

## Comprehension of climate change and environmental attitudes across the lifespan

In view of the demographic shift towards an aging society, it is currently assumed that 29% of eligible voters in Germany will be above the age of 65 by 2030 [6]. At the same time, climate change will have progressed, challenging aging political decision makers to take action to mitigate greenhouse gases and to initiate appropriate adaptation measures [18]. It has been put forward that pro-environmental behavior is determined by the intention to act pro-environmentally, which in turn is dependent on (1) pro-environmental attitudes and values and (2) environmental knowledge [9].

The adoption of pro-environmental behaviors requires the actor to be sufficiently motivated. Primary motives, such as altruistic and social values are often outweighed by more immediate motives which evolve around personal needs [10]. With respect to elderly individuals, the matter is complicated further by the fact that the aging voter is unlikely to directly profit from pro-environmental actions. As a result, fewer pro-environmental attitudes may be adopted [1]. Contrary to this assumption stands Erikson's notion of generativity, according to which middle-aged individuals develop an increasing concern for guiding future generations. Socially valued contributions in the form of raising a family or working toward a betterment of society are adopted and in turn lead to a sense of accomplishment, while decisions driven by egoistic reasons lead to a feeling of stagnation and dissatisfaction [5]. Studies revealing a positive relationship of age and social preferences [11] are in line with this theory. This would imply that the aging decision mak-

er is more and not less likely to adopt pro-environmental behavior [10].

A thorough understanding of climate change may be as important for the adoption of pro-environmental actions. A central aspect of understanding climate change is the ability of the actor to be able to think in systems. System thinking, as opposed to analytical thinking, includes discovering and representing cyclical (as opposed to linear) cause-effect relationships and identifying nonlinearities [2]. As an example, the relationship between methane emissions and global mean temperature is both linear as well as cyclical, i.e., methane linearly increases global mean temperature while an increase in temperature leads to the melting of permafrost in arctic regions which in turn unlocks further methane. It seems plausible that comprehension of such complex system structures depends on cognitive capacities—in particular executive functioning, including abstract thinking skills and deductive reasoning. Current estimations based on longitudinal studies [20] find that approximately 25% of individuals in their mid-sixties and even 30% of individuals in their mid-seventies suffer from verifiable cognitive decline, exceeding that typically observed in healthy aging. These changes are primarily observed in individuals with a rather low educational level or cognitive reserve, i.e., those who tend to be less aware of environmental hazards (for a review, see [15]). Moreover, it is conceivable that older generations are less well informed about climate change than younger generations given that climate change is a relatively new phenomenon. For these reasons, it seems

likely that some fraction of political decision makers is overburdened when faced with decisions pertaining to the complex climate system.

However, the link between attitude, knowledge, and pro-environmental behavior is not straight forward. Studies have demonstrated that even detailed technical knowledge of climate change does not necessarily foster pro-environmental behavior [4]. Likewise, a pronounced increase in climate change relevant knowledge as gathered and compiled by the Intergovernmental Panel on Climate Change (IPCC) has not been accompanied by an increase in pro-environmental behavior. Different explanatory approaches for this apparent gap have been put forward (for review refer to [10]), one of them being that a fundamental misunderstanding of complex processes underlying climate change exists [17]. Accordingly, the decision maker is incapable to fully grasp a multitude of complex feedback processes, accumulation dynamics (stock and flow, SF) as well as far-reaching time lags resulting from the inertia of the climate system. In previous research we were able to demonstrate that the comprehension of accumulation dynamics is at least partially determined by the display format. Scientific notations and complex graphical displays of such accumulation dynamics foster reasoning errors. As these formats are avoided, the vast majority of participants correctly interpreted accumulation scenarios. Consequently, it was argued that there exists no fundamental reasoning error and individuals are capable of thinking in systems—if presented adequately [7]. Thus, the so-called val-

### Question 9

9.1 Cold water is able to absorb larger quantities of CO<sub>2</sub> than warm water. Given that global warming leads to an increase in ocean temperature: How will ocean temperature and CO<sub>2</sub> absorption develop over time? (Given that no other influences exist).

9.2 Please draw an arrow diagram depicting the relationship(s) between ocean temperature and CO<sub>2</sub> absorption:



9.3 Which of the following situations best corresponds to the relationship(s) between ocean temperature and CO<sub>2</sub> absorption?

