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ORIGINAL

Continuous Glucose Monitoring – offering empowerment and self-care agency for type 1 diabetes patients

Control continuo de la glucosa: una herramienta de capacitación y autocuidado para pacientes con diabetes de tipo 1

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ABSTRACT

Introduction: technologies have increasing availability and significance in health care. Self-care tools are promoting "positive medicalization" by enabling patients to reclaim their individual agency in health care. In Type 1 Diabetes treatment, health technology is prominent - Continuous Glucose Monitoring (CGM) has been developed to facilitate management of the disease, while easing the emotional burden.
Objective: the objective of the study was to show how technology-led self-care affects individuals, and more specifically, their relationship with their doctor, when they gain agency over their own health care.
Methods: this paper draws on a quantitative study using data from the Jaeb Center for Health Research (USA); it examines the effects of CGM on patients' everyday lives right after starting the use, and after 6 and 12 months of use. The data also shed light on the role of CGM in reshaping patient-doctor relationships. ANOVA tests and binary logistic regression analysis were conducted (n=451, female: 55 %, male: 45 %, age: mean 25,04, SD 15,8).
Results: the use of the CGM gives freedom to users, but the CGM causes hassles in their daily lives after 6 months of use. Socio-demographic factors (education level, gender, age) did not play a significant role in the changing patient–doctor relationship.
Conclusion: despite the burden technology may cause, CGM seems beneficial by easing diabetes management. Regarding the patient-doctor relationship, users seemed unaware of changes despite the great gain in agency. This case offers a way to shift the focus to a more moderate critique of medicalized technologies.

Keywords: Health Technology; Type 1 Diabetes Mellitus; Blood Glucose Self-Monitoring; Humans.

RESUMEN

Introducción: las tecnologías son cada vez más accesibles e importantes para la atención sanitaria. Las herramientas de autocuidado promueven la "medicalización positiva" al permitir a los pacientes reclamar su protagonismo individual en la atención sanitaria. En el tratamiento de la diabetes tipo 1, la tecnología sanitaria ocupa un lugar destacado: se ha desarrollado la monitorización continua de la glucosa (MCG) para facilitar la gestión de la enfermedad, al tiempo que se alivia la carga emocional.
Objetivo: el objetivo del estudio era mostrar cómo el autocuidado dirigido por la tecnología afecta a los individuos, y más concretamente, a su relación con su médico, cuando adquieren agencia sobre el cuidado de su propia salud.
Métodos: este artículo se basa en un estudio cuantitativo con datos del Centro Jaeb de Investigación Sanitaria (EE.UU.); examina los efectos de la MCG en la vida cotidiana de los pacientes justo después de empezar a

usarla, y tras 6 y 12 meses de uso. Los datos también arrojan luz sobre el papel de la MCG en la remodelación de las relaciones médico-paciente. Se realizaron pruebas ANOVA y regresión logística binaria (n=451, mujeres: 55 %, hombres: 45 %, edad: media 25,04, DE 15,8).
Resultados: el uso del MCG da libertad a los usuarios, pero el MCG causa molestias en su vida diaria después de 6 meses de uso. Los factores sociodemográficos (nivel de estudios, sexo, edad) no desempeñaron un papel significativo en el cambio de la relación paciente-médico.
Conclusiones: a pesar de la carga que puede suponer la tecnología, la MCG parece beneficiosa al facilitar el control de la diabetes. En cuanto a la relación médico-paciente, los usuarios parecían no ser conscientes de los cambios a pesar de la gran ganancia en agencia. Este caso ofrece una forma de cambiar el enfoque hacia una crítica más moderada de las tecnologías medicalizadas.

Palabras clave: Tecnología Sanitaria; Diabetes Mellitus Tipo 1; Automonitorización de la Glucosa en Sangre; Seres Humanos.

INTRODUCTION

Social movements and self-help possibilities in digital health are gaining ground in modern health care systems. These possibilities are decreasing traditional professional dominance over the relationship with patients. This new scenario in health care has great relevance for the whole field, and has, therefore, enabled a move in the market, shifting the agency from the specialist to the client.[1,2] However, digital health should not be seen as a silver bullet to change the dynamics of health care altogether, but as an added value for the existing possibilities about patient agency.[3]

In recent literature, medicalization is described as more market-driven than before, changing the dynamics of doctor–patient interaction.[1] Technologies embedded in new health care devices on the market can prompt a change in the medical profession and the otherwise medically dominated doctor-patient interaction. The change is rooted in the alteration of a power relation between doctor and client, through the agency-shift, with new health care devices acting as mediators. Doctors are still the gatekeepers for treatment, but their role is changing. Market-driven medicalization has created a situation in which doctors have to cater to the needs of their patients-turned-clients because otherwise they might have a chance of losing clientele. Therefore, the patient has gained more prominence in this relationship, hence agency. And, likewise, the shift in sociological research on medicalization has also had to adapt to these changes in the current medicalization process, with repercussions for the way we view the intersection of health, science and technology.

One specific case where the development of health care technologies has been prominent is type 1 diabetes treatment. Currently, the system called Continuous Glucose Monitoring (CGM) allows the glucose level to be monitored around the clock. Patients can maintain their blood glucose levels very close to those of non-diabetics, which can enhance their general well-being and prevent eventual complications. From a sociological perspective, this empowers CGM users in their relationship with the diabetes doctor – otherwise stated, users gain in individual agency – as they can easily access their own data about diabetes management.[4,5,6,7]

By discussing this shift in agency, we look at how the doctor-patient interaction is being reshaped from a fully medically dominated encounter to other forms of interaction that are less dominated by the doctor. This is not to say that the interaction can ever be completely dominated by the patient. Analytically, if different forms of doctor-patient interactions are put on a continuum, where one extreme is doctor-dominated and the other extreme is patient-dominated, interactions can move from one extreme to the other and go through varying points across the 'middle ground'. Yet, following from Foucault,[8] when entering the medical encounter, the patient must play by the rules of that field, which in the process legitimises the medical gaze. For it is that gaze that is being used in framing and understanding the health problem and the treatment.[6,9] In practice, this implies that a patient-dominated encounter will very rarely, if ever at all, exist. It follows that CGM might increase patient's agency and shape some 'middle ground' form of relationship with the practitioner, but not fully controlled by the patient.

Type 1 diabetes is a result of a situation where one's insulin-producing beta cells in the pancreas are destroyed. That leads to a situation where insulin is not being produced by the pancreas and has to be injected. The function of insulin is to regulate changes in blood glucose levels (i.e., after eating or while fasting). Complications from too low or too high blood sugar are not only constantly worrisome but also life-threatening, thus maintaining a stable glucose level is a necessity for type 1 diabetics. This causes an emotional and physiological burden for diabetics, and that is what CGM aims to ease.[7] Overall, because of these characteristics, this seemed to be an insightful case for approaching patient agency in a professional context.

