COST OF SICKNESS ABSENCE DUE TO CHRONIC DISEASES IN THE NETHERLANDS

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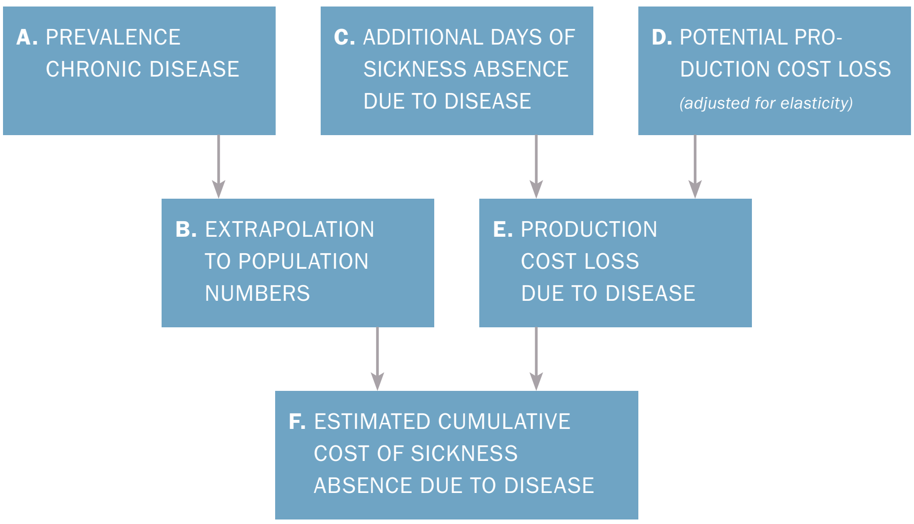
innovation for life

The cost of sickness absence is high for employers, insurance companies and society, as well as for workers themselves. In times of crisis and resource scarcity – both at company and governmental level – it becomes ever more important to shed light on the diversity of methods and resulting cost outcomes. This is exactly what this factsheet aims to provide. First, it gives a brief overview of the most prominent methods for calculating sickness absence costs, and discusses the most important differences between them. Second, it introduces a new approach, linking the Netherlands Working Conditions Survey (NEA; Koppes *et al*., 2009) with personal income data from Statistics Netherlands (CBS; van den Brakel & Moonen, 2007). Overall, this factsheet strives to be a useful overview for policy makers, (occupational) health professionals, and scientists for modeling health impact assessments and developing interventions.

FIGURE 1. General framework of cost of sickness absence estimations



METHODOLOGICAL OVERVIEW

The general method to estimate the burden of disease on society in economic terms is summarized in Figure 1. Differences between applications are primarily due to different indicators and data sources used to measure each of the depicted components.

In the literature, one distinguishes between two prominent methodologies: First, cost of sickness absence studies frequently apply the **Human Capital Approach**. According to this approach, potential loss of productivity is quantified in terms of forgone earnings, assuming full productivity (Hodgson, 1994). Second, more recently developed is the **Friction Cost Method**, estimating the production cost loss of sickness absence only during the so-called friction period. This period is defined as the number of days needed to restore the initial production level (Koopmanschap *et al*., 1995). Additionally, the Friction Cost Method incorporates elasticity, usually fixed at 80% of the earned salary. This means that one month of absence from work corresponds to 80% actual production loss for that month, and that 20% of the production has not been lost, for example due to internal labor reserves (Hutubessy *et al*., 1999).

For the Dutch situation, the cost of sickness absence due to chronic diseases was previously analyzed by **Steenbeek *et al*. (2010)** and by **de Graaf *et al*. (2011).**

Steenbeek *et al.* used one overall estimate of the *potential daily production cost loss per employee* of € 230, including costs of replacement and re-integration, and not adjusted for a person's actual salary, gender, or age (Steenbeek *et al.*, 2010). De Graaf *et al*. used the Friction Cost Table published by Hakkaart-van Roijen (2010, costs of replacement and re-integration not included), which stratifies salaries, and thus potential production cost losses, by gender and age, and incorporates 80% elasticity.