- Relationship(s) between unemployment rate and retailing of luxury goods
- Relationship(s) between number of friends and number of invitations to parties
- Relationship(s) between cigarette consumption and risk of lung cancer

Fig. 1 ▲ Example of question

ue–action gap cannot solely be explained by lack of comprehension. Also, environmental attitudes have been found to have a varying, usually small impact on pro-environmental behavior [3, 10].

In a study by Martinsson and Lundqvist [13] the relationship between environmental attitude and environmental behavior is considered more closely. The authors classified a total of 5531 participants of a large Swedish survey into one of four subtypes:

- *believers*, whose pro-environmental attitudes are congruent with pro-environmental behavior,
- *diehards*, whose non-ecological attitudes are congruent with non-ecological behavior,
- *hypocrites*, who exhibit pro-environmental attitudes but do not act accordingly, and
- *coverts*, who act pro-environmentally despite holding non-ecological attitudes.

The authors found that 81% of participants were classified as diehards, 3% as believers, 5% as hypocrites, and 11% as coverts. The results indicate that while in the majority of cases, attitudes and behavior

was congruent, a total of 16% displayed incongruence with 11% of participants not holding environmental attitudes and still acting pro-environmentally. The discrepancy is attributed to prevailing structures in Swedish society that encourage pro-environmental behavior.

It was the aim of this study to investigate three subsets of questions involving (1) the extent to which climate change attitude, information status, and altruistic character varies as a function of age, (2) the extent to which feedback processes underlying climate change are understood by individuals of different ages, and (3) potential relationships between comprehension of climate system and attitudes.

## Methods

### Participants

Participants were recruited in the Heidelberg area via bulletins in local institutions (approximately 40), distribution of leaflets and two advertisements in local newspapers (*Rhein-Neckar-Zeitung und Wochenkurier*). A total of 92 participants were finally included (37 of them were responding to bulletins, 32 had received leaflets,

and 23 responded to the newspaper advertisements). To avoid samples that are biased towards student populations we set the minimum age to 25. No maximum age was indicated, but participants had to be able to work with a computer/mouse and keyboard. Participants' age in years ranged from 25 to 75 years with an average of 49.4 years and a standard deviation of 17.0. Sixty-four percent of the participants were women and 83.7% indicated having at least a high school degree. Of our sample, 25% were living in a steady partnership, 10.9% were divorced, 22.8% were single, 36.9% were married and one participant was widowed. Fifty-seven percent of participants had at least one child.

## Instruments

### Environmental attitude, knowledge, and altruistic history

A computerized questionnaire<sup>1</sup> was used to assess attitudes towards climate change using a seven-point Likert scale. Questions included (a) the belief that climate change exists, (b) the worriedness about climate change taking place, (c) the perceived consequences of climate change being negative or positive, and (d) the degree of worriedness about such consequences. Furthermore, participants rated the frequency of seeking information about climate change in the media, from discussions with strangers and/or family, and from presentations. At the end of the questionnaire participants were asked to report their altruistic history, i.e., the amount of money they had donated to charities or alike within the past year. The framing of the questions is taken from the socio-economic panel (SOEP) [21]. Also, another item from SOEP was adopted in which subjects split a hypothetical sum of money among “savings”, “spending”, and “giving as a gift” accounts. By eliciting the share being attributed towards the “gift-giving” account, we aimed to achieve a proxy for individuals' willingness to share with others and providing altruistic gifts.

<sup>1</sup> Results from the incentivized decision task that was also elicited in the computerized part are reported in Goeschl et al. [7].

## The Non-Linear Thinking Inventory

To systematically assess participants' ability to detect feedback loops and non-linearities, we developed an easy-to-use paper and pencil inventory. The Non-Linear Thinking Inventory (Non-LTI) consists of ten different causal scenarios that describe either linear or non-linear (cyclic) causal relationships, and that consist of one to three causal elements each. For example, the causal scenarios describe relationships between sugar uptake and tooth decay (linear relationship, two causal elements); invention of a vaccine and number of people infected by a virus (cyclic relationship, two causal elements); or CO<sub>2</sub>, wild fire and global temperature (cyclic relationship, three causal elements). For each causal scenario, one to three tasks need to be completed making 19 items all in all including a sample item at the beginning to familiarize participants with the required answer formats (see [Fig. 1](#) for a sample item). This was done to avoid artifacts when people are able to detect non-linearities but have difficulties using the respective task format. The different answer formats encompass (1) drawing causal relationships that need to be discovered within the scenarios, (2) describing how the system's behavior will develop over time given its present state, and (3) drawing analogies between scenarios that are semantically different but structurally equivalent.