This study aimed to examine the transformation of patient agency associated with the adoption of new medical technologies (e.g., CGM), specifically focusing on the assumption that implementing patient-used

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equipment leads to enhanced self-care agency. We approached this topic from a theoretical standpoint and employs a quantitative method to evaluate the extent to which the data supports the assertion that the medicalization thesis could shift towards a more moderate critique of medicalization. Additionally, we posit the following hypothesis: Greater acceptance of CGM by patients is inversely related to their satisfaction with doctors, potentially stemming from an amplified personal understanding of their illness and subsequent empowerment, resulting in increased agency.

The theoretical framework builds on the concept of medicalization and its evolutionary aspects until the present day. Recently in the sociological literature appeared the concept of 'positive medicalization',[10] which has been useful in describing further developments in the subfield that challenge common assumptions.

Positive perspective for medicalization

The medicalization debate can be traced back to Michael Foucault's seminal work Madness and Civilization.[8] He discussed the case of mental health and the development of mental states which became medicalized. He considered that life during the Renaissance was free from institutional scrutiny for mentally ill people because they were not diagnosed, medicated or hospitalized. In his following publication, The Birth of the Clinic,[5] he looked at medicalization from a broader perspective and systematically criticized how medicine and health care had not become more humane throughout history; it illustrated how doctors started to use "the medical gaze" and view people as broken organs instead of whole individuals. Medical categories thus became a tool for exerting great social and moral control, which in the process enabled political legitimacy for the institution of medicine.

It follows that industrial society became increasingly medicalized, while medicalization both mirrors and reinforces Western values. Medicalization is a process through which a whole range of life problems are turned into medical categories, which makes individuals take it for granted that solutions are to be found in the medical sphere.[9] Self-care applications (apps) on people's mobile phones and computers are promoting what the sociological literature has come to call "positive medicalization". One example of positive medicalization is individuals dealing with stress and anxiety without consulting specialists but instead using self-help apps available within the reach of a hand.[10]

From a social science perspective, this development can be interpreted in two different ways: as leading to over-diagnosing illnesses when individuals detect 'abnormalities,' albeit in low measures; or as enabling early diagnostics so that potential illnesses can be prevented before the disease develops further.[10] Additionally, it is important to reflect on how we understand medicalization. It can be seen as a continuum or as a binary category. If we consider medicalization as something that can either happen or not, but not 'happen and not happen,' we are disregarding important developments in the medical sphere.[11,12]

When tablets and smartphones allow patients to have a full consultation by distance, the need to go see a doctor in a hospital or clinic changes.[13] On this same note, Maturo and Moretti[10] discuss how only 15 years ago medical practitioners controlled all diagnostic tools, whereas currently, self-monitoring enables everyone to see changes in their health, causing a change in the professional values of doctors. Self-monitoring, on the other hand, can cause 'technostress' in individuals, who may feel overwhelmed by the new information and communication possibilities. Technostress refers to the individual not being able to handle the information flow from technologies without experiencing an additional mental burden. This is one of the unintended consequences which these new health technologies carry (other consequences are well-known issues of privacy and normativity). Technostress can also have effects on the patient–doctor relationship. For example, flaws can happen when retrieving one's data, affecting the patient's interpretation and resulting in faulty communication with the doctor. These possible consequences can unintendedly weaken trust within the relationship[14,15,16] or otherwise strengthen trust when having to rely more on expert advice than the device. Yet, the dynamics are necessarily mediated by the equipment.

Besides, new health care innovations are not distributed equally across society. People with higher cultural health capital[17] appear to be more likely to explore new health care applications. They can be ahead of health care professionals when it comes to using alternative digital devices to access health information.[18] Importantly, though, the backbone of the patient-doctor relationship still lies in personal communication and understanding the needs of the individual.[13] Doctor-patient communication, as in diagnosis, is still the very cornerstone of medical practice,[19,20] while diagnosis itself remains an overarching category that highlights professional authority.[21] Personal interaction, however, is a very important factor for patient satisfaction, medication adherence, and general health outcomes. Arguably, affective communication, empathy, compassion and emotional support cannot be replaced by technological devices.[22]

Type 1 diabetes: management & care

Globally, an estimated 537 million adults suffer from diabetes. There are different types of diabetes, but the majority of diabetics are affected by type 2 diabetes (approximately 90 %-95 %). Type 1 diabetes, affecting

approximately 5 % of all diabetics, is a result of a situation where one's insulin-producing beta cells in the pancreas are either destroyed or functionally ineffective, and therefore insulin has to be injected throughout the patient's lifetime.[23,24]

Type 1 diabetes treatments can be generally divided into three categories. The first option is the most conventional method, involving a self-administered blood glucose meter and multiple daily insulin injections. The second solution is insulin pump therapy (IPT), sometimes paired with CGM. Lastly, the third category involves techniques integrating different devices, as in sensor-augmented pump (SAP) therapies.[25] Typically, CGM consists of three different parts: the first one is the sensor itself, inserted in the patient's body, which measures blood glucose levels continuously; the second part consists of an electronic processing unit, which is connected to the sensor either with wire or wirelessly; and the third part is a data display unit, data that are used to determine the need for insulin to balance the glucose level.[7]

Although helpful for managing treatment, especially at a very young age, CGM may not always be accepted all too easily. Negative attitudes towards CGM sometimes result from psychological and demographic barriers. The existing literature suggests that the more a patient is committed to using complex diabetes treatments, the higher their uptake of CGM. For youth, lower hbA1c, two-parent families and higher quality of life are variables that are associated with becoming interested in starting CGM. Adult CGM users are more likely to have private insurance and have higher household income and higher education compared to non-users.[25,26,27] Plus, it has been a longstanding issue that medical technologies may make patients feel 'sicker' (i.e., 'more diabetic' than they really are)[28,29,30] which, again, may reinforce acceptance of and identification with the institution of medicine.

New diabetes management devices can give more accurate and richer data to help patients in their self-care and, arguably, make their everyday lives more stress-free.[31] Device-produced data opens up possibilities for self-measurement, which allows patients to be more autonomous and gain self-care agency. This causes the change in the relationship with the diabetes doctor. It is no longer necessary to consult a health care practitioner regarding, for example, laboratory examinations to obtain blood glucose level information; patients can gather the data by themselves, and analyze them without consulting a doctor.[10]

We assess presently how the use of CGM has affected the patient–doctor relationship in light of the patients' increased agency through technology-led self-care, and analyze whether demographic factors, such as gender, age, or education level, help us to understand changes in satisfaction about the doctor with technology as a mediator.

METHODS

Data design and study population

The Jaeb Center for Health Research (JCHR) - Diabetes Research Studies provides data from a research project titled A Randomized Clinical Trial to Assess the Efficacy of Real-Time Glucose Monitoring in the Management of Type 1 Diabetes (trial id NCT00406133). The data were collected pre-test and then in two post-test phases: before starting the trial, after 26 weeks, and after 52 weeks since patients started using CGM. The experimental group (n=232) had the CGM in use the whole clinical trial, and the control group (n=219) used a traditional Home Glucose Meter for the first 26 weeks shifting to CGM for another 6 months. In our analysis, we used data from both of these subsets, experimental and control groups.

