Dutch diabetes prevalence estimates (DUDE-1)
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Abstract
Background: Recent decades have seen a constant upward projection in the prevalence of diabetes. Attempts to estimate diabetes prevalence rates based on relatively small population samples quite often result in underestimation. The aim of the present study was to investigate whether the Dutch diabetes prevalence estimate of 930 000 for 2013, based on a relatively small sample, still holds true when a larger population is studied using actual prevalence data.

Methods: Data were collected from 92 primary care groups, including the total number of people with and without diabetes in 2013. Patients with diabetes were identified using the International Classification of Primary Care codes T90.02 (diabetes mellitus type 2; T2DM), T90.01 (diabetes mellitus type 1) and T90 (diabetes mellitus). Prevalence data were compared with previous estimates made in 2009. Diabetes prevalence was estimated using linear extrapolation.

Results: Complete data were available from 67 (73%) care groups, which together provided care for 7 922 403 subjects; 431 396 patients were coded as having diabetes, of whom 406 183 were coded as having T2DM. Based on these results, the extrapolated Dutch diabetes prevalence was 914 387 (5.45%).

Conclusions: The results show that the previous estimate (reported in 2009), which was based on data collected in 2007, resulted in a <2% (~16 000) overestimation in diabetes prevalence in 2013 compared with the analysis presented. These results indicate that no upward adjustment in Dutch diabetes prevalence estimates is necessary. Repeated large-scale monitoring can help develop more accurate prevalence estimates and improve future prevalence predictions.

Keywords: diabetes mellitus, prevalence, The Netherlands.

Introduction
Long-term diabetes prevalence projections had often been inaccurate and nearly always needed upward adjustment after some time.1 Whether this trend will continue remains questionable because, in some countries (like the US), a plateauing of prevalence is observed.2

Significant findings of the study: Based on data of 8 million inhabitants (half the total population) of The Netherlands, the prevalence of diabetes was approximately 5.45% in 2013.

What this study adds: The estimate of the Dutch diabetes prevalence made in 2007 for 2013 in The Netherlands is in agreement with the actual prevalence.
Prevalence predictions are needed to facilitate, among other things, healthcare planning. Therefore, changes in estimates can have considerable consequences. Constant readjustment of estimates, preferably based on larger population samples, will facilitate more reliable planning. The InEen initiatives, concentrating on improving primary care through shared-care groups, enable data collection on a larger scale. These initiatives allow the estimation of an interim score of the 2025 projection of the total Dutch diabetes prevalence in 2013 and provide information as to whether a readjustment in this projection should be made.

The aim of the present study was to assess the prevalence of diabetes in The Netherlands in 2013 based on data made available by general practices providing care for a large part of the Dutch population in order to determine whether readjustments of predictions should be made.

Methods
In 2014, all primary care physicians cooperating in care groups were invited to deliver data on the total number of people treated within the care group and the number of patients known to have diabetes in 2013 (identified using the International Classification of Primary Care [ICPC] codes T90.02 [diabetes mellitus type 2; T2DM], T90.01 [diabetes mellitus type 1; T1DM] and T90 [diabetes mellitus; DM]). In The Netherlands, all patients have a primary care physician and most physicians are organized into care groups. A care group is responsible for the organization and delivery of, among other things, diabetes care within the primary care setting in a specific region.

Data were collected by InEen, the Dutch primary care organization supporting care groups (see http://inee.nl/, accessed 1 July 2015). InEen had contact information for 138 potential care groups. The data were gathered from general practice care groups and were delivered either by a regional data center or directly through a website (https://transparanteketenzorg.nl).

Only care groups that provided information on both their total patient population and their diabetes population, including information on type of diabetes (all three ICPC codes), were included in the analyses. No secondary source of information was used to systematically double-check the reliability of the information delivered. The prevalence for the entire Dutch population was calculated by linear extrapolation. The analysis presented herein is the first report from an ongoing project entitled the Dutch Diabetes Estimates (DUDE) initiative.

Results
Overall, 92 of the 138 potential care groups (67%) provided data. Data from 25 care groups were regarded as incomplete, because not all data concerning all three ICPC codes were provided and therefore these care groups were excluded from further analyses. The remaining 67 care groups (73%), provided care for 7,922,403 subjects. Table 1 provides an overview of the estimated prevalence of diabetes for 2013. According to these results, the prevalence of T2DM in The Netherlands in 2013 was 5.13%. The total Dutch population in 2013 was 16,792,320 (http://statline.cbs.nl/statweb/, accessed 1 July 2015), which would translate into a countrywide prevalence of 914,000 patients with known diabetes, of whom 861,000 were registered as having T2DM.

Discussion
The estimated prevalence of diabetes in 2013 was 5.45%, and 5.13% specifically for T2DM. This estimate was based on a sample of 7,922,403 Dutch subjects, which constitutes nearly half the Dutch population. These results show that the relative difference between the previous Dutch diabetes prevalence estimate (930,000) and the prevalence found in the present study (914,000) is <2%, which confirms that the earlier estimate was sufficiently reliable and that an upward adjustment in diabetes prevalence is, at least at present, unnecessary.

