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Utilisation of blood glucose test strips in insulin-requiring people with diabetes mellitus using continuous glucose monitoring in Saxony-Anhalt – Analysis of health insurance data

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ABSTRACT

Aims: Continuous glucose measurement (CGM) systems are increasingly utilised by people with diabetes mellitus (DM) and less is known about usage behaviour. Therefore, this study aims to analyse additionally utilisation of blood glucose measurement (BGM) for insurants who are using CGM.

Methods: The study used secondary data, health claims data from the AOK Saxony-Anhalt (Germany), from 2016 to 2021, analysing a sample of 52,296 individuals with insulin-requiring DM.

Results: Nearly all CGM users reduced their utilisation of BGM test strips. 2,306 persons with CGM long-time utilisation, about half showed a mean usage behaviour, nearly one third did not use test strips anymore, about 8 % stopped using CGM, 9 % were intense users. A high test strip utilisation beside CGM was associated with younger age, T1DM, a high number of test strip before starting CGM, no contact with a general practitioner, and no enrolment in a disease management program.

Conclusions: Great differences in reductions and usage behaviour was revealed between insurants. The results can be used to better identify and offer more tailored CGM to people with DM, and to better tailor CGM trainings.

1. Introduction

Diabetes mellitus (DM) is a metabolic disease with increasing prevalence and poor outcomes due to inadequately treated glucose concentrations.[1–4] To achieve normal blood glucose levels and reduce the risk of diabetes-related complications, self-management is essential, including a healthy low-fat diet for people with T2DM, physical activity, and knowledge of blood glucose levels for proper insulin application for people with DM who require insulin.[5–7] Blood glucose monitoring (BGM) is an indispensable prerequisite for people with DM being treated with insulin, and higher frequency of BGM is associated with good glycaemic control,[8] as well as with lower HbA1c levels.[9] However, studies have shown that people also have negative experiences with BGM, e.g. the pain of pricking the finger, feeling obliged to do monitoring, having to focus on the DM, and negative feelings when the values are poor.[10,11] In addition to other factors, like sex, age or type of DM, these can lead to different usage behaviour of test strips (TS) for BGM.[10–16] In an observational study in Canada, it was shown that 66 % of insulin-requiring people with DM used nine or more test strips (TS) weekly (equivalent to 1.29 TS daily), and the remaining one-third used less than nine TS weekly.[17] A study conducted in Scotland observed mean numbers of 2.2 daily TS in people with T1DM and 1.4 TS in people with insulin-requiring T2DM.[16].

Continuous and real-time flash glucose monitoring are alternatives to BGM and are being used increasingly nowadays. Both rely on measuring the interstitial glucose levels using sensors, which need to be changed every 7–14 days, depending on the product specifications. The predominant difference between flash glucose monitoring (FGM) and real-time continuous glucose monitoring (rtCGM) is the constant update of glucose measurements with triggered instant alarms when defined thresholds are exceeded. FGM and rtCGM (abbreviated together as CGM for simplicity in the following) are both more favourable than BGM for

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the treatment of DM, as they e.g. entail significant reduction in HbA1c levels, reduce times in hypoglycaemia, and reduce the need for BGM, thus increasing quality of life.[18,19].

Since 2016, CGM can be financed by the statutory health insurances in Germany according to the resolution of the Federal Joint Committee. In principle, utilisation of CGM could replace the utilisation of BGM, which would therefore make the negative experiences of BGM (e. g. painful finger pricking, waiting times for results) redundant and benefit the users. Furthermore, CGM was initially used only by well-informed and properly trained people with T1DM, but is now increasingly also used by people with T2DM, who have done only a few BGM measurements per day prior to the CGM initiation.[20].

To date, little is known about the implementation of CGM in DM treatment and peoplés utilisation of glucose monitoring. Initial studies have shown that most insulin-requiring people with DM reduce the frequency of supplementary BGM.[21] However, the number of reduced TS described differed considerably between studies and ranges from a mean decrease of 1.3 TS [22] (from 2.7 daily 6 months prior to CGM to 1.4 daily 6 months after CGM) over 2.2 TS[23] (from 6.1 daily at the start of CGM to 5.0 daily 6 months after CGM and to daily 4.0 one year after CGM) and 3.8 TS [24] (from daily 4.4 in the year prior to CGM to 0.6 daily 6 months after CGM) to a mean reduction of 6.15 TS[25] (from 7.46 daily prior to CGM to 1.31 daily after CGM).

