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What is important in the treatment of type 2 diabetes?

Results of a discrete choice experiment on patient preferences in the decision for a combination therapy

What Matters in the Treatment of Type 2 Diabetes? – Results of a Discrete Choice Experiment on Patient Preferences in the Decision for Combination Therapy

Type 2 diabetes (T2D) is a chronic condition that, if left untreated, can lead to serious complications. Despite a wide range of pharmacological options for combination therapy, little is known about patients' preferences when choosing their treatment. This study aimed to systematically examine these preferences. Between August and November 2023, 583 adult patients with T2D in Germany participated in a scientific online survey. In a choice experiment, participants repeatedly selected between hypothetical treatment scenarios that differed in terms of the risk of complications (e.g., heart attack, stroke), potential treatment side effects (e.g., nausea, nerve damage), as well as the mode and frequency of administration. The results showed that nausea, nerve damage, and changes in body weight were particularly important to patients. Furthermore, the findings highlighted the role of individual experiences and health literacy in how treatment alternatives are evaluated. Considering these preferences can support more informed treatment decisions, greater satisfaction, and improved adherence. The findings also offer valuable input for clinical guideline development and research.

Keywords

patient preferences, health preference research, discrete choice experiment, type 2 diabetes, combination therapy

Health preferences research plays a central role in supporting patients and physicians in their joint decision-making. Such studies reveal what is important to patients in their treatment, enabling recommendations that better suit their needs - this improves individualised care, promotes adherence to treatment and can reduce complications (Cramer 2004). The study presented investigated the value of treatments by surveying patient preferences. The aim was to gain scientifically validated insights into the preferences of people with T2D. In particular, the study investigated which aspects are important to patients when choosing medication for combination treatment.

>> Discrete choice experiments (DCE) - also known as choice experiments - are a method for eliciting preferences (Craig et al. 2017; Mühlbacher and Johnson 2016). DCEs are based on the idea that people make a choice in favour of alternatives that bring them the greatest benefit (Mühlbacher and Johnson 2016). In this study, participants had to choose between different hypothetical drug treatment options to show their preferred choice.

Literature and qualitative methods

To identify the relevant characteristics in this study, a targeted literature review and interviews with ten people with diabetes were first conducted. Eight characteristics were identified that describe the combination therapy and are relevant for a decision by those affected. They were used to develop choice tasks for the quantitative survey. These characteristics were compared with the recommendations of the current version of the NDMG (German Medical Association 2024). Three characteristics related to possible health consequences of the disease, such as the risk of heart attack, stroke and nerve damage. Three further characteristics describe the consequences of treatment, such as nausea, severe hypoglycaemia and weight changes. A further two characteristics described how and how often the medication should be taken (once a week or seven times a week, orally or by injection) and the schedule of administration (whether taken in the morning or evening and with or without meals). The properties have been proven by means of clinical studies with so-called characteristics. Characteristics are concrete indications of the strength or frequency of a property - for example, how great a risk is. They help to better understand the differences between various treatment options.

Quantitative survey to ascertain preferences

Study population

This study included participants who were currently only receiving one medication (monotherapy) and had no experience of com-

Background

Type 2 diabetes (T2D) is a major health challenge for many people. It impairs quality of life and can lead to serious secondary diseases such as heart attack, stroke or nerve damage (Abdul Basith Khan et al. 2020; Baynes 2015). Earlier surveys estimated the number of people with diabetes in Germany at around 4.6 million, 98 per cent of whom have type 2 diabetes (Saß et al. 2015; Tamayo et al. 2016). Current estimates assume that there are at least 9.1 million people with type 2 diabetes. In addition, there are around 340,000 adults and 32,000 children and adolescents with type 1 diabetes as well as over two million undiagnosed cases (German Diabetes Association (DDG) and diabetesDE - German Diabetes Aid 2025).