## Intelligence

Intelligence was assessed using the short version of the standardized Leistungsprüfungssystem 50+ (LPS, [19]). A total of four different cognitive domains were assessed including verbal fluency, technical skill, general knowledge, and deductive reasoning.

## Results

*How do climate change attitude, information status, and altruistic character vary as a function of age?*

Over all ages, participants strongly believe in the existence of climate change and 85% indicate to be convinced of it taking place. Older participants are more worried than younger participants about climate change taking place ( $\rho=0.20$ ,  $p=0.06$ ). Across all ages, participants per-

ceive consequences as equally negative (86%), yet the anxiety about these consequences significantly increases with age ( $\rho=0.21$ ,  $p=0.05$ ).

With respect to information status, we find a positive relationship with age. Older participants tend to seek information about climate change more frequently ( $\rho=0.24$ ,  $p=0.02$ ). Moreover, we find that older individuals have a stronger altruistic history, as they donated more money towards charities in the past ( $\rho=0.45$ ,  $p<0.01$ ). A similar, positive age effect can be observed with respect to the willingness to share and give gifts. Therefore, older individuals would attribute larger amounts to others ( $\rho=0.41$ ,  $p<0.01$ ) and save or spend less on themselves than younger participants.

*How are complex feedback processes understood by individuals of different ages and intelligence quotients?*

With respect to the Non-LTI, a maximum of 47 points could be reached. On average our participants scored 26.52 (SD 6.91). A negative relation with age was found for mean solution rate ( $\rho=-0.612$ ,  $p<0.001$ ) indicating that older participants were less able to understand feedback processes present in the climate system than younger participants.

IQ raw scores (mean 185.66, SD 34.20) were negatively correlated with age, as age-adjusted normative values were not applied ( $\rho=-0.234$ ,  $p=0.03$ ). A significant positive association was found between Non-LTI and IQ ( $\rho=0.502$ ,  $p<0.001$ ) with the different cognitive domains verbal fluency ( $\rho=0.299$ ,  $p=0.005$ ), technical skills ( $\rho=0.445$ ,  $p<0.001$ ), general knowledge ( $\rho=0.250$ ,  $p=0.021$ ), and deductive reasoning ( $\rho=0.549$ ,  $p>0.001$ ). Interestingly, Non-LTI scores were not correlated with years of education ( $\rho=0.189$ ,  $p=n.s.$ ).

*Are there potential relationships between comprehension of climate system on the one hand and attitudes on the other hand?*

Comprehension of feedback processes underlying climate change are positively correlated with the belief that climate change exists ( $\rho=0.226$ ,  $p=0.03$ ), and negatively correlated with seeking information in the press ( $\rho=-0.221$ ,  $p=0.035$ ), and in the liter-

ature ( $\rho=-0.255$ ,  $p=0.014$ ). Moreover, willingness to share with others was negatively related to scores on the Non-LTI ( $\rho=-0.251$ ,  $p=0.016$ ). Intelligence was positively related with belief that climate change exists ( $\rho=0.253$ ,  $p=0.019$ ) and worriedness about climate change taking place ( $\rho=0.222$ ,  $p=0.019$ ).

## Discussion

This study investigated in how far comprehension of complex processes underlying climate change and environmental attitudes vary across the lifespan. In a sample of 92 individuals aged between 25 and 75 years, we assessed attitudes towards climate change, information seeking behavior, altruistic tendencies, general intelligence as well as comprehension of systemic feedback structures underlying climate change. We show that general worriedness about climate change and its consequences as well as altruistic tendencies increase with age. In addition, more mature individuals are more inclined to seek information regarding climate change than younger participants. Concerning comprehension of underlying feedback processes, we find a negative age effect such that older participants performed more poorly than younger participants. This association is not mediated by education. We do not find significant relationships between comprehension of the climate system and intelligence on the one hand and environmental attitudes on the other hand. Understanding of the climate system was, however, associated with individuals' belief that climate change exists.

