified, multistage sample was obtained in three steps at baseline (t_0). First, municipalities were stratified by urbanization, and 90 municipalities were drawn randomly and proportionately from these strata. Second, within each municipality, households were randomly drawn from the postal register. Finally, within each household the person with the most recent birthday was selected on condition that he or she was aged between 18 and 65 years and sufficiently fluent in Dutch to be interviewed. Eligible persons who were not immediately available were contacted later in the year. The response rate was 69.7% resulting in a sample of 7076 people at t_0. The baseline sample followed the same multivariate distribution over age, sex, civil status and urbanity as the general Dutch population; however, males in the age group 18–24 years were slightly underrepresented. All data were collected in structured face-to-face interviews.

At first follow-up (t_1), which occurred 1 year ($M = 379$ days, SD = 35) after baseline measurement, 5618 persons (79.4%) continued their participation. The present study is based on the t_1 sample because minor depression and medical consumption were measured at t_1 (and not, or not sufficiently, at t_0). Because we wanted to control for common mental disorders, we excluded from the analyses 114 subjects with DSM-III-R mental disorders with a 1-year prevalence below 1% (as measured with the Composite International Diagnostic Interview (CIDI), see below: bipolar disorder, obsessive–compulsive disorder, eating disorders and schizophrenia). This resulted in an effective sample size of $n = 5504$.

Of this sample, 49% were women; the mean age was 40 (range 18–65 years); 69% was living with a partner; 5% had elementary education, 35% lower vocational, 30% secondary and 30% had higher vocational and academic education; 94% was born in the Netherlands; and 70% was employed.

We evaluated the effect of attrition from t_0 to t_1 and found no evidence that it was related to having a mental disorder at t_0 but, again, the younger males were more likely to be lost to follow-up (22). Corrective weights were used to improve generalizability (see Analysis).

Measures

DSM-III-R axis-I disorders were assessed in both waves with CIDI (23), Dutch 1.1 version (24). The CIDI is a fully computerized psychiatric interview and can be used by trained interviewers who are not clinicians. It has an acceptable inter-rater and test–retest reliability for the disorders under study (25).

In this study, the following disorders were examined: depressive disorder, dysthymia, anxiety disorder (presence of panic disorder with and without agoraphobia, generalized anxiety disorder,

simple phobia, social phobia and/or agoraphobia without a history of panic) and alcohol-related disorder (alcohol misuse and/or alcohol dependence).

Minor depression. Because the CIDI does not provide an algorithm for the diagnosis of minor depression, we used a definition which best approached the DSM-IV definition. We defined minor depression as the subject reporting one of the core symptoms of depression between t_0 and t_1 during at least 2 weeks, plus at least one other symptom, but the total number of symptoms not exceeding four.

Major depression was defined according to the DSM-III-R classification and measured with the CIDI.

Chronic medical condition was assessed at t_0 with a questionnaire listing 31 common illnesses from the Health Survey of Statistics Netherlands, among them, diabetes mellitus, chronic obstructive lung disease, cardiac disease, arthritis of knee or hip and cancer (26).

Sociodemographic characteristics were assessed in structured face-to-face interviews. The following variables were used: female gender, age (in years), education, living with a partner, born in the Netherlands or elsewhere, employment status.

Resource use and costing

All costs are expressed in dollars (US$) for the reference year 2003. For conversion from euros (the currency in The Netherlands) to US$, we used Purchasing Power Parities (PPPs), which are currency conversion rates that both convert currency and equalize the purchasing power of different currencies. The Organization for Economic Cooperation and Development (OECD) equates US$ 1.00 to € 0.920 in The Netherlands in 2003 (cf. http://www.oecd.org/std/ppp).

Because the time frame of this study is restricted to this single year, we did not correct for inflation and did not discount costs. Conceptually, the following types of costs can be distinguished.

Direct medical costs are the costs of health service resource use. All direct medical costs refer to costs made in the mental healthcare sector in the Netherlands. There were only three exceptions: we also included GP costs, costs of social work and physiotherapy. This was done because people with mental problems often make use of their services. Information on the subjects' use of health services was obtained with a prototype version of the Trimbos and Institute of Medical Technology Assessment Cost questionnaire for Psychiatry (TIC-P) (27). This questionnaire registers the number of general practitioner visits, sessions with psychiatrists, hospital days, etc. In a next step, medical resource use was calculated by multiplying the number of health service units (consultations, hospital days, etc.) by their integral cost price (28).

