

# Trends in the use and costs of intermittent urinary catheters in the Netherlands from 1997 to 2018: A population-based observational study

Sophie A. Berendsen MD  | Tess van Doorn MD  | Bertil F. M. Blok MD, PhD 

Department of Urology, Erasmus MC, Rotterdam, The Netherlands

## Correspondence

Sophie A. Berendsen, MD, Department of Urology, Erasmus MC, Dr. Molewaterplein 40, 3015 GD Rotterdam, The Netherlands.  
Email: s.berendsen@erasmusmc.nl

## Abstract

**Aim:** To obtain insight into the use and costs of clean intermittent catheterization (CIC) in the Netherlands from 1997 to 2018.

**Methods:** For this population-based study, data on the use and costs of disposable catheters were provided by the Drug Information Project database. This database contains information about the Dutch insured population, which increased from 9.9 to 17.1 million persons between 1997 and 2018 (64%–100% of the Dutch population). The following trends were evaluated: (1) CIC users, (2) distribution of users by gender and age-group, (3) distribution of users by neurogenic and non-neurogenic cause for CIC, (4) total costs, and (5) costs per user. Total users are adjusted for the Dutch population. Costs are corrected for inflation and expressed in euros.

**Results:** Extramural use of CIC increased from 14,258 users in 1997 to 45,909 users in 2018. CIC users per 100,000 persons nearly tripled from 92 users to 267 users. Male CIC users almost quadrupled from 92 to 334 per 100,000 insured persons, whereas female users more than doubled from 91 to 201 per 100,000 insured persons. In 2018, 49% of the users had a non-neurogenic cause for CIC. Total costs increased from 16.4 million euros in 1997 to 74.6 million euros in 2018. Costs per user rose from 1151 to 1624 euros (41.1%).

**Conclusions:** The use and costs of disposable catheters in the Netherlands increased substantially over the past two decades. Non-neurogenic bladder patients represent 49% of the population on CIC, which has not been described before in the literature.

## KEYWORDS

CIC, clean intermittent catheterization, health-care expenditure, neurogenic bladder, prevalence, underactive bladder, urinary retention

## 1 | INTRODUCTION

Due to exponential population growth, there is an ongoing increase in health-care use and expenditure. The consequential rising costs and environmental waste are a widespread concern. Raising awareness and knowledge can help to identify potential cost and waste reduction opportunities. A potential opportunity for this reduction is the use of catheters for urinary drainage. The global market size for urinary catheters was valued at 3.4 billion USD in 2015, with a gradual growth in future perspective.<sup>1</sup> Around 60% of this global market is consumed by intermittent disposable urinary catheters.

Intermittent catheterization encompasses emptying of the urinary bladder by a catheter that is removed after urine is discharged, mostly at regular intervals, 4–6 times per day. Clean intermittent catheterization (CIC) is the treatment of choice for chronic urinary retention or patients with postvoid residual urine due to neurogenic or non-neurogenic causes.<sup>2</sup> Compared with indwelling catheters, CIC reduces the risk for complications like catheter-associated urinary tract infections (CA-UTIs), bladder stones, and renal deterioration, while increasing the quality of life due to more independence, mobility, regaining the possibility of sexual activity, and decreasing catheter-associated pain.<sup>3</sup> If patients are able to catheterize themselves, clean intermittent self-catheterization (CISC) is preferred due to the lower risk of CA-UTIs. CIC was introduced in 1972 as a nonsterile method of catheterization without additional lubricant or sterilizing solution.<sup>3</sup> CIC was accepted very gradually by patients and health-care providers and in the 90s adopted by relevant guidelines of professional organizations like the European Association for Urology and the American Urological Association.<sup>4,5</sup> The use of disposable polyvinylchloride (PVC) catheters became the norm and the use of reusable catheters was discouraged until now.<sup>6–8</sup> At this moment, in Europe only disposable catheters are reimbursed and a reusable, Conformité Européenne-marked, catheter is not available. This is in contrast to non-European high-income countries like Australia, Canada, and Japan, where the reuse of catheters is relatively common.<sup>9</sup> Consequently, the costs and environmental burden of disposable intermittent catheters in Europe, including the Netherlands, are possibly relatively high, but numbers are not available. A worrisome consequence of the preferential use of disposable catheters is the increase in nonbiodegradable plastic waste generated since the introduction of CIC. It was estimated that neurogenic bladder patients in the United States use up to 39 million kilograms of nonbiodegradable waste due to disposable catheters annually.<sup>10</sup> Dutch patient instruction folders on CIC, endorsed by the Dutch Society for Continence Nurses