Drug therapy for T2D usually begins with the use of metformin as the only medication. If this is not sufficient or patients have a higher risk of cardiovascular disease, among other things, other medications are added (Davies et al. 2018; Buse et al. 2020; National Care Guideline et al.). SGLT-2 inhibitors and GLP-1 receptor agonists are particularly recommended if patients have an increased risk of heart or kidney disease (Nauck and Quast 2021). GLP-1 receptor agonists can help with weight loss, but sometimes cause gastrointestinal discomfort (Nathan et al. 2022; He et al. 2022). DPP-4 inhibitors have a less pronounced blood glucose-lowering effect (Nathan et al. 2022). Sulphonylureas lower blood sugar well, but can lead to hypoglycaemia and weight gain (Bolen et al. 2016; Madsen et al. 2019). These medications also have different modes of administration and intake (injections or tablets).

The choice of the best treatment should also depend on what is important to patients. The current guidelines emphasise shared decision making between doctors and patients. This method can improve treatment as patients are more involved. This can have a positive impact on treatment outcomes and adherence to treatment (National Care Guideline et al. 2024).

bination therapy. These participants were assigned to population 1. On the other hand, participants who were receiving combination therapy at the time of the survey were included. These participants were assigned to population 2. Population 1 is mentally faced with the decision in favour of combination therapy, while Population 2 has to put itself in this decision-making situation retrospectively. All participants had to be 18 years or older, live in Germany and speak German.

Survey instrument Each participant answered 12 optional tasks. Each task comprised three treatment alternatives. All 12 choice tasks were designed as simplified choice tasks (Chrzan 2010). This means that only five of eight characteristics were shown per task, the characteristics of which differed. The remaining three characteristics remained the same and were shown above the task. See Figure 1.

In addition to the choice tasks, participants answered additional questions, including questions about the inclusion criteria, their consent to participate, personal experiences (e.g. with nerve damage or nausea), their background, previous treatment experiences, health status, quality of life, adherence to treatment and health literacy.

Data analysis The data was analysed to find out which characteristics influenced the decisions. Two calculation models were used for this: a simple model (conditional logit) and a model that takes into account differences between people (random parameter logit). In addition, a latent class analysis was carried out to recognise different groups with similar preferences.