To these costs we added the costs of pharmacological interventions as the cost price per standard daily dose (obtained from the Pharmaceutical Compass at http://www.fk.cvz.nl), plus 6% VAT, multiplied by the number of prescription days, plus the pharmacist's dispensing costs of US$ 7.91 per prescription.

Direct non-medical costs arise when patients travel to health service providers and pay for parking. In the Netherlands, the average travel distance between a random address and a general practitioner's practice is 1.8 km. Travel distances to other health services are also known (28). This information was combined with the information about actual use of health services. Travel distances were valued at US$ 0.17 per km and 1 h parking time was valued at US$ 2.70. To this we added the costs of the patients' time spent in travel, waiting and in treatment at US$ 9.00 per hour (see Appendix 1).

Indirect non-medical costs arise when production losses occur due to illness. Subjects were asked about the number of days spent in bed due to illness. These days in bed are split according to workdays (resulting in production losses due to loss of work days) and days spent in bed while not having to work (resulting in production losses in the domestic sphere). To value a lost day in a paid job we used the costs which represent the age and gender-specific monetary counter-value of production losses that occur during absence from work (29).

For persons too ill to perform domestic tasks, these costs were valued at the black market price of domestic help at US$ 9.00 per hour. The black market price is used for these costs because they are assumed to reflect the true costs.

The cost calculations were conducted in accordance with the latest Dutch guideline for health economic evaluations (28), which closely resembles other international guidelines (30–32).

Analysis

Our analytical strategy consisted of establishing a baseline of the costs across different diagnostic categories, after which we computed the additional or excess costs over and above that base rate. The base rate consists of the costs which are generated annually by every person, on average.

First, we conducted a series of multiple regression analyses. In the first analysis, the overall excess per capita costs (the costs above the base rate) were used as dependent variable, while the presence of minor depression, major depression, dysthymia, any anxiety, any alcohol-related disorder and somatic disorders were used as predictors. This allowed us to examine the costs of minor depression, while controlling for other common mental disorders. In the second regression analysis, we used direct medical excess costs as dependent variable and the same variables as predictors. In the third and fourth regression analyses, the direct non-medical and the indirect non-medical costs were used as the dependent variables.

To account for initial non-response and drop-out, corrective weights were used. After weighting, the sample followed exactly the same multivariate distribution over age, sex, civil status and urbanization as the population according to Statistics Netherlands (downloadable from http://www.cbs.nl).

To account for the possible non-normality of the cost data, sample errors, 95% confidence intervals (CIs) and *P*-values were based on 1000 bootstrap replications, while at each bootstrap step robust sample errors were obtained using the first-order Tailor-series linearization method. The latter was done to obtain correct 95% CIs and *P*-values under weighting.

The bootstrap method is often used for getting 95% CIs in economic studies, especially when it is expected that standard statistical (asymptotic) theory may not hold – as might have been the case for the non-normally distributed cost data. For our data we found that the 95% bootstrap intervals were nearly identical with the 95% CIs that were obtained with help of the robust standard errors (based on the Hubert–White sandwich method). So, there is no appreciable difference. Nevertheless, we lend preference to the bootstrap intervals, because they are more robust.

Next, we recalculated the per capita costs into the costs per 1 million inhabitants (on the basis of the societal costs per capita and the prevalence rates for each disorder). For these costs per 1 million inhabitants, we used the prevalence rates of mental disorders as reported earlier (2, 21).

Then we examined whether the costs of minor depression were related to the number of depressive symptoms. We devised three categories of minor depression (with two, three or four symptoms). We then regressed the total societal per capita costs on these three types of minor depression, major depression, dysthymia, any anxiety disorder and any alcohol-related disorder, while adjusting for somatic illnesses. Again, we recalculated the per capita costs of each of these three types of minor depression into the costs per 1 million inhabitants.

To examine whether an increase in number of symptoms in minor depression was related to an increase in costs, we conducted a new regression analysis with the economic costs as dependent variable and the number of symptoms as predictor, while controlling for other common mental disorders and for somatic disorders (*P* for linear trend).

Finally, we examined whether the excess costs of minor depression were related to specific symptoms. We made a new variable indicating whether the subject had minor depression with lack of appetite (one of the symptoms of depressive disorders) or minor depression without lack of appetite. Then we entered both variables as predictors in a multivariate regression analysis (while partialling out the excess costs of major depression, dysthymia, any anxiety and any alcohol-related disorder, and adjusting for the presence of somatic disorders). We repeated this procedure for every symptom of depression. Because we found no significant effects and because the standard errors were large (as generally occurs in cost-of-illness studies in psychiatric disorders), we decided to calculate both the 95% CIs and 90% CIs (all based on 1000 bootstrap replications).