Nevertheless, there are indications that some people continue to use TS for BGM to a high extent despite using CGM.[21] One study found no differences in decrease of TS for type of DM, gender or age, but higher chances for the non-use of BGM 6 months after CGM were found for men and persons with low TS-use prior to CGM.[22] However, this study analysed data only in a short period of 12 months of TS utilisation after CGM uptake. In order to shed light on glucose testing behaviour and different utilisation groups and taking longer time courses and more emphasis on high-intense utilisation behaviour into consideration, this study aims to analyse changes in utilisation of BGM for insulin-requiring insurants with DM who use CGM, and explores different types of users and their characteristics.

2. Material and methods

2.1. Study design and participants

The study was conducted as a retrospective anonymized claims data analysis of a cohort of persons with continuous insurance coverage in the statutory health insurance AOK Saxony-Anhalt (AOK ST) in the period from January 2016 to December 2021, who had insulin-requiring DM, defined as having any diagnosis of DM (ICD-10 E10-E14) and with at least one prescription for insulin or analogues (ATC Code A10A*) during the study period.

2.2. Data

The data included basic personal information (age, sex, date of death, care dependence) about the insurants, enrolment in the disease management program for DM and, for those enrolled, their HbA1c-values. Required diagnoses were obtained from data billed for in-hospital care (main diagnosis or secondary diagnosis) and outpatient care (only confirmed diagnoses). Required drug prescriptions were available with date of issue and package size. Data on supplied glucose measurement tools were available with date. Data on prescriptions for BGM-TS were available until 2022.

2.3. Dependent variable and covariate measures

Utilisation of FGM and rtCGM was each dichotomized and defined ‘yes’, when a medical prescription for any specific component of FGM or rtCGM occurred in the billing data. CGM utilisation for each quarter in the time period 2016 to 2021 was dichotomized (yes, no) depending on billed prescriptions for sensors. The quarter in which any CGM-component was prescribed and billed for the first time was defined as the individual CGM start.

Utilisation of BGM was determined when any TS prescription for BGM was handed in. In addition, TS utilisation in every quarter was calculated for every insurant by dividing the number of dispensed TS by the number of days until the next prescription. According to two time periods (mean values in 2016, and for those using CGM the four quarters before their personally-defined first quarter of CGM use) insurants with DM were determined as having low (mean $<$ 2 TS per day), middle (mean 2–4 TS per day), or high (mean $>$ 4 TS per day) TS utilisation.

In a first step, the data was explored to identify the behavioural pattern of utilisation of CGM and TS after starting CGM in order to differentiate between several types of users. A combination of the information on CGM utilisation in each quarter and the number of TS in each quarter before and after the first quarter of CGM use helped to define four utilisation groups of insurants:

- “Returners” were defined as those, who stopped using CGM, which was determined as there being more than seven months between their last CGM sensor prescription and death or the end of the study
- “Full-changers” were defined as those, who were not returners, but who had no more BGM TS prescriptions after 2 quarters following the first quarter of CGM use until death or the end of the study
- “Normal-users” were defined as those, who were not returners, but who had BGM TS prescriptions after their individual first quarter of CGM use, but where there was no quarter with a mean of more than 1.5 TS per day until death or the end of the study
- “Intense-users” were defined to be those, who were not returners, but who had BGM TS prescriptions after their individual first quarter of CGM use, and where there were quarters with a mean of more than 1.5 TS per day until death or the end of the study.

Demographic data included sex, age (at the end of 2021, and categorized in age groups $<$ 19, 19–40, 41–65, or $>$ 65 years), and care dependency (dichotomized as “care dependent” or not).

Data on healthcare included ICD-10 codes of DM, and we defined a confirmed diagnosis as being T1DM (E10.x), T2DM (E11.x) or other DM (E12.x-14.x), when the ICD-10 code was found either in inpatient data, or in two quarters in outpatient data in at least one year from 2016 to 2021, but no confirmed diagnosis of any other DM in any (other) year. Insurants were defined ‘unclear DM’ if there was a confirmed diagnosis of T1DM and of T2DM in any year from 2016 to 2021.