and patient advocate organizations, reported in 2014 that there are 13,000 CIC patients in the Netherlands.<sup>11</sup>

This study investigated the trends of extramural (non-hospitalized and non-institutionalized) CIC use by neurogenic and non-neurogenic bladder patients, including the associated costs and environmental burden in the Netherlands over the past 21 years (1997–2018) with the use of combined national databases. Our hypothesis was that the number of CIC users increased over the years, which led to increasing costs and nonbiodegradable plastic waste. Furthermore, we hypothesized that a large amount of CIC users had urinary retention due to non-neurogenic causes. This group of non-neurogenic bladder patients has virtually not been described in the literature, are not organized in patient advocate groups, and are under the radar for governmental lobbyism.

## 2 | METHODS

### 2.1 | Study design

For this retrospective, database study, data were requested from the Drug Information System (Genees-en hulpmiddelen Informatie Project [GIP]) of the National Health Care Institute in the Netherlands (Zorginstituut Nederland [ZIN]). This database contains information on expenditure of extramural (non-hospitalized and non-institutionalized) medication and medical devices prescribed by general practitioners and physicians, and are reimbursed under the Health Care Insurance Act in the Netherlands, which was introduced in 2006. Before 2006, the GIP database only contains information about insured persons under the public Health Insurance Law (Ziekenfondswet). Currently, the database covers the years 1997–2018 and is based on the number of prescriptions per patient per year. All data used were obtained and handled according to the Dutch privacy laws.

The following time trends were evaluated per year:

- (1) Number of CIC users from 1997 to 2018.
- (2) Distribution of CIC use among different gender and age groups from 1997 to 2018.
- (3) Distribution of CIC use among neurogenic and non-neurogenic bladder patients from 2012 to 2018.
- (4) Costs of disposable intermittent catheters and urine drainage bags from 1997 to 2018.
- (5) Costs of disposable intermittent catheters and urine drainage bags per individual CIC user from 1997 to 2018.

In the Netherlands, all declarations of medical devices by pharmacists or medical devices suppliers are

coded through ZI-numbers or Generic Product code for devices (Generieke Product codes Hulpmiddelen: GPH). ZI-numbers are published in the G-Standaard by Z-index, a database containing product information of medicines and medical devices that are dispensed or used in the Dutch health-care system.<sup>12</sup> GPH codes are managed by Vektis, a noncommercial database that is responsible for relaying pseudonymised data from health-care insurers to the National Healthcare Institute.<sup>13</sup> Health insurance companies share these declarations with the GIP database. The GIP database links the ZI-numbers and GPH-codes to a corresponding ISO9999-code, which is translated into a classification. All urinary catheters and accessories are classified under the monitor code “A1535 Catheters” and are subcategorized into different types of catheters by an ISO-code (e.g., disposable intermittent catheters is ISO92406).