All analyses were conducted with STATA version 7.0/SE (Stata Corp., College Station, TX, USA).

Results

Per capita costs and costs at the population level

Table 1 shows that the annual excess per capita costs of having minor depression is, on average, US$ 2141 (SE = 708; 95% CI = 753–3529), while the excess costs of major depression are US$ 3313 (SE = 1061; 95% CI = 1234–5390).

As indicated earlier, these costs should be interpreted as the excess costs of the disorder, because every person generates, on average, a 'base rate' of US$ 1023 annually. The actual costs when someone experiences an episode of minor depression are in a given year US$ 2141 + US$ 1023 = US$ 3164. The annual direct medical and direct non-medical excess costs are very small and non-significant for minor depression, indicating that subjects with minor depression receive hardly any excess professional help compared to subjects without mental or other disorders. The indirect non-medical costs are significantly different from the base rate and are relatively high (US$ 2101).

Table 1. Annual per capita costs* (in US$) by DSM-III-R disorder (sample errors and 95% confidence intervals, † weighted analysis, $n = 5491$)

	Total‡			Direct medical			Direct non-medical			Indirect non-medical		
Disorder	Costs	SE	95% CI	Costs	SE	95% CI	Costs	SE	95% CI	Costs	SE	95% CI
Minor depression	2141	708	753–3529	10	27	−42–63	29	24	−18–76	2101	723	684–3518
Major depression	3313	1061	1234–5390	478	134	215–740	313	138	42–583	2535	1013	549–4520
Dysthymia	13 679	3688	6450–20 907	349	473	−578–1276	−49	184	−409–311	13 373	3783	5959–20 787
Any anxiety disorder	3190	916	1393–4987	278	172	−60–615	238	109	25–451	2671	841	1022–4320
Any substance-related disorder	1369	880	−357–3094	161	109	−53–375	34	31	−34–101	1172	880	−555–2898
Somatic illness	3265	260	2756–3774	27	18	−10–63	13	13	−13–39	3224	259	2718–3731
Base rate (constant)	1023	147	735–1310	8	15	−21–37	8	13	−18–34	1008	150	714–1302

*Costs are the societal costs, including direct medical, direct non-medical and indirect non-medical costs.

†(Robust) sample errors and 95% CIs are based on 1000 bootstraps.

‡The sum of the direct medical, direct non-medical and indirect non-medical costs is not exactly the same as the total costs, because each type of cost was estimated separately and may vary slightly.

These latter costs approach the costs of major depression (US$ 2535).

We used the per capita costs to calculate the costs per 1 million inhabitants aged 18–65 years. This includes all cost categories (health service uptake, out-of-pocket costs, production losses; and is equivalent to the per capita excess costs × prevalence × 1 000 000). Table 2 shows that the costs of minor depression are 160 million dollars per year, which is somewhat less than the 192 million dollars per year for major depression. Thus, the economic costs associated with both disorders are considerable.

Costs associated with the number of symptoms

We examined the possibility that an increasing number of symptoms is associated with higher per capita costs by calculating the per capita costs associated with minor depression with two symptoms, three and with four symptoms. The results are presented in Fig. 1. The per capita costs increased significantly with the increasing number of symptoms (two symptoms: US$ 987, three: US$ 2866 and four: US$ 3474; P for linear trend < 0.001).

We also calculated the number of subjects with minor depression with two, three and four symptoms, and the total annual costs per 1 million inhabitants. Although the number of subjects with these three types of minor depression decreases somewhat with the increase in the number of symptoms (prevalence of 0.025 for two symptoms, 0.026 for three and 0.023 for four symptoms; overall prevalence 0.075), the total annual costs per 1 million inhabitants increases strongly with the increase in the number of symptoms.