Contact to a general practitioner (GP) was determined for every year where the Physician’s Fee Schedule showed the billing of a GP-specific code. Contact to an outpatient specialist for outpatients was determined for every year where a specialist-specific code was billed. Disease management program (DMP) utilisation was defined as having at least one day of enrolment in the DM DMP throughout the study period. For those enrolled in the DM DMP, HbA1c-values were available that were categorized based on a general and rough classification into normal, low, and raised HbA1c-value for every year.

2.4. Data analysis

Data were analysed descriptively using absolute and relative frequencies and mean with standard deviation. Group comparisons between intense users compared to returners, full-changers, or normal users were analysed with bivariate and multivariable generalized linear models calculating Odds Ratios (OR) with 95 % Confidence Intervals (95 % CI) for the changes in odds of sociodemographic and treatment variables. The multivariable model 1 includes all variables. The multivariable model 2 includes only variables necessary to reach the best AIC-fit in a stepwise backward elimination process.

3. Results

3.1. Sample

The study sample comprised 52,296 individuals with continuous insurance coverage by the statutory health insurance AOK ST and a diagnosis of a DM with insulin prescription. Of those 3,551 (6.8 %) utilised CGM. Characteristics are presented in Table 1. Compared to all insulin-requiring insurants with DM, CGM-users were younger (66.78 vs. 77.9 mean age), more often male (53.6 % vs. 44.3 %), less often care dependent (42.4 % vs. 63.1 %), and more often T1DM (9.2 % vs. 1.1 %).

3.2. Change of BGM utilisation in CGM users

Overall 3,551 CGM users were identified in the study period. For 3,506 of these users we had information on their BGM TS utilisation for at least one quarter in the year prior to the first quarter of CGM use and for any time thereafter. 3,077 (87.8 %) of those users reduced the amount of their daily TS utilisation in the third months after starting to use CGM, 429 (12.2 %) had no reduction. In total, CGM users used 3.13 daily TS in the year before the first quarter of CGM use and reduced the utilisation by 2.22 daily TS to 0.90 TS in the quarter after starting to use CGM. Long-term information on TS utilisation for more than one year after starting to use CGM could be observed for 2,604 CGM users. Of those with long-term information, 2,386 (91.6 %) reduced the utilisation, 218 (8.4 %) did not reduce their daily TS utilisation in the second year after starting to use CGM-Start. Overall, those 2,604 CGM users with long-term information used 3.30 daily TS in the year before starting to use CGM and reduced the utilisation by 2.69 to 0.60 daily TS in the second year.

Table 1
Characteristics of the study sample for insulin-requiring insurants with DM and insurants with DM using CGM. Values are numbers (percentage) unless stated otherwise.

Variable	Insulin requiring insurants with DM (n = 52,296)	Subgroup: Insulin requiring insurants with DM and CGM* (n = 3,551)
Age, mean in years (± SD)	77.90 ± 12.40	65.78 ± 16.48
Age Group in years		
<19	101 (0.2)	94 (2.6)
19–40	553 (1.1)	205 (5.8)
41–65	7,076 (13.6)	1,140 (32.1)
>65	44,566 (85.2)	2,112 (59.5)
Sex		
male	23,164 (44.3)	1,902 (53.6)
female	29,132 (55.7)	1,649 (46.4)
Care Dependent (yes vs. no)	33,018 (63.1)	1,506 (42.4)
Type of Diabetes mellitus		
Type 1 DM	514 (1.1)	326 (9.2)
Type 2 DM	44,843 (85.7)	1,982 (55.8)
Unclear DM	6,798 (13.0)	1,242 (35.0)
Other DM	141 (0.3)	1 (0.0)
BGM Use (yes vs. no)	50,286 (96.2)	3,529 (99.4)
FGM Use (yes vs. no)	3,442 (6.6)	3,442 (96.9)
rtCGM Use (yes vs. no)	176 (0.3)	176 (5.0)
Utilisation of test strips (BGM) in 2016		
Low (mean < 2 TS per day)	33,873 (64.8)	1,308 (36.8)
Middle (mean 2–4 TS per day)	12,426 (23.8)	1,167 (32.9)
High (mean > 4 TS per day)	4,383 (8.4)	1,014 (28.6)
No utilisation	1,614 (3.1)	62 (1.7)

Abbreviations: DM, diabetes mellitus; BGM, blood glucose measurement; FGM, flash glucose monitoring; rtCGM, real-time continuous glucose monitoring; TS, test strips.