Our results are in line with the theory of generativity, according to which prosocial tendencies increase during middle age. Older individuals in our sample were more worried about climate change taking place and feared more consequences than younger participants. At the same time, they indicate to be more willing to give up private wealth for the benefit of others. In this view, the aging political decision maker should be more inclined to invest in climate change management than young voters. However, considering the clear dissociation between attitudes and actions taken interpretation regarding the translation of such attitudes into behav-

ior needs to be held with caution. Recent studies extend our results by finding positive associations of pro-environmental attitudes and willingness-to-pay towards climate change mitigation [12] as well as age and climate change mitigation contributions [8].

In this study, we found that older individuals tend to seek more information on climate change than younger participants. More than likely, this can partially be attributed to the fact that older individuals in our sample—usually retirees—have more time to do so. Also, there may be a generational bias based on the fact that climate change is a relatively new phenomenon which is nowadays discussed as a part of formal education. This may also be related to the finding that elderly individuals performed more poorly on our Non-LTI than younger participants. While this relation is not mediated by education in years, the content of formal education has indisputably changed within the past 5 decades.

While this study suffers from various limitations, the application of the Non-LTI in addition to traditional assessment of intelligence represents a definite strength of this study. Traditional measures of general intelligence, such as Raven's Matrices [14], WAIS-IV, or LPS [19], assess people's ability to detect linear relationships, be it within series of digits, or geometric displays. Furthermore, up to now, no paper and pencil inventory exists that specifically tests system thinking. Booth Sweeny and Sterman [16] developed a semistructured interview that consists of 17 probes designed to surface intuitive models of (among others) feedback loops and nonlinearities. Due to its length (roughly 45 min) and structure (one-by-one sessions), however, it can hardly be used in regular experimental group sessions involving a large number of participants. The high correlation of the Non-LTI with general IQ, technical skills, and deductive reasoning can be taken as a starting point to externally validate our assessment tool.

Potential limitations of this study arise from the fact that no behavioral measures of pro-environmental attitudes were assessed and attitudes and values were indicated via self-rating questions only. Moreover, our sample is relatively small making generalizations to a wider public difficult.

Z Gerontol Geriat 2014 · 47:490–494 DOI 10.1007/s00391-014-0675-0  
© Springer-Verlag Berlin Heidelberg 2014

C. Degen · S.E. Kettner · H. Fischer · J. Lohse · J. Funke · C. Schwieren · T. Goeschl · J. Schröder

## Comprehension of climate change and environmental attitudes across the lifespan

### Abstract

Given the coincidence of the demographic change and climate change in the upcoming decades the aging voter gains increasing importance in climate change mitigation and adaptation processes. It is generally assumed that information status and comprehension of complex processes underlying climate change are prerequisites for adopting pro-environmental attitudes and taking pro-environmental actions. In a cross-sectional study, we investigated in how far (1) environmental knowledge and comprehension of feedback processes underlying climate change and (2) pro-environmental attitudes change as a function of age. Our sample consisted of 92 participants aged 25–75 years (mean age 49.4 years, SD 17.0). Age was negatively related to comprehension of system structures in-

herent to climate change, but positively associated with level of fear of consequences and anxiousness towards climate change. No significant relations were found between environmental knowledge and pro-environmental attitude. These results indicate that, albeit understanding of relevant structures of the climate system is less present in older age, age is not a limiting factor for being engaged in the complex dilemma of climate change. Results bear implications for the communication of climate change and pro-environmental actions in aging societies.

### Keywords

Climate change · Age · Cognitive capacity · System thinking · Pro-environmental attitude

## Verständnis von Klimawandeldynamiken und Umwelteinstellungen über die Lebensspanne

### Zusammenfassung

Der demographische Wandel wird in den kommenden Jahrzehnten dazu führen, dass der alternde Entscheidungsträger und Wähler im politischen Kontext an Bedeutung gewinnt. Zugleich wird der Klimawandel u. a. weitreichende Entscheidungen über die Durchführung von Klimaschutzmaßnahmen und möglicher Anpassungsprozesse erfordern. Es ist davon auszugehen, dass klimarelevantes Wissen sowie das Verständnis für komplexe Dynamiken, die dem System Klima unterliegen, Voraussetzungen für umweltbewusstes Verhalten bilden. In dieser Querschnittstudie haben wir den Zusammenhang von (1.) klimaspezifischem Wissen und Verständnis für Feedback-Prozesse und (2.) umweltbewusste Einstellung im Hinblick auf das Lebensalter bei 92 Probanden im Alter von 25 bis 75 Jahren (Durchschnittsalter: 49,4 Jahre; SD 17,0) untersucht. Es ergaben sich nega-