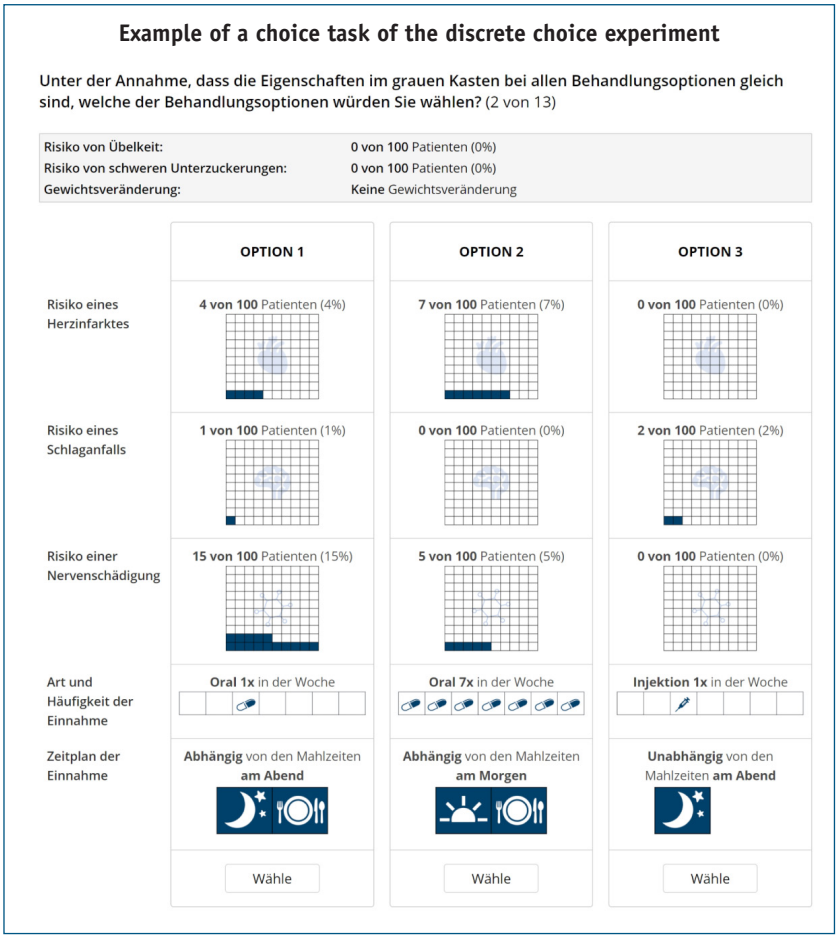


Fig. 1: Example of a choice task of the discrete choice experiment. In each of the twelve choice tasks, various attributes were displayed above the choice task, and the values within the choice task changed constantly. Own presentation.

Results

Results of the choice decisions (discrete choice experiment)

Who are the participants?

The data was collected in an online survey conducted between August and November 2023 among people with T2D in Germany. 583 adult participants were included in the final data analysis: 292 people in Population 1 and 291 in Population 2. 55% of the participants were women, and the average age was 58 years. See table 2.

What are the main results?

The characteristic 'risk of nausea' was particularly important to participants. They clearly favoured treatment options where there was no risk of nausea. As the risk increased (e.g. 10%, 30%, 50%), agreement with these options fell sharply. This shows that a higher risk of nausea is rejected by the participants.

The characteristic 'risk of nerve damage' also played a central role. Treatments without a risk of nerve damage were clearly favoured. As the risk increased (e.g. 5%, 10%, 15%), approval fell noticeably, which shows that a higher risk of nerve damage has a negative influence on the treatment decision.

The characteristic 'weight change' also had an influence on the decisions. Treatments that lead to weight loss were favoured. A weight loss of 2 or 6 kg was rated positively. Weight gain, on the other hand, was clearly rejected.

The characteristic 'type and frequency of use' showed a clear preference for weekly use. A tablet or injection taken only once a week was favoured. Options requiring daily use, such as tablets or injections seven times a week, were rejected. Interestingly, participants favoured a weekly injection over a tablet that had to be taken daily.

For the characteristic 'risk of a heart attack', the agreement in favour of a treatment option decreased with increasing risk (e.g. 2%, 4%, 7%), as did the 'risk of a stroke' (e.g. 1%, 2%, 4%).

The characteristic 'risk of severe hypoglycaemia' had only a minor influence on the decisions. Treatments with no or low risk were favoured.

The characteristic 'schedule of intake' had the least influence on the decisions overall. The participants showed a slight rejection of treatments that are dependent on meals in the morning.

An analysis of the relative importance of the characteristics shows which characteristics were most important for the participants overall:

- 'Risk of nausea' had the greatest influence on participants' decisions.
- Less important was, for example, the time of day

at which the medication should be taken. See Figure 2.

Differences between BMI groups

The first comparison between the study populations showed that most of the characteristics had similar patterns in both groups, with only small differences. However, for the trait 'weight change' it was noticeable that Population 2 showed a stronger desire for weight loss (especially 6 kg less) and a greater rejection of weight gain (especially 6 kg more) than Population 1.