* CGM users comprise FGM and rtCGM.

Among the CGM users, four groups were defined according to their utilisation behaviour with BGM and CGM. Exclusion criteria for utilisation groups were: using CGM for less than nine months before death or the end of the study on December 31th in 2021 (n = 892), having had two or more quarters of non-utilisation within the total utilisation period (n = 272), and having already used CGM in 2016 due to lacking information on their BGM utilisation behaviour before CGM (n = 81). Of the remaining 2,306 (64.9 %) CGM users, 50.7 % were normal users, 31.7 % were full-changers, and 9.0 % were intense users of TS after CGM. The remaining 8.6 % were returners, who stopped using CGM after a minimum of nine months of utilisation. Mean daily utilisation of BGM TS for these CGM-user-groups prior to and after starting CGM is shown in Fig. 1. Intense users had a slightly higher TS use in the quarter prior to CGM (mean 4.0 per day) compared to others, while full-changers had a lower TS use prior to CGM (mean 2.8 per day). In the second year after starting with CGM, intense users had the lowest reduction of 1.9 TS per day, while normal users reduced TS use by 3.0 TS, and full-changers by 2.8 TS.

3.3. Determinants for utilisation groups of BGM after starting CGM

The descriptive data in Table 2 show that intense users were more often children and adolescents, while returners were more often 19–40 years old. Full-changers were usually male (59.3 %) and returners were usually female (52.26 %). Furthermore, full-changers were more frequently care dependent (45.48 %) compared to the other CGM-user-groups. Intense users were the group with the highest number of T1DM users, while full-changers had the lowest number. Returners had the highest frequencies of raised HbA1c-values in 2016. Intense users were shown more often to have a high TS-utilisation before CGM utilisation (51.92 %), while returners and full-changers more often had low TS utilisation (34.17 % and 33.42 %).

In the multivariable linear regression model (Table 3), which included only the 2,306 insurants who could be assigned to a CGM utilisation group, it was found the best-fitting predictors (multivariable model 2) for the odds of being an intense user of TS were: age, type of DM, TS utilisation prior to CGM, contact to a GP in 2016, DMP enrolment, and HbA1c-values in 2016. Where having T1DM compared to T2DM (OR 2.09, 95 % CI 1.06; 4.12), high TS utilisation prior to CGM compared to middle TS utilisation prior to CGM (OR 2.05, 95 % CI 1.37; 3.05), having no contact with a GP in 2016 compared to having contact with a GP in 2016 (OR 0.26, 95 % CI 0.10; 0.65), and DMP enrolment compared to no enrolment (OR 0.06, 95 % CI 0.01; 0.30) could reach equivalence of statistical significance.

4. Discussion

Analysing the utilisation of CGM and BGM TS by insulin-requiring insurants with DM, this study found that the majority of new CGM users reduced their BGM TS use by a mean reduction over all CGM users of 2.22 daily TS to 0.90 in the quarter after starting with CGM. Of those with more than nine months of non-interrupted utilisation, about 8 % stopped using CGM, half of the people showed a normal usage behaviour besides CGM, nearly one third did not use TS anymore, and 9 % were intense users. Younger age, T1DM, high TS utilisation before starting CGM, no visits to a GP, and not being enrolled in a DMP increases the chance of having high TS utilisation besides CGM.