tive Zusammenhänge zwischen Lebensalter und Verständnis für komplexe Klimadynamiken sowie positive Zusammenhänge zwischen Lebensalter und Besorgnis über die Konsequenzen des Klimawandels. Eine Abhängigkeit zwischen klimarelevantem Wissen und Umweltbewusstsein ließ sich dagegen nicht bestätigen. Die Resultate deuten darauf hin, dass der alternde Entscheidungsträger, trotz eingeschränktem Verständnis für komplexe Klimadynamiken, umweltbewusste Einstellungen vertritt. Die klare Unterscheidung kognitiver und sozialer Ansätze ist v. a. für altersgeschichtete Interventionen und Kommunikationsansätze von großer Bedeutung.

### Schlüsselwörter

Klimawandel · Alter · Kognitive Leistungsfähigkeit · Einstellung · Umweltbewusstsein

A sample bias may have occurred owing to the fact that participants were volunteers, actively approaching us rather than being randomly selected. Future research should investigate whether attitude, comprehension and information seeking behavior vary as a function of age in a longitudinal setup. This way, generational effects can be avoided. Moreover, an analysis of how attitudes, comprehension, and

information status translate into actual ecological behavior is required.

Our results bear a number of important theoretical and practical implications. Comprehension of the climate system seems to enhance people's conviction of the existence of climate change but does not necessarily increase their worriedness about the climate. Thus, the question of the mere *existence* of climate

change seems to be moderated purely by cognition, whereas *worriedness* about the climate seems to be moderated by other, noncognitive factors, possibly emotions or values. Both types of variables are affected by age, with cognitive factors decreasing and noncognitive factors increasing across the lifespan. In addition, cohort effects have to be considered since the younger old in this country belong to the generation which was particularly concerned about ecological questions from the early 1970s on. Communication of climate change should therefore address both aspects (cognitive as well as noncognitive, emotional or value factors) to appeal to all age groups and to be most effective. This dissociation between cognitive factors to be more important in the younger and noncognitive ones in the elderly can facilitate the development of information programs to approach the respective groups. One can argue that younger individuals are more willing to act pro-environmentally if external incentives (e.g., financial rewards) are given, while, according to theory of generativity, older individuals derive motivation to act pro-environmentally intrinsically. Structural changes in society, by means of legislation, taxes, etc. may be more focused on young, rather than old individuals.

**Corresponding address**

**C. Degen**  
 Universitätsklinikum Heidelberg  
 Voßstr. 4, 69115 Heidelberg  
 Germany  
 Christina.Degen@med.uni-heidelberg.de

**Acknowledgments.** We gratefully acknowledge the Bundesministerium für Bildung und Forschung for supporting our project "ClimAge".

**Compliance with ethical guidelines**

**Conflict of interest.** C. Degen, S.E. Kettner, H. Fischer, J. Lohse, J. Funke, C. Schwieren, T. Goeschl, and J. Schröder state that there are no conflicts of interest.

All studies on humans described in the present manuscript were carried out with the approval of the responsible ethics committee and in accordance with national law and the Helsinki Declaration of 1975 (in its current, revised form). Informed consent was obtained from all patients included in studies.