On this basis, a detailed analysis was carried out in relation to

Overview of the participants' sociodemographic data and current treatment						
	Population 1		**Population 2**		**Total**	
	n = 292		**n = 291**		**N = 583**	
Aktuelle T2D-Behandlung	**N**	**%**	**N**	**%**	**N**	**%**
Ich nehme nur ein Diabetesmedikament in Tablettenform (Metformin).	292	100	0	0	292	50.1
Ich nehme ein Diabetesmedikament in Tablettenform (Metformin) und ein weiteres Diabetesmedikament in Tablettenform.	0	0	189	65	189	32.4
Ich nehme mindestens ein Diabetesmedikament (Metformin) in Tablettenform und spritze ein weiteres Diabetesmedikament (kein Insulin).	0	0	102	35.1	102	17.5
Eigenschaften der Studienpopulation	**N**	**%**	**N**	**%**	**N**	**%**
Alter Mittelwert – Standardabweichung – Minimum – Maximum	58 - 8.8 - 24 - 77		57 - 8.6 - 29 - 74		58 - 8.7 - 24 - 77	
Geschlecht						
Männlich	123	42.1	136	46.7	259	44.3
Weiblich	166	56.8	154	52.9	320	54.9
Divers	3	1.0	1	0.3	4	0.7
Familienstand						
In einer Partnerschaft oder verheiratet	173	59.3	190	65.3	363	62.3
Ledig	34	11.6	33	11.3	67	11.5
Verwitwet	15	5.1	6	2.1	21	3.6
Geschieden oder getrennt lebend	70	23.9	62	21.3	132	22.6
Bildungsabschluss						
Kein Schulabschluss	4	1.4	2	0.7	6	1.0
Hauptschul-/Volksschulabschluss	34	11.6	34	11.7	68	11.7
Mittlere Reife, Realschulabschluss, POS	111	38.0	100	34.4	211	36.2
Fachhochschulreife	17	5.8	30	10.3	47	8.1
Abitur, Allgemeine Hochschulreife, EOS	52	17.8	48	16.5	100	17.2
Abschluss einer Fachschule oder Berufsfachschule	25	8.6	33	11.3	58	10.0
Abschluss an einer Fachhochschule oder Universität	41	14.0	37	12.7	78	13.4
Promotion	7	2.4	6	2.1	13	2.2
Habilitation	1	0.3	1	0.3	2	0.3
Hauptberuflicher Status						
Angestellt, vollzeitbeschäftigt (mehr als 30 Arbeitsstunden pro Woche)	111	38.0	137	47.1	248	42.5
Angestellt, teilzeitbeschäftigt (genau oder weniger als 30 Arbeitsstunden pro Woche)	82	28.1	68	23.4	150	25.7
Selbstständig oder freiberuflich tätig	23	7.9	14	4.8	37	6.4
In der Ausbildung	0	0.0	1	0.3	1	0.2
Im Studium	1	0.3	2	0.7	3	0.5
In der Rente, im Ruhestand oder in der Altersteilzeit	69	23.6	61	21.0	130	22.3
Nicht arbeitstätig	6	2.1	8	2.8	14	2.4
Lebensumfeld						
Ich lebe auf dem Land.	125	42.8	98	33.7	223	38.3
Ich lebe in der Stadt.	167	57.2	193	66.3	360	61.8

Tab. 1: Overview of the participants' sociodemographic data and current treatment. Own presentation.

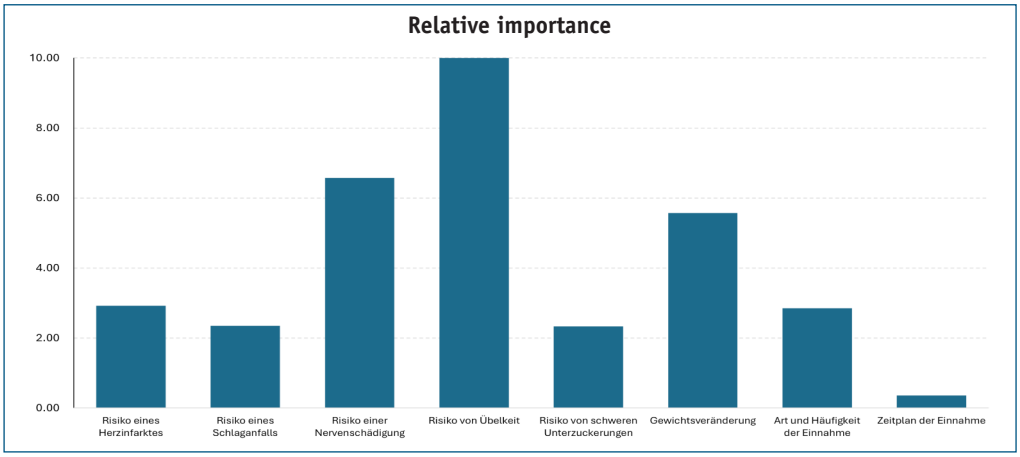


Fig. 2: Relative importance, N = 583. own illustration. Relative importance - differences between populations