The participants (patients or their caregivers) were asked to report on different life areas of themselves and their family members with reference to diabetes management. The overall aim of the JCHR project was to determine whether CGM improved quality of life and glycemic control among children and adults who had type 1 diabetes. Participants had been clinically diagnosed with type 1 diabetes, were older than 8 years and used either insulin pump therapy or multiple daily injections by the time they were recruited.[1]

The subset used in this paper combines data from the CGM Satisfaction Scale and the Problem Areas with Diabetes tool (adult subject version), both pertaining to the same trial protocol. The Problem Areas with Diabetes tool was developed by the Joslin Diabetes Center (Boston, MA) to measure diabetes-specific emotional distress.

Variables

"Feeling unsatisfied with your diabetes physician" was recorded on a 5-point Likert scale, and will be used as a proxy for changes in dominance and agency in patient–doctor relationship. Also, other diabetes-related questions (Figure 1; Figure S1-S7) were recorded on a 5-point Likert scale. When the patient–doctor relationship was examined, demographic factors were considered (i.e., age, gender, and educational level of the subject/primary caregiver). As for the educational level of the caregiver, by caregiver it was meant the subject themselves (n=212, 47,0 %), spouse (n=4, 0,9 %), mother (n=192, 42,6 %) or father (n=43, 9,5 %).

Analysis strategy

The analysis included a one-way repeated measurement analysis of variance (ANOVA), in which we observed changes between the pre-test and the two post-test phases. Bivariate statistics and binary logistic regression analysis was conducted to look at the patient-doctor relationship more specifically to examine whether demographic factors, such as age, educational level of the primary caregiver, and gender of the subject, affected the satisfaction with the diabetes doctor. Binary logistic regression analysis is an appropriate analytical tool when scrutinizing the relationship between three independent variables and one binary dependent variable, when the dependent variable is not normally distributed. A binary logistic regression analysis involved the results after 52 weeks of CGM use.

This dataset had not been subject to analyses other than clinical, although CGM technologies have since advanced. This dataset was deemed appropriate for this research because it measured many aspects of type 1 diabetics' lives at the time they started using CGM, which represents a rather rare case. The statistical analysis was conducted using IBM SPSS version 26.

RESULTS

Firstly, we describe the study population as a whole (n=451), combining both experimental and control groups (Table 1).

Table 1. Characteristics of the study population (n=451).

Variable	Category	n (%) or mean (SD)
Age		25,04 (15,8)
Gender	Male	203 (45 %)
	Female	248 (55 %)
Educational level of the primary caregiver	Associates	61 (13,5 %)
	Bachelors	197 (43,7 %)
	Masters	100 (22,2 %)
	Professional	35 (7,8 %)
	Other/unknown	58 (12,9 %)
Feeling satisfied with your diabetes physician	Satisfied	214 (96 %)
	Not satisfied	9 (4 %)

Note: Socio-demographic variables combine experimental and control groups, dependent variable (feeling satisfied with your diabetes physician) reported by experimental group (n=232).

The results are supportive of the idea that CGM is making patients' everyday lives easier, as it allows more freedom (Figure 1). They also suggest that using CGM does cause technostress, even after a considerable period of time, because of the attention it requires and the problems it causes, albeit seen as beneficial.

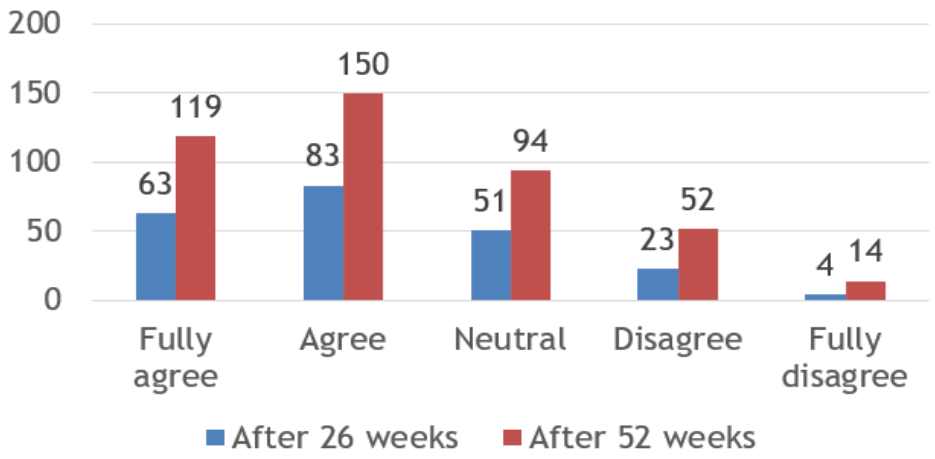

Figure 1. It allows more freedom in daily life

Respondents did not explicitly report that they experienced technostress from the large amount of information that CGM gives; rather, they found the information and data helpful and easy to understand (Figure 2). When

asked if the device caused too many interruptions during the day, the results displayed a more balanced distribution around the neutral option, indicating more dissatisfaction (Figure 3). This can be explained by being new to the equipment at the beginning of test rounds, when respondents had not internalized the routines and bugs were more likely to happen.