## 2.2 | Data analysis

For this study, all links between ZI-numbers/GPH-codes and ISO-codes were analyzed and checked by visual control of the product names. In addition, all ZI-numbers were checked with the product information in Bever-Online, a medical devices database from Nigella IT.<sup>14</sup> Improper links between the ZI-numbers, GPH-codes, and ISO-codes, or incorrectly classified products, were removed, which resulted in an improved classification for medical devices which had been incorrectly classified. All individual catheter users were linked with a unique pseudonymised number to specific ISO codes. After reclassification of the medical devices, we categorized all CIC users for neurogenic or non-neurogenic causes. For this classification, we used the data of combined diagnosis and treatment codes (DBC code or Diagnose Behandeling Combinatie code) in the Netherlands from 2012 to 2018. The modified DBC code (DOT or Dbc On the way to Transparency) was introduced on January 1, 2012, and is a code based on diagnosis and treatment for individual patients. In the Netherlands, hospitals are reimbursed for patients based on the DBC codes which are maintained in the DBC-information system (DIS) by the Dutch Healthcare Authority (Nederlandse Zorgautoriteit; NZA). A predefined list of DBC codes was made, and every DBC code was labeled for neurogenic or non-neurogenic cause (Supporting Information Appendix A). There are no DBC codes available in the GIP database before 2012. Every CIC user with a DBC code from this predefined list between 2012 and 2018 was categorized into a neurogenic or non-neurogenic cause. If patients had multiple DBC codes, the neurogenic overruled the non-neurogenic DBC code. Users without any DBC

between 2012 and 2018 were classified as unknown. We adjusted the development of expenditures of intermittent disposable catheters for inflation using the Consumer Price Index (CPI) published by Statistics Netherlands.<sup>15</sup> By adjusting for the general price development of consumer goods and services, the changes in the expenditures on CIC are the result of changes in volume and specific price movements. All expenditures are expressed in prices of 2018 in euros.

## 3 | RESULTS

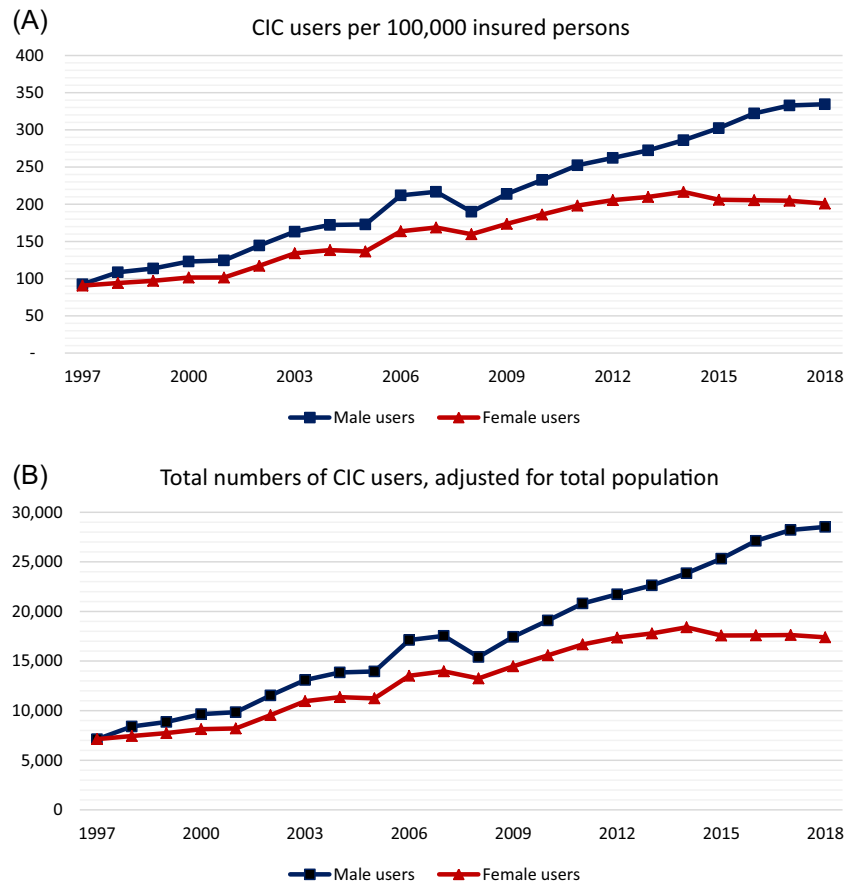
Before 2006, the GIP database only contained data on the insured population under the public health insurance law (Ziekenfondswet), which increased from 9.9 million individuals (64% of the Dutch population) in 1997 to 10.2 million (63% of the Dutch population) in 2005. The remaining population was insured by private health-care insurers and not included in the GIP database. In 2006, the Dutch health insurance act was implemented. Since then, data were available for the total insured population, which increased from 16.2 million (99% of the Dutch population in 2006) to 17.1 million (100% of the Dutch population in 2018). As the insured population between 1997 and 2005 was only 63%–64% of the total Dutch population, total numbers of CIC users were calculated using population data over the years 1997–2018 of Statistic Netherlands (Centraal Bureau Voor de Statistiek [CBS]).<sup>16</sup>