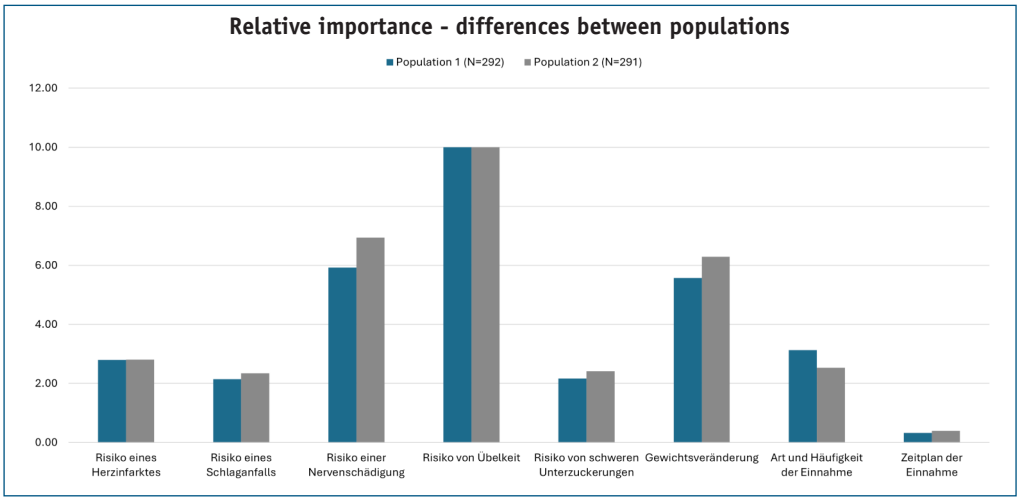


Fig. 3: Relative importance - differences between populations, N = 583. Own illustration.

the body mass index (BMI). The participants were categorised into three BMI groups:
- BMI < 25 (underweight or normal weight): This group favoured a moderate weight loss of 2 kg compared to 6 kg.
- BMI 25-29.9 (overweight): No clear difference in preference between 2 kg and 6 kg weight loss was evident here; both options were rated similarly.
- BMI ≥ 30 (obesity): This group clearly favoured a weight loss of 6 kg over 2 kg.

However, all groups rejected weight gain and always favoured weight loss.

Different assessments between participants

Further analysis showed that individual characteristics were rated very differently. There were major differences between the participants, particularly with regard to 'weight change', 'risk of nausea', 'type and frequency of intake' and 'risk of nerve damage'. It also emerged that the 'type and frequency of use' was more important to many than classic risks such as heart attack, stroke or severe hypoglycaemia. The results indicate different needs and experiences.

Differences between the study populations

There are significant differences between the two groups, particularly with regard to the characteristics “weight change,” “risk of nerve damage,” and “type and frequency of intake,” which shows that participants have different preferences for the various characteristics. For participants in population 2, who already had experience with combination therapy, the characteristics “risk of nerve damage” and “weight change” were significantly more important than for the inexperienced participants in population 1. In contrast, the characteristic “type and frequency of administration” was less important for population 2 than for population 1. See Fig. 3.

Different ratings in three subgroups

In a further calculation, three groups of participants were found to rate treatments differently. For group 2, weight was particularly important. Group 1 and Group 3 placed more importance on avoiding nausea. Group 2 consisted more often of working people and people who were very concerned with weight and nutrition.