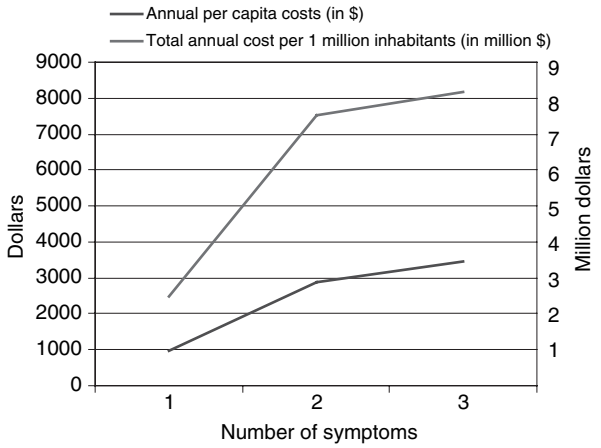

Fig. 1. Annual per capita costs of three types of minor depression (with one, two or three symptoms plus the key symptom) and total annual costs of these three types of minor depression per 1 million inhabitants.

Table 2. Annual costs (in million US$) attributable to prevalent cases per 1 million inhabitants aged 18–65 years

	Prevalence (in %)	Costs (in million US$)
Minor depression	7.5	160.4
Major depression	5.8	192.2
Dysthymia	2.3	314.6
Any anxiety disorder	12.4	395.6
Any substance-related disorder	8.9	121.9

Costs associated with specific symptoms

We found only few indications that specific symptoms of minor depression were associated with increased per capita costs. None of the analyses reached a significance level of 0.05. Because the standard errors were large, we also calculated the 90% CIs (Table 3). We found a trend ($p < 0.1$) indicating that the costs associated with minor depression in which lack of appetite was present were lower than the costs associated with minor depression without lack of appetite. Furthermore,

Table 3. Annual per capita costs† (in US$) of minor depression with and without specific symptoms (sample errors and 90% confidence intervals, ‡ weighted analysis, $n = 5491$)

Symptom	Costs§	SE¶	90% CI
Change in appetite			
Yes	−421	1015	−2091–1250
No	2801	825**	1442–4159
Sleeping problems			
Yes	2379	1064*	628–4131
No	1973	949*	412–3534
Agitation, restlessness			
Yes	1363	2784	−3216–5944
No	2169	769**	904–3433
Fatigue, lack of energy			
Yes	2404	1262	328–4481
No	2016	860*	602–3431
Worthlessness, guilt			
Yes	8161	3132**	3010–13 312
No	1210	650	140–2279
Concentration problems			
Yes	885	1053	−848–2617
No	2712	928**	1186–4238
Thoughts of death, suicide			
Yes	2994	1141**	115–4871
No	1510	904	23–2998

†Costs are the societal costs, including direct medical, direct non-medical and indirect non-medical costs.

‡(Robust) sample errors and 90% confidence intervals are based on 1000 bootstraps.

§The sum of the direct medical, direct non-medical and indirect non-medical costs is not exactly the same as the total costs, because each type of cost was estimated separately and may vary slightly.

¶* and ** indicate that the costs differ significantly from the mean costs; *$p < 0.05$; **$p < 0.01$.

there was a trend indicating that feelings of worthlessness and guilt in minor depression were associated with higher per capita costs.

Discussion

In the present study the economic costs associated with minor depression were found to be considerable, and approaching the costs of major depression. Per million inhabitants, the excess costs were about 160 million dollars, compared to about 190 million dollars for major depression. Minor depression was hardly associated with increased direct medical and direct non-medical costs, and virtually all excess costs were those associated with production losses due to illness (i.e. indirect non-medical costs). This indicates that subjects with minor depression do not receive more professional help than the average person, which is in contrast to other studies reporting that minor depression is associated with more use of mental health services (2, 5). However, most research in this area has focused on subjects who actually receive professional help and have not used data from the general population.

However, in an earlier analysis of the same data, we found that minor depression was associated with increased use of services (2). The reason for this discrepancy is that in the present study we controlled for comorbid mental disorders, which was not done in our earlier study.

In the present study the per capita excess costs of major depression were substantially higher than those of minor depression, but because the prevalence of minor depression was higher, the total costs per million inhabitants were similar in both disorders. This is an important finding from a public health perspective: At the individual level minor depression costs less, but at the population level the costs are considerable and approach those of major depression. This suggests that large-scale treatment of minor depression will probably result in increased medical costs, but may be cost-effective from a societal perspective.

There was evidence to support our hypothesis that a larger number of symptoms of depression are associated with higher excess per capita costs in minor depression. Because most excess costs are non-medical costs, this suggests that a larger number of symptoms is associated with more role limitations and more production losses.

Apart from the number of symptoms, the excess per capita costs could also be associated with specific symptoms. On examination we found some (contra-intuitive) indications that lack of appetite may be associated with lower costs. In addition, feelings of worthlessness may be associated with higher costs. These latter results indicate that it is not so much the type of symptom, but the number of symptoms which is associated with excess costs.