### 3.1 | CIC users

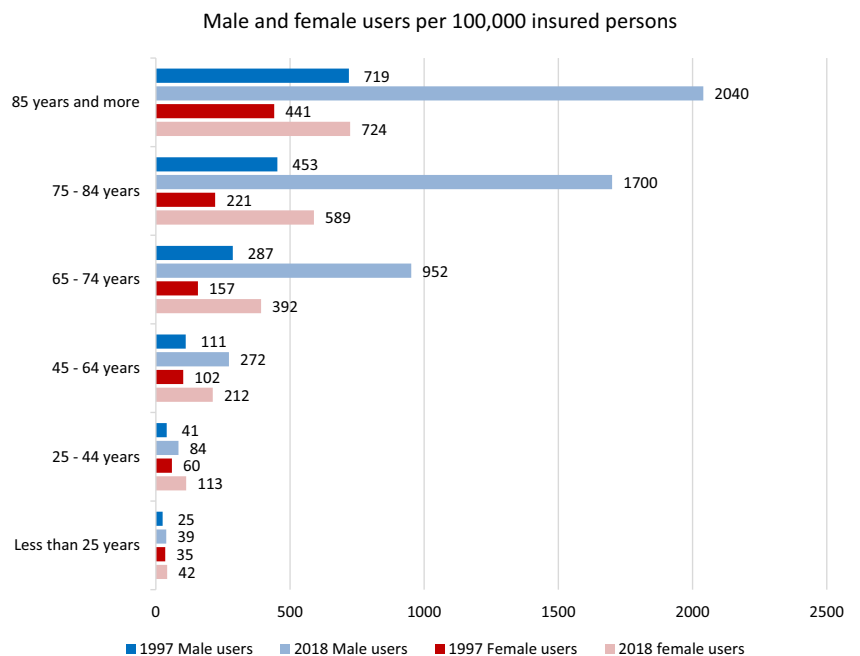
Between 1997 and 2018, the number of CIC users increased from 92 per 100,000 insured persons in 1997 to 267 per 100,000 insured persons in 2018. During this 21-year period, the number of male CIC users almost quadrupled from 92 to 334 per 100,000 insured persons, female users more than doubled from 91 to 201 per 100,000 insured persons. Male and female CIC users per 100,000 insured persons are shown separately in Figure 1A. The number of CIC users adjusted for the total Dutch population is shown in Figure 1B. Number of total users increased from 14,258 users (7117 males/7140 females) in 1997 to 45,909 users (28,518 males/17,391 females) in 2018.

Figure 2 presents the distribution of CIC use among different gender and age groups. The number of male users above 65 years old increased the most. Male users between 75 and 84 years old almost quadrupled from 453 users per 100,000 insured persons in 1997 to 1700 users per 100,000 insured in 2018. In the age-group 65–74 years old, male CIC users tripled from 287 per 100,000 insured persons to 952 per 100,000 insured persons.