Generally, it was seen that CGM users more often had a high TS utilisation prior to CGM than the other insulin-requiring people with DM. This means that predominantly poorly controlled patients with complicated DM and therefore high TS utilisation started measuring their glucose values with CGM. This is in line with recommendations that CGM should be offered to people with DM treated with intensive insulin therapy, which is defined as having three or more injections per

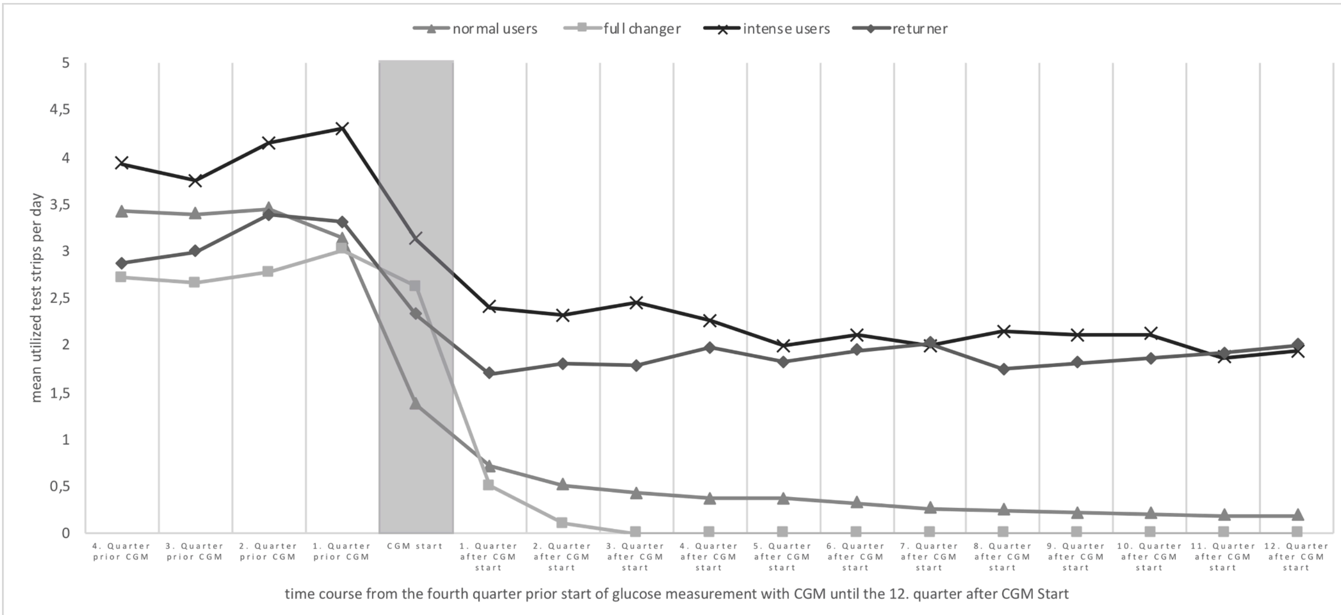

Fig. 1. Mean utilisation of BGM test strip over time in the year before starting CGM and for three years after CGM start for four defined groups of CGM users (n = 2,300).

Table 2
Comparing sociodemographic and healthcare characteristics for four CGM-User-Groups (n = 2,306). Values are percentages unless stated otherwise.

Variable	Returners (n = 199)	Full-changers (n = 730)	Normal users (n = 1169)	Intense users (n = 208)
Age group in years				
<19	1.01	0.14	1.97	14.9
19–40	18.09	3.29	4.36	7.69
41–65	45.73	30.14	33.70	33.65
>65	35.18	66.44	59.97	43.75
Women	52.26	40.68	47.65	43.75
Care dependent	32.66	45.48	36.87	39.42
Type of DM, % with T1DM	11.56	4.79	8.21	26.92
With contact to GP 2016	93.97	96.03	96.41	83.17
With contact to outpatient specialist 2016	12.06	14.11	14.29	18.27
HbA1c-value				
Normal HbA1c-value 2016	35.77	41.80	42.76	44.20
Raised HbA1c-value 2016	55.47	48.85	46.38	50.72
TS utilisation before CGM-Start				
Low TS utilisation	34.17	33.42	21.73	18.75
Middle TS utilisation	29.15	44.11	43.97	29.33
High TS utilisation	36.68	22.47	34.30	51.92

Abbreviations: DM, diabetes mellitus; GP, General practitioner; TS, test strips.