Health and satisfaction with treatment

Additionally, the study found differences in health status and satisfaction with medication treatment between the study populations. Around 72% of people rated their state of health as 'good' or 'very good'. Around 28% felt that their state of health was 'satisfactory' or 'less good'. In both populations, around 72% had a positive impression of their health. In population 2, despite a positive state of health, there was less satisfaction with the treatment. Only about 53% were 'very satisfied' or 'somewhat satisfied' with their medication. Almost 47% were neutral or less satisfied. Satisfaction was higher in population 1. Around 75% were 'very satisfied' or 'somewhat satisfied'. Only around 25% were less satisfied. The results show that good health does not always mean that people are satisfied with their treatment.

Access to and understanding of health information

Most participants stated that they were able to understand

health information well. Almost 97% found treatment information 'easy' or 'very easy' to access. Around 95% knew how to find professional support. Participants found it slightly more difficult to understand medical instructions. Only 63% rated this as 'easy' or 'very easy'. Getting a second opinion was 'difficult' or 'very difficult' for around a third. Participants in population 2 found it more difficult to understand instructions from doctors or pharmacists (26%). In population 1, only 5% had these difficulties. These results show that while many people cope well with health information, there are also areas where support is needed.

How patient representatives assess the results

In order to better incorporate the patient perspective into such studies and decision-making processes, a workshop was organised with patient representatives in the field of diabetes, obesity and overweight. The aim of this workshop was to discuss the results of the presented study together and supplement them with practical perspectives. The focus was on developing a better understanding of the integration of patient preferences into decision-making in the treatment of T2D, particularly in the selection of combination therapies. The workshop was organised to present the key findings of the study in an understandable and concise form and to discuss them with the participants. In addition, the patient representatives contributed their everyday perspectives to enrich the results from their point of view.

Together, the results were analysed with regard to the perception of attributes, the assessment of risks, short-term and long-term risks, the influence of experiences, the influence of patient characteristics, psychological and mental influences, the perspective on the use of treatment, treatment adherence and shared decision-making, as well as the differences between those affected by T2D and T1D.

Perception of attributes

People perceive certain attributes of therapies differently depending on what they are currently experiencing in everyday life. Problems such as nausea are often perceived more strongly than long-term risks such as heart attacks because they are more immediately noticeable. Side effects such as nausea or weight gain play a particularly important role for people who are overweight. 'Nausea is just more tangible. It's really more tangible when you're told:

'You're going to be sick every day. It's different to 'you get a heart attack every day'. I have to live with the nausea for now, but with the heart attack I'm out of business anyway.'

Assessment of risks

The panellists were of the opinion that many people underestimate long-term risks such as heart attacks or strokes. The difference between the groups shows that people with a high BMI perceive risks differently, often because they are already struggling with major limitations such as poor mobility. This can lead to short-term side effects such as nausea being weighted more heavily.

'Stroke and heart attack, that's sometime later, and nausea, that hits you now. '

Short-term vs. long-term risks

Patients often perceive short-term symptoms such as nausea or weight gain as more stressful than long-term risks.

'People know nausea and weight gain from experience. But a heart attack - I don't have one every month. Because it's so far away, just like a stroke. '

Influence of experience

Experiences with treatments or complications influence patients' decisions from the perspective of the panellists. Those who have already experienced serious consequences such as nerve damage evaluate treatments differently. Factors such as the duration of the disease and how side effects are dealt with also play a role.

'The risk of nerve damage is more important to me because I know how bad it is. I want to avoid that at all costs. '

Influence of patient characteristics

Factors influencing the assessment of therapies, such as age, level of education and life circumstances, were discussed. Older people are often more exposed to risks such as heart attacks or strokes. People with structured daily routines often find it easier to implement therapy instructions.

'Someone in their early 30s might not think about a heart attack as often as I do at 53.'