In this factsheet we introduce a **newly developed TNO-approach** using *each employee's personal income* to measure the potential production cost loss due to chronic diseases. Naturally, this indicator is stratified by gender and age, as well as by chronic disease and various other potentially relevant variables. The results of the above described approaches are summarized in Table 1.

TABLE 1. A comparison of different approaches of the cumulative cost of sickness absence in the Netherlands in 2008 (€ Million/year).

CHRONIC DISEASE	Steenbeek *et al.* (2010)	De Graaf *et al.* (2011)	Human Capital Approach using table-salaries from Hakkaart-van Roijen *et al.* (2010) [1]	Friction Cost Method using table-salaries from Hakkaart-van Roijen *et al.* (2010) [1]	Friction Cost Method using individual personal incomes (TNO approach introduced and applied here) [1,2]
Psychological complaints/diseases	€ 1.153	€ 2.697	€ 1.059	€ 847	€ 480
Respiratory diseases	€ 525	€ 1.001	€ 213	€ 170	€ 110
Cardiovascular diseases	€ 723	€ 68	€ 620	€ 496	€ 303
Digestive diseases	€ 710	€ 576	€ 511	€ 409	€ 241
Diabetes	€ 398	€ 252	€ 270	€ 216	€ 131
Musculoskeletal disorders (arms/legs/back/neck)	€ 2.416	€ 1.748	€ 1.774	€ 1.419	€ 858
Migraine	€ 658	€ 32	€ 264	€ 212	€ 133
Vision- or hearing-diseases	€ 355	€ 79	€ 0	€ 0	€ 0
Life-threatening diseases (e.g. cancer, AIDS)	€ 493	€ -- [3]	€ 519	€ 415	€ 259
Other disorders (incl. epilepsy and skin-diseases)	€ 1.252	€ 2.091	€ 949	€ 759	€ 461
Any disorder (physical or psychological)	€ 8.683	€ 7.225	€ 5.358	€ 4.286	€ 2.660

1) Results in these columns are based on the NEA-2008 data regarding chronic diseases and sickness absence.
2) Results in this column are based on the matched individual personal incomes (CBS; van den Brakel & Moonen, 2007).
3) Life-threatening diseases were not specifically addressed in De Graaf et al. (2011).

TNO-APPROACH APPLIED TO NEA-DATA ON SICKNESS ABSENCE AND CBS-DATA ON PERSONAL INCOME

The TNO-approach we introduce in this factsheet was applied to the NEA-2008 data in combination with the CBS-2008 data on personal income, and is summarized in detail in Table 2. Columns E and F follow straightforward from the earlier columns as indicated in Table 2, but columns A through D result from a number of procedures and decisions which we discuss in the next paragraphs.

PREVALENCE

For column A, the prevalence of each disease in the Netherlands, we used the NEA-2008 data (Koppes *et al*., 2009). The NEA is a yearly survey under a representative sample of the Dutch workforce aged 15-64 years, excluding self-employed. This is different from e.g. de Graaf *et al*. (2011), who also included self-employed workers in their research and subsequent calculations. We did not make any selection of employees, thus also including those with a small contract (<12 hours/week).

POPULATION

In column B, we extrapolated the prevalence of column A to the number of employees with each chronic disease in the Netherlands, by using population weights. In collaboration with the CBS, and using population based information (Polisadministratie), it is known for each individual NEA respondent, how many persons in the population he or she represents (Koppes *et al*., 2009). Although we used individual population weights to calculate column B, this is tantamount to multiplying the prevalence in column A with 6.834.000.