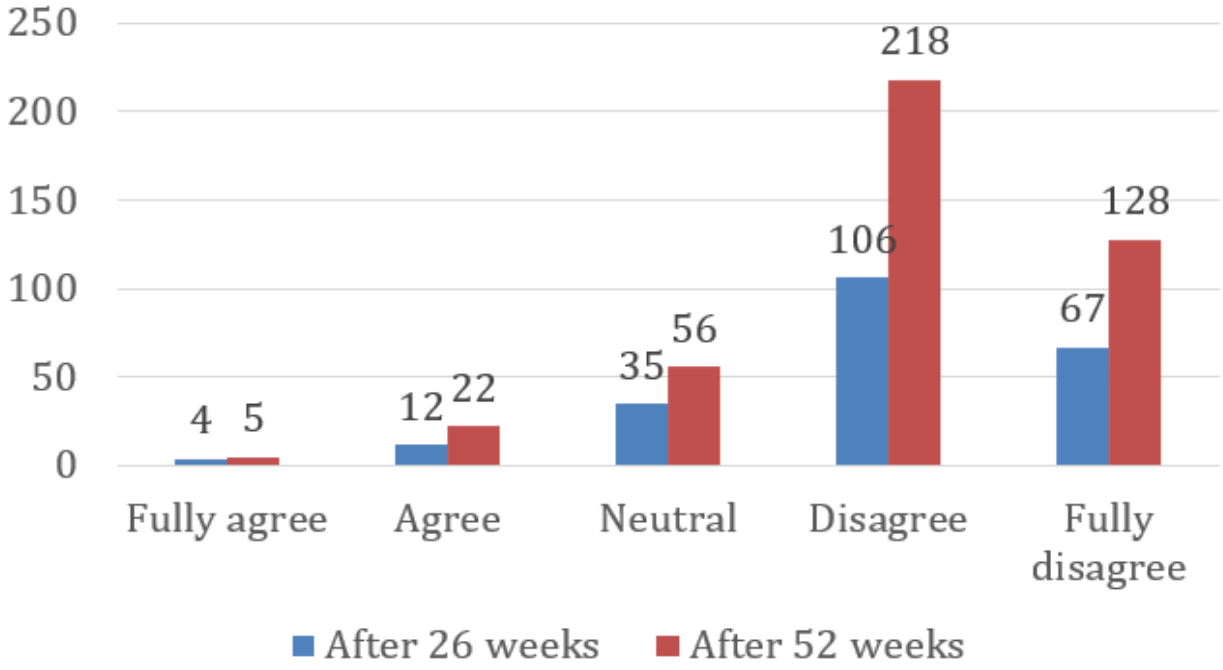

Figure 2. The feedback from the device is not easy to understand or useful.

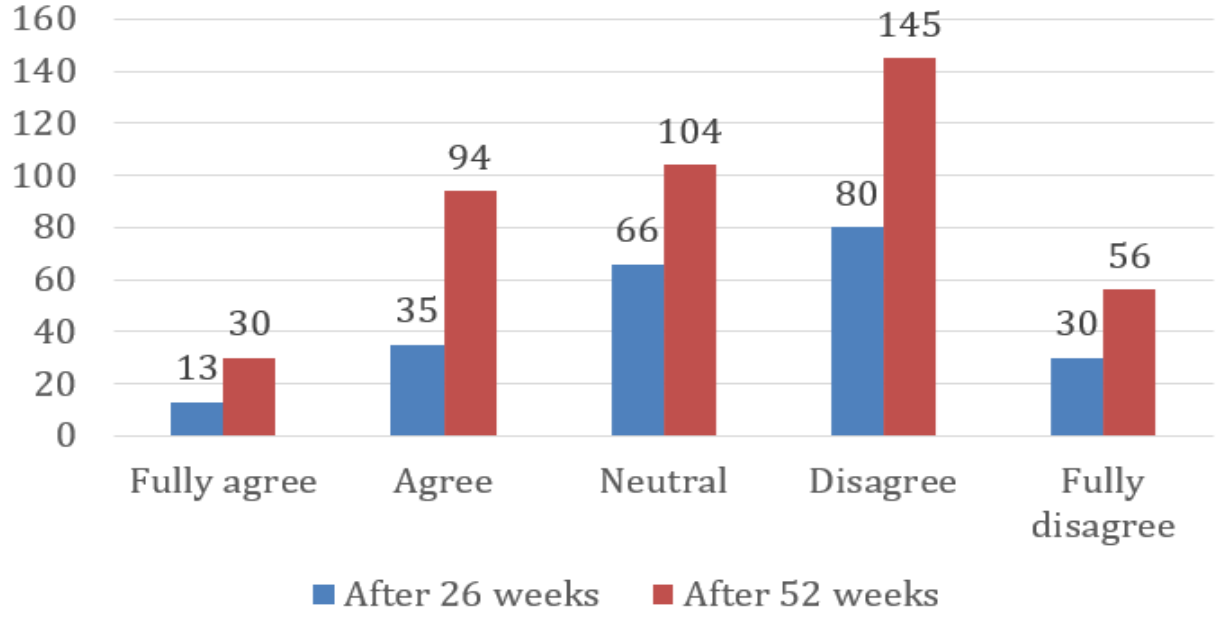

Figure 3. It causes too many interruptions during the day

CGM helped the participants to adjust their insulin doses (Figure S1), likely because it maintained blood glucose levels stable, leading to better general health outcomes. This was also supported by the answers about how CGM had allowed the respondents to worry less about low blood sugar levels (oftentimes much more maligned than high sugar levels), which would result from poor diabetes management (Figure S2). Participants reported that they did not consider that CGM caused them to feel more worried about controlling blood sugar levels (Figure S3).

They reported that CGM did cause hassles in daily life (Figure S4), but regardless of all the hassles and reasons why CGM can be seen as causing a burden for diabetics, answers clearly stated that CGM was not more

trouble than it was worth (Figure S5) and that it was not too hard to get it to work right (Figure S6).

Generally speaking, the results indicate that CGM gave freedom to users (Figure 1). Important for our research question, this caused a shift in professional practice – doctors need to adapt their approach and advice when there may be changes in diabetes care. In the following section, the changing relationship between the patient and the doctor shall be analyzed more specifically.

The patient-doctor relationship

First, we observed that there was no significant difference in feeling unsatisfied with their diabetes doctor in the different rounds of questionnaires (p=0,396). The results indicate that for the patient-doctor relationship, it did not seem to make any difference whether CGM was in use or not. Franklin (2016) in his study concluded that patients with insulin pump therapy cooperate more with their diabetes doctor than patients with traditional treatments, implying that patients using new technologies have a generally good relationship with their doctors. Perhaps, too, because they are permanently reminded that they are diabetic or because of a perception of increased severity. When respondents were asked whether they felt discouraged with their diabetes treatment plan, the answers were significantly different between pre-test and both post-tests (p=0,000). Cooperation with doctors was also tighter after starting CGM, which mirrors the feeling of loneliness surrounding being diabetic, and was statistically significant between the pre-test and the second post-test (p=0,028). Also, the perception of not having clear and concrete goals for diabetes care and feeling overwhelmed by diabetes had significant changes between the pre-test and both post-tests (Table 2).

Table 2. Repeated measures ANOVA results

	Sig. 1	**Time**	**Sig. 2**
Feeling unsatisfied with your diabetes physician	0,396		
Feeling discouraged with your diabetes treatment plan	**0,000**	a - b	0,000
		b - c	0,082
		a - c	0,000
Feeling alone with your diabetes	**0,034**	a - b	0,258
		b - c	0,605
		a - c	0,028
Not having clear and concrete goals for your diabetes care	**0,000**	a - b	0,000
		b - c	0,217
		a - c	0,000
Feeling overwhelmed by your diabetes	**0,002**	a - b	0,002
		b - c	1,000
		a - c	0,010

Note: Sig 1 reports if there is significant difference across 3 time points, sig 2 indicates where the significance occurs. Time-column, a = pre-test, b = after 26 weeks, c = after 52 weeks, significant results bolded

When looking back at the change that was not significant in the patient-doctor relationship, a binary logistic regression analysis was performed to infer whether demographic factors could explain the result.

The bivariate analysis shows that none of the independent variables had a significant effect on the dependent variable (Table 3).