**FIGURE 1** (A) Male and female CIC users (clean intermittent catheter users) per 100,000 insured persons in the Netherlands between 1997 and 2018. (B) Male and female CIC users (clean intermittent catheter users), adjusted for the total population in the Netherlands between 1997 and 2018

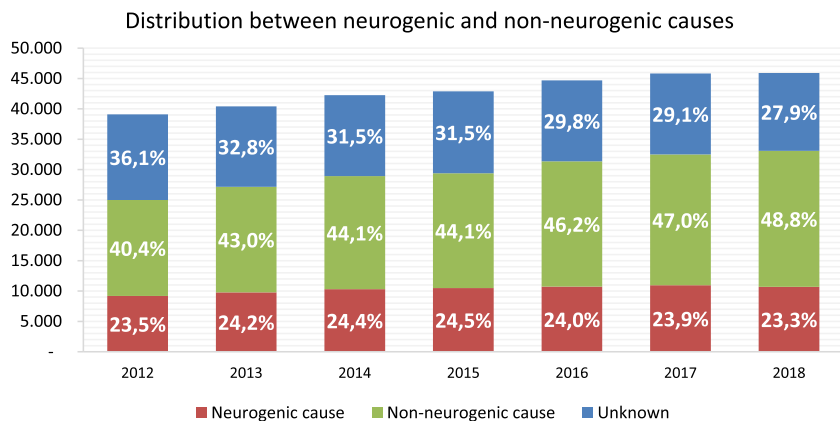


**FIGURE 2** Age distribution of male and female CIC users (clean intermittent catheter users) in 1997 and 2018

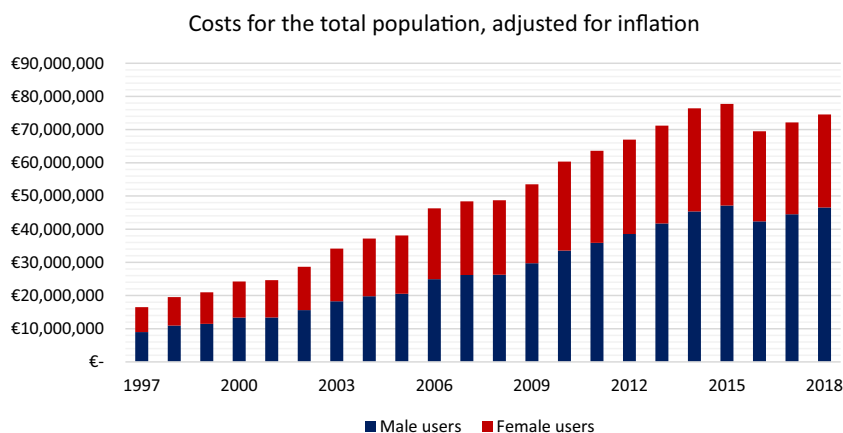


Total numbers of neurogenic and non-neurogenic patients on CIC can be seen in Figure 3. CIC was mostly performed by patients with a non-neurogenic cause, the numbers increased from 40.4% (13,395 users) in 2012 to 48.8% (19,046 users) in 2018. The

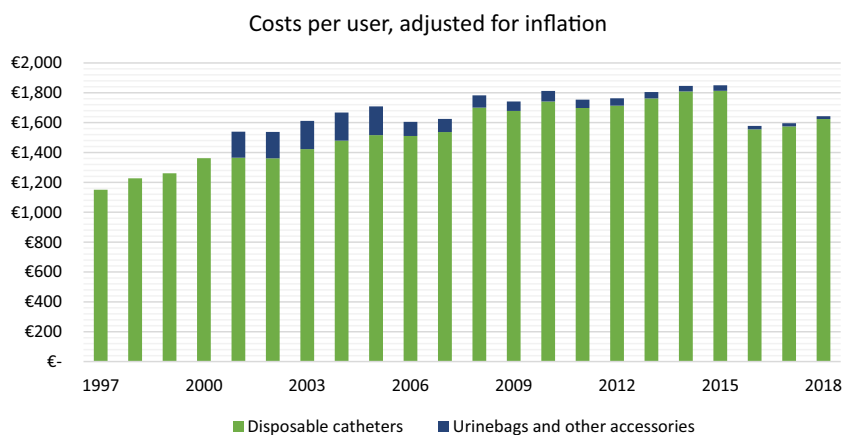
percentage of neurogenic bladder patients on CIC remained stable (23.5%—7779 users to 23.3%—9090 users). The underlying cause of CIC was unknown in 27.9%—36.1% of the users, due to unknown DBC codes.