According to the International Diabetes Federation, the estimated number of patients with diabetes in Europe in 2013 is 56.3 million (6.2%) from a total population of 907 million, and varies from 2.4% to 14.8% among countries. Looking at countries surrounding The Netherlands, the prevalence of diabetes has varies from 4.70% in Norway to 8.27% in Germany. The prevalence of diabetes prevalence in Belgium, Finland, France, the UK, Sweden, and Denmark is 4.77%, 5.78%, 5.42%, 4.92%, 4.69%, and 6.29%, respectively.

Because there was no quickening in the increase in the rate of increase of diabetes prevalence in The Netherlands for 2013, it could mean that the estimate of 1.3 million patients with diabetes in 2025 in The Netherlands is a

<table>
<thead>
<tr>
<th>Table 1</th>
<th>Prevalence of diabetes in The Netherlands in 2013</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. care groups</td>
<td>67</td>
</tr>
<tr>
<td>No. patients with DM</td>
<td>431,396</td>
</tr>
<tr>
<td>No. patients with T2DM</td>
<td>406,183</td>
</tr>
<tr>
<td>No. people in registries</td>
<td>7,922,403</td>
</tr>
<tr>
<td>No. inhabitants of NL</td>
<td>16,792,320</td>
</tr>
<tr>
<td>Prevalence of DM in NL</td>
<td></td>
</tr>
<tr>
<td>Absolute</td>
<td>914,387 (95% CI 911,733–917,040)</td>
</tr>
<tr>
<td>Relative (%)</td>
<td>5.45 (95% CI 5.43%–5.46%)</td>
</tr>
<tr>
<td>Prevalence of T2DM in NL</td>
<td></td>
</tr>
<tr>
<td>Absolute</td>
<td>860,945 (95% CI 858,366–863,524)</td>
</tr>
<tr>
<td>Relative (%)</td>
<td>5.13 (95% CI 5.11–5.14)</td>
</tr>
</tbody>
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realistic growth estimate, or possibly even an overestimation. However, this still means a substantial increase in diabetes prevalence and emphasizes the need for a master plan aimed at both effective preventive strategies, such as more emphasis on the importance of healthy living and changing unhealthy lifestyles by changing exercise patterns and eating habits, and other approaches to diabetes care as part of integrated care initiatives.\(^5\) Whether we will observe a plateauing in the diabetes prevalence, as has been observed in the US, will need constant assessment and evaluation of available data.\(^2\)

A strength of the present study is the availability of data on half the Dutch population. Furthermore, our estimate is not far from the estimate made by the International Diabetes Federation of 5.24%.\(^4\) The methodology of the present analysis has some limitations. The data provided were not double-checked or validated. Furthermore, patients not known to have diabetes were not included in the study. Still, the selection of patients for this analysis was essentially the same as made by the RIVM, thus allowing, in our opinion, a reliable comparison with RIVM estimates.\(^3\) Furthermore, care groups that provided data could have applied different case finding methods compared with care groups that did not provide data. We do not know whether these general practitioners have a different prevalence of diabetes in their population. We expect that this would probably not have had a great impact on the results and only a minority of general practitioners are not organized in care groups. The results of the present study are dependent on the quality of registration of diabetes. However, because not being properly registered means no payment for diabetes-related care, there is a significant financial incentive for proper registration. Furthermore, no further detailing of type of diabetes is possible other than T1DM and T2DM, because, for example, latent autoimmune diabetes in adults (LADA) or maturity onset diabetes of the young (MODY) are not specifically registered. Finally, differences between the total number of patients with diabetes and T2DM is approximately 53 000; it is likely that these 53 000 individuals will mostly have T1DM. Estimates regarding the prevalence of T1DM in The Netherlands range from 75 000 to 125 000 (http://www.nationaalompas.nl/gezondheid-en-ziekte/ziekten-en-aandoeningen/endocriene-voeding-en-stofwisselingsziekten-en-immuniteitsstoornissen/diabetes-mellitus/omvang/, accessed 15 January 2016), although reliable estimates reported in peer-reviewed journals are not available as far as we know. At the same time, we do know that, for example, in children the incidence of T1DM has doubled in the past three decades in The Netherlands,\(^6\) which has recently been confirmed in a nationwide study.\(^7\) This strengthens the idea that 53 000 is low. Of course, there may still be underreporting through the primary care sources used in the present study, with incomplete registration in the primary care electronic systems of patients with T1DM treated in secondary care. Alternatively, patients may be misclassified within the present registration.

Other studies combining data from primary and secondary care in various regions, and using other resources, could be used in future studies to increase the validity of the findings. Alternatively, a national diabetes registry, comparable with the one in Sweden (https://www.ndr.nu/#/english, accessed 01 July 2015), could result in yearly and reliable prevalence estimates.

In conclusion, the 2013 Dutch diabetes prevalence is approximately 5.45% and this figure is largely comparable to an estimate for 2013 made by the RIVM based on data up to 2007. Possibly, no further readjustments in estimated diabetes prevalence need to be made.

**Disclosure**

None declared.

**References**