Table 3: Bivariate statistics of the dependent variable (Feeling unsatisfied with your diabetes physician) with each independent variable (gender, age, educational level of the primary caregiver)

Variable	**Sig.**
Educational level of the primary caregiver	0,223
Age	0,447
Gender	0,909

Note: Age significance tested with ANOVA, education level and gender with Chi-square

The results of the binary logistic regression model (Table 4) showed that these demographic factors of the

patients did not have a significant effect on the patients' satisfaction with their diabetes doctor. The Chi-square test had a p-value of 0,336, indicating that the socio-demographic variables, predictor variables, do not make a significant improvement to the null model. The pseudo-R squares, Cox & Snell R square (0,030) and Nagelkerke R square (0,105) indicate that the socio-demographic variables explain about 3 % to 10,5 % of the model.

Table 4. Binary logistic regression model of the Feeling unsatisfied with your diabetes physician and independent variables (educational level of the primary caregiver, age, gender)

Variable	Sig.	Odds ratio	Β
Educational level of the primary caregiver			
Bachelors (reference category)	0,746		
Masters	0,339	0,428	-0,849
Professional	0,171	0,168	-1,782
Associate	0,998	0,000	-19,114
Other	0,998	0,000	-19,21
Age	0,892	1,004	0,004
Gender (male as a reference category)	0,898	0,914	-0,90
Negelkerke R square	0,105		
Cox & Snell R square	0,030		
Chi-square p-value	0,336		

DISCUSSION

Our empirical results are largely in agreement with existing literature on better possibilities for a stress-free life regarding diabetes management. This supports the claim that new treatment methods can have positive effects on individual life satisfaction. The results show that CGM is making patients' conditions more manageable in many respects, for example, by reducing worrisomeness about low blood sugar and future long-term complications and enabling easier adjustment of insulin doses. Drawing on previous observations that technologies mediate our lives and form the basic conditions that shape our identities as individuals[33,34] our research has import for the medicalization thesis. CGM users' identity is being medicalized when a new treatment technology takes its toll in the form of glitches and hassles, especially if life itself becomes 'monitored' continuously, when every ordinary activity in one's day is contemplated, planned, pondered, done, assessed and watched in reference to glucose levels.

Technostress is one of the unintended consequences of the use of new devices, which in the end might induce some sense of dependence on the practitioner. Technostress can cause flaws when using the device, which is more likely to happen when it has been recently put to use and there is no habit yet in interpreting the data to reach the best possible outcomes.

In the introduction of this paper, we hypothesized that due to increasing agency, more patients would feel unsatisfied with their GP. However, this was proven not to be the case. It is possible that patients who were still adjusting to this new technology were still waiting to see actual measurable outcomes in their health. Additionally, considering our results, we understand that when a doctor endorses a well-fitting solution that works well, one is likely to feel satisfied with and embrace the therapy and the practitioner's approach.

Moreover, what we were able to study was the *perception* of the patient-doctor relationship, which did not seem to be informed by the great gain in patients' agency. While patients may feel they are exerting more agency by self-monitoring and handling the device themselves, the sense of being diabetic, a medical condition, may be overemphasized. Otherwise, the results also showed that cooperation between patient and doctor remained constant throughout the study, though patients developed clearer goals about their self-care over time as compared to before they started using CGM. Alternatively, technostress may have induced some sense of (imagined) dependence on the practitioner, diminishing in the process the perception of agency. When the new device is put into use, practitioners no longer hold as much power with theoretical knowledge as they did before, although the patient has already been labelled with a diagnostic category, which controls the relationship on a broader level. Yet the patient has gained both practical knowledge and knowledge from the data produced by the new device, while none is under the doctor's control.

The treatments for type 1 diabetes have been developing for decades and becoming increasingly technologized. CGM is part of that same process of treatment and, consequently, medicalization – spheres of life that are not essentially medical, such as family life and even one's identity, may be continuously framed

within the parameters of medicine. CGM offers a new technological device to manage diabetes better, boosting the process of medicalization of management and participation on the part of the patient. Yet medicalization has been criticized ever since the term came about. One of the main criticisms focuses on how market forces are driving medicalizing processes further to sell more medicines, thus favouring the drug and technology industries at the expense of patients' best interests. These developments can be seen as drawing doctors and health care professionals to using the medical gaze instead of looking at the human as a person.[1,5,10] CGM is, indeed, a device to boost health care market consumption and possibly influence the growth of spending in the health care industry; yet one can also argue it may potentially reduce spending by preventing additional illnesses and increasing the life satisfaction and life expectancy of those who use it.

Our findings are largely aligned with a growing literature supporting the claim that CGM allows more freedom in the daily lives of patients. The subjects found CGM self-management data reassuring and helpful in their own self-care. However, there seemed to be no significant results suggesting a change in the patient-doctor relationship, likely indicating either that subjects may not be aware of the changing nature of the relationship with their diabetes doctor or, as we had anticipated, that the use of medical technology reinforces medically dominated dynamics within the relationship. In the latter case, positive medicalization might be an overoptimistic notion in contexts such as this.

Additionally, our findings also suggest that patients might not be aware of the changing nature of their relationship when they are gaining more agency in their own self-care, though this is very likely to be beneath their overall sense of assurance. Shim[17] discusses how people with high health cultural capital are more likely to 'hit it off' with their diabetes doctor. This would be an insightful case for further research, looking at the different components of building a high cultural health capital and their possible causal connection to the patient's satisfaction with the doctor.

Although the dataset might look dated (collection period of 2007-2009), and the study could benefit from repeating with more recent trials, it proved to be relevant in light of recent developments in medical technologies, i.e., how modern technologies enhance empowerment and self-care agency and change the relationship between patient and doctor. Plus, the dataset was useful for analyzing changes over time and provided a rich source of valuable information. Additionally, the users mostly represented a single cultural background and were typically from a highly educated class, which reflects more homogeneity than diversity within the sample. Thus, analyses might vary across participants with more diverse cultural backgrounds, both ethnic and educational, which is advised for future research.

CONCLUSION

On a larger scale and in light of recent literature, the results of this study encourage us to look at medicalization from a positive perspective, as a chance to improve health services by using digital technologies that are currently available. This contrasts with the view that regards medicalization as an inevitably negative process with market-oriented goals towards profit maximization at the expense of the public interest. And yet, a cautionary note may be healthy as to how a user's life and identity may be acquiring an overly medical layer, which may have consequences for how the person defines themselves, presents themselves in society, and are reacted to by others. Without disregarding the cumulative effects of the medical gaze in contemporary society, we should highlight how digital technologies allow patient empowerment and therefore recognize the relative weight of each polar stance in the spectrum. Aware of the need for further analyses, at a policy-making level this study encourages the support of digital health technologies and new device development while keeping a critical attitude towards other unintended consequences of health devices and an eventual reshaping of the professional ethos. Overall, the paper offers an empirically driven contribution towards bridging the gap between technology-related optimism and pessimism in health care settings.