**FIGURE 3** Distribution between neurogenic and non-neurogenic causes for CIC (clean intermittent catheter users) in the Netherlands between 2012 and 2018



**FIGURE 4** Total costs of intermittent catheterization for male and female users in the Netherlands between 1997 and 2018, adjusted for inflation



**FIGURE 5** Costs per CIC user (clean intermittent catheter users) in the Netherlands between 1997 and 2018, adjusted for inflation

### 3.2 | Costs of CIC

Costs adjusted for the total population can be seen in Figure 4. The total costs of disposable catheters increased from 16.4 million euros in 1997 to 74.6 million euros in 2018. Costs per user increased by 41% from 1151 euros in 1997 to 1624 euros in 2018 (Figure 5). The costs of urine drainage bags per CIC user decreased from 175 euros in 2001 to 19 euros in 2018. There were no GIP data available of urine drainage bag costs before 2001.

## 4 | DISCUSSION

This study explored the trends in use and costs of intermittent catheters in the national database of the Netherlands from 1997 to 2018. We demonstrated that CIC use nearly tripled, with the highest increase in men between 75 and 84 years old. Almost half of all users (49%) had a non-neurogenic cause as underlying disease. The total costs for CIC quadrupled to 74.4 million euros in 2018, which was 5% of the total expenditure on

outpatient medical devices in the Netherlands (1.5 billion euros).<sup>17</sup> These findings demonstrate clearly a significant increase in the use and costs of disposable catheters. The actual number of CIC users found in this study is at least three times higher than the 13,000 used in patient brochures endorsed by the Dutch Society for Continence Nurses.<sup>11</sup> The increasing trend in CIC use demonstrates the importance of this therapy for underactive bladder patients as not all patients are suitable for alternative therapies, such as sacral neuromodulation. This study reports for the first time the prevalence of CIC patients in the overall Dutch population. Other studies have tried to address the prevalence of CIC in small groups of selected neurogenic bladder patients in other countries, but could not show reliable estimations for the total population.<sup>2</sup> It is also the first study to describe the amount of CIC patients with both neurogenic and non-neurogenic causes. However, it should be taken into account that this distribution was unknown in 27.9% to 36.1%, due to unavailable DBC codes. Individuals started before 2012, without control visits in the hospital, lacked a registered DBC code, and therefore, cannot be classified into a neurogenic or non-neurogenic cause. Regarding the considerable increase of disposable catheter use in the Netherlands, several factors might have contributed. For example, the ageing population remains longer independent, and CIC can still be performed at old age. The number of users in the older population increased substantially. However, this can only explain part of the observed increase in CIC users, as users increased in every age category. A possible important explanation is the adaptation of the recommendation of the preferred use of CIC for urinary retention in the professional guidelines of urologists and rehabilitation physicians.<sup>2,4,18,19</sup> Second, (temporarily) CIC use for dilatation of urethral strictures might become more common in ageing men. Another explanation is the ongoing development of intermittent catheters resulting in higher usability. Unfortunately, detailed information about the intermittent catheters was not available. Therefore, we were not able to allocate the increased use due to specific developments in intermittent catheters, such as coated, hydrophilic catheters, or catheters with a curved tip (Tiemann or Coudé catheter).

Costs of outpatient medical devices in the Netherlands are rising, and intermittent catheters are in the top four of the highest expenditures.<sup>20</sup> Generalized to the global market size for CIC, estimated at 2.0 billion dollars in 2015, the Netherlands contributes up to 3.8% of the expenditures for disposable catheters worldwide.<sup>1</sup> These findings show an obvious increase in total costs paralleled to increased disposable catheter use. Besides this paralleled increase, costs per user gradually rose by 41%. On top

of this increase, tax rates dropped in 2001 from 21% to 6%. Remarkably, costs per user still increased in that year. This increase and the slight decrease since 2016 might be explained by changes in the purchase policy of the health insurance companies in the Netherlands. Unfortunately, the annual reimbursement agreements between suppliers and health insurance companies are confidential, so we cannot give a certain explanation for the rise in costs per user. According to Prieto et al., weekly costs for single-use hydrophilic catheters are around 36.4 euros per week, resulting in annual costs per user around 1890 euros, which is similar to the costs in this particular study (1624 euros).<sup>21</sup>