Psychological and mental influences on decisions

Emotions and psychological stress play a major role. People with a high level of psychological stress often accept negative side effects if they are promised relief from their symptoms. The mobility restrictions associated with a high BMI further reinforce this perception.

'The greater the level of suffering, the more likely people are to accept nausea as a necessary consequence of treatment.'

Administration of the treatment

How and how often medication has to be taken has a major influence on adherence to treatment. Weekly administration is usually preferred - regardless of whether tablets or injections are used. Although it was discussed whether injections are more time-consuming, most of the panellists agreed that for people with irregular daily routines, such as shift workers, even daily oral administration can be challenging.

'When I'm out in the evening or doing sport, I don't think about my tablets. It would be much easier to take them once a week.'

Treatment adherence and decision-making

Knowledge about one's own illness and therapy plays a major role in treatment adherence. People who understand the importance of regular use are more likely to stick to it. At the same time, it has been shown that habits and thought patterns are just as important for implementing therapies in everyday life. The current importance of joint decision-making between doctors and patients was also addressed in this context.

'It's about forming routines, like storing tablets next to the toothbrush. That doesn't happen on its own. '

Discussion and conclusions

Summary of the study results

The results show that the risk of nausea, nerve damage and weight changes were the most important factors, followed by the type and frequency of use. In particular, people with higher BMI or experience with second-line therapies favoured treatments that promote weight loss. Personal characteristics such as professional status, dietary focus and perceived weight influenced the choice decision. Health status, satisfaction with treatment and how health information is handled are also important aspects. Differences in the perception of therapy aspects reflected individual needs and experiences.

The workshop with patient representatives added practical perspectives to the study. Key topics such as the perception of risks and the importance of shared decision-making were discussed. It was shown that personal characteristics such as age, experience or physical abilities can strongly influence the perception of risks. Aspects such as psychological distress and individual stress also had an impact on the assessment of treatment characteristics. These findings underline the importance of a patient-centred design of T2D therapies that takes into account the diverse needs and experiences of patients.

Implications for shared decision-making

This study emphasises the importance of considering patients' needs when selecting medications for the treatment of T2D. Patients are particularly opposed to treatments that interfere with everyday life - for example through nausea or daily use, whether as a tablet or injection. The assessment of individual characteristics depends heavily on individual experiences and backgrounds. Doctors should take these preferences into account when making treatment decisions in order to promote adherence to treatment and improve quality of life. Personalised treatment leads to higher satisfaction and better outcomes.

Implications for clinical practice and studies

Future clinical trials should take greater account of patient preferences and incorporate patient-centred outcomes to achieve more real-world results. The results of this study also provide a basis for differentiated target group approaches, e.g. according to personal experiences or life situations. In this way, clinical studies can be better tailored to the diversity of patients.

Implications for regulatory decisions

The results are also relevant for guideline development and benefit assessments of drugs. Patient preferences should be systematically incorporated into evaluation processes. Data that reflects the patient's perspective is an important addition to traditional evidence of efficacy.

The results of this study and the workshop with patient representatives emphasise the importance of not only conducting preference studies, but also preparing and reflecting on them in a practical way. This is crucial to ensure their application in joint decision-making between doctors and patients, in clinical trials and at the regulatory level, for example in the context of health technology assessment processes. <<

Data release

The data sets generated and/or analysed during the study are not publicly available. The analysis will be published with the publication of the results. Individual datasets can be requested from the corresponding author.

Ethics

The study was reviewed and approved by the Ethics Committee of the Neubrandenburg University of Applied Sciences (HSNB/195/22). The study, including the proposed preference survey instruments, the consent form and the study design, was reviewed and approved by the Ethics Committee of the Neubrandenburg University of Applied Sciences (HSNB/195/22). The study takes into account the Declaration of Helsinki, the German Federal Data Protection Act (BDSG), the EU Data Protection Directive and the Good Clinical Practice Guidelines (CPM/ICH/135/95) regarding the reporting of serious adverse events (SAEs).

Author's declaration

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