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CONSENT

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ETHICS APPROVAL

For the primary trial, ethics approval was granted by the JCHR Institutional Review Board (trial id NCT00406133). As for secondary analyses, we accessed anonymized statistical data from the Jaeb Center for Health Research (JCHR) complying with privacy regulations.

AUTHORSHIP CONTRIBUTIONS

Conceptualization: Terhi Kangas.
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Investigation: Terhi Kangas.
Methodology: Terhi Kangas.
Writing - original draft: Terhi Kangas.
Investigation: Ricardo Ayala.
Supervision: Ricardo Ayala.
Writing - reviewing and editing: Ricardo Ayala.

SUPPLEMENTARY MATERIAL

Figure S1

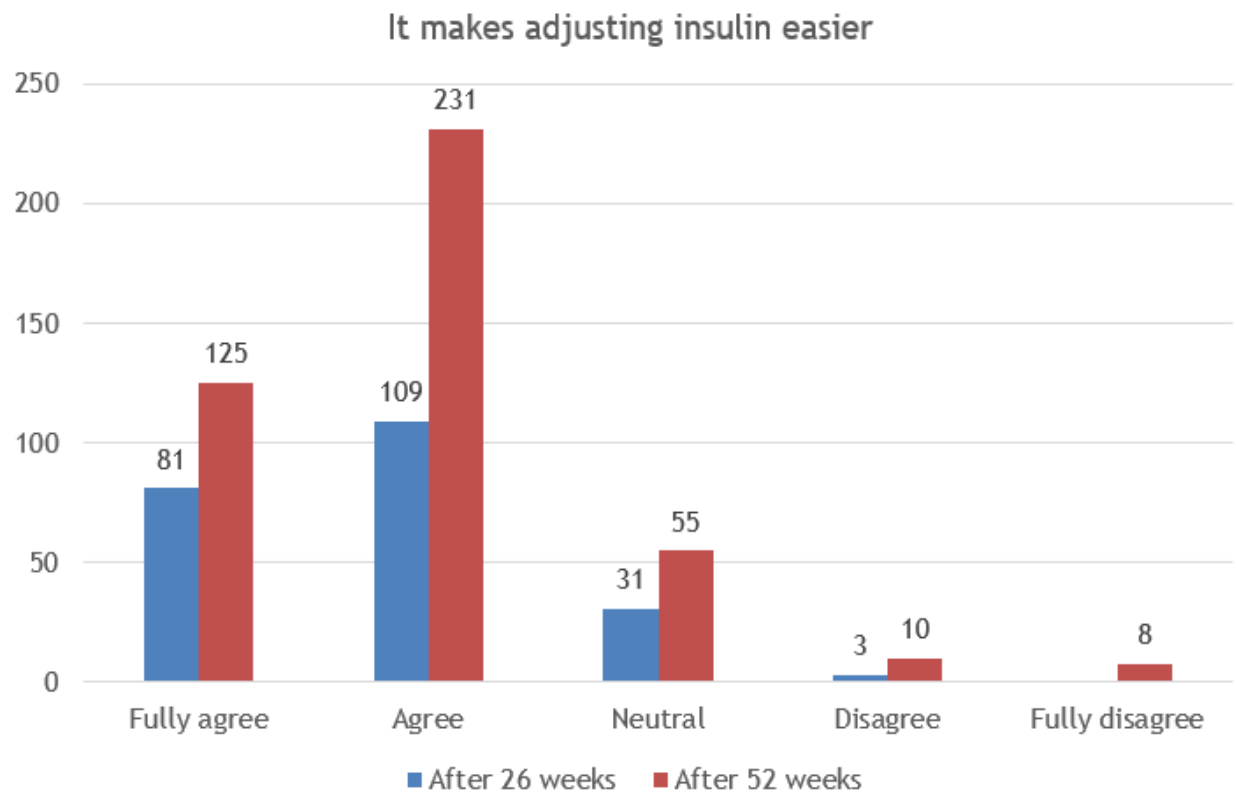

Figure S2