The generalizability of these results is subject to limitations. First, disposable intermittent catheters are reimbursed in the Netherlands and most European Union countries, which might be in contrast to many other non-European countries. The results are therefore difficult to extrapolate to other countries with different reimbursement policies and, consequently, less availability of CIC equipment. This is especially the case for low-income countries in Africa and Central and South-east Asia. A recent study from Tanzania described the use of intermittent catheters among hospitalized and outpatient individuals.<sup>22</sup> Only 41.7% of all patients started CIC, for the remaining patients CIC equipment was unavailable. After discharge from the rehabilitation center, most CIC patients discontinued CIC. Second, the GIP database only contains information about the number of prescriptions. No detailed information is available for the period CIC was performed, nor the number of catheters used per day. Patients on temporary CIC or low frequent use of catheters are consequently also included in this analysis (e.g., after botulinum toxin treatment or patients with urethral strictures). Thus, no precise calculation could be made on the number of catheters used annually, nor on the plastic waste generated. Assuming that two-thirds of all users are chronic users with 4–6 catheters a day, we estimate that 55 million disposable catheters are used in the Netherlands in 2018. According to Sun et al., this is equivalent to 1.3 million kilograms of nonbiodegradable waste.<sup>10</sup>

## 5 | CONCLUSIONS

Although this study is based on the total non-hospitalized and non-institutionalized Dutch population, the findings show substantial growth over the past two decades in costs, use, and therefore plastic waste. Another important observation is that almost half of the CIC users have lower urinary tract problems due to non-neurogenic causes, which have never been

described before. Only a part of the increased costs is due to a price increase from manufacturers. It seems that the main driver behind the exponential increase of CIC use is the adaptation of professional guidelines. Together with the unavailability of CIC equipment in low-income countries, and lack of evidence for the superiority of disposable catheters compared with reusable catheters, it is time to rethink the value of disposable catheters.

### CONFLICT OF INTERESTS

All authors declare that there are no conflicts of interest.

### DATA AVAILABILITY STATEMENT

The datasets analyzed during this study are available from the corresponding author on reasonable request.