**References**

1. Balestra C, Dottori D (2012) Aging society, health and the environment. *J Popul Econ* 25(3):1045–1076
2. Booth Sweeney L, Sterman JD (2000) Bathtub dynamics: initial results of a system thinking inventory. *Syst Dyn Rev* 16(4):249–294
3. Chawla L (1999) Life paths into effective environmental action. *J Environ Edu* 31(1):15–26
4. Diekmann A, Preisendörfer P (1998) Environmental behavior: discrepancies between aspirations and reality. *Rationality Soc* 10:79–102
5. Erikson EH (1968) Identity, youth and crisis. New York: W. W. Norton & Co.
6. Federal Statistical Office (2011) Im Blickpunkt – Ältere Menschen in Deutschland und der EU. Federal Statistical Office, Wiesbaden
7. Fischer H, Degen C, Funke J (2014) Improving stock-flow reasoning with verbal formats. *Simulation and Gaming* (accepted)
8. Goeschl, Kettner, Lohse, Schwieren (2014) What do we learn from public good games about climate change? Mimeo, University of Heidelberg
9. Kaiser FG, Wölfling S, Fuhrer U (1999) Environmental attitude and ecological behaviour. *J Environ Psychol* 19:1–19
10. Kollmuss A, Agyeman J (2002) 'Mind the gap: why do people act environmentally and what are the barriers to pro-environmental behavior?' *Environmental education research*, Vol 8, pp 239–260
11. List JA (2004) Young, selfish and male: field evidence of social preferences. *Econ J* 114(492):121–149
12. Löschel A, Sturm B, Vogt C (2013) The demand for climate protection—empirical evidence from Germany. *Econ Lett* 118(3):415–418
13. Martinsson J, Lundqvist L (2010) Ecological citizenship: coming out "clean" without turning "green"? *Environ Politics* 19:518–537
14. Raven JC (1936) Mental tests used in genetic studies: The performance of related individuals on tests mainly educative and mainly reproductive. MSc Thesis, University of London
15. Schröder J, Pantel J (2011) Die leichte kognitive Beeinträchtigung – Klinik, Diagnostik, Therapie und Prävention im Vorfeld der Alzheimer Demenz. Schattauer-Verlag, Stuttgart
16. Sterman JD, Booth Sweeney L (2007) Understanding public complacency about climate change: adults' mental models of climate change violate conservation of matter. *Clim Change* 80(3–4):213–238
17. Sterman JD (2011) Communicating climate change risks in a skeptical world. *Clim Change*. doi:10.1007/s10584-011-0189-3
18. Stern N (2007) Stern review on the economics of climate change. Executive summary. HM Treasury, London
19. Sturm W, Wilmes K, Horn W (1993) Leistungsprüfungssystem für 50–90jährige (LPS 50+). Hogrefe, Göttingen
20. Toro P, Schönknecht P, Schröder J (2009) Type II diabetes in mild cognitive impairment and Alzheimer's disease: results from a prospective population-based study in Germany. *J Alzheimers Dis* 16(4):687–6691
21. Wagner GG, Frick JR, Schupp J (2007) The German Socio-Economic Panel Study (SOEP)—scope, evolution and enhancements. *Schmollers Jahrbuch* 127(1):139–169

**Neue Therapie gegen Atempausen im Schlaf**

Etwa fünf Prozent der erwachsenen Bevölkerung sind von obstruktiver Schlafapnoe (OSA) betroffen. Diese tritt überwiegend in der Altersgruppe der 40- bis 65-jährigen auf. Ursache der OSA sind funktionelle Störungen der Atemwegssteuerung. Die Muskulatur erschlafft im Schlaf, sodass die Zunge in den Rachen fällt und die Atemwege verschließt. Bisherige Standardtherapie ist das Beatmungssystem Continuous Positive Airway Pressure (CPAP). Dieses ist wirksam, jedoch stören viele Betroffene die Atemmaske und das rauschende Gerät im Schlafzimmer. Abhilfe könnte nun die sogenannte Upper Airway Stimulation (UAS) schaffen. Dabei handelt es sich um ein vollständig implantiertes Schrittmachersystem, das den Unterzungennerv milde stimuliert. So verhindert es direkt, dass die Muskulatur, die für die Atempausen verantwortlich ist, erschlafft. Der Patient atmet dadurch im Schlaf wieder gleichmäßig. In einer, auf der 85. Jahresversammlung der Deutschen Gesellschaft für Hals-Nasen-Ohren-Heilkunde, Kopf- und Hals-Chirurgie e.V. vorgestellten, Studie wurden die Nebenwirkungen des Schrittmachers als gering eingestuft, da durch die Operation keine irreversiblen Veränderungen der oberen Atemwege entstehen. Schlucken und Sprechen bleiben dadurch unbeeinträchtigt, Atemaussetzer sind um 68 Prozent verringert, der Sauerstoffabfall im Blut um 70 Prozent. Ebenso wurde auf dem Kongress vorgestellt, wie solchen Schrittmacher implantiert werden und welchen Patienten zu dem Eingriff geraten werden kann.

*Quelle: 85. Jahresversammlung 2014 der Deutschen Gesellschaft für Hals-Nasen-Ohren-Heilkunde, Kopf- und Hals-Chirurgie e. V., Bonn, www.hno.org/kongress*