day (needing at least three TS daily when measuring BGM) or using an insulin pump.[26] The observed high reduction of 2.22 after one year to 2.69 in the second year in daily TS utilisation after starting CGM is in line with the results of other studies that found differing reductions between 1.3 and 6.15 daily TS.[22,24,25,27] As was found in other studies, where people used only 0.6 to 1.4 daily TS in addition to glucose measurements with CGM,[22,24,25] insurants in this current study reduced their mean daily TS utilisation to 0.9 after one year and to 0.6 in the second year after starting with CGM. Only one study showed a reduced, but still high, utilisation of 4.0 daily TS one year after starting with CGM.[23] In these other studies, the numbers of TS were self-reported and not gathered from 'real-life' prescription and billing data. This relevant reduction in utilisation of BGM daily TS after starting to measure glucose values with CGM is known from other studies and is an important advantage for the people when measuring blood glucose with CGM. We found that nearly all insurants reduced their consumption. However, nearly one third actually stopped using TS and BGM and another 9 % had high daily TS utilisation of around 2.0 in addition to CGM, whereas the majority of CGM insurants showed low utilisation of less than 0.5 daily TS. This was confirmed in other studies, which found that some people continue using high amounts of BGM TS in addition to CGM.[21,22].

Less is known about the positive and negative effects of CGM utilisation on outcomes (PROM, clinical outcomes) for this group of intense users. However, one can argue that there might be no benefit of the concurrent utilisation of CGM and high BGM TS utilisation. This may refer to the negative effects associated exclusively with BGM testing, such as the pain of finger pricking and the feeling of having to monitor,[10,11] which might not be reduced in a relevant way by the concomitant high use of BGM alongside CGM utilisation. Moreover, this may refer to the effect of multiple BGM testing on improved HbA1c levels as found in studies conducted prior to CGM,[9,28] and to the effect of the increase in the number of scans per day in studies with CGM.[27] This study proves that people with DM with poorer glycaemic control and those who performed BGM less than five times per day benefited the most with regard to improved HbA1c levels, and people who performed BGM five times or more per day had no benefits in terms of reducing HbA1c levels.[27] Furthermore, it might be interesting to evaluate the mediation of intense utilisation of BGM and CGM on the association of anxiety with less frequent BGM and suboptimal glycaemic control.[29] In general, several studies proved that the range of locus of control in people with DM from autonomy to self-blame was associated with the effect on outcomes,[30] and was associated with numbers of self-monitored measurements.[12].

The possibly unfavourable behaviour (for quality of life and costs with no further benefit for outcomes) of dual utilisation of BGM and CGM was found to be higher in people with DM who were younger, had T1DM, had high TS utilisation before starting CGM, did not visit a GP,

Table 3
Relationship between sociodemographic variables and healthcare characteristics of intense users of TS after starting CGM- and analysed with a bivariable and multivariable logistic regression model.

Variable	Bivariable model (OR, 95 % CI)	Multivariable model 1 (OR, 95 % CI)[+]	Multivariable model 2 (OR, 95 % CI)[++]
Sex (reference: male)	0.93 [0.69; 1.23]	1.03 [0.71; 1.48]	/
Age in years	0.97 [0.96; 0.98]	0.98 [0.97; 1.00]	0.99 [0.97; 1.00]
Care Dependent (vs. not)	1.00 [0.75; 1.34]	1.25 [0.83; 1.91]	/
DM Type			
Type of DM: T2DM	ref	ref	ref
Type of DM: T1DM	5.91 [4.00; 8.71]	2.14 [1.08; 4.24]	2.09 [1.06; 4.12]
Type of DM: unclear DM Type	1.66 [1.19; 2.32]	1.16 [0.76; 1.75]	1.16 [0.77; 1.75]
TS utilisation prior CGM			
Middle TS utilisation prior CGM	ref	ref	ref
Low TS utilisation prior CGM	1.01 [0.66; 1.53]	0.38 [0.18; 0.78]	0.37 [0.18; 0.76]
High TS utilisation prior CGM	2.48 [1.78; 3.45]	2.04 [1.37; 3.04]	2.05 [1.37; 3.05]
With contact to GP 2016 (reference: no contact)	0.20 [0.13; 0.31]	0.29 [0.12; 0.75]	0.26 [0.10; 0.65]
With contact to outpatient specialist 2016 (reference: no contact)	1.37 [0.94; 1.99]	1.37 [0.86; 2.17]	/
DMP enrolment (reference: no DMP enrolment)	0.43 [0.28; 0.67]	0.06 [0.12; 0.31]	0.06 [0.01; 0.30]
HbA1c-values			
Normal HbA1c-value 2016	ref	ref	ref
Low HbA1c-value 2016	0.47 [0.21; 1.05]	0.44 [0.19; 1.00]	0.44 [0.20; 1.03]
Raised HbA1c-value 2016	1.00 [0.70; 1.43]	0.92 [0.63; 1.34]	0.93 [0.64; 1.35]