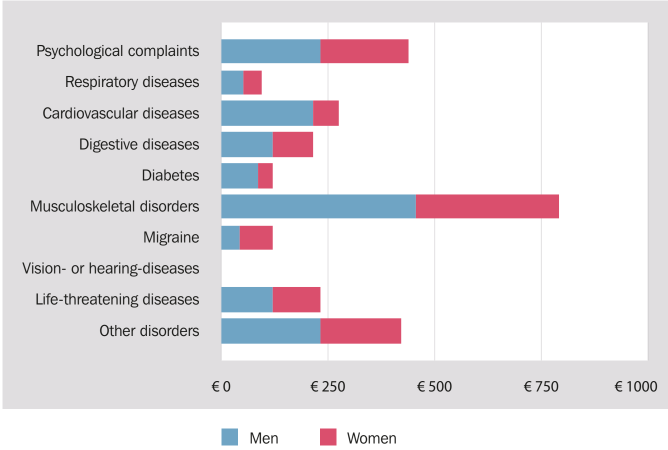
SICKNESS ABSENCE

In column C, the additional days of sickness absence due to each chronic disease are deduced from the NEA-2008 data, using linear multiple regression analyses. Number of sickness absence days (excluding pregnancy-related absence) was the dependent variable, the specific chronic disease the main predictor, and gender, age, education, living situation, urbanization and comorbidity served as covariates. Using regression analysis to this end is similar to de Graaf *et al*. (2011), although they used a different estimator (generalized linear model). The correction for the type and number of covariates is nearly similar in both approaches. More important is a different operationalization of sickness absence. The NEA uses the number of physically absent working days in the previous 12 months, whereas de Graaf et al. (2001) asked: 'During the past 30 days, how many days were you completely unable to work', and additionally: 'During the past 30 days, how many days were you partially unable to work', and operationalized sickness absence as the number of days completely absent, combined with half the days partially absent (and recalculated from 30 days to one year). Steenbeek *et al*., 2010, also used the NEA-2008 data, but operationalized the number of extra days absent due to each specific chronic disease as the number of days the group with that disease was absent, diminished with the number of sickness days in the subgroup with no chronic disease at all (4,9 days), not corrected for covariates. This led to an overestimation of sickness absence days per chronic disease.

POTENTIAL PRODUCTION COST LOSS

In column D, we present the potential daily production cost loss. The Human Capital Approach uses 100% of the daily income, while the Friction Cost Method uses 80% of the daily income, and restricts itself to the friction period. In the newly developed TNO method, we also used 80% of the daily income and a friction period of 160 days (Hakkaart-van Roijen, 2010). Our newly developed TNO approach is unique in the sense that the production cost losses are based on the matched individual personal income of each respondent. The source of the daily personal income of each particular respondent was the Dutch income tax authority, and was collected by the CBS (van den Brakel & Moonen, 2007). We used ‘personal income’. The yearly personal income was matched to the individual NEA-records using a registration identification number conforming to the Dutch laws on privacy protection. Next, the yearly income was recalculated to the income earned on each working day. For full-time workers, the yearly income was divided by 215 working days per year, the average number of full-time working days in the Netherlands (excluding weekends, private and national holidays, and other days off; CBS Web magazine, August 28, 2006). For part-timers, the yearly personal income was proportionally divided by fewer days. We used each individual income figure in all calculations. However, in column D, we summarize these figures as the mean of the subgroups defined by each chronic disease. The overall mean working day production cost loss, adjusted for elasticity, among the NEA-2008 respondents was € 152. This amount is lower than used by Steenbeek *et al*. (2010), € 230, and De Graaf *et al*. (2011) € 234. In most practical applications, however, the individual income figures will not be known. In those cases, one may use the mean figures on potential daily production cost loss for each particular chronic disease, corrected for elasticity, as summarized in column D in Table 2.

FIGURE 2. Estimated cumulative cost of sickness absence in the Netherlands due to specific chronic diseases by gender. Amounts are per year in € Million.



PRODUCTION COST LOSS DUE TO DISEASE

Columns E and F follow from earlier columns as indicated (E = C * D, and F = B * E / 106). In practice, we calculated all numbers of individual respondents and without any rounding errors to the end, so there may be small deviations from multiplying the figures as presented in Table 2.