This study has several strengths and limitations. Strengths include the relatively large, representative community sample ($n = 5504$), the inclusion of direct medical and non-medical costs, as well as the indirect non-medical costs, and the use of well-validated diagnostic instruments to assess the presence of mental disorders. There are, however, also some limitations. First, we used data from the second measurement point of the NEMESIS study; at this measurement point some attrition had taken place which may have distorted the results. However, corrective weights were used to control for selective drop-out.

Second, we used a definition of minor depression which approached the DSM-IV definition. However, whereas the DSM-IV definition stipulates that the symptoms should co-occur during 2 weeks, our definition defined minor depression as having had the symptoms during 1 year. Thus in some cases, the symptoms may have occurred at

different times during the past years. This may have lead to misclassification in some cases: some participants may have been diagnosed with minor depression while they did not experience all the symptoms simultaneously. This type of misclassification is especially important when the diagnosis spans longer periods of time (for instance when studying the life time occurrence of disorders). In a study of the 1-year occurrence of disorders it is much less likely to have an effect. However, some misclassification may have occurred. The effect would be that participants with less than the required symptoms were classified as minor depression, which would probably lead to an underestimation of the true costs of minor depression.

Third, although our number of subjects was large, it was relatively small for economic studies (33). This resulted in large standard errors and confidence intervals.

The costs reported in this paper should be interpreted as conservative estimates for the following reasons. First, the medical costs that were considered in this study were limited to those related to mental health services and psychopharmaca, whereas it is well known that mental disorders also generate medical costs outside the sector of mental health services (34). Second, the cost calculations were based on self-reported medical consumption, which is known to result in an underestimate of the medical consumption and the corresponding costs (35). Third, people who are ill but still go to their job may work less efficiently, resulting in production losses; such production losses are not included in this study, but can be substantial.(36, 37).

This study has shown that minor depression is not only an important health problem but also involves considerable economic costs, approaching those of major depression. From a public health point of view, it is important to continue the attempts to develop treatments for minor depression and to test their effects (38, 39).

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Appendix 1

Table 1. Direct medical and direct non-medical costs by health service type (in 2003 US$)

	Direct medical costs		Direct non-medical	
Health service type	Unit	Cost price*	km, P, h†	Cost price‡
Medical doctor	Consult	22,00	1.8 km, 1 h	12.10
Medical specialist	Consult	106.50	7 km, 2 h	22.00
Regional mental health service	Contact	134.80	10 km, 3 h	31.50
Regional addiction service§	Contact	134.80	10 km, 3 h	31.50
Mental hospital – out-patient	Consult	95.70	12 km, 4 h	40.40
Mental hospital – day care	Contact	135.90	12 km, 4 h	40.40
Mental hospital – in-patient	Day	271.80	8 h	72.20
General hospital – out-patient	Consult	60.90	7 km, 3 h	31.00
General hospital – day care	Contact	248.90	7 km, 4 h	40.00
General hospital – in-patient	Day	366.30	8 h	72.20
Teaching hospital – out-patient	Consult	108.70	12 km, 3 h	31.80
University hospital – day care	Contact	248.90	12 km, 4 h	40.90
University hospital – in-patient	Day	517.40	8 h	72.20
Private practice psychotherapist	Session	82.60	5 km, 2 h	21.60
Social worker¶	Contact	48.90	7 km, 3 h	31.00
Physiotherapist	Contact	24.70	1.8 km, 2 h	21.10
Home care	Hour	33.40	0 km, 0 h	0.00
Informal care (family, friends)**	Hour	9.00	0 km, 0 h	0.00

*Integral unit cost prices (28).
†Based on average distances (in km) and travel + waiting + treatment times (in h) for receiving treatment [cf. (28)].
‡Costs of 1 km = US$ 0.17, parking = US$ 2.70, 1 h time = US$ 9.00 (28).
§Valued as out-patient mental health services.
¶From DFL 77.00 in 1993, converted into dollars, indexed for 2003 (cf. http://www.cbs.nl) and rounded.
**Valued as domestic help [cf. (28)].

Table 2. Indirect non-medical costs: average cost of production losses for persons in paid employment (in US$ per h) by sex and age*

Age (year)	Men	Women
15–24	22.27	21.82
25–34	35.59	32.48
35–44	41.41	36.52
45–54	49.32	37.19
55–64	51.98	39.58
65+	51.98	39.58

*According to the friction costs method [cf. (28)].