Abbreviations: DM, diabetes mellitus; TS, test strips; CGM, continuous glucose monitoring including FGM and rtCGM; GP, General practitioner; DMP, disease management program.

[+] The multivariable model 1 includes all variables adjusted for each other.

[++] The multivariable model 2 includes all variables with lowest AIC-fit, adjusted for each other.

and who were not enrolled in a DMP. In general, it might be that high utilisation of TS by people with DM is adopted as being 'good self-management behaviour' and reflects their experience of their chronic disease. It might be helpful, if diabetic training on the new CGM-systems were to include information and assistance on how to modify self-management behaviours from multiple BGM testing to multiple CGM reading, especially for people with T1DM. Furthermore, the underlying reasons of intense utilisation by people of a younger age and the role of GP visits in the usage behaviour for CGM and BGM might be of interest for further studies. Another study found that men and those with low TS use prior to CGM more often stopped using BGM and changed fully to CGM.[22].

Lastly, this study found that nearly 8 % of CGM users stopped using CGM and changed back to BGM tools, but TS utilisation remained lower than prior to CGM throughout three years of follow-up. To our knowledge, there is no evidence on the percentage of people who stop using CGM, and in particular none concerning their reasons and possible countermeasures that can be addressed in diabetic trainings.

The study has several limitations that need to be considered while interpreting the results. The data are claims data from one statutory health insurance in one federal state in Germany only. The data were not collected for scientific reasons, but for billing reasons. In addition, only services (medication, remedies and aids) that have been prescribed and supplied are available. Thus, it cannot be clarified whether some – defined as being irregular – CGM-users had other sources for obtaining the sensors. However, it seems unlikely that CGM providers would give their devices free of charge to a larger number of users, or that users would buy them over the counter at their own expense. Strengths of the study are the long period of data from 2016 to 2021, and detailed accounting data for every TS and CGM device. However, we identified that nearly half of CGM users showed utilisation of less than nine months or had interruptions in CGM utilisation for two or more quarters, and we were able to exclude these insurants from the analysis of TS utilisation after starting CGM, which is advantageous compared to other studies.

While the overall reduction in test strip usage suggests a potential for cost savings, particularly as CGM becomes more widely adopted, certain patient behaviours could present economic burden. Specifically, a subset of users—those classified as intense TS users—continued using significant numbers of TS despite adopting CGM. This dual usage behaviour could increase individual healthcare costs without providing additional clinical benefit with the concurrent use of both monitoring systems.

5. Conclusion

In summary, this study gave detailed insights into the usage behaviour of CGM measurement and BGM TS in insurants with DM. The majority of insurants reduced their TS utilisation after starting CGM, but major differences in changes in utilisation could be revealed between the users. However, the results can be used to better tailor CGM training to the needs of people with insulin-requiring DM, and to better identify and offer more tailored CGM to appropriate people with DM who are best supported by a CGM system of self-management.

CRediT authorship contribution statement

Sara Lena Lückmann: Writing – original draft, Validation, Software, Project administration, Methodology, Formal analysis, Conceptualization. **Antonia Förster:** Writing – review & editing, Conceptualization. **Stephanie Heinrich:** Writing – review & editing, Validation, Supervision, Resources, Project administration, Methodology, Data curation, Conceptualization. **Christian Buhtz:** Writing – review & editing, Software, Data curation. **Gabriele Meyer:** Writing – review & editing, Supervision, Funding acquisition, Conceptualization. **Rafael Mikolajczyk:** Writing – review & editing, Supervision, Methodology, Funding acquisition, Conceptualization. **Steffen Fleischer:** Writing – review & editing, Validation, Methodology, Conceptualization.

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Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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