COST OF SICKNESS ABSENCE

Column F presents the final result of the newly developed approach, also summarized in Figure 2, broken down by gender, comprising 3.679.000 male employees (53,8%) and 3.156.000 female employees (46,2%). It reveals that there was a production cost loss of € 858 million due to musculoskeletal disorders, and of € 480 million due to psychological complaints among the entire Dutch population of working employees in 2008.

TABLE 2. Composition of the cumulative cost of sickness absence in the Netherlands in 2008 (€ Million/year) using personal income data from CBS-2008, individually matched to the NEA-2008 data.

CHRONIC DISEASE	Prevalence (including respondents working <12 hours/ week) 1)	Employees in the Netherlands (x 1.000) 2)	Extra days of sickness absence due to disease (per person per year) 3)	Potential production cost loss (per person per day) (mean: € 152) 4)	Production cost loss due to disease (per person per year) 5)	Estimated cumulative cost of sickness absence in the Netherlands due to disease (per year, € Million) 5)
	A	B = A * 6.834	C	D	E = C * D	F = B * E / 10^6
Psychological complaints/diseases	2,5%	171	21,4	€ 132	€ 2.812	€ 480
Respiratory diseases	5,3%	359	2,1	€ 148	€ 306	€ 110
Cardiovascular diseases	2,6%	179	10,1	€ 167	€ 1.696	€ 303
Digestive diseases	3,5%	243	7,0	€ 141	€ 993	€ 241
Diabetes	2,1%	140	5,7	€ 163	€ 931	€ 131
Musculoskeletal disorders (arms/legs/back/neck)	15,9%	1.083	5,3	€ 148	€ 792	€ 858
Migraine	5,6%	380	2,5	€ 141	€ 351	€ 133
Vision- or hearing-diseases	4,1%	281	0,0	€ 155	€ 0	€ 0
Life-threatening diseases (e.g. cancer, AIDS)	0,8%	56	29,1	€ 160	€ 4.654	€ 259
Other disorders (incl. epilepsy and skin-diseases)	6,9%	474	6,7	€ 144	€ 972	€ 461
Any disorder (physical or psychological)	36,2%	2.544	7,0	€ 149	€ 1.045	€ 2.660

1) NEA-2008 respondents were allowed to give multiple answers; so the same person may be included in several rows.
2) NEA-2008 respondents weighted with their individual population weight.
3) Result of regression analyses of the NEA-2008 data; with workdays of sickness absence as dependent variable; the specific chronic disease as predictor; and gender, age, education, living situation, urbanization and comorbidity as covariates.
4) The daily production cost loss is adjusted for elasticity (80%). Source: matched individual personal incomes (CBS; van den Brakel & Moonen, 2007).
Although the model uses the individual personal income to the end, this Table gives the averages over persons with each specific chronic disease.
5) Adjusted for 80% elasticity.

CONCLUSION

The differences in cost outcomes among the cited approaches are determined by the following factors:

- The choice to only include salary costs as measure of potential production cost loss.
- The definition of the diverse chronic diseases such as e.g. psychological complaints.
- The estimate of the prevalence of the various chronic diseases.
- The calculation techniques and estimates used to measure the additional days absent due to each chronic disease.
- The definition and hence the size of the population to which the sample results are extrapolated.
- Small differences reside in the method of extrapolation. De Graaf *et al*. (2011) extrapolated to 7.501.000 working persons in the Netherlands. Steenbeek *et al*. (2010) extrapolated to the entire working population of 7.714.000. In the approach used in this factsheet, we used each respondent's individual population weight to extrapolate to the population, instead of using the same extrapolation-factor for each respondent. In practice, this procedure resulted in extrapolating to a population number of 6.834.000; so much less than in the other approaches. Excluded were the non-employed and the self-employed.

Taking all together, the newly developed TNO- approach introduced and applied here, results in a lower estimated cost of sickness absence due to chronic diseases than found in the literature so far. This approach uses empirically based personal income as proxy for potential production cost loss, individually matched to the data on sickness absence and thus draws a realistic picture of the sickness absence costs due to chronic diseases among employees in the Netherlands.

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