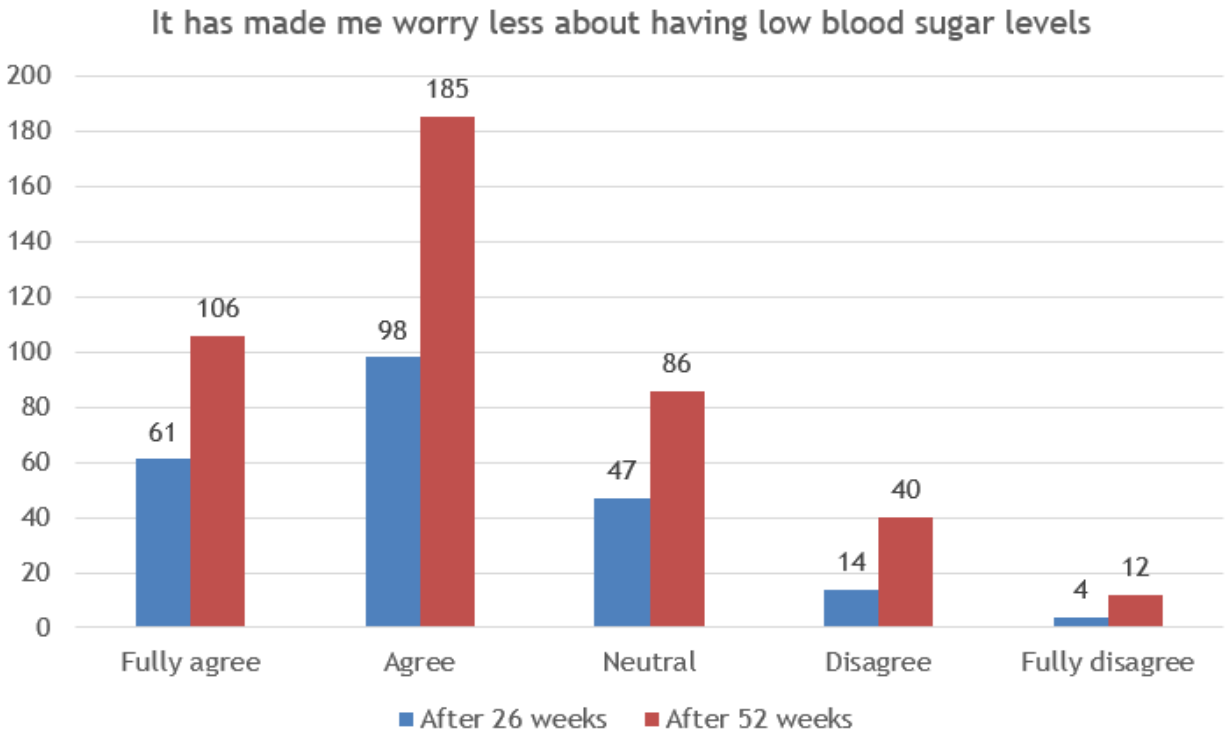

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Figure S3

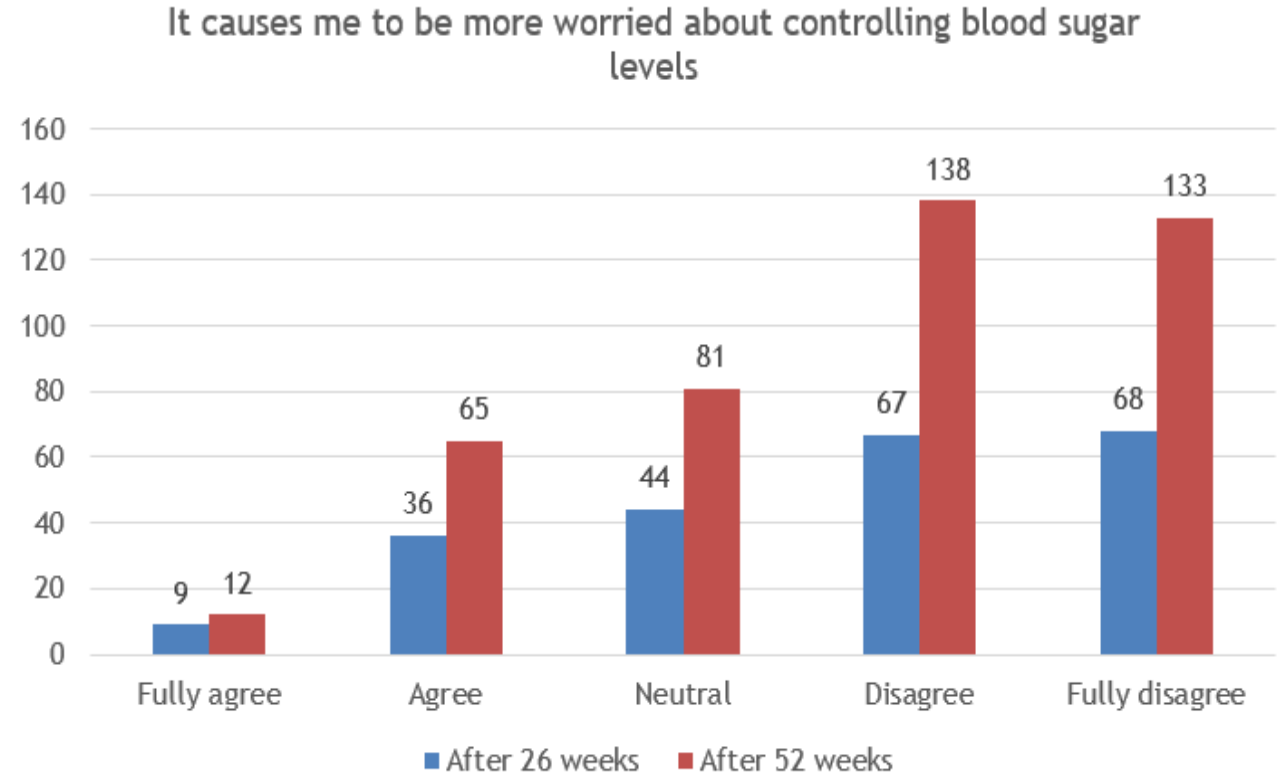

Figure S4

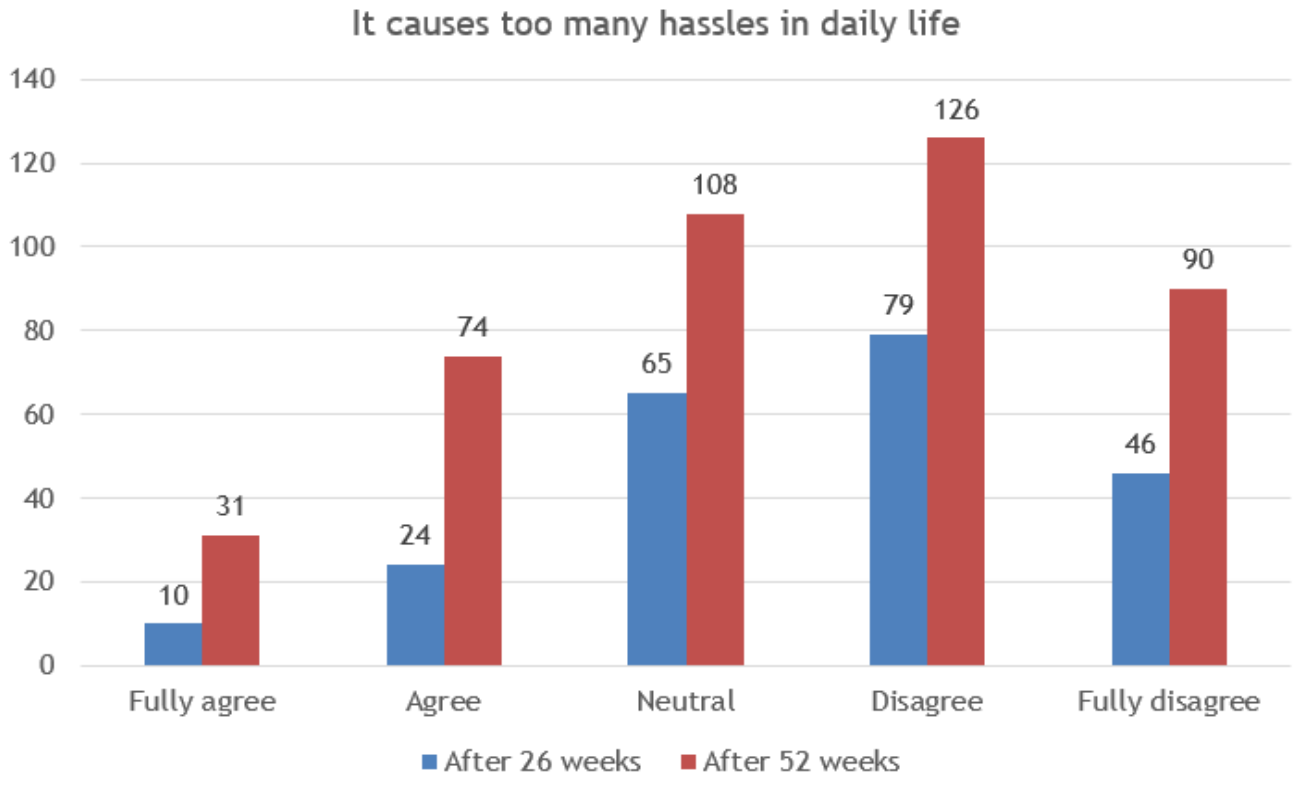

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Figure S5

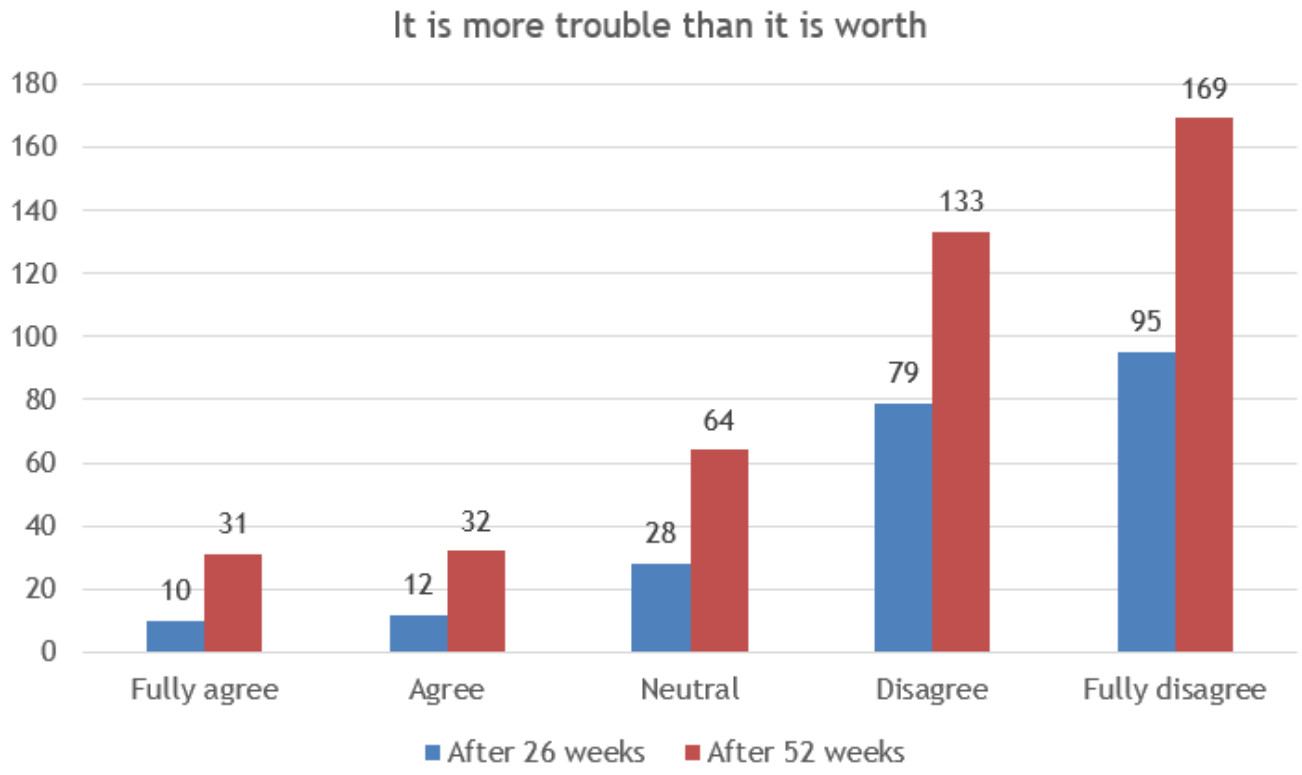
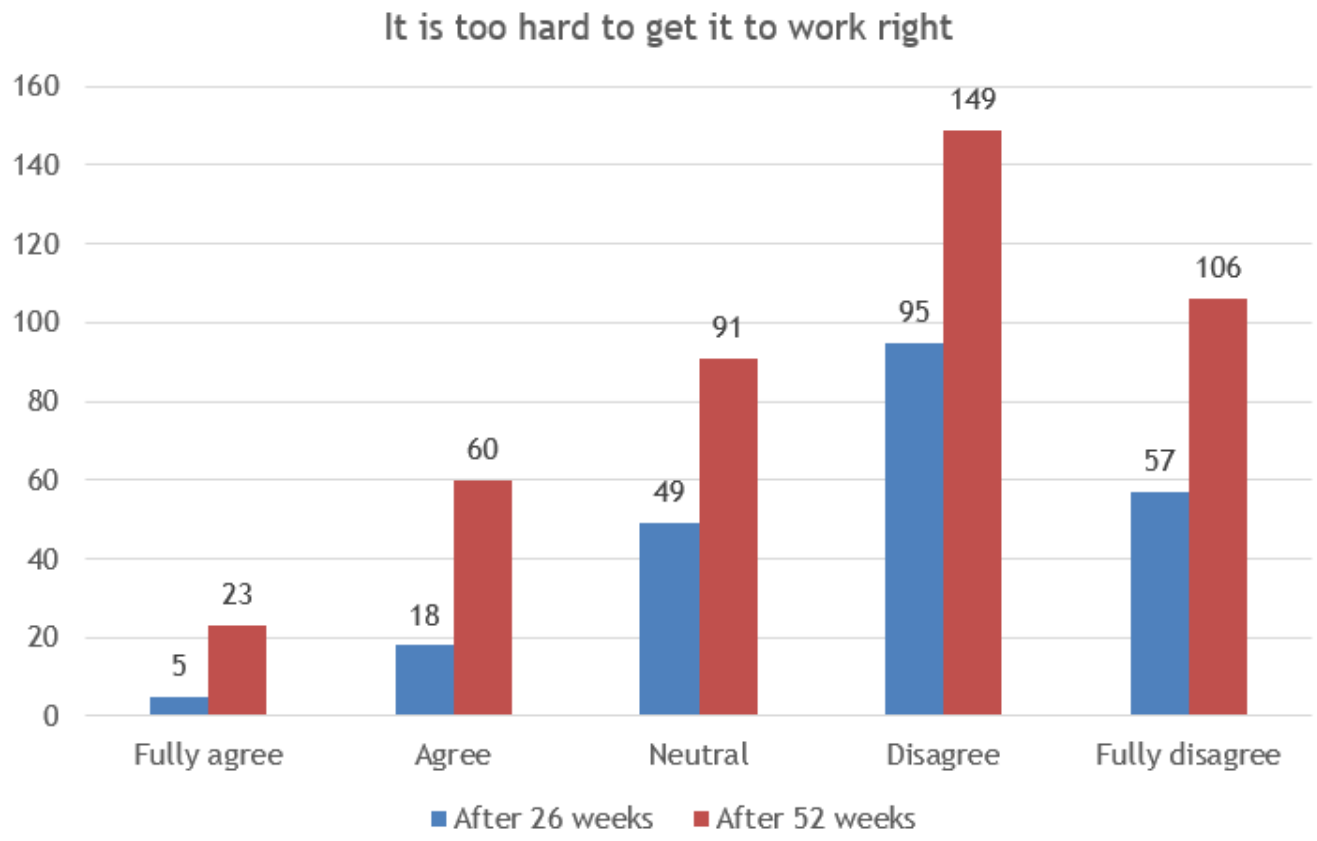


Figure S6



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