### ORCID

Sophie A. Berendsen  <https://orcid.org/0000-0002-5620-3275>

Tess van Doorn  <http://orcid.org/0000-0003-1034-0263>

Bertil F. M. Blok  <http://orcid.org/0000-0001-9354-7395>

### REFERENCES

- Grand View Research. Urinary Catheters Market Size, Share & Trends Analysis Report By Product, (Intermittent Catheters, Foley/Indwelling Catheters, External Catheters), By Application, (Benign Prostate Hyperplasia, Urinary Incontinence), And Segment Forecasts, 2018–2024. <https://www.grandviewresearch.com/industry-analysis/urinary-catheters-market>. Accessed December 12, 2020.
- Blok BFM, Castro-Diaz D, Del Popolo J, et al EAU guidelines on neuro-urology; 2020. <https://uroweb.org/guideline/neuro-urology/#3>. Accessed August 31, 2020.
- Lapides J, Diokno AC, Silber SJ, Lowe BS. Clean, intermittent self-catheterization in the treatment of urinary tract disease. *J Urol*. 1972;107(3):458-461.
- Stoffel JT, Peterson AC, Sandhu JS, Suskind AM, Wei JT, Lightner DJ. AUA white paper on nonneurogenic chronic urinary retention: consensus definition, treatment algorithm, and outcome end points. *J Urol*. 2017;198(1):153-160.
- Stöhrer M, Blok B, Castro-Diaz D, et al. EAU guidelines on neurogenic lower urinary tract dysfunction. *Eur Urol*. 2009; 56(1):81-88.
- van Doorn T, Blok BFM. Multiuse catheters for clean intermittent catheterization in urinary retention: is there evidence of inferiority? *Eur Urol Focus*. 2020;6(5):809-810.
- Christison K, Walter M, Wyndaele JJM, et al. Intermittent catheterization: the devil is in the details. *J Neurotrauma*. 2018;35(7):985-989.
- Kovindha A, Mai WN, Madersbacher H. Reused silicone catheter for clean intermittent catheterization (CIC): is it safe for spinal cord-injured (SCI) men? *Spinal Cord*. 2004;42(11): 638-642.
- Håkansson M. Reuse versus single-use catheters for intermittent catheterization: what is safe and preferred? Review of current status. *Spinal Cord*. 2014;52(7):511-516.
- Sun AJ, Comiter CV, Elliott CS. The cost of a catheter: an environmental perspective on single use clean intermittent catheterization. *Neurourol Urodyn*. 2018;37(7):2204-2208.
- V&VN Continente Verpleegkundigen en Verzorgenden. Informatiefolder Zelfkatheterisatie. Vijfde druk ed:5. 2014.
- G-Standaard, databank met informatie over zorgproducten. Z-index. <https://www.z-index.nl/english>. Accessed December 18, 2020.
- Vektis. Declaratie hulpmiddelen-GPH codes. <https://www.vektis.nl/standaardisatie/standaarden/LH307-5.2>. Accessed December 18, 2020.
- BeverOnline. BeverOnline databank. Nigella IT. <https://www.nigella.nl/producten-beveronline/>. Accessed December 18, 2020.
- StatLine. 2020. Consumer Prices: price index 2015=100. <https://opendata.cbs.nl/statline/#/CBS/en/dataset/83131ENG/table?ts=1600613659151>. Accessed December 18, 2020.
- StatLine. 2019. Population; key figures. <https://opendata.cbs.nl/statline/#/CBS/en/dataset/37296eng/table?dl=3FA47>. Accessed December 18, 2020.
- GIPdatabank.nl. GIP peilingen: totale kosten (1=1.000) 2015-2019 voor extramuraal hulpmiddelen gebruik in Nederland, per hulpmiddelcategorie. [www.gipdatabank.nl/](http://www.gipdatabank.nl/)
- Groen J, Pannek J, Castro Diaz D, et al. Summary of European association of urology (EAU) guidelines on neuro-urology. *Eur Urol*. 2016;69(2):324-333.
- Blok BFM, de Kort LMO, Heesakkers JPFA, et al. Multi-disciplinaire richtlijnen neurogene blaas. [https://dwarslaesie.nl/wp-content/uploads/2016/09/Richtlijnen-behandeling-NEUROGENE\\_BLAAS.pdf](https://dwarslaesie.nl/wp-content/uploads/2016/09/Richtlijnen-behandeling-NEUROGENE_BLAAS.pdf). Accessed September 21, 2020.
- GIP databank.nl. GIP peilingen: top 10 van hulpmiddelen op basis van de totale kosten in 2019. [https://www.gipdatabank.nl/databank?infotype=h%26label=00-totaal%26tabel\\_h\\_00-totaal=R\\_05\\_top10\\_hm%26geg=tk%26spec=%26item=home](https://www.gipdatabank.nl/databank?infotype=h%26label=00-totaal%26tabel_h_00-totaal=R_05_top10_hm%26geg=tk%26spec=%26item=home)
- Prieto JA, Murphy C, Moore KN, Fader MJ. Intermittent catheterisation for long-term bladder management (abridged cochrane review). *Neurourol Urodyn*. 2015;34(7):648-653.
- Nade ES, Andriessen MVE, Rimoy F, et al. Intermittent catheterisation for individuals with disability related to spinal cord injury in Tanzania. *Spinal Cord Ser Cases*. 2020;6(1):66.

### SUPPORTING INFORMATION

Additional Supporting Information may be found online in the supporting information tab for this article.

**How to cite this article:** Berendsen SA, Doorn T, Blok BFM. Trends in the use and costs of intermittent urinary catheters in the Netherlands from 1997 to 2018: a population-based observational study. *Neurourology and Urodynamics*. 2021;40:876–882. <https://doi.org/10.1002/nau.24643>